

MathsWatch Worksheets

FOUNDATION and HIGHER

Questions
and
Answers
interleaved

Clip No	Name of clip	Tier	Grades	Pg No
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2	Ordering Decimals	F	G to E	2
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4	Reading scales	F	G to E	4
5	Multiply or divide by powers of 10	F	G to E	5
6	Negatives in real life	F	G to E	6
7	Multiplication and division with negatives	F	G to E	7
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9	Square and Cube Numbers	F	G to E	9
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11	Money questions	F	G to E	11
12	Shading fractions of rectangles	F	G to E	12
13	Ordering Fractions, Decimals & Percentages	F	G to E	13
14	Estimating answers	F	G to E	14
15	Place value when multiplying	F	G to E	15
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Clip No	Name of clip	Tier	Grades	Pg No
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176	Areas of triangles using $\frac{1}{2} ab \sin C$	H	A to A*	169
177	Cones and Spheres	H	A to A*	170
178	Segments and Frustums	H	A to A*	171
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180	Vectors	H	A to A*	173-174
181	Histograms	H	A to A*	175
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183	Stratified sampling	H	A to A*	177

Place Value

1 000 000	100 000	10 000	1 000	100	10	1
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- 1)
 - a) Write the number forty five thousand, two hundred and seventy three in figures.
 - b) Write the number five thousand, one hundred and three in figures.
 - c) Write the number three hundred thousand, seven hundred and ninety one in figures.
 - d) Write the number two and a half million in figures.
 - e) Write the number one and three quarter million in figures.

- 2) Write the following numbers in words
 - a) 1 250
 - b) 3 502
 - c) 72 067
 - d) 192 040
 - e) 30 000 000

- 3)
 - a) Write down the value of the 7 in the number 3752.
 - b) Write down the value of the 6 in the number 56025.
 - c) Write down the value of the 2 in the number 99723.
 - d) Write down the value of the 5 in the number 258610.
 - e) Write down the value of the 2 in the number 1253549.

Place Value

1 000 000	100 000	10 000	1 000	100	10	1
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- 1) a) Write the number forty five thousand, two hundred and seventy three in figures. **45 273**
- b) Write the number five thousand, one hundred and three in figures. **5 103**
- c) Write the number three hundred thousand, seven hundred and ninety one in figures. **300 791**
- d) Write the number two and a half million in figures. **2 500 000**
- e) Write the number one and three quarter million in figures. **1 750 000**
- 2) Write the following numbers in words
- a) 1 250 **One thousand, two hundred and fifty**
- b) 3 502 **Three thousand, five hundred and two**
- c) 72 067 **Seventy two thousand, and sixty seven**
- d) 192 040 **One hundred and ninety two thousand, and forty**
- e) 30 000 000 **Thirty million**
- 3) a) Write down the value of the 7 in the number 3752. **Seven hundred**
- b) Write down the value of the 6 in the number 56025. **Six thousand**
- c) Write down the value of the 2 in the number 99723. **Twenty**
- d) Write down the value of the 5 in the number 258610. **Fifty thousand**
- e) Write down the value of the 2 in the number 1 253 549. **Two hundred thousand**

Put these numbers in order, starting with the smallest:

- 1) 74, 57, 38, 8, 61
- 2) 39, 84, 11, 128, 24
- 3) 76, 102, 12, 140, 73
- 4) 3.1, 31, 1.3, 13, 1.03
- 5) 0.321, 0.312, 1.04, 1.23
- 6) 0.34, 0.047, 0.4, 0.43, 0.403
- 7) 0.79, 0.709, 0.97, 0.792
- 8) 2.71, 2.074, 2.071, 2.701
- 9) 0.875, 0.88, 0.0885, 0.008, 0.11
- 10) 3, -2, -7, 10, -1
- 11) -3, -11, 1, -5, 7
- 12) -4, 6, 0, -6, -1

Ordering Numbers

Put these numbers in order, starting with the smallest:

- 1) 74, 57, 38, 8, 61
8, 38, 57, 61, 74
- 2) 39, 84, 11, 128, 24
11, 24, 39, 84, 128
- 3) 76, 102, 12, 140, 73
12, 73, 76, 102, 140
- 4) 3.1, 31, 1.3, 13, 1.03
1.03, 1.3, 3.1, 13, 31
- 5) 0.321, 0.312, 1.04, 1.23
0.312, 0.321, 1.04, 1.23
- 6) 0.34, 0.047, 0.4, 0.43, 0.403
0.047, 0.34, 0.4, 0.403, 0.43
- 7) 0.79, 0.709, 0.97, 0.792
0.709, 0.79, 0.792, 0.97
- 8) 2.71, 2.074, 2.071, 2.701
2.071, 2.074, 2.701, 2.71
- 9) 0.875, 0.88, 0.0885, 0.008, 0.11
0.008, 0.0885, 0.11, 0.875, 0.88
- 10) 3, -2, -7, 10, -1
-7, -2, -1, 3, 10
- 11) -3, -11, 1, -5, 7
-11, -5, -3, 1, 7
- 12) -4, 6, 0, -6, -1
-6, -4, -1, 0, 6

1) Round these numbers to the nearest 10:

- a) 26
- b) 62
- c) 75
- d) 231
- e) 797
- f) 5842
- g) 9875
- h) 13758

2) Round these numbers to the nearest 100:

- a) 78
- b) 223
- c) 549
- d) 1450
- e) 1382
- f) 4537
- g) 9193
- h) 17625

3) Round these numbers to the nearest 1000:

- a) 850
- b) 1455
- c) 3230
- d) 7500
- e) 8455
- f) 9690
- g) 12390
- h) 28910

1) Round these numbers to the nearest 10:

- a) 26 **30**
- b) 62 **60**
- c) 75 **80**
- d) 231 **230**
- e) 797 **800**
- f) 5842 **5 840**
- g) 9875 **9 880**
- h) 13758 **13 760**

2) Round these numbers to the nearest 100:

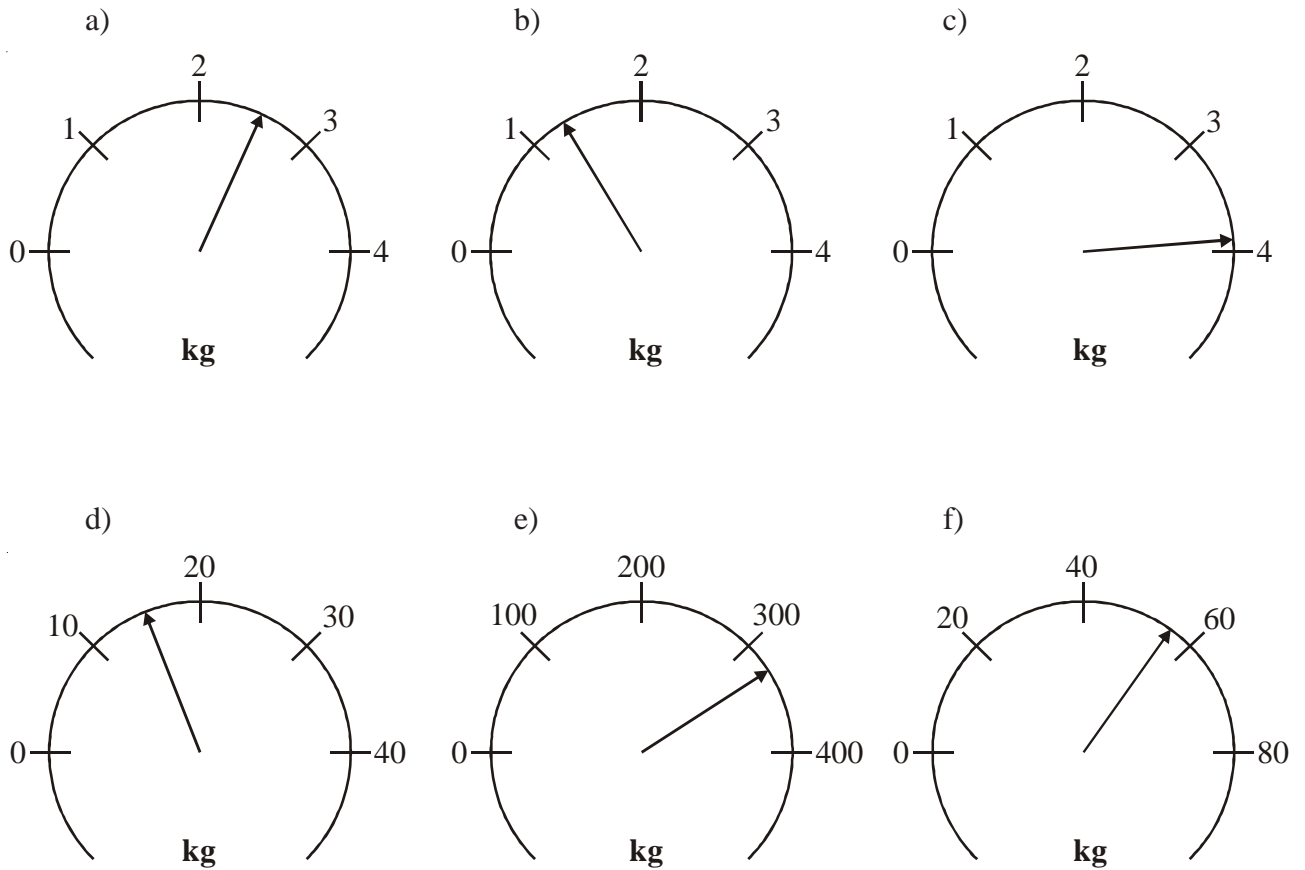
- a) 78 **100**
- b) 223 **200**
- c) 549 **500**
- d) 1450 **1 500**
- e) 1382 **1 400**
- f) 4537 **4 500**
- g) 9193 **9 200**
- h) 17625 **17 600**

3) Round these numbers to the nearest 1000:

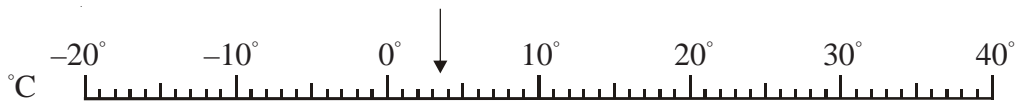
- a) 850 **1 000**
- b) 1455 **1 000**
- c) 3230 **3 000**
- d) 7500 **8 000**
- e) 8455 **8 000**
- f) 9690 **10 000**
- g) 12390 **12 000**
- h) 28910 **29 000**

Reading Scales

1) What is the reading on each of these scales?

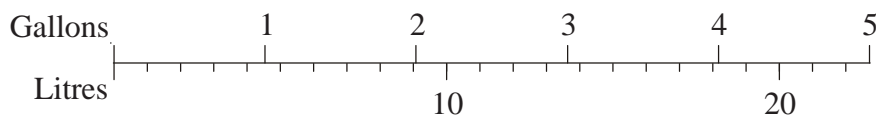


2) This scale shows degrees Centigrade.



- What temperature is the arrow pointing to?
- Draw an arrow which points to -17°C

3) This is a diagram for converting gallons to litres.



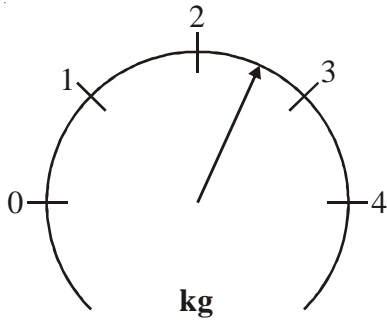
Use the diagram to convert

- 3 gallons to litres.
- 4.5 gallons to litres.
- 6 litres to gallons.

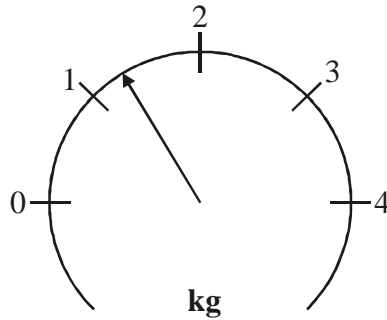
Reading Scales

1) What is the reading on each of these scales?

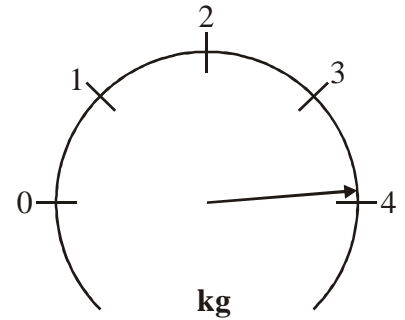
a) **2.5**



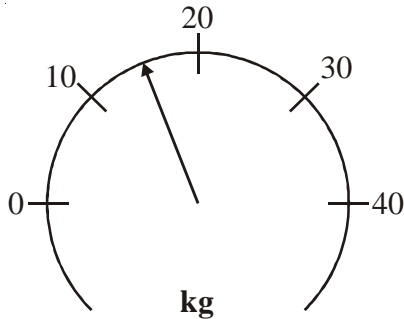
b) **1.3**



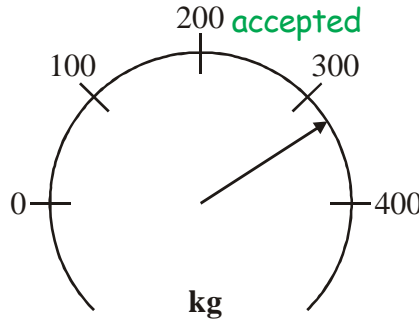
c) **3.9**



d) **15**

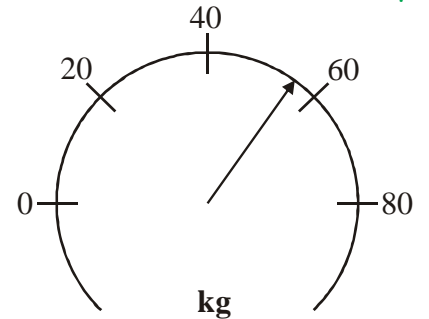


e) **325**



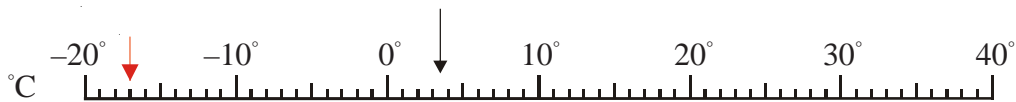
any value between 320 and 330 inclusive would be accepted

f) **56**



55, 56 or 57 would be accepted

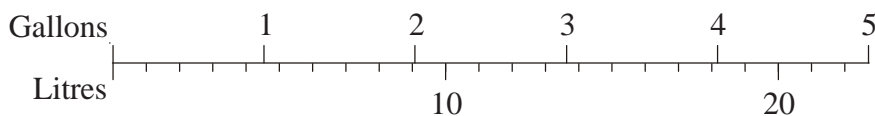
2) This scale shows degrees Centigrade.



a) What temperature is the arrow pointing to? **3.5°C**

b) Draw an arrow which points to -17°C

3) This is a diagram for converting gallons to litres.



Use the diagram to convert

a) 3 gallons to litres. **13.7 litres**

b) 4.5 gallons to litres. **20.5 litres**

c) 6 litres to gallons. **1.3 gallons**

1) Multiply the following numbers by 10, 100 and 1000:

		$\times 10$	$\times 100$	$\times 1000$
<i>e.g.</i>	21	210	2100	21000
	9			
	63			
	845			
	3.65			
	0.4			
	1.324			

2) Divide the following numbers by 10, 100 and 1000:

		$\div 10$	$\div 100$	$\div 1000$
<i>e.g.</i>	21	2.1	0.21	0.021
	9			
	63			
	845			
	3.65			
	0.4			
	1.324			

3) Work out the following:

$$3 \times 100 =$$

$$65 \times 10 =$$

$$17 \div 10 =$$

$$359 \times 10 =$$

$$0.5 \div 100 =$$

$$2.3 \times 1000 =$$

$$42 \div 100 =$$

$$3582 \div 100 =$$

$$0.9 \times 10 =$$

$$3.645 \times 100 =$$

$$88 \div 1000 =$$

$$39.62 \times 1000 =$$

Multiply and Divide by Powers of 10

1) Multiply the following numbers by 10, 100 and 1000:

		×10	×100	×1000
<i>e.g.</i>	21	210	2100	21000
	9	90	900	9 000
	63	630	6 300	63 000
	845	8 450	84 500	845 000
	3.65	36.5	365	3 650
	0.4	4	40	400
	1.324	13.24	132.4	1 324

2) Divide the following numbers by 10, 100 and 1000:

		÷10	÷100	÷1000
<i>e.g.</i>	21	2.1	0.21	0.021
	9	0.9	0.09	0.009
	63	6.3	0.63	0.063
	845	84.5	8.45	0.845
	3.65	0.365	0.0365	0.00365
	0.4	0.04	0.004	0.0004
	1.324	0.1324	0.01324	0.001324

3) Work out the following:

$$3 \times 100 = 300$$

$$65 \times 10 = 650$$

$$17 \div 10 = 1.7$$

$$359 \times 10 = 3\,590$$

$$0.5 \div 100 = 0.005$$

$$2.3 \times 1000 = 2\,300$$

$$42 \div 100 = 0.42$$

$$3582 \div 100 = 35.82$$

$$0.9 \times 10 = 9$$

$$3.645 \times 100 = 364.5$$

$$88 \div 1000 = 0.088$$

$$39.62 \times 1000 = 39\,620$$

- 1) At midnight, the temperature was -7°C .
By 7am the next morning, the temperature had increased by 6°C .
a) Work out the temperature at 7am the next morning.

At midday, the temperature was 3°C .

- b) Work out the difference between the temperature at midday and the temperature at midnight.
c) Work out the temperature which is halfway between -7°C and 3°C .
- 2) The table below gives the temperature recorded on 25th December of 7 cities across the world.

City	Edinburgh	London	New York	Moscow	Paris	Rome	Cairo
Temperature	-6°C	0°C	-15°C	-23°C	3°C	5°C	18°C

- a) Which city recorded the lowest temperature?
b) What is the difference in temperature between New York and Paris?
c) What is the difference in temperature between Cairo and Edinburgh?
d) The temperature in Madrid was 9°C lower than in Rome.
What was the temperature in Madrid?
e) The temperature in Mexico was 6°C higher than in New York.
What was the temperature in Mexico?
- 3) The table shows the temperature on the surface of each of five planets.

Planet	Temperature
Venus	210°C
Jupiter	-150°C
Saturn	-180°C
Neptune	-210°C
Pluto	-230°C

- a) Work out the difference in temperature between Jupiter and Pluto.
b) Work out the difference in temperature between Venus and Saturn.
c) Which planet has a temperature 30°C lower than Saturn?

The temperature on Mars is 90°C higher than the temperature on Jupiter.

- d) Work out the temperature on Mars.

Negatives in Real Life

- 1) At midnight, the temperature was -7°C .

By 7am the next morning, the temperature had increased by 6°C .

- a) Work out the temperature at 7am the next morning.

-1°C

At midday, the temperature was 3°C .

- b) Work out the difference between the temperature at midday and the temperature at midnight.

10°C

- c) Work out the temperature which is halfway between -7°C and 3°C .

-2°C

- 2) The table below gives the temperature recorded on 25th December of 7 cities across the world.

City	Edinburgh	London	New York	Moscow	Paris	Rome	Cairo
Temperature	-6°C	0°C	-15°C	-23°C	3°C	5°C	18°C

- a) Which city recorded the lowest temperature?

Moscow

- b) What is the difference in temperature between New York and Paris?

18°C

- c) What is the difference in temperature between Cairo and Edinburgh?

24°C

- d) The temperature in Madrid was 9°C lower than in Rome.

What was the temperature in Madrid?

-4°C

- e) The temperature in Mexico was 6°C higher than in New York.

What was the temperature in Mexico?

-9°C

- 3) The table shows the temperature on the surface of each of five planets.

Planet	Temperature
Venus	210°C
Jupiter	-150°C
Saturn	-180°C
Neptune	-210°C
Pluto	-230°C

- a) Work out the difference in temperature between Jupiter and Pluto.

80°C

- b) Work out the difference in temperature between Venus and Saturn.

390°C

- c) Which planet has a temperature 30°C lower than Saturn?

Neptune

The temperature on Mars is 90°C higher than the temperature on Jupiter.

- d) Work out the temperature on Mars.

-60°C

Multiplication & Division with Negatives

Work out the following:

1) $-3 \times 6 =$

2) $4 \times 2 =$

3) $10 \div -2 =$

4) $-6 \div -3 =$

5) $-5 \times -7 =$

6) $7 \times -3 =$

7) $12 \div 4 =$

8) $-24 \div 6 =$

9) $-8 \times 2 =$

10) $-9 \div 3 =$

11) $4 \div -1 =$

12) $-3 \times -9 =$

13) $-70 \div -7 =$

14) $11 \times -6 =$

15) $4 \times -3 \times 2 =$

16) $-5 \times 2 \times -4 =$

17) $4 \times 5 \div -2 =$

18) $-8 \div -2 \times -6 =$

19) $-2 \times -3 \times -4 =$

20) $8 \div -2 \times -6 =$

Work out the following:

1) $-3 \times 6 = -18$

2) $4 \times 2 = 8$

3) $10 \div -2 = -5$

4) $-6 \div -3 = 2$

5) $-5 \times -7 = 35$

6) $7 \times -3 = -21$

7) $12 \div 4 = 3$

8) $-24 \div 6 = -4$

9) $-8 \times 2 = -16$

10) $-9 \div 3 = -3$

11) $4 \div -1 = -4$

12) $-3 \times -9 = 27$

13) $-70 \div -7 = 10$

14) $11 \times -6 = -66$

15) $4 \times -3 \times 2 = -24$

16) $-5 \times 2 \times -4 = 40$

17) $4 \times 5 \div -2 = -10$

18) $-8 \div -2 \times -6 = -24$

19) $-2 \times -3 \times -4 = -24$

20) $8 \div -2 \times -6 = 24$

Fraction of an Amount

1) Work out the following:

a) $\frac{1}{2}$ of £10 b) $\frac{1}{3}$ of £9 c) $\frac{1}{5}$ of £25 d) $\frac{1}{2}$ of 24kg

e) $\frac{1}{4}$ of 36cm f) $\frac{1}{6}$ of 42kg g) $\frac{1}{8}$ of 48kg h) $\frac{1}{11}$ of £66

i) $\frac{1}{9}$ of 90km j) $\frac{1}{7}$ of £28 k) $\frac{1}{5}$ of 125kg l) $\frac{1}{6}$ of 240km

2) Work out the following:

a) $\frac{1}{4}$ of 20 b) $\frac{3}{4}$ of 20 c) $\frac{1}{3}$ of 21 d) $\frac{2}{3}$ of 21 e) $\frac{3}{4}$ of 44

f) $\frac{2}{3}$ of 24 g) $\frac{3}{5}$ of 15 h) $\frac{3}{4}$ of 36 i) $\frac{7}{9}$ of 81 j) $\frac{5}{7}$ of 56

k) $\frac{3}{10}$ of 50 l) $\frac{6}{11}$ of 33 m) $\frac{1}{4}$ of 14 n) $\frac{3}{4}$ of 14 o) $\frac{3}{8}$ of 20

3) The highest possible mark for a Maths test was 64.

Dora got $\frac{7}{8}$ of the full marks.

How many marks did she get?

4) At MathsWatch School there are 1500 students.

$\frac{7}{15}$ of these students are male.

a) What fraction of students are female?

b) How many are male?

c) How many are female?

1) Work out the following:

a) $\frac{1}{2}$ of £10
£5

b) $\frac{1}{3}$ of £9
£3

c) $\frac{1}{5}$ of £25
£5

d) $\frac{1}{2}$ of 24kg
12kg

e) $\frac{1}{4}$ of 36cm
9cm

f) $\frac{1}{6}$ of 42kg
7kg

g) $\frac{1}{8}$ of 48kg
6kg

h) $\frac{1}{11}$ of £66
£6

i) $\frac{1}{9}$ of 90km
10km

j) $\frac{1}{7}$ of £28
£4

k) $\frac{1}{5}$ of 125kg
25kg

l) $\frac{1}{6}$ of 240km
40km

2) Work out the following:

a) $\frac{1}{4}$ of 20
5

b) $\frac{3}{4}$ of 20
15

c) $\frac{1}{3}$ of 21
7

d) $\frac{2}{3}$ of 21
14

e) $\frac{3}{4}$ of 44
33

f) $\frac{2}{3}$ of 24
16

g) $\frac{3}{5}$ of 15
9

h) $\frac{3}{4}$ of 36
27

i) $\frac{7}{9}$ of 81
63

j) $\frac{5}{7}$ of 56
40

k) $\frac{3}{10}$ of 50
15

l) $\frac{6}{11}$ of 33
18

m) $\frac{1}{4}$ of 14
3.5

n) $\frac{3}{4}$ of 14
10.5

o) $\frac{3}{8}$ of 20
7.5

3) The highest possible mark for a Maths test was 64.

Dora got $\frac{7}{8}$ of the full marks.

How many marks did she get? **56 marks**

$$64 \div 8 = 8$$

$$8 \times 7 = 56$$

4) At MathsWatch School there are 1500 students.

$\frac{7}{15}$ of these students are male.

a) What fraction of students are female? **$\frac{8}{15}$**

b) How many are male? **700**

$$1500 \div 15 = 100$$

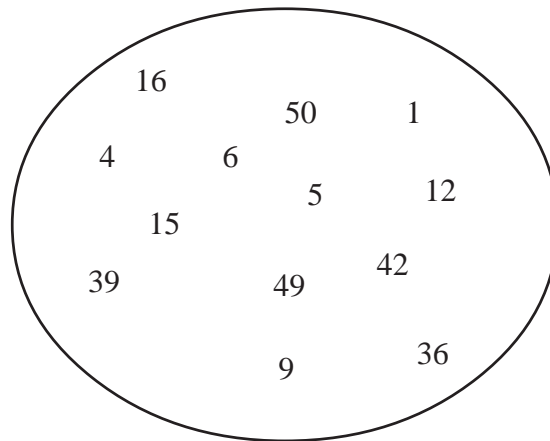
$$100 \times 7 = 700$$

c) How many are female? **800**

$$1500 - 700 = 800$$

Square and Cube Numbers

1)



- a) In the numbers, above, find six of the first seven square numbers.
b) Which of the first seven square numbers is missing?

2) Work out the following:

- a) 10^2 b) 9^2 c) $7^2 + 3^2$ d) $8^2 - 2^2$

3) For each pair of numbers, below, there is just one square number that lies between them. In each case, write the square number:

- a) 7 15 b) 21 29 c) 72 96 d) 130 156

4) Work out the following:

- a) $\sqrt{25}$ b) $\sqrt{81}$ c) $\sqrt{16} + 6^2$

5) The first cube number is $1^3 = 1$

Write out the 2nd, 3rd, 4th and 10th cube numbers.

6) Work out the following:

- a) $1^3 + 3^3$ b) $10^3 + 5^3$

7) Work out the following:

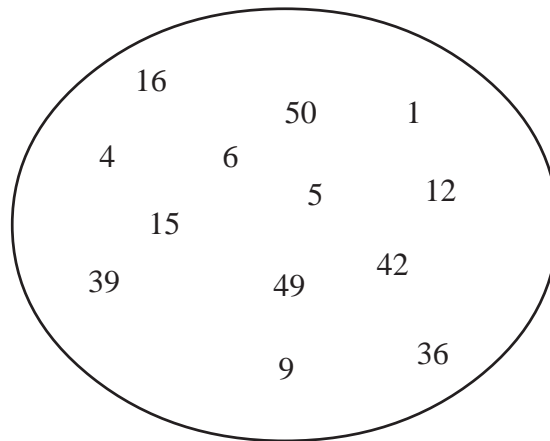
- a) $3^3 + 6^2$ b) $10^3 + \sqrt{100}$

8) Work out what should go in the boxes:

- a) $\sqrt{\square} = 6$ b) $\sqrt{\square} = 8$

Square and Cube Numbers

1)



a) In the numbers, above, find six of the first seven square numbers.

1, 4, 9, 16, 36, 49

b) Which of the first seven square numbers is missing?

25

2) Work out the following:

a) 10^2

100

b) 9^2

81

c) $7^2 + 3^2$

$49 + 9 = 58$

d) $8^2 - 2^2$

$64 - 4 = 60$

3) For each pair of numbers, below, there is just one square number that lies between them. In each case, write the square number:

a) 7 15

9

b) 21 29

25

c) 72 96

81

d) 130 156

144

4) Work out the following:

a) $\sqrt{25}$

5

b) $\sqrt{81}$

9

c) $\sqrt{16} + 6^2$

$4 + 36 = 40$

5) The first cube number is $1^3 = 1$

Write out the 2nd, 3rd, 4th and 10th cube numbers.

8, 27, 64, ..., 1000

6) Work out the following:

a) $1^3 + 3^3$

$1 + 27 = 28$

b) $10^3 + 5^3$

$1000 + 125 = 1125$

7) Work out the following:

a) $3^3 + 6^2$

$27 + 36 = 63$

b) $10^3 + \sqrt{100}$

$1000 + 10 = 1010$

8) Work out what should go in the boxes:

a) $\sqrt{\boxed{36}} = 6$

b) $\sqrt{\boxed{64}} = 8$

1. Write the following fractions as decimals and percentages:

eg. $\frac{1}{10} \xrightarrow{1 \div 10} 0.1 \xrightarrow{0.1 \times 100} 10\%$

a) $\frac{3}{10} =$

b) $\frac{1}{5} =$

c) $\frac{2}{5} =$

d) $\frac{1}{4} =$

e) $\frac{3}{4} =$

f) $\frac{1}{2} =$

g) $\frac{1}{3} =$

2. Fill in the blanks in the table below:

Fraction	Decimal	Percentage
$\frac{6}{10}$		
	0.2	
	0.9	
		40%
		25%
	$0.\dot{3}$	
		70%

1. Write the following fractions as decimals and percentages:

$$\text{eg. } \frac{1}{10} \xrightarrow{1 \div 10} 0.1 \xrightarrow{0.1 \times 100} 10\%$$

$$\text{a) } \frac{3}{10} = 0.3 = 30\%$$

$$\text{b) } \frac{1}{5} = 0.2 = 20\%$$

$$\text{c) } \frac{2}{5} = 0.4 = 40\%$$

$$\text{d) } \frac{1}{4} = 0.25 = 25\%$$

$$\text{e) } \frac{3}{4} = 0.75 = 75\%$$

$$\text{f) } \frac{1}{2} = 0.5 = 50\%$$

$$\text{g) } \frac{1}{3} = 0.\dot{3} = 33\frac{1}{3}\%$$

2. Fill in the blanks in the table below:

Fraction	Decimal	Percentage
$\frac{6}{10}$	0.6	60%
$\frac{1}{5}$	0.2	20%
$\frac{9}{10}$	0.9	90%
$\frac{2}{5}$	0.4	40%
$\frac{1}{4}$	0.25	25%
$\frac{4}{5}$	0.8	80%
$\frac{12}{100}$	0.12	12%
$\frac{1}{3}$	$0.\dot{3}$	$33\frac{1}{3}\%$
$\frac{7}{10}$	0.7	70%

- 1) Bill buys 3 melons at £1.09 each.
- a) How much does he spend?
- b) How much change does he get from £5?

- 2) Jenny is taking her family to the cinema.
Jenny pays for 1 adult and 3 children.
- a) How much does she spend?
- b) How much change does she get from £20?

<p>Cinema</p> <p>Adult: £6.50</p> <p>Child: £4.00</p>
--

- 3) Bob is paid £7 per hour.
- a) Last monday Bob worked for 8 hours
Work out his pay for that day.
- b) Yesterday Bob was paid £42.
Work out how many hours Bob worked.

- 4) Complete this bill.

1½ kg of carrots at 40p per kg = £.....

3 kg of potatoes at 52p per kg = £.....

..... boxes of tea bags at 90p each = £1.80

4 packs of yogurts at each = £4.80

Total = £.....

Money Questions

1) Bill buys 3 melons at £1.09 each.

a) How much does he spend? **£3.27**

b) How much change does he get from £5? **£1.73**

2) Jenny is taking her family to the cinema.
Jenny pays for 1 adult and 3 children.

a) How much does she spend? **£18.50**

b) How much change does she get from £20? **£1.50**

Cinema
Adult: £6.50
Child: £4.00

3) Bob is paid £7 per hour.

a) Last monday Bob worked for 8 hours
Work out his pay for that day. **£56**

b) Yesterday Bob was paid £42.
Work out how many hours Bob worked. **6 hours**

4) Complete this bill.

1½ kg of carrots at 40p per kg = **£0.60**

3 kg of potatoes at 52p per kg = **£1.56**

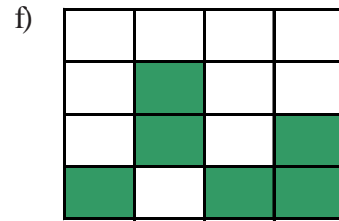
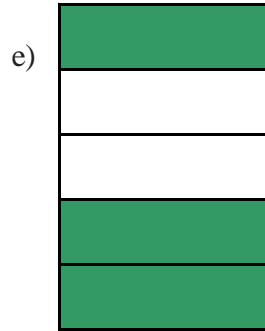
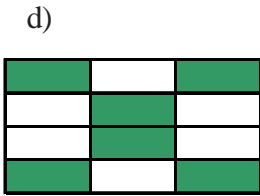
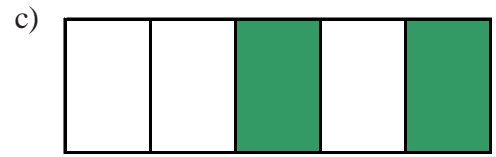
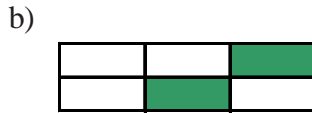
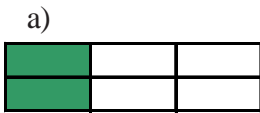
...**2**... boxes of tea bags at 90p each = £1.80

4 packs of yogurts at **£1.20** each = £4.80

Total = **£8.76**

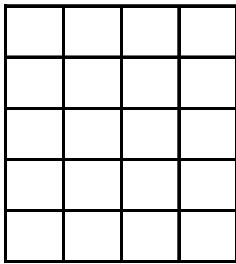
Shading Fractions

1) What fraction of each of the following shapes is shaded?

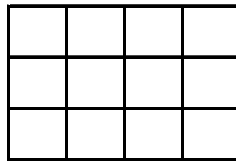


2) Shade the given fraction in the following grids.

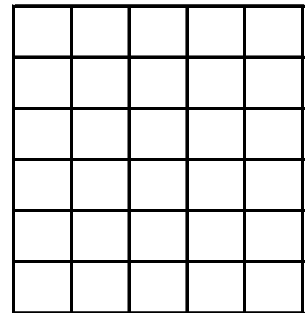
$$\frac{3}{5}$$



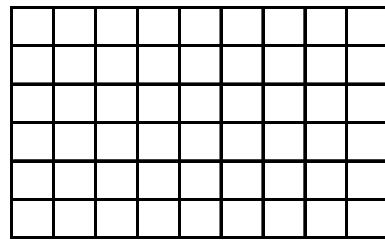
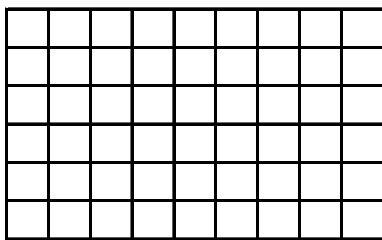
$$\frac{1}{4}$$



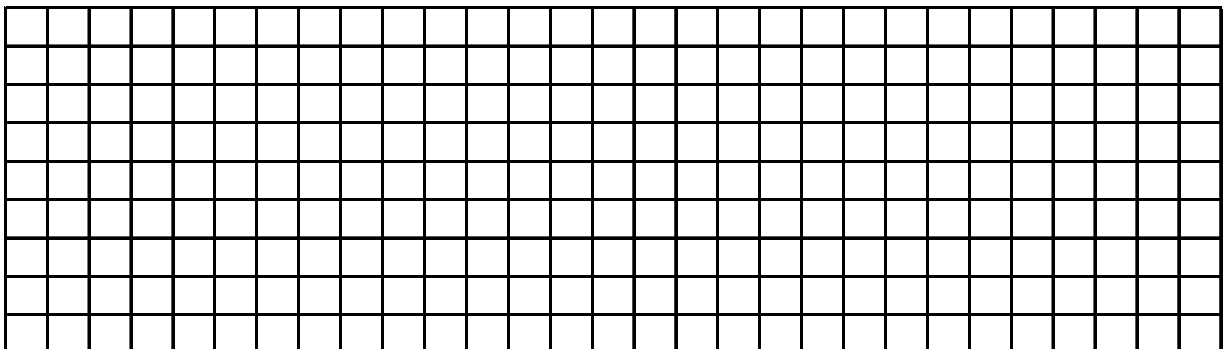
$$\frac{4}{6}$$



3) Which of these fractions is the smallest? $\frac{5}{6}$ or $\frac{7}{9}$ (use the grids to help)

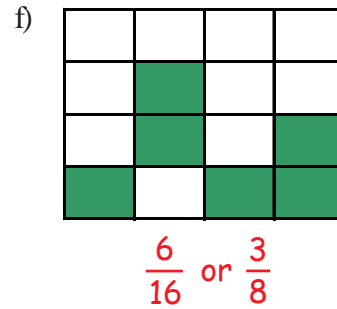
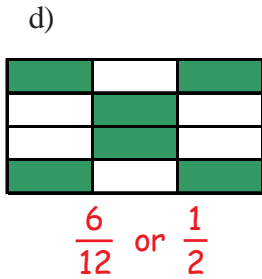
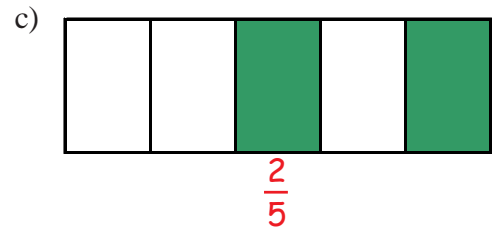
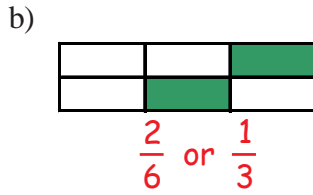
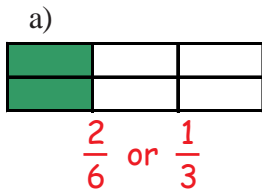


4) Which of these fractions is the largest? $\frac{2}{7}$ or $\frac{1}{3}$ (you must show your working)

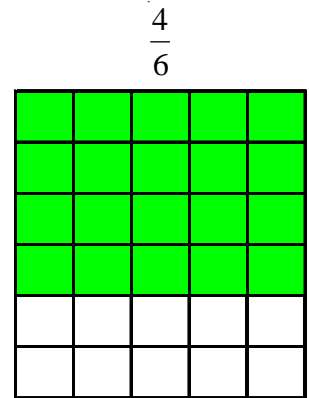
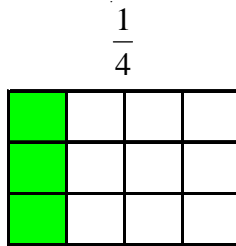
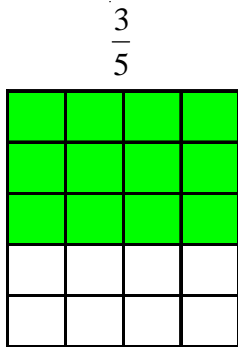


Shading Fractions

1) What fraction of each of the following shapes is shaded?

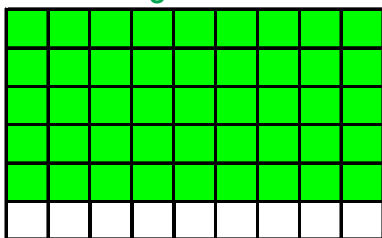


2) Shade the given fraction in the following grids.



3) Which of these fractions is the smallest?

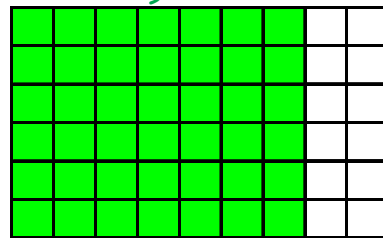
$\frac{5}{6} = 45 \text{ sq.}$



$\frac{5}{6}$ or $\frac{7}{9}$

(use the grids to help)

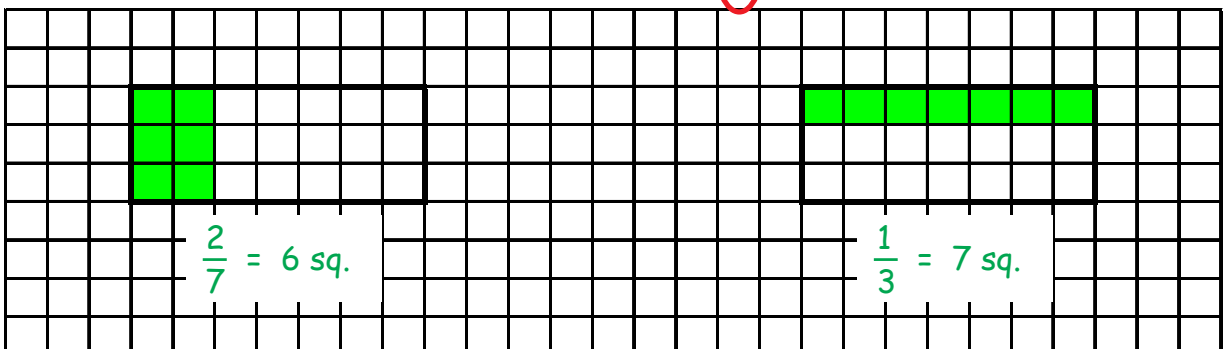
$\frac{7}{9} = 42 \text{ sq.}$



4) Which of these fractions is the largest?

$\frac{2}{7}$ or $\frac{1}{3}$

(you must show your working)



1. Change these fractions to decimals

eg. $\frac{1}{5} \xrightarrow{1 \div 5} 0.2$

a) $\frac{3}{5}$ b) $\frac{4}{5}$ c) $\frac{1}{4}$ d) $\frac{3}{4}$ e) $\frac{1}{3}$ f) $\frac{2}{3}$

2. Change these percentages to decimals

eg. $52\% \xrightarrow{52 \div 100} 0.52$

a) 63% b) 8% c) 59% d) 81% e) 28.5% f) 6.5%

3. Write the following numbers in order of size (smallest to largest)

a) 0.61 $\frac{2}{3}$ 59% 0.55 $\frac{3}{5}$

b) 81% 0.78 $\frac{4}{5}$ $\frac{3}{4}$ 0.805

c) $\frac{1}{3}$ 0.3 $\frac{1}{4}$ 28.5% 0.32

d) 0.23 21% $\frac{1}{5}$ $\frac{22}{100}$ 19.2%

e) 1% 0.012 $\frac{3}{100}$ 0.021 $\frac{1}{40}$

1. Change these fractions to decimals

eg. $\frac{1}{5} \xrightarrow{1 \div 5} 0.2$

a) $\frac{3}{5}$ **0.6** b) $\frac{4}{5}$ **0.8** c) $\frac{1}{4}$ **0.25** d) $\frac{3}{4}$ **0.75** e) $\frac{1}{3}$ **$0.\dot{3}$** f) $\frac{2}{3}$ **$0.\dot{6}$**

$$5 \overline{) 30} \begin{array}{r} 0.6 \\ \end{array}$$

2. Change these percentages to decimals

eg. $52\% \xrightarrow{52 \div 100} 0.52$

a) 63% **0.63** b) 8% **0.08** c) 59% **0.59** d) 81% **0.81** e) 28.5% **0.285** f) 6.5% **0.065**

3. Write the following numbers in order of size (smallest to largest)

a)	0.61	$\frac{2}{3}$	59%	0.55	$\frac{3}{5}$
	0.61	$0.\dot{6}$	0.59	0.55	0.6
	0.55	59%	$\frac{3}{5}$	0.61	$\frac{2}{3}$
<hr/>					
b)	81%	0.78	$\frac{4}{5}$	$\frac{3}{4}$	0.805
	0.81	0.78	0.8	0.75	0.805
	$\frac{3}{4}$	0.78	$\frac{4}{5}$	0.805	81%
<hr/>					
c)	$\frac{1}{3}$	0.3	$\frac{1}{4}$	28.5%	0.32
	$0.\dot{3}$	0.3	0.25	0.285	0.32
	$\frac{1}{4}$	28.5%	0.3	0.32	$\frac{1}{3}$
<hr/>					
d)	0.23	21%	$\frac{1}{5}$	$\frac{22}{100}$	19.2%
	0.23	0.21	0.2	0.22	0.192
	19.2%	$\frac{1}{5}$	21%	$\frac{22}{100}$	0.23
<hr/>					
e)	1%	0.012	$\frac{3}{100}$	0.021	$\frac{1}{40}$
	0.01	0.012	0.03	0.021	0.025
	1%	0.012	0.021	$\frac{1}{40}$	$\frac{3}{100}$

1) Work out an estimate

eg. $17 \times 193 \longrightarrow 20 \times 200 = 4000$

a) 12×304

c) 231×56

b) 38×72

d) 773×13

2) Work out an estimate

eg. $4.7 \times 54 \longrightarrow 5 \times 50 = 250$

a) 3.8×52

c) 9.6×265

b) 7.9×103

d) 512×2.4

3) Work out an estimate

eg. $37 \div 12 \longrightarrow 40 \div 10 = 4$

a) $122 \div 53$

c) $\frac{341}{28}$

b) $372 \div 44$

d) $\frac{109}{96}$

4) Work out an estimate

eg. $37 \div 1.2 \longrightarrow 40 \div 1 = 40$

a) $68 \div 1.7$

c) $\frac{253}{4.6}$

b) $37 \div 7.9$

d) $\frac{96}{10.4}$

5) Work out an estimate

eg. $\frac{62 \times 28}{89} \longrightarrow \frac{60 \times 30}{90} = \frac{1800}{90}$

a) $\frac{45 \times 21}{14}$

c) $\frac{42 \times 53}{2.2}$

b) $\frac{76 \times 17}{42}$

d) $\frac{33 \times 61}{8.7}$

1) Work out an estimate

eg. $17 \times 193 \longrightarrow 20 \times 200 = 4000$

a) 12×304 **3000**

10×300

b) 38×72 **2800**

40×70

c) 231×56 **12000**

200×60

d) 773×13 **8000**

800×10

2) Work out an estimate

eg. $4.7 \times 54 \longrightarrow 5 \times 50 = 250$

a) 3.8×52 **200**

4×50

b) 7.9×103 **800**

8×100

c) 9.6×265 **3000**

10×300

d) 512×2.4 **1000**

500×2

3) Work out an estimate

eg. $37 \div 12 \longrightarrow 40 \div 10 = 4$

a) $122 \div 53$ **2**

$100 \div 50$

b) $372 \div 44$ **10**

$400 \div 40$

c) $\frac{341}{28}$ $\frac{300}{30}$ **10**

d) $\frac{109}{96}$ $\frac{100}{100}$ **1**

4) Work out an estimate

eg. $37 \div 1.2 \longrightarrow 40 \div 1 = 40$

a) $68 \div 1.7$ **35**

$70 \div 2$

b) $37 \div 7.9$ **5**

$40 \div 8$

c) $\frac{253}{4.6}$ $\frac{300}{5}$ **60**

d) $\frac{96}{10.4}$ $\frac{100}{10}$ **10**

5) Work out an estimate

eg. $\frac{62 \times 28}{89} \longrightarrow \frac{60 \times 30}{90} = \frac{1800}{90}$

a) $\frac{45 \times 21}{14}$ $\frac{50 \times 20}{10}$ **100**

10

b) $\frac{76 \times 17}{42}$ $\frac{80 \times 20}{40}$ **40**

40

c) $\frac{42 \times 53}{2.2}$ $\frac{40 \times 50}{2}$ **1000**

2

d) $\frac{33 \times 61}{8.7}$ $\frac{30 \times 60}{9}$ **200**

9

- 1) Use the information that $23 \times 68 = 1564$
work out the value of:
- a) 2.3×68
 - b) 2.3×6.8
 - c) 0.23×68
 - d) 2.3×0.68
 - e) 230×68
 - f) 230×6.8
 - g) 2300×680
 - h) $1564 \div 23$
 - i) $1564 \div 2.3$
 - j) $15640 \div 23$
- 2) Using the information that $416 \times 35 = 14560$
work out the value of:
- a) 4.16×35
 - b) 41.6×0.35
 - c) 41600×350
 - d) 0.416×350
 - e) 4160×0.035
 - f) 41.6×350000
 - g) 0.00416×0.0035
 - h) $14560 \div 3.5$
 - i) $145.6 \div 4.16$
 - j) $1.456 \div 0.35$
- 3) If $78 \div 2.5 = 31.2$, what do you have to divide 78 by to get an answer of 0.312?
- 4) If $812 \times 2.9 = 2354.8$, what do you have to multiply 8.12 by to get an answer of 23548?

- 1) Use the information that $23 \times 68 = 1564$
work out the value of:
- a) 2.3×68 **156.4**
 - b) 2.3×6.8 **15.64**
 - c) 0.23×68 **15.64**
 - d) 2.3×0.68 **1.564**
 - e) 230×68 **15 640**
 - f) 230×6.8 **1 564**
 - g) 2300×680 **1 564 000**
 - h) $1564 \div 23$ **68**
 - i) $1564 \div 2.3$ **680**
 - j) $15640 \div 23$ **680**
- 2) Using the information that $416 \times 35 = 14560$
work out the value of:
- a) 4.16×35 **145.6**
 - b) 41.6×0.35 **14.56**
 - c) 41600×350 **14 560 000**
 - d) 0.416×350 **145.6**
 - e) 4160×0.035 **145.6**
 - f) 41.6×350000 **14 560 000**
 - g) 0.00416×0.0035 **0.00001456**
 - h) $14560 \div 3.5$ **4160**
 - i) $145.6 \div 4.16$ **35**
 - j) $1.456 \div 0.35$ **4.16**
- 3) If $78 \div 2.5 = 31.2$, what do you have to divide 78 by to
get an answer of 0.312? **250**
- 4) If $812 \times 2.9 = 2354.8$, what do you have to multiply 8.12 by to
get an answer of 23548? **2900**

1) a) $\begin{array}{r} 42 \\ +26 \\ \hline \end{array}$ b) $\begin{array}{r} 57 \\ +38 \\ \hline \end{array}$ c) $\begin{array}{r} 96 \\ +75 \\ \hline \end{array}$

2) a) $\begin{array}{r} 637 \\ +961 \\ \hline \end{array}$ b) $\begin{array}{r} 983 \\ +442 \\ \hline \end{array}$ c) $\begin{array}{r} 969 \\ +758 \\ \hline \end{array}$

3) a) $452 + 38$ b) $147 + 763$ c) $813 + 431 + 38$

- 4) There were two exhibitions at the NEC one Sunday.
3816 people went to one of the exhibitions and 13427 people went to the other exhibition.
How many people went to the NEC, in total, on the Sunday?

5) a) $2.6 + 1.2$ b) $2.74 + 6.81$ c) $45.36 + 6.81$

6) a) $23 + 1.5$ b) $13.6 + 38$ c) $13.2 + 17.82$

7) a) $\begin{array}{r} 78 \\ -42 \\ \hline \end{array}$ b) $\begin{array}{r} 74 \\ -26 \\ \hline \end{array}$ c) $\begin{array}{r} 62 \\ -39 \\ \hline \end{array}$

8) a) $\begin{array}{r} 485 \\ -291 \\ \hline \end{array}$ b) $\begin{array}{r} 773 \\ -486 \\ \hline \end{array}$ c) $\begin{array}{r} 100 \\ -34 \\ \hline \end{array}$

9) a) $653 - 48$ b) $362 - 183$ c) $2000 - 461$

- 10) There were two films showing at a cinema one Saturday.
One of the films was shown in a large room and the other was in a smaller room.
The film in the larger room was watched by a total of 3562 people.
The film in the smaller room was watched by 1671 people.
How many more people saw the film in the larger room?

11) a) $782 + 426 - 278$ b) $8162 + 1149 - 799$

$$1) \quad \begin{array}{r} \text{a) } 42 \\ + 26 \\ \hline 68 \end{array} \quad \begin{array}{r} \text{b) } 57 \\ + 38 \\ \hline 95 \end{array} \quad \begin{array}{r} \text{c) } 96 \\ + 75 \\ \hline 171 \end{array}$$

$$2) \quad \begin{array}{r} \text{a) } 637 \\ + 961 \\ \hline 1598 \end{array} \quad \begin{array}{r} \text{b) } 983 \\ + 442 \\ \hline 1425 \end{array} \quad \begin{array}{r} \text{c) } 969 \\ + 758 \\ \hline 1727 \end{array}$$

$$3) \quad \begin{array}{r} \text{a) } 452 + 38 \\ 490 \end{array} \quad \begin{array}{r} \text{b) } 147 + 763 \\ 910 \end{array} \quad \begin{array}{r} \text{c) } 813 + 431 + 38 \\ 1282 \end{array}$$

4) There were two exhibitions at the NEC one Sunday.
3816 people went to one of the exhibitions and 13427 people
went to the other exhibition.

$$\begin{array}{r} 13427 \\ + 3816 \\ \hline 17243 \end{array}$$

How many people went to the NEC, in total, on the Sunday? **17243**

$$5) \quad \begin{array}{r} \text{a) } 2.6 + 1.2 \\ 3.8 \end{array} \quad \begin{array}{r} \text{b) } 2.74 + 6.81 \\ 9.55 \end{array} \quad \begin{array}{r} \text{c) } 45.36 + 6.81 \\ 52.17 \end{array}$$

$$6) \quad \begin{array}{r} \text{a) } 23 + 1.5 \\ 24.5 \end{array} \quad \begin{array}{r} \text{b) } 13.6 + 38 \\ 51.6 \end{array} \quad \begin{array}{r} \text{c) } 13.2 + 17.82 \\ 31.02 \end{array}$$

$$7) \quad \begin{array}{r} \text{a) } 78 \\ - 42 \\ \hline 36 \end{array} \quad \begin{array}{r} \text{b) } 74 \\ - 26 \\ \hline 48 \end{array} \quad \begin{array}{r} \text{c) } 62 \\ - 39 \\ \hline 23 \end{array}$$

$$8) \quad \begin{array}{r} \text{a) } 485 \\ - 291 \\ \hline 194 \end{array} \quad \begin{array}{r} \text{b) } 773 \\ - 486 \\ \hline 287 \end{array} \quad \begin{array}{r} \text{c) } 100 \\ - 34 \\ \hline 66 \end{array}$$

$$9) \quad \begin{array}{r} \text{a) } 653 - 48 \\ 605 \end{array} \quad \begin{array}{r} \text{b) } 362 - 183 \\ 179 \end{array} \quad \begin{array}{r} \text{c) } 2000 - 461 \\ 1539 \end{array}$$

10) There were two films showing at a cinema one Saturday.

One of the films was shown in a large room and the other was
in a smaller room.

The film in the larger room was watched by a total of 3562 people.

The film in the smaller room was watched by 1671 people.

$$\begin{array}{r} 3562 \\ - 1671 \\ \hline 1891 \end{array}$$

How many more people saw the film in the larger room? **1891**

$$11) \quad \begin{array}{r} \text{a) } 782 + 426 - 278 \\ 930 \end{array} \quad \begin{array}{r} \text{b) } 8162 + 1149 - 799 \\ 8512 \end{array}$$

- 1) Work out
 - a) 13×18
 - b) 135×27
 - c) 116×41
 - d) 264×43
 - e) 326×24
 - f) 281×59
 - g) 286×48
 - h) 428×34
 - i) 461×45
- 2) “MathsWatch Travel” has 36 coaches.
Each of these coaches can carry 53 passengers.
How many passengers in total can all the coaches carry?
- 3) “MathsWatch Tours” has a plane that will carry 47 passengers.
To fly from Manchester to Lyon, each passenger pays £65
Work out the total amount that the passengers pay.
- 4) A litre of petrol costs 86p.
Work out the cost of 35 litres of petrol.
Give your answer in pounds (£).
- 5) Last week, MathsWatch posted 439 parcels.
Each parcel needed a 97p stamp.
Work out the total cost of the stamps.
Give your answer in pounds (£).
- 6) A stationery supplier sells rulers for 23p each.
MathsWatch college buys 455 of these rulers.
Work out the total cost of these 455 rulers.
Give your answer in pounds (£).
- 7) A Maths book costs £1.99
Mr Smith buys a class set of 36 books.
Work out the total cost of the 36 books.
- 8) The cost of a calculator is £7.39
Work out the cost of 32 of these calculators.
- 9) Salvatore makes pizzas.
He receives an order for 34 pizzas.
Salvatore charges £2.55 for each pizza.
Work out the total amount he would charge for 34 pizzas.
- 10) A ream of tracing paper costs £3.23
Work out the cost of 45 reams of tracing paper.

- 1) Work out
- a) 13×18 **234** d) 264×43 **11 352** g) 286×48 **13 728**
- b) 135×27 **3 645** e) 326×24 **7 824** h) 428×34 **14 552**
- c) 116×41 **4 756** f) 281×59 **16 579** i) 461×45 **20 745**
- 2) “MathsWatch Travel” has 36 coaches.
Each of these coaches can carry 53 passengers. **36×53**
How many passengers in total can all the coaches carry? **1 908**
- 3) “MathsWatch Tours” has a plane that will carry 47 passengers.
To fly from Manchester to Lyon, each passenger pays £65 **47×65**
Work out the total amount that the passengers pay. **£3 055**
- 4) A litre of petrol costs 86p.
Work out the cost of 35 litres of petrol. **$86 \times 35 = 3010$**
Give your answer in pounds (£). **£30.10**
- 5) Last week, MathsWatch posted 439 parcels.
Each parcel needed a 97p stamp.
Work out the total cost of the stamps. **$439 \times 97 = 42583$**
Give your answer in pounds (£). **£425.83**
- 6) A stationery supplier sells rulers for 23p each.
MathsWatch college buys 455 of these rulers.
Work out the total cost of these 455 rulers. **$23 \times 455 = 10465$**
Give your answer in pounds (£). **£104.65**
- 7) A Maths book costs £1.99
Mr Smith buys a class set of 36 books. **$199 \times 36 = 7164$**
Work out the total cost of the 36 books. **£71.64**
- 8) The cost of a calculator is £7.39 **$739 \times 32 = 23648$**
Work out the cost of 32 of these calculators. **£236.48**
- 9) Salvatore makes pizzas.
He receives an order for 34 pizzas.
Salvatore charges £2.55 for each pizza. **$34 \times 255 = 8670$**
Work out the total amount he would charge for 34 pizzas. **£86.70**
- 10) A ream of tracing paper costs £3.23 **$323 \times 45 = 14535$**
Work out the cost of 45 reams of tracing paper. **£145.35**

- 1) Work out
- | | | |
|------------------|------------------|------------------|
| a) $325 \div 5$ | d) $377 \div 29$ | g) $75 \div 4$ |
| b) $448 \div 8$ | e) $27 \div 6$ | h) $135 \div 20$ |
| c) $221 \div 13$ | f) $123 \div 15$ | i) $381 \div 12$ |

- 2) A box can hold 19 books.
Work out how many boxes will be needed to hold 646 books.

- 3) The distance from Glasgow to Paris is 1290 km.
A flight from Glasgow to Paris lasts 3 hours.

Given that

$\text{Average speed} = \frac{\text{Distance}}{\text{Time}}$
--

Work out the average speed of the aeroplane in km/h.

- 4) Pencils cost 25p each.
Mr Smith spends £15 on pencils.
Work out the number of pencils he gets.
- 5) Yesterday, Gino was paid £19.61 for delivering pizzas.
He is paid 53p for each pizza he delivers.
Work out how many pizzas Gino delivered yesterday.
- 6) Emma sold 38 teddy bears for a total of £513
She sold each teddy bear for the same price.
Work out the price at which Emma sold each teddy bear.

- 7)
- | |
|--|
| Canal boat for hire
£1855.00
for 14 days |
|--|

Work out the cost per day of hiring the canal boat.

- 8) A teacher has £539 to spend on books.
Each book costs £26
How many books can the teacher buy?
- 9) John delivers large wooden crates with his van.
The weight of each crate is 68 kg.
The greatest weight the van can hold is 980 kg.
Work out the greatest number of crates that the van can hold.
- 10) Rulers costs 17p each.
MathsWatch High School has £120 to spend on rulers.
Work out the number of rulers bought.

- 1) Work out
- a) $325 \div 5$ **65** d) $377 \div 29$ **13** g) $75 \div 4$ **18.75**
- b) $448 \div 8$ **56** e) $27 \div 6$ **4.5** h) $135 \div 20$ **6.75**
- c) $221 \div 13$ **17** f) $123 \div 15$ **8.2** i) $381 \div 12$ **31.75**
- 2) A box can hold 19 books. **$646 \div 19$**
 Work out how many boxes will be needed to hold 646 books. **34 boxes**
- 3) The distance from Glasgow to Paris is 1290 km.
 A flight from Glasgow to Paris lasts 3 hours.
- Given that

$Average\ speed = \frac{Distance}{Time}$
--

 $1290 \div 3$
 Work out the average speed of the aeroplane in km/h. **430 km/h**
- 4) Pencils cost 25p each.
 Mr Smith spends £15 on pencils. **$1500 \div 25$**
 Work out the number of pencils he gets. **60 pencils**
- 5) Yesterday, Gino was paid £19.61 for delivering pizzas.
 He is paid 53p for each pizza he delivers. **$1961 \div 53$**
 Work out how many pizzas Gino delivered yesterday. **37 pizzas**
- 6) Emma sold 38 teddy bears for a total of £513
 She sold each teddy bear for the same price. **$513 \div 38$**
 Work out the price at which Emma sold each teddy bear. **£13.50**
- 7)

Canal boat for hire £1855.00 for 14 days
--

 $1855 \div 14$
 Work out the cost per day of hiring the canal boat. **£132.50**
- 8) A teacher has £539 to spend on books.
 Each book costs £26 **$539 \div 26$**
 How many books can the teacher buy? **20 books**
- 9) John delivers large wooden crates with his van.
 The weight of each crate is 68 kg.
 The greatest weight the van can hold is 980 kg. **$980 \div 68$**
 Work out the greatest number of crates that the van can hold. **14 crates**
- 10) Rulers costs 17p each.
 MathsWatch High School has £120 to spend on rulers. **$12000 \div 17$**
 Work out the number of rulers bought. **705 rulers**

1) Work out

a) 6×0.2

d) 0.2×0.8

b) 0.2×0.3

e) 0.03×0.9

c) 0.4×7

f) 1.5×0.2

2) A box contains 7 books, each weighing 2.5 kg.
Work out the total weight of the box.

3) John takes 13 boxes out of his van.
The weight of each box is 25.5 kg
Work out the total weight of the 13 boxes.

4) Work out

a) $9 \div 0.3$

d) $25 \div 0.5$

b) $6 \div 0.1$

e) $21 \div 0.3$

c) $12 \div 0.4$

f) $15 \div 0.2$

5) Work out

a) $3.6 \div 0.4$

d) $0.56 \div 0.08$

b) $0.8 \div 0.2$

e) $5.5 \div 0.05$

c) $2.4 \div 0.4$

f) $8.1 \div 0.09$

6) John takes boxes out of his van.
The total weight of the boxes is 4.9 kg
The weight of each box is 0.7 kg
Work out the number of boxes in John's van.

7) Mr Rogers bought a bag of elastic bands for £6
Each elastic band costs 12p.
Work out the number of elastic bands in the bag.

1) Work out

a) 6×0.2 **1.2**

d) 0.2×0.8 **0.16**

b) 0.2×0.3 **0.06**

e) 0.03×0.9 **0.027**

c) 0.4×7 **2.8**

f) 1.5×0.2 **0.3**

2) A box contains 7 books, each weighing 2.5 kg. **7×2.5**
Work out the total weight of the box. **17.5 kg**

3) John takes 13 boxes out of his van.
The weight of each box is 25.5 kg **13×25.5**
Work out the total weight of the 13 boxes. **331.5 kg**

4) Work out

a) $9 \div 0.3$ **30**

d) $25 \div 0.5$ **50**

b) $6 \div 0.1$ **60**

e) $21 \div 0.3$ **70**

c) $12 \div 0.4$ **30**

f) $15 \div 0.2$ **75**

5) Work out

a) $3.6 \div 0.4$ **9**

d) $0.56 \div 0.08$ **7**

b) $0.8 \div 0.2$ **4**

e) $5.5 \div 0.05$ **110**

c) $2.4 \div 0.4$ **6**

f) $8.1 \div 0.09$ **90**

6) John takes boxes out of his van.
The total weight of the boxes is 4.9 kg
The weight of each box is 0.7 kg **$4.9 \div 0.7$**
Work out the number of boxes in John's van. **7 boxes**

7) Mr Rogers bought a bag of elastic bands for £6
Each elastic band costs 12p. **$600 \div 12$**
Work out the number of elastic bands in the bag. **50 elastic bands**

- 1) Round the following numbers to 1 decimal place
 - a) 13.681
 - b) 344.7234
 - c) 0.76133

- 2) Round the following numbers to 2 decimal places
 - a) 45.7241
 - b) 0.6851
 - c) 4623.33621

- 3) Round the following numbers to 1 significant figure
 - a) 4252
 - b) 26112
 - c) 7523987

- 4) Round the following numbers to 1 significant figure
 - a) 963
 - b) 9562
 - c) 991236

- 5) Round the following numbers to 1 significant figure
 - a) 0.005621
 - b) 0.07756
 - c) 0.0000523647

- 6) Round the following numbers to 2 significant figures
 - a) 752305
 - b) 147006
 - c) 296124

- 7) Round the following numbers to 2 significant figures
 - a) 0.00036264
 - b) 0.00045921
 - c) 0.0003654871

- 8) Round the following numbers to 3 significant figures
 - a) 923146
 - b) 0.0048912
 - c) 299622

- 9) Use a calculator to work out the following sums.
Give all answers to 3 significant figures.
 - a) 236×149
 - b) $17.3 \div 0.14$
 - c) $67 \div 3892$
 - d) 779×9984
 - e) $47.5 \div 0.0037$
 - f) $215 \times 3.2 \div 0.0018$

1) Round the following numbers to 1 decimal place

- a) 13.681
13.7
- b) 344.7234
344.7
- c) 0.76133
0.8

2) Round the following numbers to 2 decimal places

- a) 45.7241
45.72
- b) 0.6851
0.69
- c) 4623.33621
4623.34

3) Round the following numbers to 1 significant figure

- a) 4252
4 000
- b) 26112
30 000
- c) 7523987
8 000 000

4) Round the following numbers to 1 significant figure

- a) 963
1 000
- b) 9562
10 000
- c) 991236
1 000 000

5) Round the following numbers to 1 significant figure

- a) 0.005621
0.006
- b) 0.07756
0.08
- c) 0.0000523647
0.00005

6) Round the following numbers to 2 significant figures

- a) 752305
750 000
- b) 147006
150 000
- c) 296124
300 000

7) Round the following numbers to 2 significant figures

- a) 0.00036264
0.00036
- b) 0.00045921
0.00046
- c) 0.0003654871
0.00037

8) Round the following numbers to 3 significant figures

- a) 923146
923 000
- b) 0.0048912
0.00489
- c) 299622
300 000

9) Use a calculator to work out the following sums.

Give all answers to 3 significant figures.

- a) 236×149
35 200
- b) $17.3 \div 0.14$
124
- c) $67 \div 3892$
0.0172
- d) 779×9984
7 780 000
- e) $47.5 \div 0.0037$
12 800
- f) $215 \times 3.2 \div 0.0018$
382 000

- 1) Which number is in the middle of
 - a) 3 and 9
 - b) 12 and 28
 - c) 11 and 22
 - d) 17 and 32
 - e) 72 and 108
 - f) 1 and 100
 - g) -6 and 2
 - h) -9 and -3
 - i) 3.2 and 3.8
 - j) 5.7 and 6.3
 - k) 58.3 and 73.5

- 2)
 - a) 7 is in the middle of 3 and which other number?
 - b) 16 is in the middle of 9 and which other number?
 - c) 2.4 is in the middle of 1.1 and which other number?

- 1) Which number is in the middle of
- a) 3 and 9 **6**
 - b) 12 and 28 **20**
 - c) 11 and 22 **16.5**
 - d) 17 and 32 **24.5**
 - e) 72 and 108 **90**
 - f) 1 and 100 **50.5**
 - g) -6 and 2 **-2**
 - h) -9 and -3 **-6**
 - i) 3.2 and 3.8 **3.5**
 - j) 5.7 and 6.3 **6**
 - k) 58.3 and 73.5 **65.9**
- 2) a) 7 is in the middle of 3 and which other number? **11**
- b) 16 is in the middle of 9 and which other number? **23**
- c) 2.4 is in the middle of 1.1 and which other number? **3.7**

1) Write down the reciprocal of

a) 8

b) 3

c) 1

d) 12

2) Write down the reciprocal of

a) $\frac{1}{2}$

b) $\frac{1}{3}$

c) $\frac{1}{4}$

d) $\frac{1}{8}$

3) Write down the reciprocal of

a) 0.1

b) 0.5

c) 0.2

4) Why can't we have a reciprocal of 0?

1) Write down the reciprocal of

a) 8 $\frac{1}{8}$

b) 3 $\frac{1}{3}$

c) 1 1

d) 12 $\frac{1}{12}$

2) Write down the reciprocal of

a) $\frac{1}{2}$ 2

b) $\frac{1}{3}$ 3

c) $\frac{1}{4}$ 4

d) $\frac{1}{8}$ 8

3) Write down the reciprocal of

a) 0.1 $\frac{1}{0.1}$ 10

b) 0.5 $\frac{1}{0.5}$ 2

c) 0.2 $\frac{1}{0.2}$ 5

4) Why can't we have a reciprocal of 0? *Because division by "0" does not exist.*

Non-Calculator

- 1) 8 bananas cost £1.60
Work out the cost of 5 bananas.
 - 2) Emily bought 4 identical pairs of sock for £3.60
Work out the cost of 9 pairs of these socks.
 - 3) The price of a box of chocolates is £7.20
There are 36 chocolates in the box.
Work out the cost of one chocolate.
 - 4) Theresa bought 5 theatre tickets for £60
Work out the cost of 9 theatre tickets.
 - 5) Jenny buys 4 folders.
The total cost of these 4 folders is £6.40
Work out the total cost of 7 of these folders.
-

Calculator

- 6) The cost of 15 litres of petrol is £12
Work out the cost of 20 litres of petrol.
- 7) 3 maths books cost £7.47
Work out the cost of 5 of these.
- 8) Five 1 litre tins of paint cost a total of £48.75
Work out the cost of seven of these 1 litre tins of paint.
- 9) William earns £9.30 for $1\frac{1}{2}$ hours of work.
Work out how much he would earn for:
 - a) 30 minutes
 - b) 5 hours
- 10) It took 1 hour for Emyr to lay 150 bricks.
He always works at the same speed.
How long will it take Emyr to lay 720 bricks?
Give your answer in hours and minutes.

Non-Calculator

- 1) 8 bananas cost £1.60
Work out the cost of 5 bananas. **£1.00**
- $$\begin{array}{r} 0.20 \\ 8 \overline{) 1.60} \\ \underline{160} \\ 0 \end{array}$$
- $$5 \times 0.20 = 1.00$$
- 2) Emily bought 4 identical pairs of sock for £3.60
Work out the cost of 9 pairs of these socks. **£8.10**
- $$\begin{array}{r} 0.90 \\ 4 \overline{) 3.60} \\ \underline{360} \\ 0 \end{array}$$
- $$9 \times 0.90 = 8.10$$
- 3) The price of a box of chocolates is £7.20
There are 36 chocolates in the box.
Work out the cost of one chocolate. **£0.20 or 20p**
- $$\begin{array}{r} 0.20 \\ 36 \overline{) 7.20} \\ \underline{720} \\ 0 \end{array}$$
- 4) Theresa bought 5 theatre tickets for £60
Work out the cost of 9 theatre tickets. **£108**
- $$\begin{array}{r} 12 \\ 5 \overline{) 60} \\ \underline{60} \\ 0 \end{array}$$
- $$9 \times 12 = 108$$
- 5) Jenny buys 4 folders.
The total cost of these 4 folders is £6.40
Work out the total cost of 7 of these folders. **£11.20**
- $$\begin{array}{r} 1.60 \\ 4 \overline{) 6.40} \\ \underline{640} \\ 0 \end{array}$$
- $$7 \times 1.60 = 11.20$$

Calculator

- 6) The cost of 15 litres of petrol is £12
Work out the cost of 20 litres of petrol. **£16**
- $$12 \div 15 = \pounds 0.80$$
- $$20 \times 0.8 = 16$$
- 7) 3 maths books cost £7.47
Work out the cost of 5 of these. **£12.45**
- $$7.47 \div 3 = \pounds 2.49$$
- $$5 \times 2.49 = 12.45$$
- 8) Five 1 litre tins of paint cost a total of £48.75
Work out the cost of seven of these 1 litre tins of paint. **£68.25**
- $$48.75 \div 5 = 9.75$$
- $$7 \times 9.75 = 68.25$$
- 9) William earns £9.30 for $1\frac{1}{2}$ hours of work.
Work out how much he would earn for:
- a) 30 minutes **£3.10**
- $$9.30 \div 1.5 = \pounds 6.20/\text{hr}$$
- $$0.5 \times 6.2 = 3.10$$
- b) 5 hours **£31**
- $$5 \times 6.2 = 31$$
- 10) It took 1 hour for Emyr to lay 150 bricks.
He always works at the same speed.
How long will it take Emyr to lay 720 bricks?
Give your answer in hours and minutes. **4 hrs and 48 mins** or
- $$1 \text{ hr} = 60 \text{ mins}$$
- $$60 \div 150 = 0.4 \text{ mins/brick}$$
- $$720 \times 0.4 = 288 \text{ mins}$$
- $$720 \div 150 = 4.8 \text{ hours}$$
- $$0.8 \text{ hours} = 0.8 \times 60 = 48 \text{ mins}$$
- $$4.8 \text{ hours} = 4 \text{ hours and } 48 \text{ mins}$$

- 1) The table shows the distances in kilometres between some cities in the USA.

San Francisco			
4827	New York		
4990	2132	Miami	
668	4541	4375	Los Angeles
3493	1352	2183	3366

Chicago

- a) Write down the distance between San Francisco and Miami.

One of the cities in the table is 4541 km from Los Angeles.

- b) Write down the name of this city.
- c) Write down the name of the city which is furthest from Chicago.

- 2) The table shows the distances in miles between four cities.

London			
155	Cardiff		
212	245	York	
413	400	193	Edinburgh

- a) Write down the distance between London and York.
- b) Write down the distance between Edinburgh and Cardiff.
- c) Which two cities are the furthest apart?

Tom travels from London to York.

He then travels from York to Edinburgh.

He finally travels back to London from Edinburgh.

- d) Work out the total distance travelled by Tom.

Peter and Jessica both drive to York.

Peter travels from London whilst Jessica travels from Cardiff.

- e) Who travels the furthest out of Peter and Jessica and by how much?

Distance Tables

1) The table shows the distances in kilometres between some cities in the USA.

San Francisco			
4827	New York		
4990	2132	Miami	
668	4541	4375	Los Angeles
3493	1352	2183	3366 Chicago

a) Write down the distance between San Francisco and Miami. **4990 km**

One of the cities in the table is 4541 km from Los Angeles.

b) Write down the name of this city. **New York**

c) Write down the name of the city which is furthest from Chicago. **San Francisco**

2) The table shows the distances in miles between four cities.

London			
155	Cardiff		
212	245	York	
413	400	193	Edinburgh

a) Write down the distance between London and York. **212 miles**

b) Write down the distance between Edinburgh and Cardiff. **400 miles**

c) Which two cities are the furthest apart? **London and Edinburgh**

Tom travels from London to York. **212**
 He then travels from York to Edinburgh. **+ 193**
 He finally travels back to London from Edinburgh. **+ 413**

d) Work out the total distance travelled by Tom. **818 miles**

Peter and Jessica both drive to York.
 Peter travels from London whilst Jessica travels from Cardiff.

$$245 - 212 = 33$$

e) Who travels the furthest out of Peter and Jessica and by how much? **Jessica by 33 miles**

- 1) Change the following to the 24 hour clock
 - a) 4.30 pm
 - b) 5 am
 - c) 10.26 am
 - d) 7.15 pm
 - e) Quarter past midnight
 - f) Half past noon

- 2) Change the following to the 12 hour clock
 - a) 06 35
 - b) 14 30
 - c) 12 45
 - d) 19 15
 - e) 00 50
 - f) Half past midnight

- 3) What is the difference in hours and minutes between the following
 - a) 10.15 pm and 11.30 pm
 - b) 14 20 and 17 10
 - c) 11.50 pm and 3.20 am
 - d) 22 45 and 01 00

- 4) Here is part of a train timetable

Manchester	05 15	06 06	06 45	07 05	07 15	07 46
Stockport	05 26	06 16	06 55	07 15	07 25	07 55
Macclesfield	05 39	06 29	07 08		07 38	08 08
Stoke	05 54	06 45	07 24		07 54	08 24
Stafford	06 12		07 41		08 11	
Euston	08 09	08 26	09 06	09 11	09 50	10 08

- a) Tim catches the 06 06 train from Manchester.
At what time should he expect to arrive at Euston?

- b) Jenny arrives at the Stockport train station at 07 00
 - (i) How long should she expect to wait for a train to Stoke?
 - (ii) How long should her train journey take?

- c) Sarah needs to travel to Euston from Macclesfield.
She has to arrive at Euston before 09 30.
What is the departure time of the latest train she can catch to get there on time?

- 1) Change the following to the 24 hour clock
- a) 4.30 pm **16 30** d) 7.15 pm **19 15**
 b) 5 am **05 00** e) Quarter past midnight **00 15**
 c) 10.26 am **10 26** f) Half past noon **12 30**
- 2) Change the following to the 12 hour clock
- a) 06 35 **6.35 am** d) 19 15 **7.15 pm**
 b) 14 30 **2.30 pm** e) 00 50 **0.50 am**
 c) 12 45 **12.45 pm** f) Half past midnight **0.30 am**
- 3) What is the difference in hours and minutes between the following
- a) 10.15 pm and 11.30 pm **1 hr 15 mins**
 b) 14 20 and 17 10 **2 hrs 50 mins**
 c) 11.50 pm and 3.20 am **3 hrs 30 mins**
 d) 22 45 and 01 00 **2 hrs 15 mins**
- 4) Here is part of a train timetable

Manchester	05 15	06 06	06 45	07 05	07 15	07 46
Stockport	05 26	06 16	06 55	07 15	07 25	07 55
Macclesfield	05 39	06 29	07 08		07 38	08 08
Stoke	05 54	06 45	07 24		07 54	08 24
Stafford	06 12		07 41		08 11	
Euston	08 09	08 26	09 06	09 11	09 50	10 08

- a) Tim catches the 06 06 train from Manchester.
 At what time should he expect to arrive at Euston? **08 26**
- b) Jenny arrives at the Stockport train station at 07 00
- (i) How long should she expect to wait for a train to Stoke? **25 mins**
 (ii) How long should her train journey take? **29 mins**
- c) Sarah needs to travel to Euston from Macclesfield.
 She has to arrive at Euston before 09 30.
 What is the departure time of the latest train she can catch to get there on time? **07 08**

- 1) Write the following using indices:

eg. $3 \times 3 \times 3 \times 3 = 3^4$

a) $2 \times 2 \times 2 \times 2$

d) $12 \times 12 \times 12 \times 12 \times 12$

b) $4 \times 4 \times 4$

e) 3.6×3.6

c) $5 \times 5 \times 5 \times 5 \times 5 \times 5$

f) $5.2 \times 5.2 \times 5.2$

- 2) Write each of the following as a single power:

eg. $5^2 \times 5^4 = 5^6$

a) $6^2 \times 6^3$

d) $5^3 \times 5$

b) $7^4 \times 7^2$

e) $2^9 \times 2^3$

c) $9^3 \times 9^6$

f) $7.2^3 \times 7.2^2$

- 3) Write each of the following as a single power:

eg. $7^5 \div 7^2 = 7^3$

a) $9^5 \div 9^3$

d) $\frac{7^8}{7^3}$

b) $6^9 \div 6^5$

e) $\frac{3^6}{3}$

c) $11^7 \div 11^2$

f) $\frac{8^{15}}{8^4}$

- 4) Write each of the following as a single power:

eg. $\frac{7^3 \times 7^8}{7^6} = \frac{7^{11}}{7^6} = 7^5$

a) $\frac{4^7 \times 4^3}{4^6}$

b) $\frac{9^2 \times 9^6}{9^4}$

- 5) Match together cards with the same answer

5^7

$5^{10} \div 5^6$

$5^6 \times 5^2$

5^3

5^2

5^8

5×5

$\frac{5^2 \times 5^4}{5^3}$

$5^2 \times 5^5$

5^4

1) Write the following using indices:

eg. $3 \times 3 \times 3 \times 3 = 3^4$

a) $2 \times 2 \times 2 \times 2 = 2^4$

d) $12 \times 12 \times 12 \times 12 \times 12 = 12^5$

b) $4 \times 4 \times 4 = 4^3$

e) $3.6 \times 3.6 = 3.6^2$

c) $5 \times 5 \times 5 \times 5 \times 5 \times 5 = 5^6$

f) $5.2 \times 5.2 \times 5.2 = 5.2^3$

2) Write each of the following as a single power:

eg. $5^2 \times 5^4 = 5^6$

a) $6^2 \times 6^3 = 6^5$

d) $5^3 \times 5 = 5^4$

b) $7^4 \times 7^2 = 7^6$

e) $2^9 \times 2^3 = 2^{12}$

c) $9^3 \times 9^6 = 9^9$

f) $7.2^3 \times 7.2^2 = 7.2^5$

3) Write each of the following as a single power:

eg. $7^5 \div 7^2 = 7^3$

a) $9^5 \div 9^3 = 9^2$

d) $\frac{7^8}{7^3} = 7^5$

b) $6^9 \div 6^5 = 6^4$

e) $\frac{3^6}{3} = 3^5$

c) $11^7 \div 11^2 = 11^5$

f) $\frac{8^{15}}{8^4} = 8^{11}$

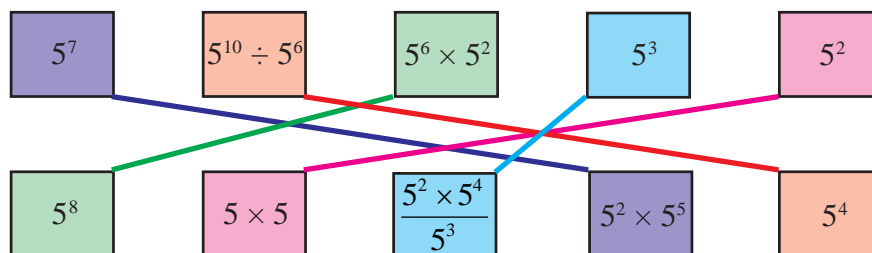
4) Write each of the following as a single power:

eg. $\frac{7^3 \times 7^8}{7^6} = \frac{7^{11}}{7^6} = 7^5$

a) $\frac{4^7 \times 4^3}{4^6} = \frac{4^{10}}{4^6} = 4^4$

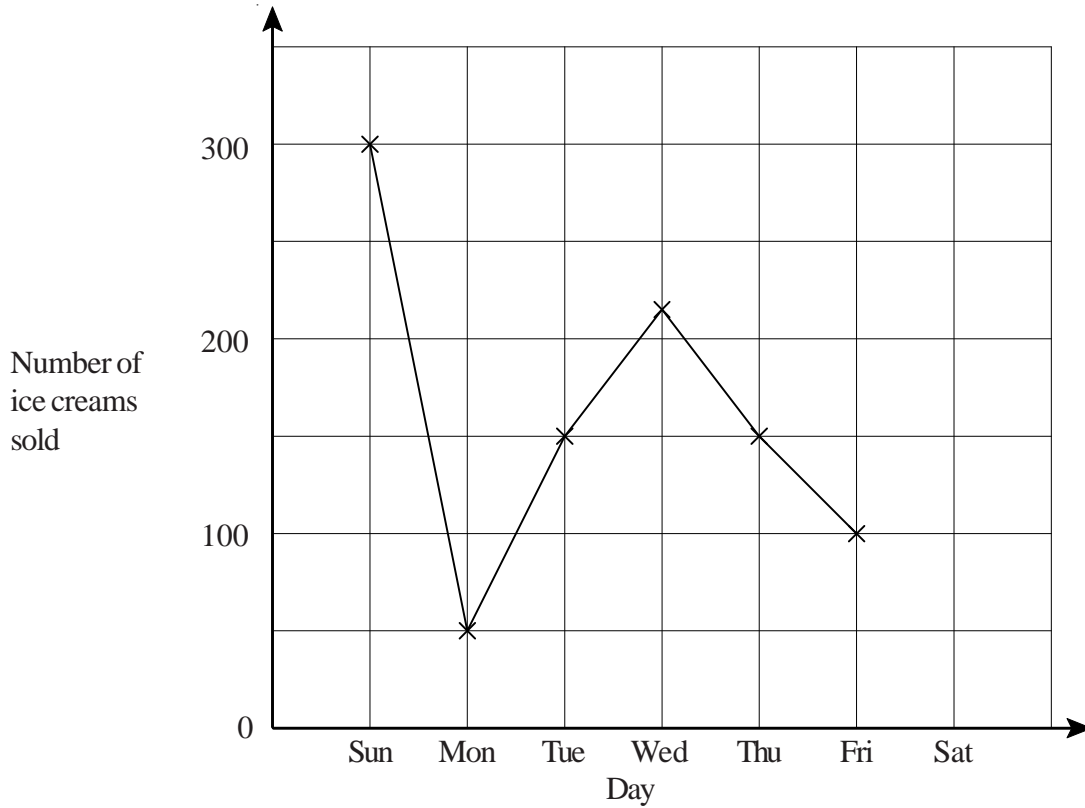
b) $\frac{9^2 \times 9^6}{9^4} = \frac{9^8}{9^4} = 9^4$

5) Match together cards with the same answer



Line Graphs

1) The graph shows the number of ice creams sold each day during one week.



- a) How many more ice creams were sold on Sunday than on Friday?
- b) Explain what might have happened on Monday.
- c) On Saturday, 250 ice creams were sold.
Update the graph with this information.
- d) About how many ice creams were sold on Wednesday?

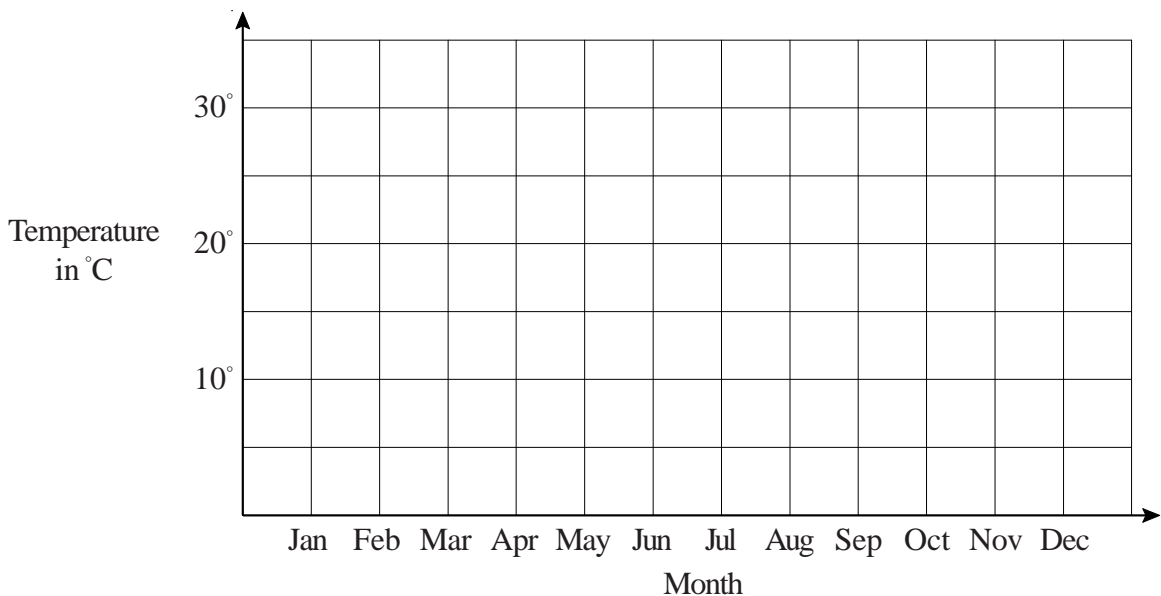
2) The average temperature, in degrees Centigrade, was recorded for each month.

The results are as follows:

January 5°C February 3°C March 8°C April 13°C May 15°C June 21°C

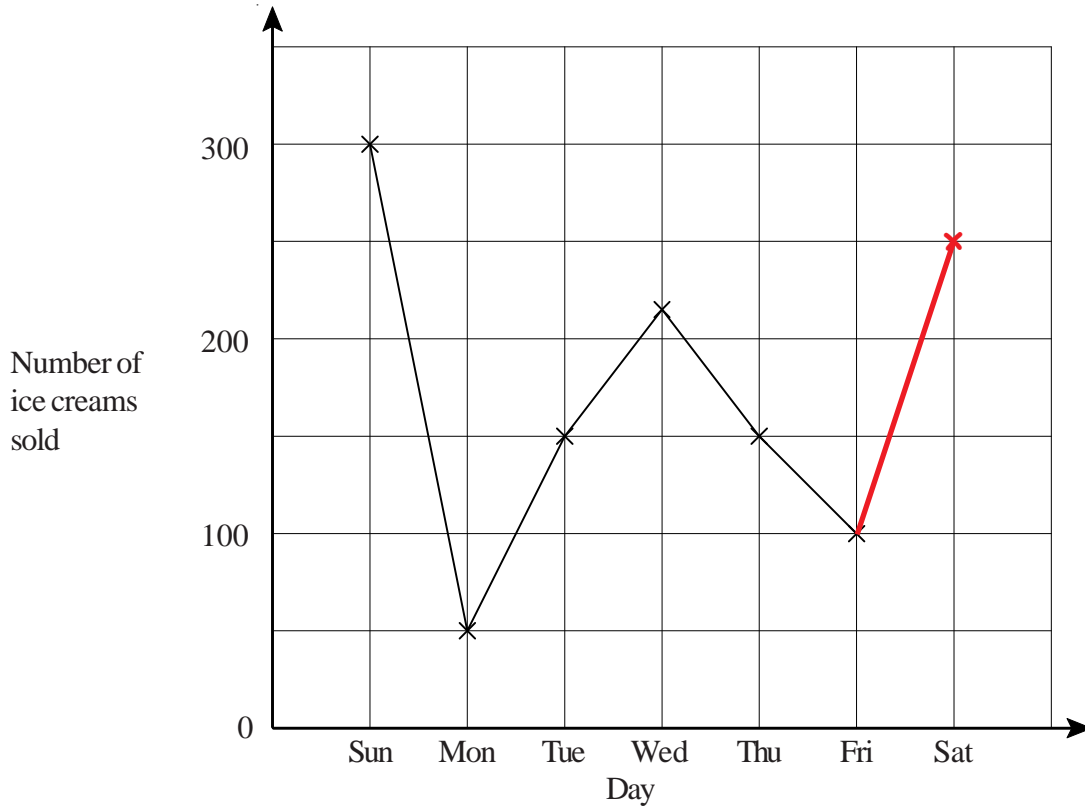
July 34°C August 29°C September 20°C October 12°C November 8°C December 6°C

Draw a line graph to show these results.



Line Graphs

1) The graph shows the number of ice creams sold each day during one week.



- a) How many more ice creams were sold on Sunday than on Friday? **200**
- b) Explain what might have happened on Monday. **It might have been raining.**
- c) On Saturday, 250 ice creams were sold.
Update the graph with this information.
- d) About how many ice creams were sold on Wednesday? **213 (you can have between 206 and 220)**

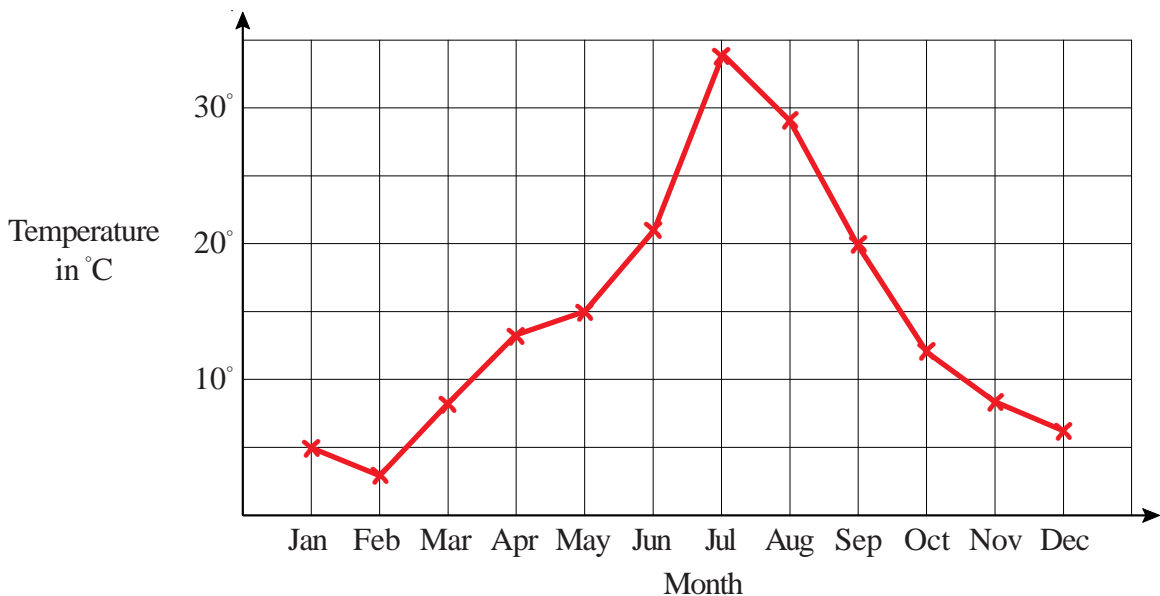
2) The average temperature, in degrees Centigrade, was recorded for each month.

The results are as follows:

January 5°C February 3°C March 8°C April 13°C May 15°C June 21°C

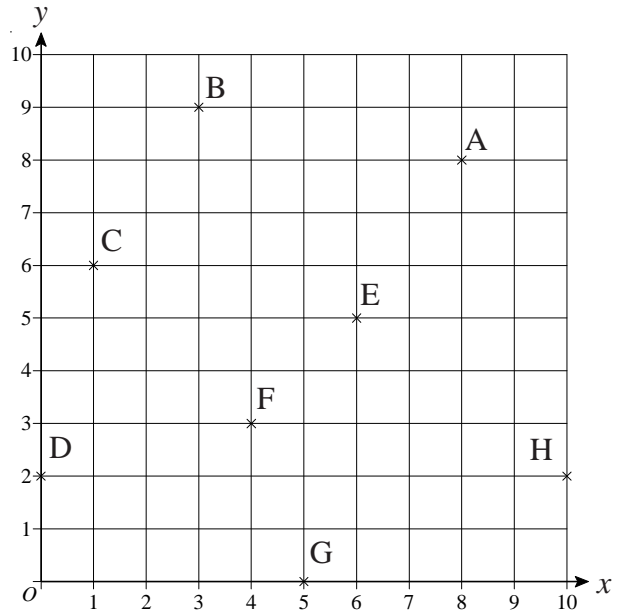
July 34°C August 29°C September 20°C October 12°C November 8°C December 6°C

Draw a line graph to show these results.

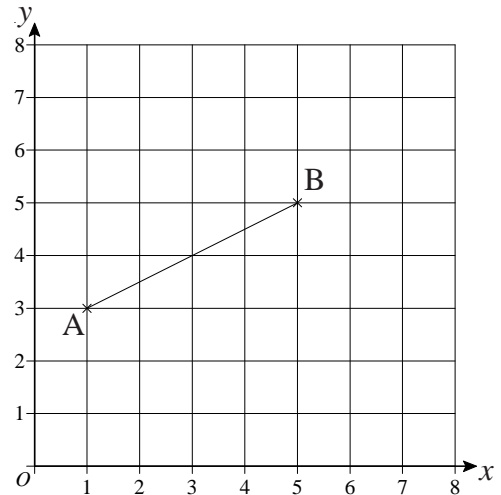


Coordinates

1. Write down the coordinates of the points *A* to *H*.



2. a) Write down the coordinates of: (i) *A* (ii) *B*
- b) Write down the coordinates of the midpoint of the line *AB*.



3. Using the pair of axes,
- a) Plot the points *A*(2, 0), *B*(4, 0), *C*(5, 2) and *D*(3, 2).

b) Join the points in order, to form a shape and name the shape.

M is the midpoint of the line segment *AC*.

c) Find the coordinates of *M*.

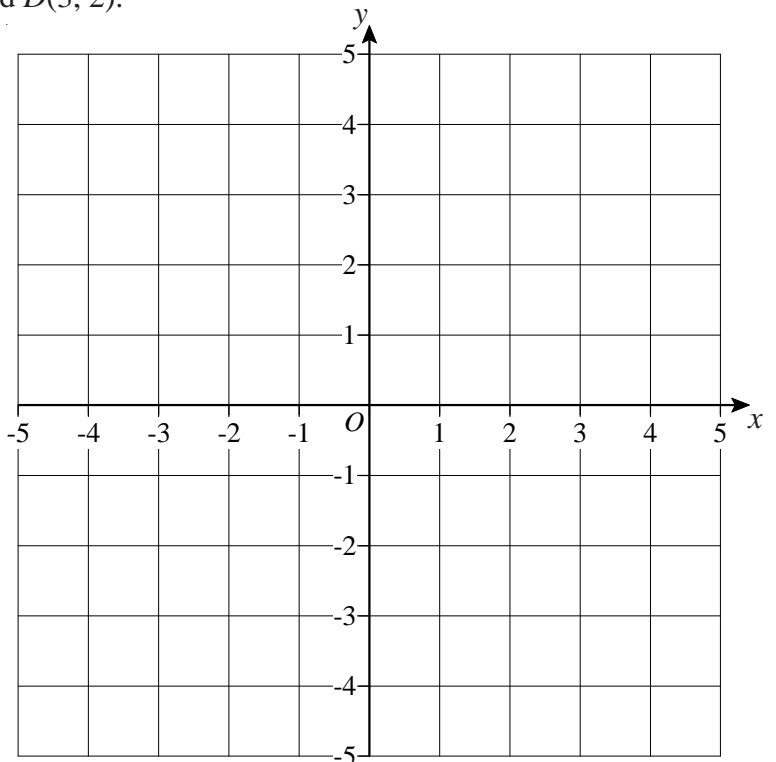
4. Using the same pair of axes,

a) Plot the points *R*(-1, -2), *S*(1, 1) and *T*(-1, 2).

b) Join *R* to *S* and *S* to *T*.

RSTU is a kite.

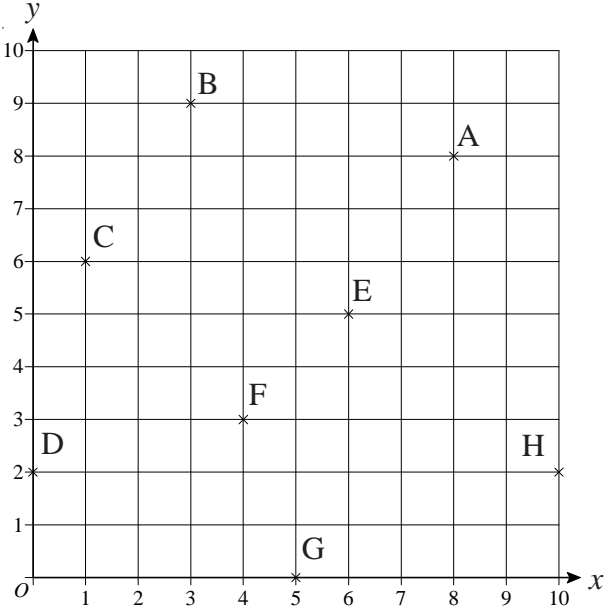
c) Write the coordinates of point *U*.



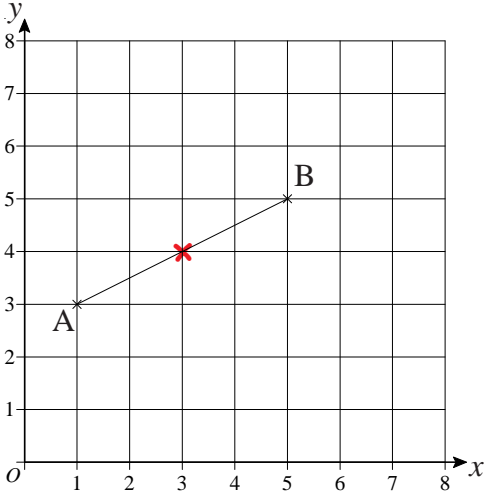
Coordinates

1. Write down the coordinates of the points *A* to *H*.

- A* (8, 8)
- B* (3, 9)
- C* (1, 6)
- D* (0, 2)
- E* (6, 5)
- F* (4, 3)
- G* (5, 0)
- H* (10, 2)

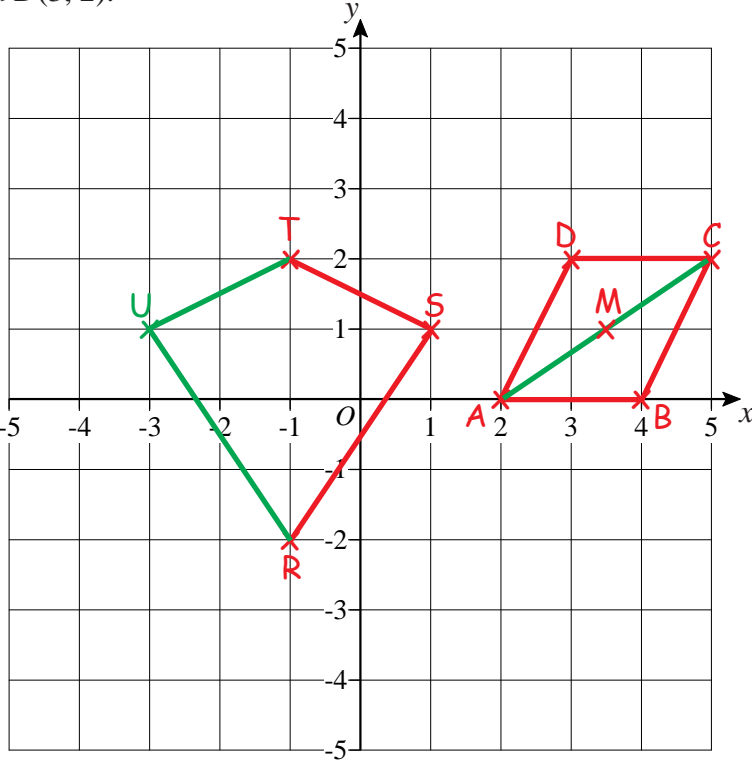


2. a) Write down the coordinates of: (i) *A* (1, 3) (ii) *B* (5, 5)
- b) Write down the coordinates of the midpoint of the line *AB*. (3, 4)



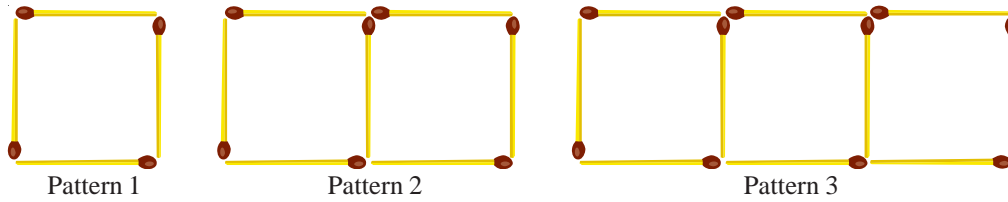
3. Using the pair of axes,
a) Plot the points *A*(2, 0), *B*(4, 0), *C*(5, 2) and *D*(3, 2).

- b) Join the points in order, to form a shape and name the shape.
Parallelogram
- M* is the midpoint of the line segment *AC*.
- c) Find the coordinates of *M*. (3.5, 1)



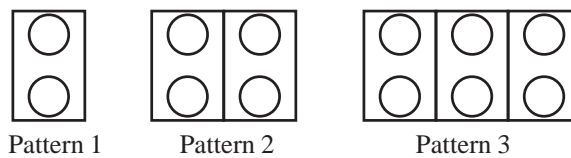
4. Using the same pair of axes,
a) Plot the points *R*(-1, -2), *S*(1, 1) and *T*(-1, 2).
- b) Join *R* to *S* and *S* to *T*.
- RSTU* is a kite.
- c) Write the coordinates of point *U*. (-3, 1)

1) Here are some patterns made from matchsticks



- a) Draw pattern 4.
- b) How many matchsticks are used in
 - (i) Pattern 5
 - (ii) Pattern 10
- c) Which pattern will have 46 matchsticks?

2) A pattern is made of rectangles and circles



- a) Draw pattern 4.
- b) Complete the table below.

Pattern number	1	2	3	4	5	10
Number of rectangles	1	2				
Number of circles	2	4				
Total rectangles + circles	3	6				

- c) Which pattern will have 64 circles?
- d) Which pattern will have a total (rectangles + circles) of 90?

3) For each of the following sequences write down the next two terms.

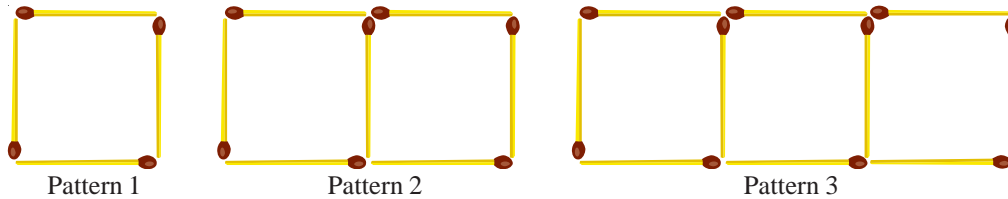
- a) 5, 10, 15, 20...
- b) 9, 16, 23, 30...
- c) 27, 23, 19, 15...
- d) 12, 7, 2, -3...

4) Look at this number sequence: 4, 10, 16, 22...

The 50th term of the sequence is 298.

- a) Write down the 51st term.
- b) Will 643 be a term in this sequence?
Explain your answer.

1) Here are some patterns made from matchsticks



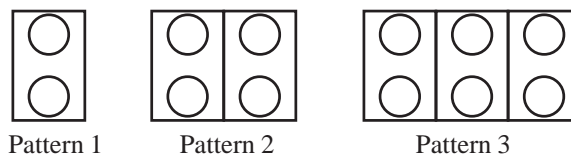
a) Draw pattern 4.  Pattern 4

b) How many matchsticks are used in
(i) Pattern 5 **16 matchsticks**

(ii) Pattern 10 **31 matchsticks**

c) Which pattern will have 46 matchsticks? **pattern 15**

2) A pattern is made of rectangles and circles



a) Draw pattern 4.  Pattern 4

b) Complete the table below.

Pattern number	1	2	3	4	5	10
Number of rectangles	1	2	3	4	5	10
Number of circles	2	4	6	8	10	20
Total rectangles + circles	3	6	9	12	15	30

c) Which pattern will have 64 circles? **32**

d) Which pattern will have a total (rectangles + circles) of 90? **30**

3) For each of the following sequences write down the next two terms.

a) 5, 10, 15, 20... **25, 30** c) 27, 23, 19, 15... **11, 7**

b) 9, 16, 23, 30... **37, 44** d) 12, 7, 2, -3... **-8, -13**

4) Look at this number sequence: 4, 10, 16, 22...

The 50th term of the sequence is 298.

a) Write down the 51st term. **304**

b) Will 643 be a term in this sequence? **No.**
Explain your answer. **All the numbers in this sequence are "even".**

- 1) Here is a table for the rule $\times 3$ then -1

$\times 3$ then -1	
Input	Output
1	2
2	
3	
5	
	20
	35

Complete the table.

- 2) Here is the table for the rule $+5$ then $\div 2$

$+5$ then $\div 2$	
Input	Output
1	3
2	3.5
3	
4	
	7
	10

Complete the table.

- 3) Here is a table for the rule $\times 4$ then -3 then $\times 2$

$\times 4$ then -3 then $\times 2$	
Input	Output
1	2
2	10
3	
5	
7	
	74
	82

Complete the table.

- 1) Here is a table for the rule $\times 3$ then -1

$\times 3$ then -1	
Input	Output
1	2
2	5
3	8
5	14
7	20
12	35

Complete the table.

- 2) Here is the table for the rule $+5$ then $\div 2$

$+5$ then $\div 2$	
Input	Output
1	3
2	3.5
3	4
4	4.5
9	7
15	10

Complete the table.

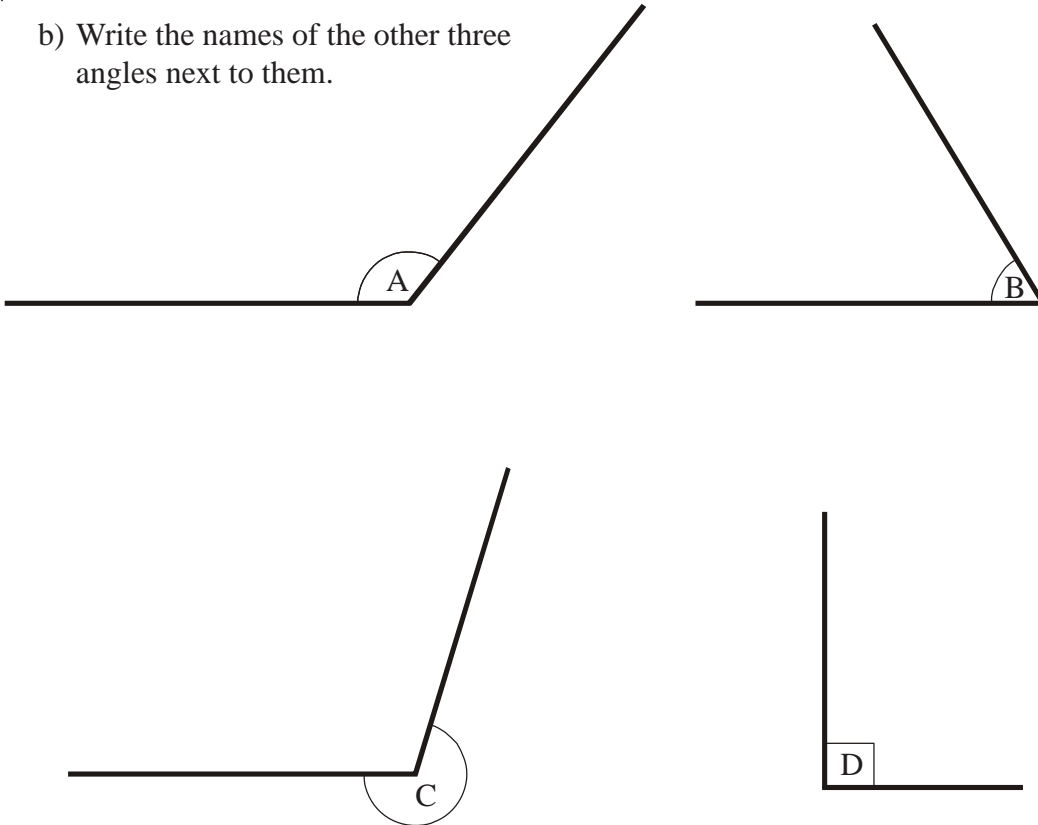
- 3) Here is a table for the rule $\times 4$ then -3 then $\times 2$

$\times 4$ then -3 then $\times 2$	
Input	Output
1	2
2	10
3	18
5	34
7	50
10	74
11	82

Complete the table.

- 1) a) One of these angles is an acute angle.
Which one?

- b) Write the names of the other three angles next to them.



- 2) a) Sketch a triangle which has three internal (inside) acute angles.
b) Sketch a right-angled triangle.
c) Sketch a triangle with one internal obtuse angle.

- 3) Debbie says she is going to draw a triangle with two internal obtuse angles.

Harry says that this is impossible.

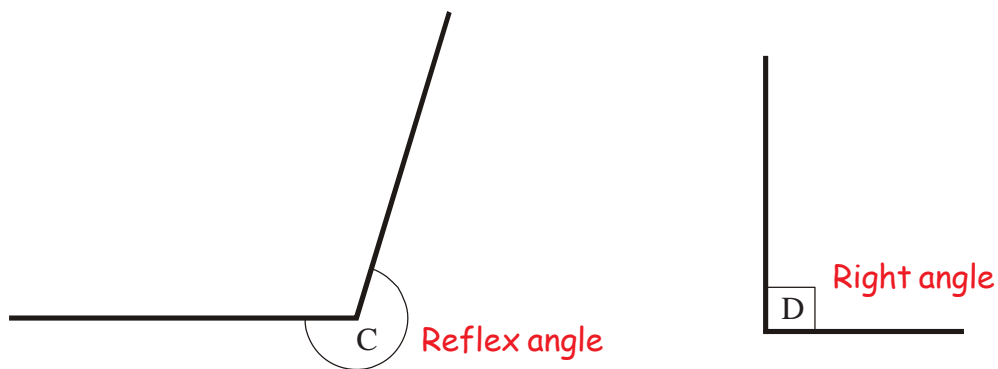
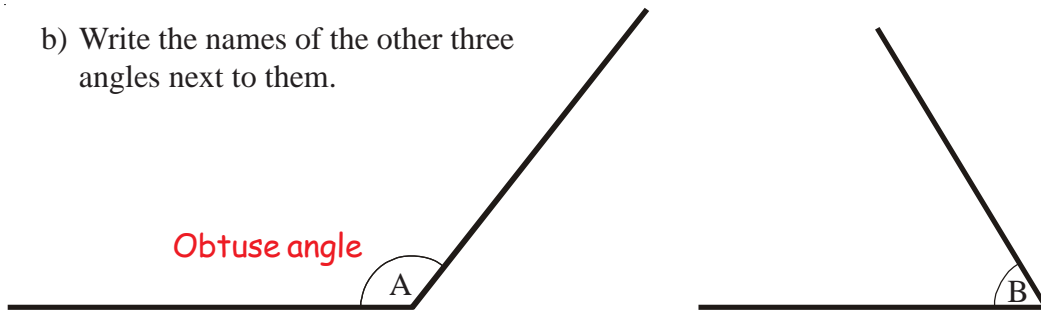
Is Harry correct? Explain why.

- 4) Draw a quadrilateral with

- a) Two internal acute angles, one reflex angle and one obtuse angle.
b) Three internal acute angles and one reflex angle.

- 1) a) One of these angles is an acute angle.
Which one? **Angle B**

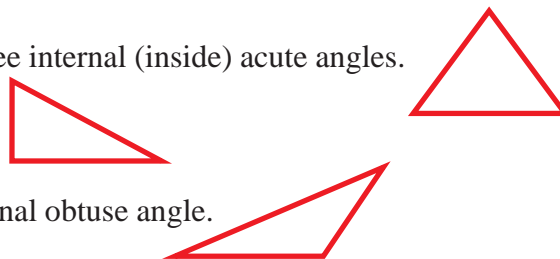
- b) Write the names of the other three angles next to them.



- 2) a) Sketch a triangle which has three internal (inside) acute angles.

- b) Sketch a right-angled triangle.

- c) Sketch a triangle with one internal obtuse angle.



- 3) Debbie says she is going to draw a triangle with two internal obtuse angles.

Harry says that this is impossible.

Is Harry correct? Explain why.

Harry is correct.

An obtuse angle is bigger than 90° .

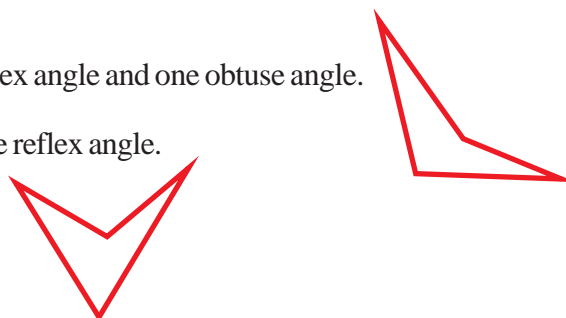
Two of them would mean the angles added up to more than 180° .

But we know the angles of a triangle add up to 180° .

- 4) Draw a quadrilateral with

- a) Two internal acute angles, one reflex angle and one obtuse angle.

- b) Three internal acute angles and one reflex angle.

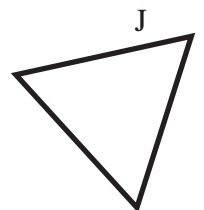
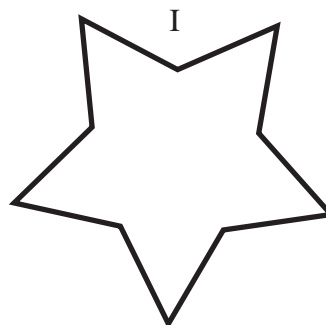
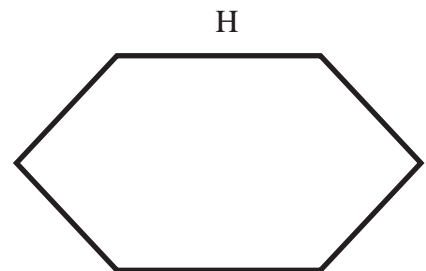
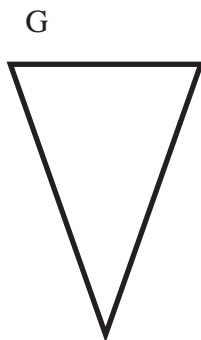
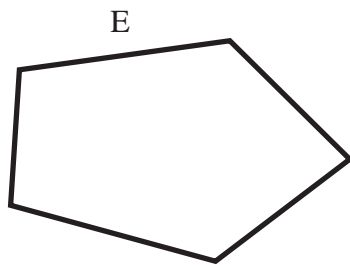
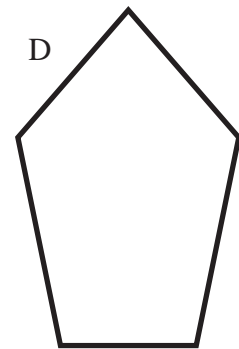
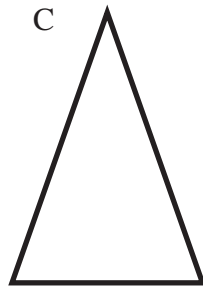
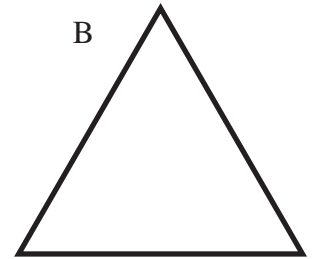
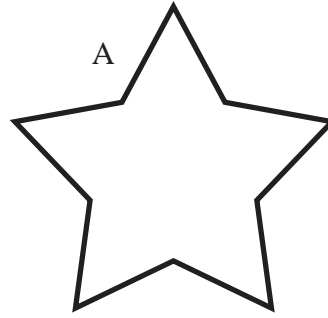


Congruent and Similar Shapes

	Congruent to	Similar to
A		
B		
C		
D		
E		
F		
G		
H		
I		
J		

Fill in the table on the left.

You are allowed to use tracing paper to help get the correct answers.

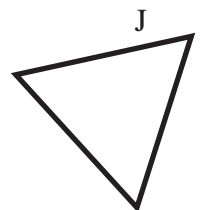
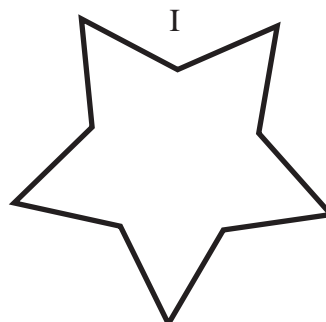
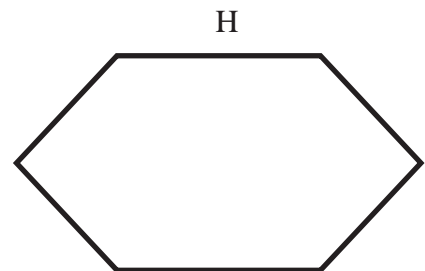
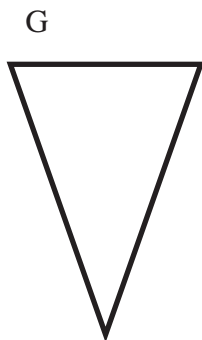
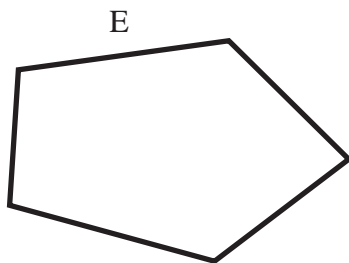
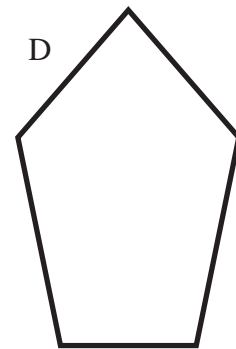
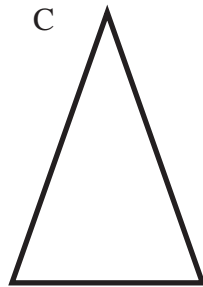
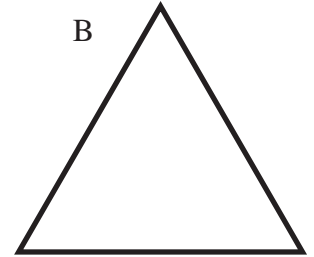
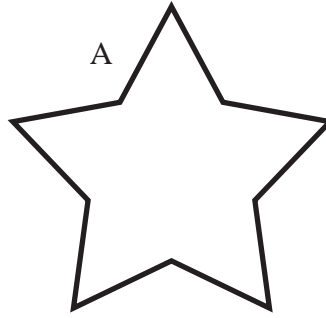


Congruent and Similar Shapes

	Congruent to	Similar to
A	I	F
B		J
C	G	
D	E	
E	D	
F		A and I
G	C	
H		
I	A	F
J		B

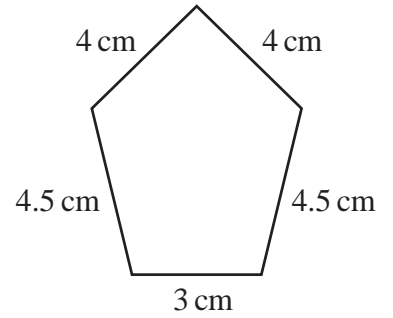
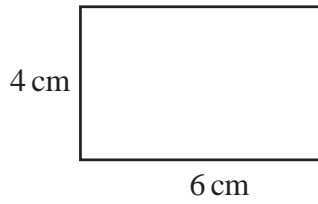
Fill in the table on the left.

You are allowed to use tracing paper to help get the correct answers.



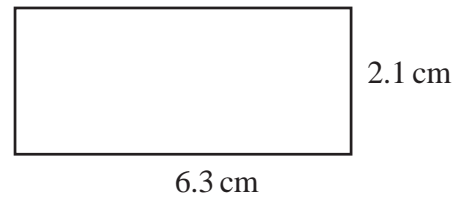
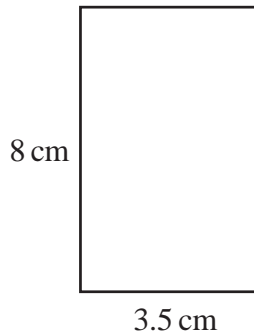
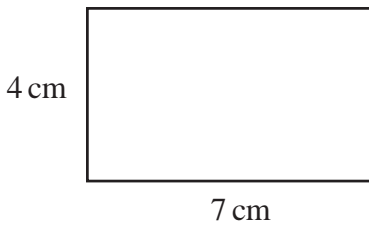
Perimeter and Areas

- 1) Find the perimeter of the following rectangle and pentagon:



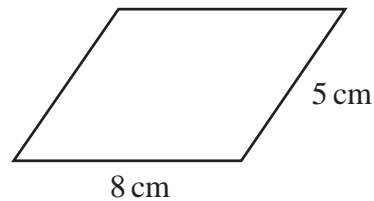
- 2) A rectangle has a perimeter of 40 cm. The length of the longest side is 12 cm. Sketch the rectangle, and find the length of the shorter side.

- 3) Find the area of the following rectangles:

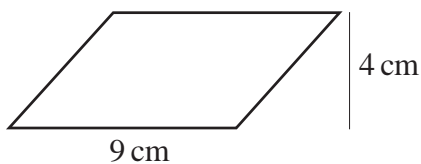


- 4) A rectangle has an area of 40cm^2 and a length of 8 cm. Sketch the rectangle and find the width.

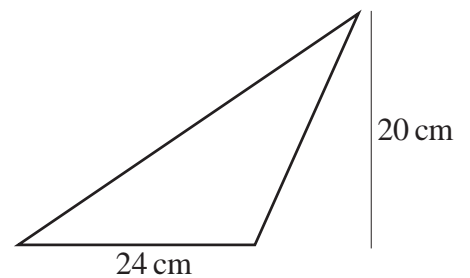
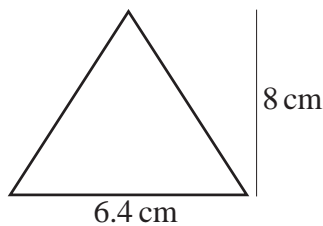
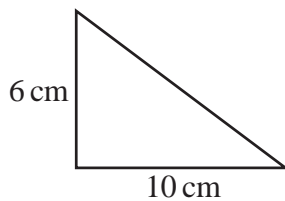
- 5) Why can't we find the area of this parallelogram?



- 6) What is the area of the parallelogram, below?



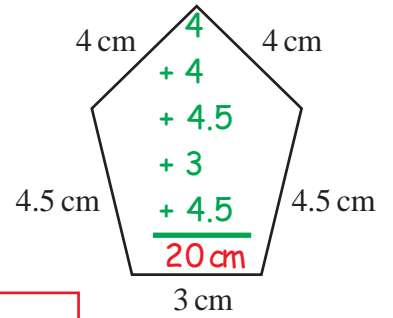
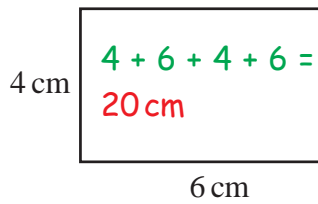
- 7) Find the area of the following triangles:



- 8) The area of a triangle is 60cm^2 . The base of the triangle is 12 cm long. Sketch a triangle with this area and base and work out the height of the triangle.

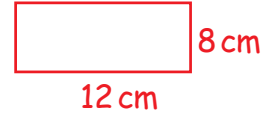
Perimeter and Areas

- 1) Find the perimeter of the following rectangle and pentagon:

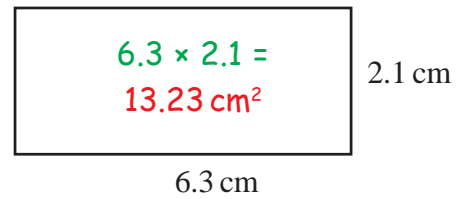
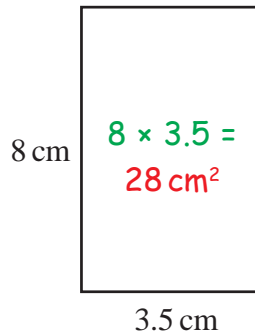
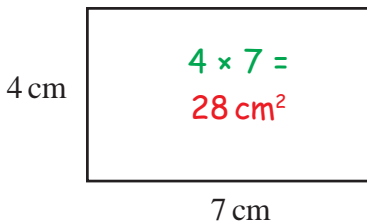


- 2) A rectangle has a perimeter of 40 cm. The length of the longest side is 12 cm. Sketch the rectangle, and find the length of the shorter side.

$40 - 12 - 12 = 16$
 $16 \div 2 = 8 \text{ cm}$



- 3) Find the area of the following rectangles:

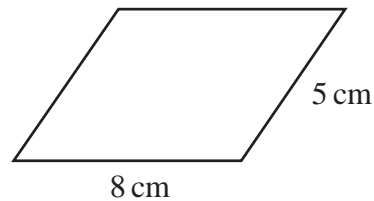


- 4) A rectangle has an area of 40 cm² and a length of 8 cm. Sketch the rectangle and find the width.

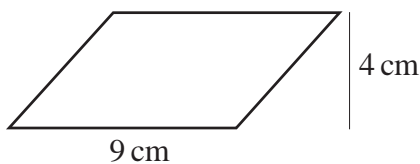
$40 \div 8 = 5 \text{ cm}$



- 5) Why can't we find the area of this parallelogram?
 Because we don't know its height.

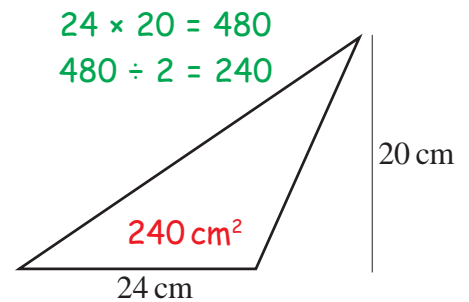
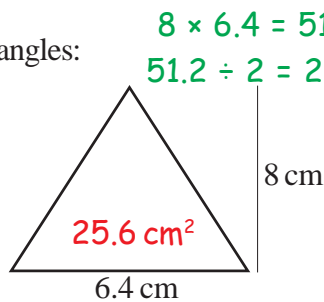
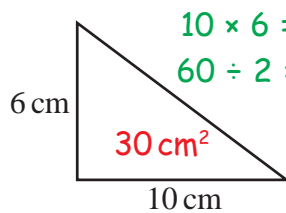


- 6) What is the area of the parallelogram, below?



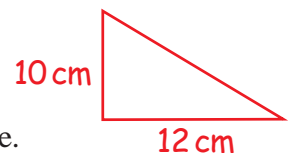
$9 \times 4 = 36 \text{ cm}^2$

- 7) Find the area of the following triangles:

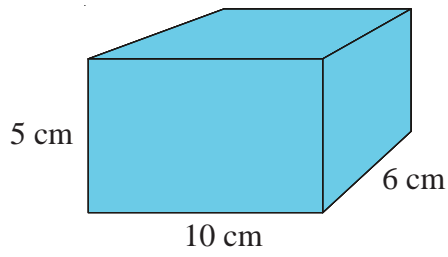


- 8) The area of a triangle is 60 cm². The base of the triangle is 12 cm long. Sketch a triangle with this area and base and work out the height of the triangle.

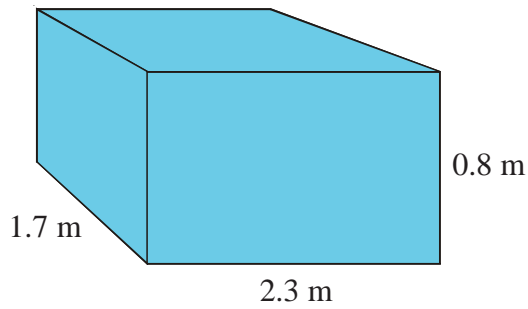
$60 \times 2 = 120$
 $120 \div 12 = 10$



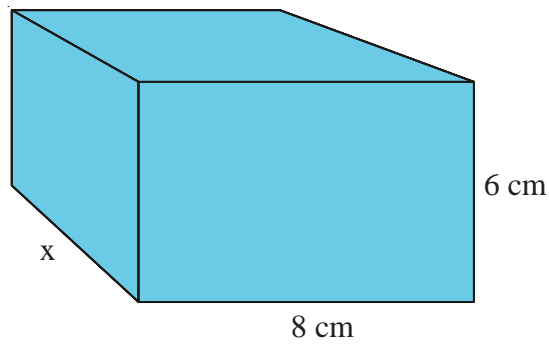
- 1) Find the volume of this cuboid.



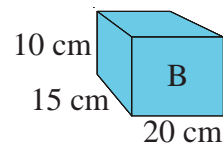
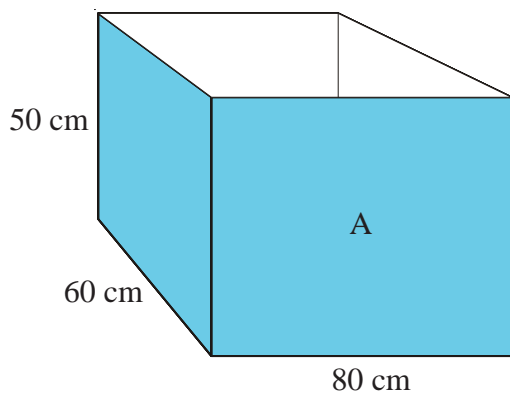
- 2) Find the volume of this cuboid.



- 3) The volume of this cuboid is 480 cm^3 .
Find the length of the side marked x .

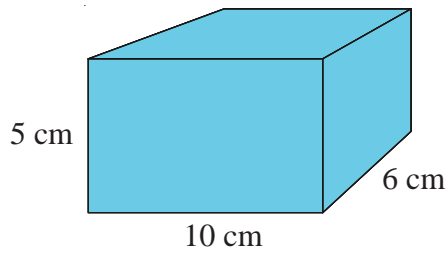


- 4) Boxes A and B are both cuboids.
How many of box B could be packed into box A?



Volume of Cuboids

- 1) Find the volume of this cuboid. **Volume = 300 cm³**

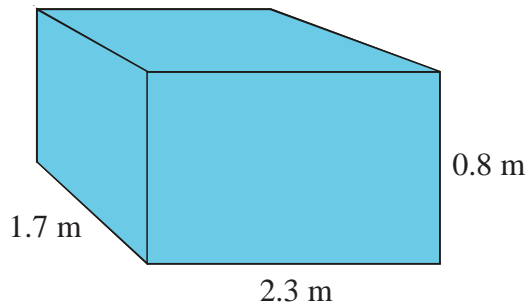


$$V = W \times L \times H$$

$$V = 10 \times 6 \times 5$$

$$V = 300 \text{ cm}^3$$

- 2) Find the volume of this cuboid. **Volume = 3.128 m³**

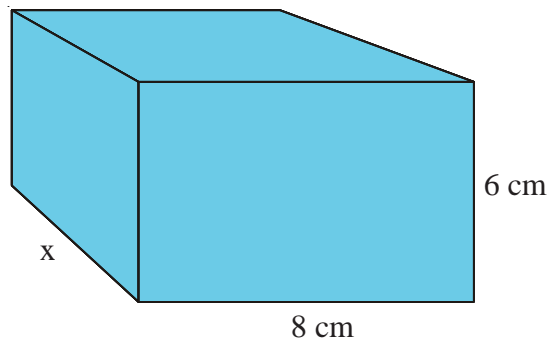


$$V = W \times L \times H$$

$$V = 2.3 \times 1.7 \times 0.8$$

$$V = 3.128 \text{ m}^3$$

- 3) The volume of this cuboid is 480 cm³.
Find the length of the side marked x. **x = 10 cm**



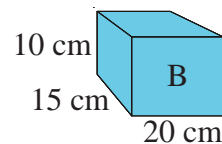
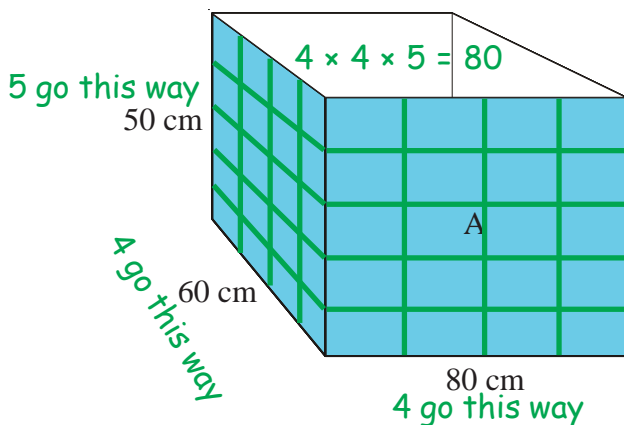
$$V = W \times L \times H$$

$$480 = 8 \times x \times 6$$

$$480 = 48 \times x$$

$$x = 10 \text{ cm}$$

- 4) Boxes A and B are both cuboids.
How many of box B could be packed into box A? **80 of box B go into box A**



Converting Metric Measures

- 1) Complete this table by writing down a sensible unit for each measurement.
Four have been done for you.

	Metric	Imperial
The distance between London and Manchester		miles
The length of a pen	cm	
The weight of your Maths Teacher		pounds
The amount of petrol in a car		gallons
The length of an ant		

- 2) Change the following measurements:

- | | | |
|---------------|----------------|---------------|
| a) 4 cm to mm | d) 10 cm to mm | g) 1 km to m |
| b) 7 m to cm | e) 25 m to mm | h) 1 km to cm |
| c) 5 m to mm | f) 34 m to cm | i) 23 km to m |

- 3) Change the following measurements:

- | | | |
|-----------------|-----------------|-----------------|
| a) 300 cm to m | d) 6 cm to m | g) 4386 cm to m |
| b) 4 mm to cm | e) 412 cm to m | h) 549 mm to cm |
| c) 7425 mm to m | f) 1500 m to km | i) 0.3 km to m |

- 4) Change the following measurements:

- | | | |
|---------------------------------------|---|--|
| a) 5 m^2 to cm^2 | d) 8.2 m^2 to cm^2 | g) 5.1 m^3 to cm^3 |
| b) 8 cm^2 to mm^2 | e) 7320 mm^2 to cm^2 | h) 53478 mm^3 to cm^3 |
| c) 250 cm^2 to m^2 | f) 8 m^3 to cm^3 | i) 183000 cm^3 to m^3 |

Converting Metric Measures

- 1) Complete this table by writing down a sensible unit for each measurement.
Four have been done for you.

	Metric	Imperial
The distance between London and Manchester	km	miles
The length of a pen	cm	inches
The weight of your Maths Teacher	kg	pounds
The amount of petrol in a car	litres	gallons
The length of an ant	mm	inches

- 2) Change the following measurements:

- a) 4 cm to mm **40 mm** d) 10 cm to mm **100 mm** g) 1 km to m **1 000 m**
 b) 7 m to cm **700 cm** e) 25 m to mm **25 000 mm** h) 1 km to cm **100 000 cm**
 c) 5 m to mm **5 000 mm** f) 34 m to cm **3 400 cm** i) 23 km to m **23 000 m**

- 3) Change the following measurements:

- a) 300 cm to m **3 m** d) 6 cm to m **0.06 m** g) 4386 cm to m **43.86 m**
 b) 4 mm to cm **0.4 cm** e) 412 cm to m **4.12 m** h) 549 mm to cm **54.9 cm**
 c) 7425 mm to m **7.425 m** f) 1500 m to km **1.5 km** i) 0.3 km to m **300 m**

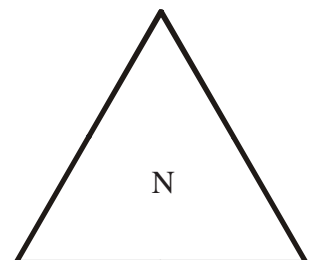
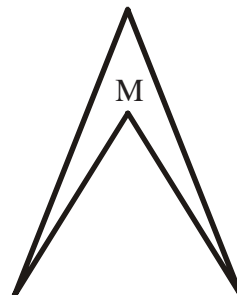
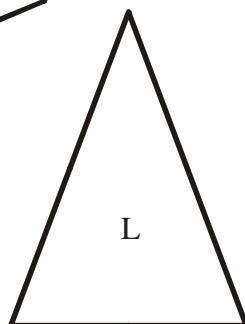
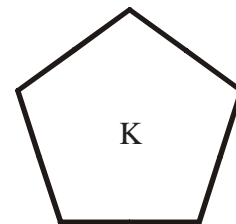
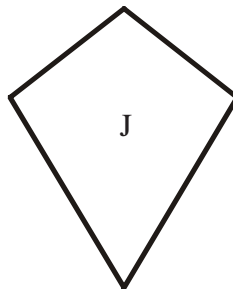
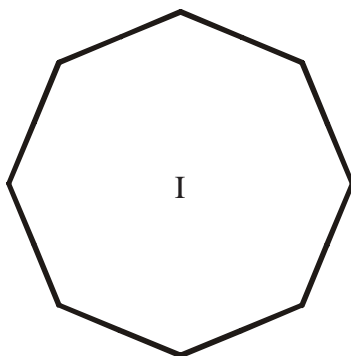
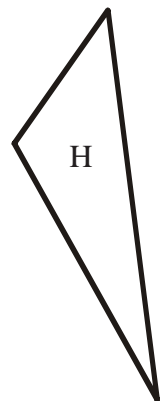
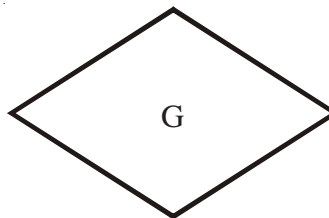
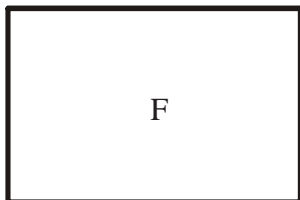
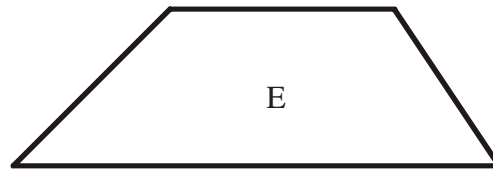
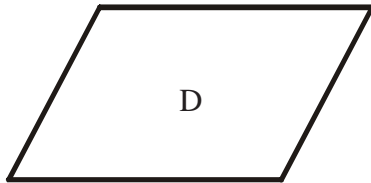
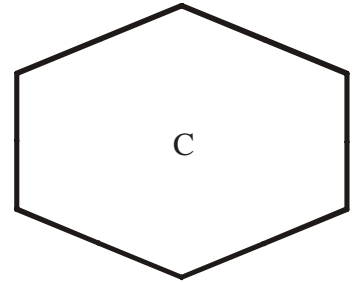
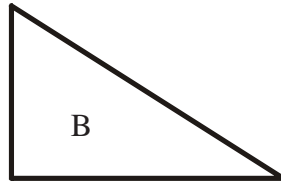
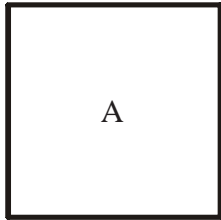
- 4) Change the following measurements:

- a) 5 m² to cm² **50 000 cm²** d) 8.2 m² to cm² **82 000 cm²** g) 5.1 m³ to cm³ **5 100 000 cm³**
 b) 8 cm² to mm² **800 mm²** e) 7320 mm² to cm² **73.2 cm²** h) 53478 mm³ to cm³ **53.478 cm³**
 c) 250 cm² to m² **0.025 m²** f) 8 m³ to cm³ **8 000 000 cm³** i) 183000 cm³ to m³ **0.183 m³**

Triangles, Quadrilaterals, Polygons

For each of the shapes A to N, below:

- Name the shape.
- Mark on the shape, or write in words, the features that make it special.
- Shape A is a **square** because it has four equal sides and four right angles.

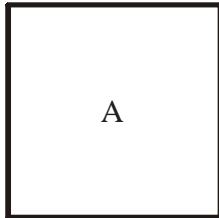


Triangles, Quadrilaterals, Polygons

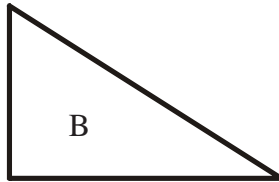
For each of the shapes A to N, below:

- Name the shape.
- Mark on the shape, or write in words, the features that make it special.
- Shape A is a **square** because it has four equal sides and four right angles.

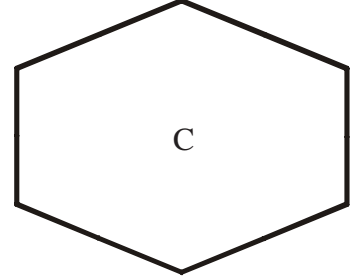
Square
4 equal sides
4 right angles



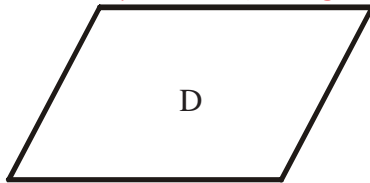
Right-angled triangle
1 right angle



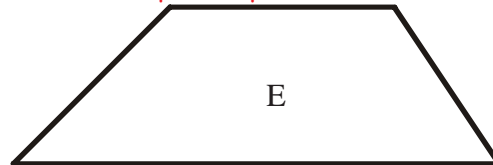
Hexagon
6 sides



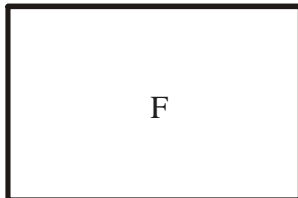
Parallelogram
2 pair of parallel sides
2 pairs of equal angles



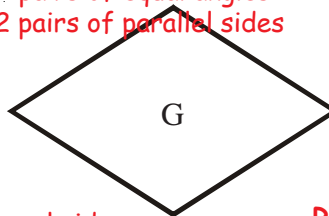
Trapezium
1 pair of parallel sides



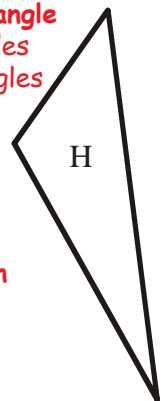
Rectangle
2 pairs of equal sides
4 right angles



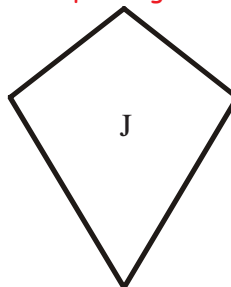
Rhombus
4 equal sides
2 pairs of equal angles
2 pairs of parallel sides



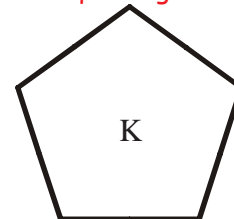
Scalene triangle
No equal sides
No equal angles



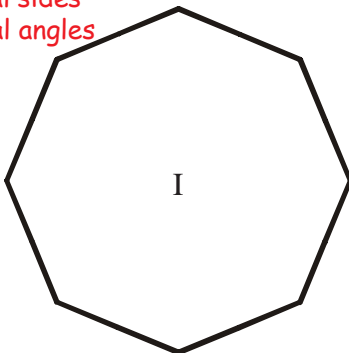
Kite
2 pairs of equal sides
1 pair of equal angles



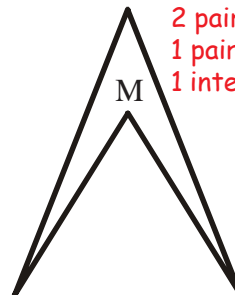
Regular pentagon
5 equal sides
5 equal angles



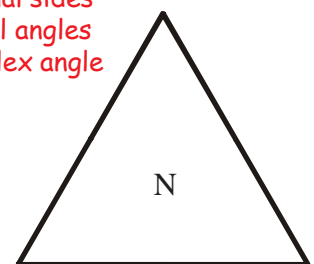
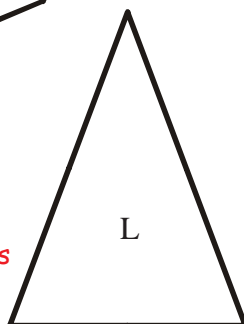
Regular Octagon
8 equal sides
8 equal angles



Arrowhead
2 pairs of equal sides
1 pair of equal angles
1 internal reflex angle



Isosceles triangle
1 pair of equal sides
1 pair of equal angles

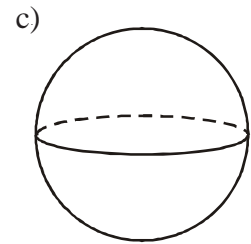
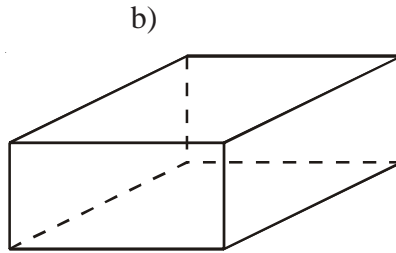
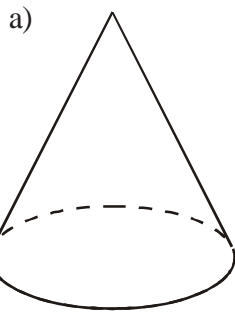


Equilateral triangle
All sides equal
All angles 60°

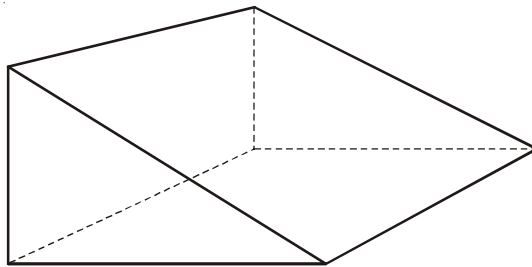
1) Draw a sketch of each of the following solids:

- a) A cube.
- b) A cylinder.

2) Write down the mathematical name of each of these 3-D shapes.



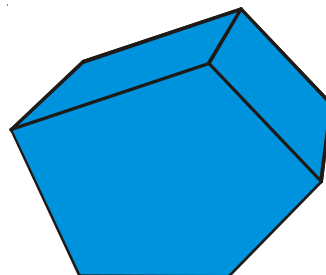
3) Look at this solid.



- a) What is its name?
- b) How many vertices does it have?
- c) How many edges are there?
- d) How many faces does it have?

4) This is a picture of a pentagonal prism.

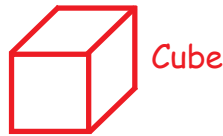
- a) How many faces does it have?
- b) How many edges does it have?
- c) How many vertices does it have?



Names of Solids

1) Draw a sketch of each of the following solids:

- a) A cube.
- b) A cylinder.

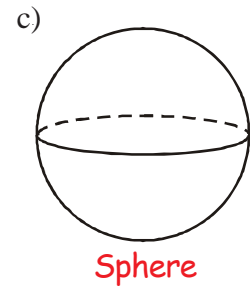
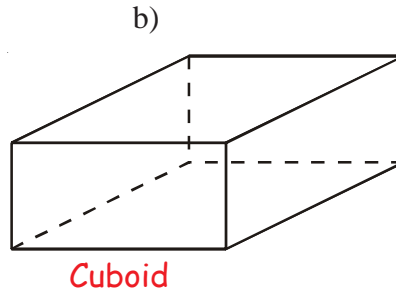
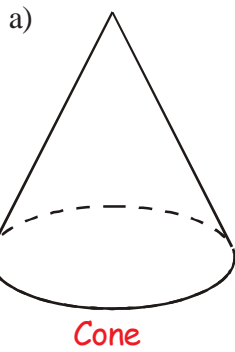


Cube

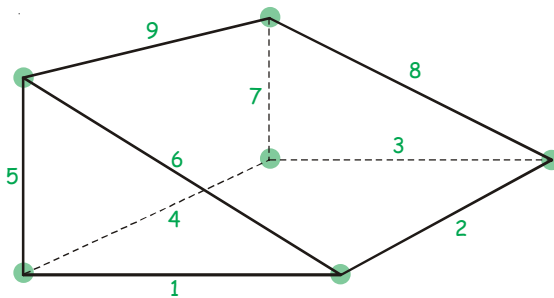


Cylinder

2) Write down the mathematical name of each of these 3-D shapes.



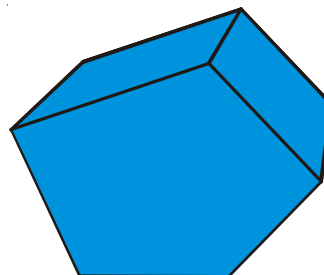
3) Look at this solid.



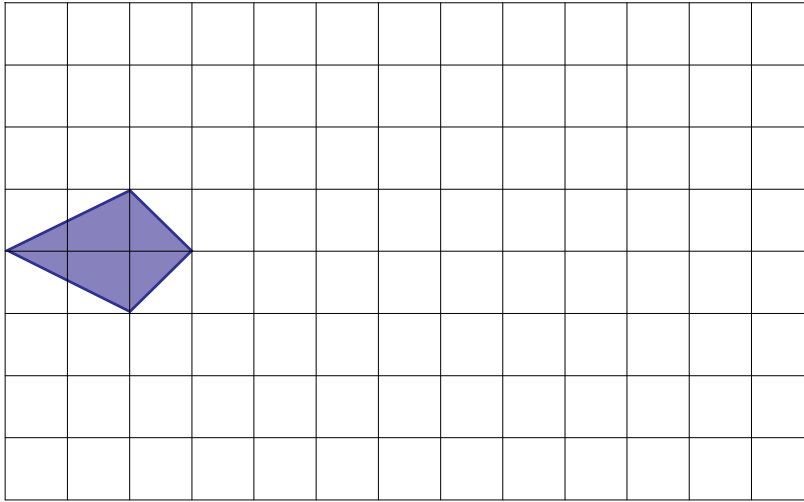
- a) What is its name? **Triangular prism**
- b) How many vertices does it have? **6**
- c) How many edges are there? **9**
- d) How many faces does it have? **5**

4) This is a picture of a pentagonal prism.

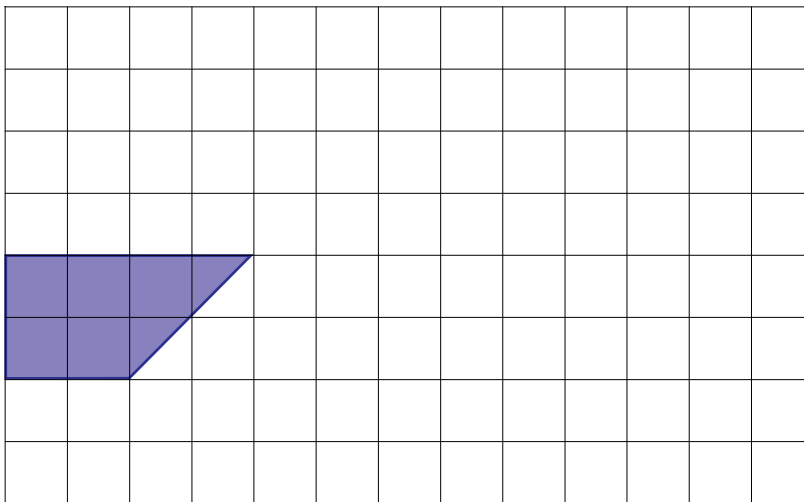
- a) How many faces does it have? **7**
- b) How many edges does it have? **15**
- c) How many vertices does it have? **10**



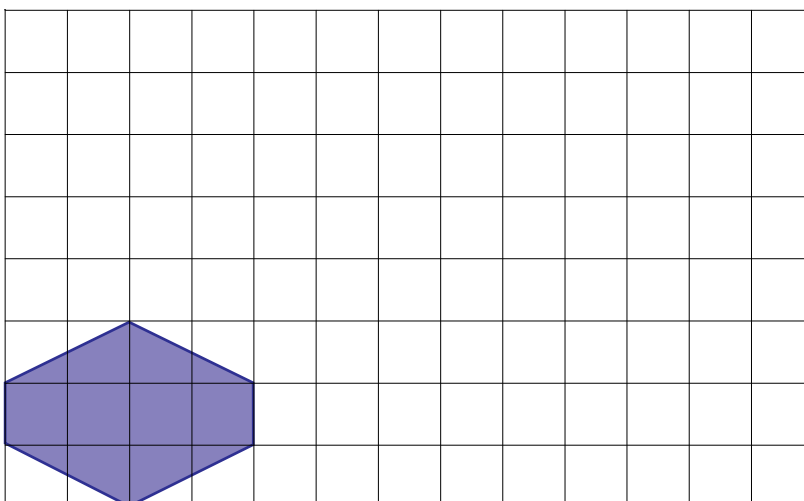
- 1) On the grid below, show how the shaded shape will tessellate.
You should draw at least six shapes.



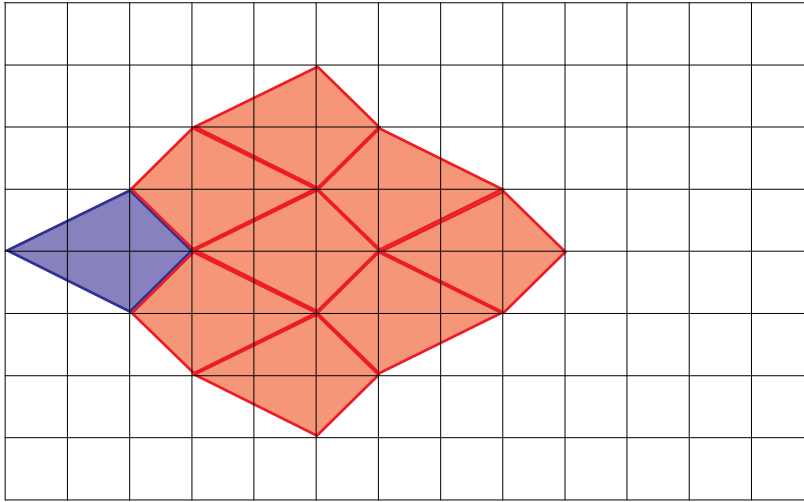
- 2) On the grid below, show how the shaded shape will tessellate.
You should draw at least six shapes.



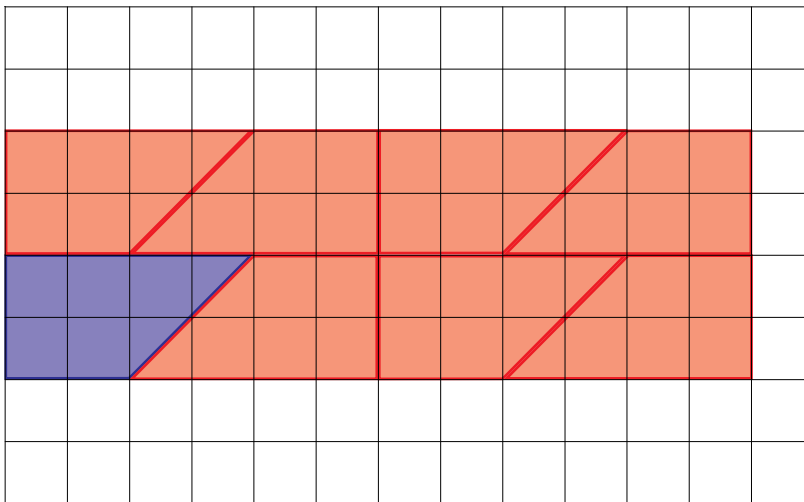
- 3) On the grid below, show how the shaded shape will tessellate.
You should draw at least six shapes.



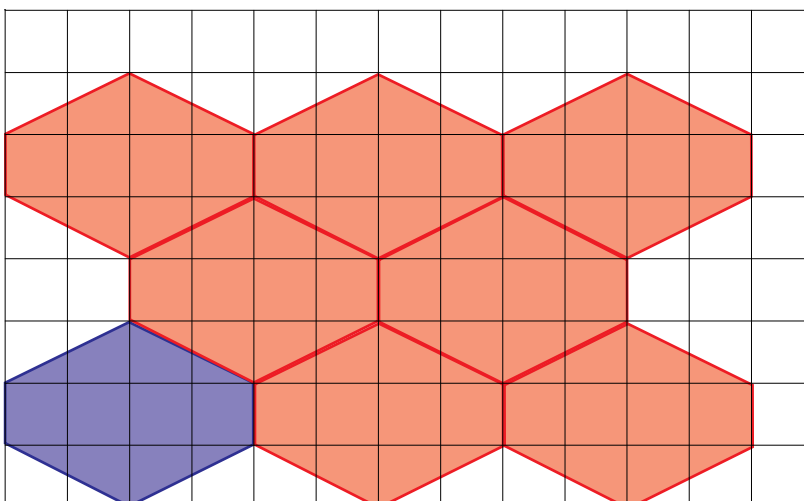
- 1) On the grid below, show how the shaded shape will tessellate.
You should draw at least six shapes.



- 2) On the grid below, show how the shaded shape will tessellate.
You should draw at least six shapes.

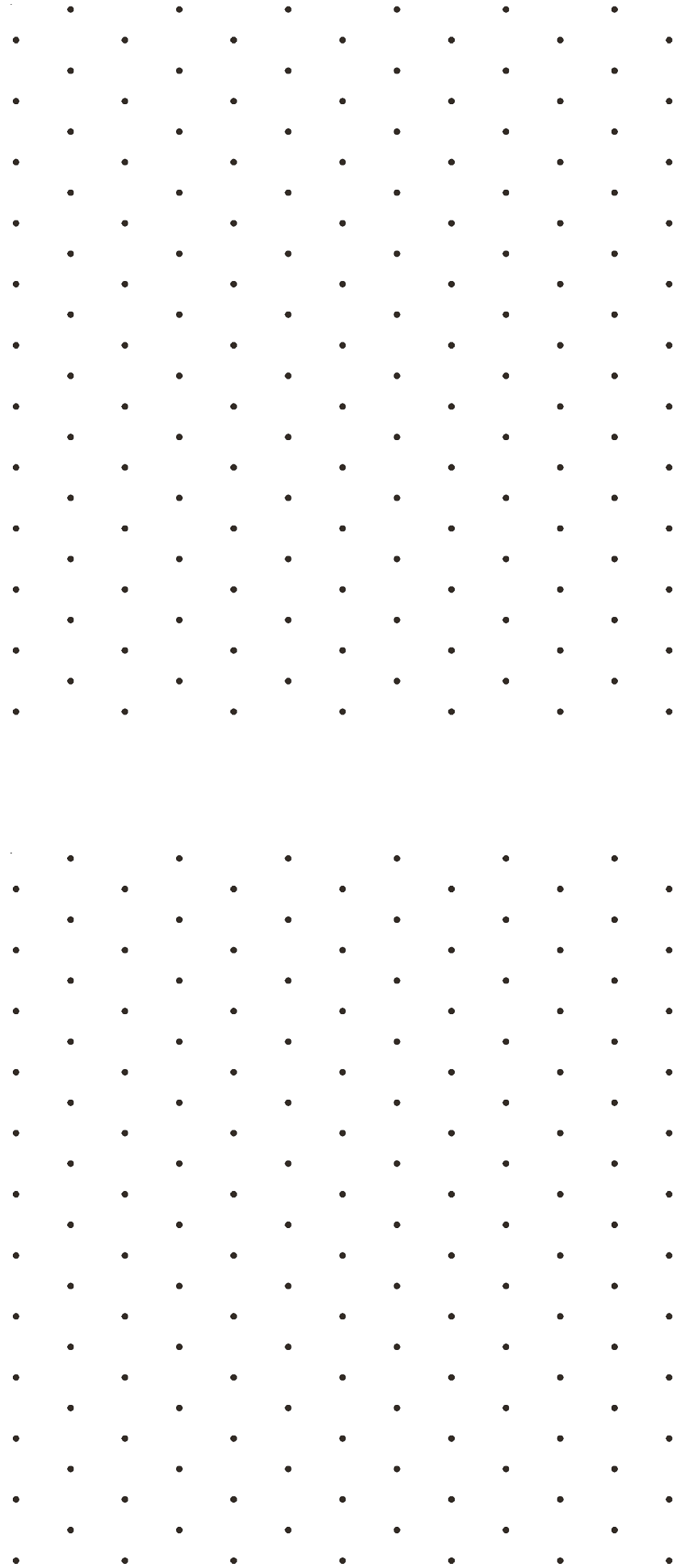
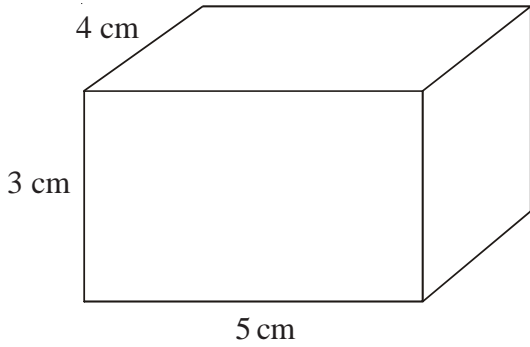


- 3) On the grid below, show how the shaded shape will tessellate.
You should draw at least six shapes.

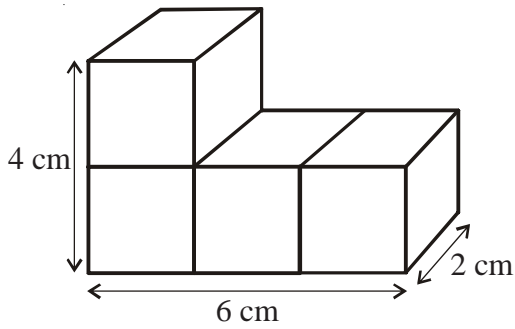


Isometric Drawing

- 1) Copy the shape below, onto the isometric grid.

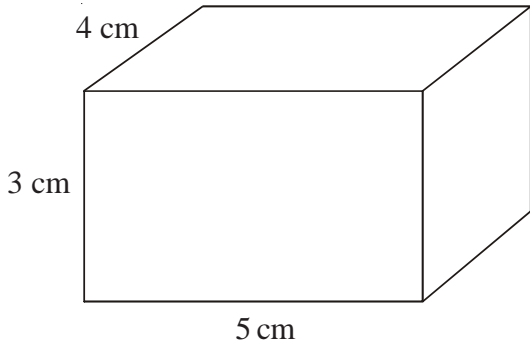


- 2) The shape below, is made out of 2 cm by 2 cm by 2 cm cubes.
Copy the shape onto the isometric grid.

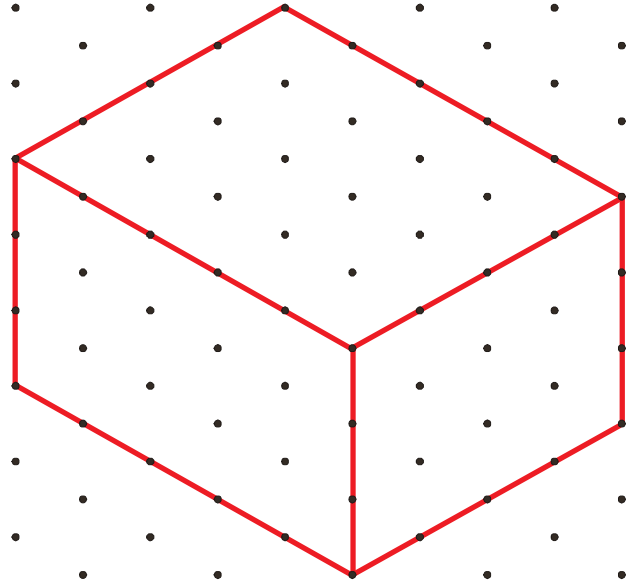


Isometric Drawing

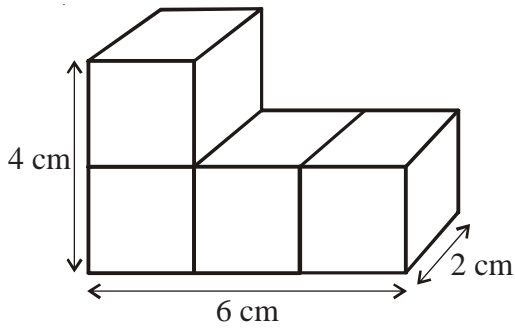
- 1) Copy the shape below, onto the isometric grid.



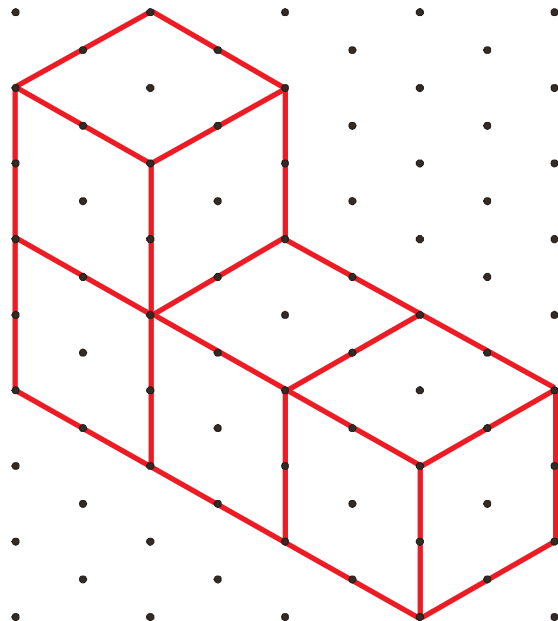
Other correct diagrams are possible.



- 2) The shape below, is made out of 2 cm by 2 cm by 2 cm cubes.
Copy the shape onto the isometric grid.

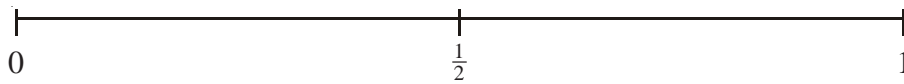


Other correct diagrams are possible.

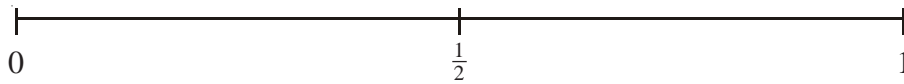


The Probability Scale

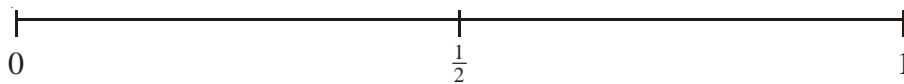
- 1) a) On the probability scale below, mark with a cross (×) the probability that it will snow in Birmingham in July.



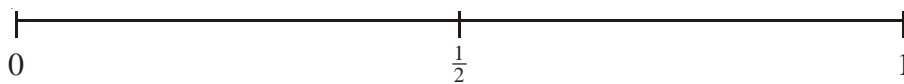
- b) On the probability scale below, mark with a cross (×) the probability that it will rain in Wales next year.



- c) On the probability scale below, mark with a cross (×) the probability that you will get a tail when you flip a fair coin.



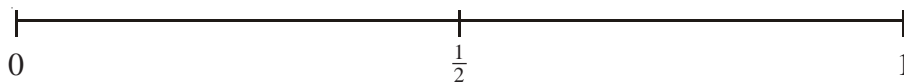
- d) On the probability scale below, mark with a cross (×) the probability that you will get a number bigger than 4 when you roll an ordinary dice.



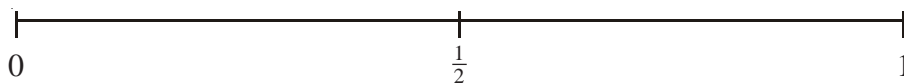
- 2) 4 jelly babies are in a bag.
2 are red, 1 is green and 1 is black.

Without looking in the bag, a jelly baby is taken out.

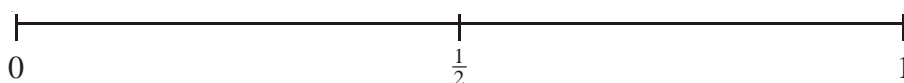
- a) On the probability scale below, mark with a cross (×) the probability that the jelly baby taken from the bag is green.



- b) On the probability scale below, mark with a cross (×) the probability that the jelly baby taken from the bag is green or black.

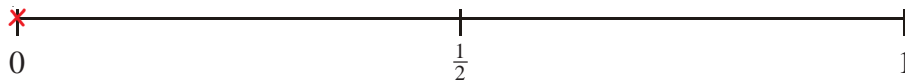


- c) On the probability scale below, mark with a cross (×) the probability that the jelly baby taken from the bag is red or black.

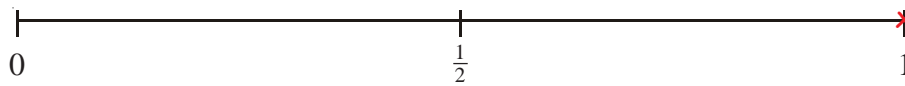


The Probability Scale

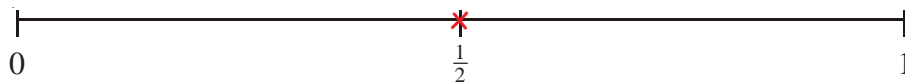
- 1) a) On the probability scale below, mark with a cross (×) the probability that it will snow in Birmingham in July.



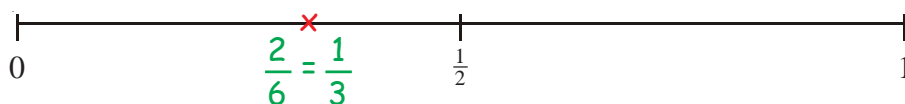
- b) On the probability scale below, mark with a cross (×) the probability that it will rain in Wales next year.



- c) On the probability scale below, mark with a cross (×) the probability that you will get a tail when you flip a fair coin.



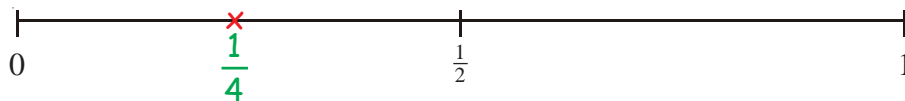
- d) On the probability scale below, mark with a cross (×) the probability that you will get a number bigger than 4 when you roll an ordinary dice.



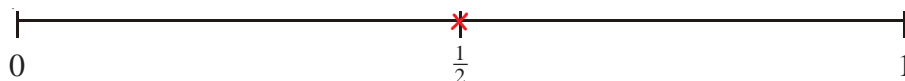
- 2) 4 jelly babies are in a bag.
2 are red, 1 is green and 1 is black.

Without looking in the bag, a jelly baby is taken out.

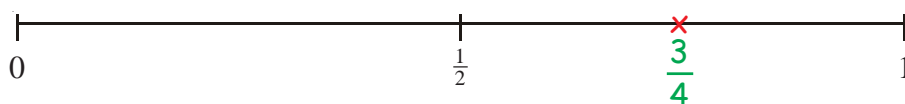
- a) On the probability scale below, mark with a cross (×) the probability that the jelly baby taken from the bag is green.



- b) On the probability scale below, mark with a cross (×) the probability that the jelly baby taken from the bag is green or black.



- c) On the probability scale below, mark with a cross (×) the probability that the jelly baby taken from the bag is red or black.



- 1) Kaya made a list of his homework marks.

3 2 3 4 1 4 5 5 2 4

- a) Write down the mode of Kaya's marks.
b) Work out his mean homework mark.

- 2) Lydia rolled an 8-sided dice ten times.

Here are her scores.

5 1 2 5 3 8 6 6 3 2

- a) Work out Lydia's median score.
b) Work out the mean of her scores.
c) Work out the range of her scores.

- 3) 20 students scored goals for the school football team.

The table gives information about the number of goals they scored.

Goals scored	Number of students	
1	8	
2	3	
3	6	
4	3	

- a) Write down the modal number of goals scored.
b) Work out the range of the number of goals scored.
c) Work out the mean number of goals scored.

- 4) Laura spun a 4-sided spinner 100 times.

The sides of the spinner are labelled 1, 2, 3 and 4.

Her results are shown in the table.

Score	Frequency
1	24
2	30
3	21
4	25

Work out the mean score.

- 1) Kaya made a list of his homework marks.

3 2 3 4 1 4 5 5 2 4

- a) Write down the mode of Kaya's marks.
- 4**

- b) Work out his mean homework mark.
- 3.3**

$$3 + 2 + 3 + 4 + 1 + 4 + 5 + 5 + 2 + 4 = 33 \quad 33 \div 10 = 3.3$$

- 2) Lydia rolled an 8-sided dice ten times.

Here are her scores.

5 1 2 5 3 8 6 6 3 2

- a) Work out Lydia's median score.
- 4**

$$1, 2, 2, 3, 3, 5, 5, 6, 6, 8$$

- b) Work out the mean of her scores.
- 4.1**

$$5 + 1 + 2 + 5 + 3 + 8 + 6 + 6 + 3 + 2 = 41 \quad 41 \div 10 = 4.1$$

- c) Work out the range of her scores.
- 7**

$$8 - 1 = 7$$

- 3) 20 students scored goals for the school football team.

The table gives information about the number of goals they scored.

Goals scored	Number of students	
1	8	$1 \times 8 = 8$
2	3	$2 \times 3 = 6$
3	6	$3 \times 6 = 18$
4	3	$4 \times 3 = 12$
	20	44

- a) Write down the modal number of goals scored.
- 1**

- b) Work out the range of the number of goals scored.
- 3**

$$4 - 1 = 3$$

- c) Work out the mean number of goals scored.
- 2.2**

$$8 + 6 + 18 + 12 = 44$$

$$8 + 3 + 6 + 3 = 20$$

$$44 \div 20 = 2.2$$

- 4) Laura spun a 4-sided spinner 100 times.

The sides of the spinner are labelled 1, 2, 3 and 4.

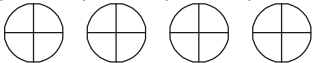


Her results are shown in the table.

Score	Frequency	
1	24	$1 \times 24 = 24$
2	30	$2 \times 30 = 60$
3	21	$3 \times 21 = 63$
4	25	$4 \times 25 = 100$
	100	247

- Work out the mean score.
- 2.47**

Pictograms

- 1) The pictogram shows the number of watches sold by a shop in January, February and March.

January	
February	
March	
April	
May	

Key  represents 4 watches.


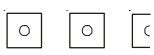
- a) How many watches were sold in January?
 b) Work out how many **more** watches were sold in March than in February?

19 watches were sold in April.

14 watches were sold in May.

- c) Use this information to complete the pictogram.

- 2) The pictogram shows the number of DVDs borrowed from a shop on Monday and Tuesday.

Monday	
Tuesday	
Wednesday	
Thursday	

Key  represents 10 DVDs.

- a) How many DVDs were borrowed on
 (i) Monday,
 (ii) Tuesday

On Wednesday, 50 DVDs were borrowed.

On Thursday, 15 DVDs were borrowed.

- b) Show this information in the pictogram.

Pictograms

- 1) The pictogram shows the number of watches sold by a shop in January, February and March.

January	
February	
March	
April	
May	

Key represents 4 watches.

- a) How many watches were sold in January? **16 watches**
- b) Work out how many **more** watches were sold in March than in February? **3 watches more**

19 watches were sold in April.

14 watches were sold in May.

- c) Use this information to complete the pictogram.

- 2) The pictogram shows the number of DVDs borrowed from a shop on Monday and Tuesday.

Monday	
Tuesday	
Wednesday	
Thursday	

Key represents 10 DVDs.

- a) How many DVDs were borrowed on
- (i) Monday, **40 DVDs**
- (ii) Tuesday **25 DVDs**

On Wednesday, 50 DVDs were borrowed.

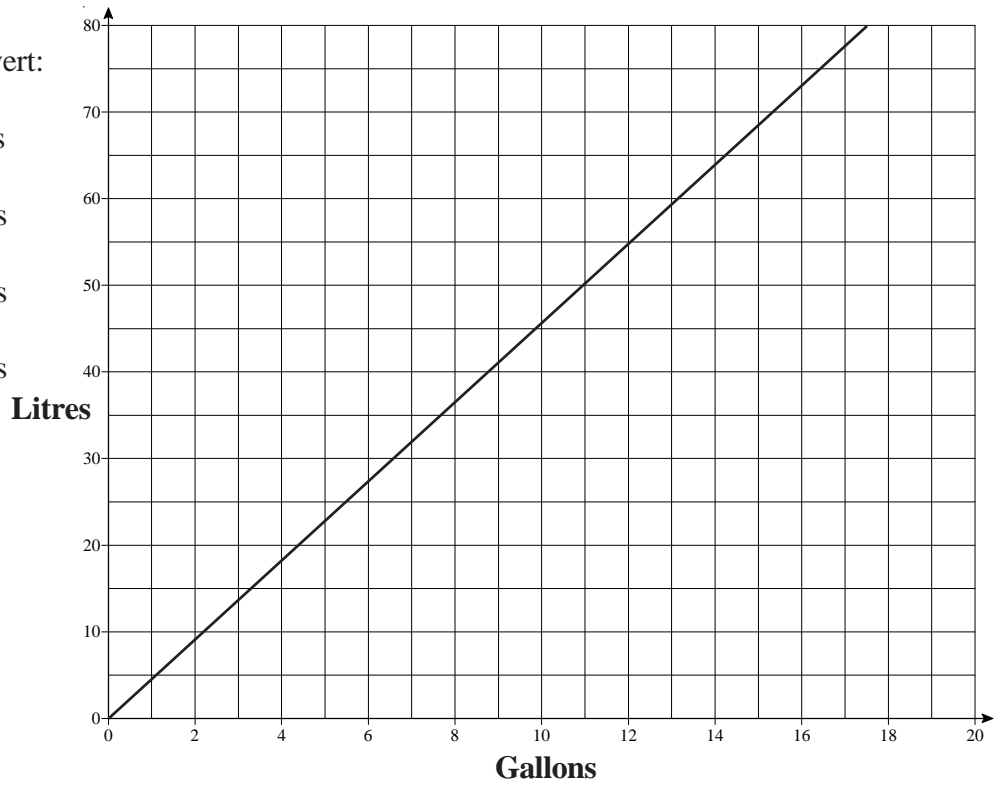
On Thursday, 15 DVDs were borrowed.

- b) Show this information in the pictogram.

Conversion Graphs

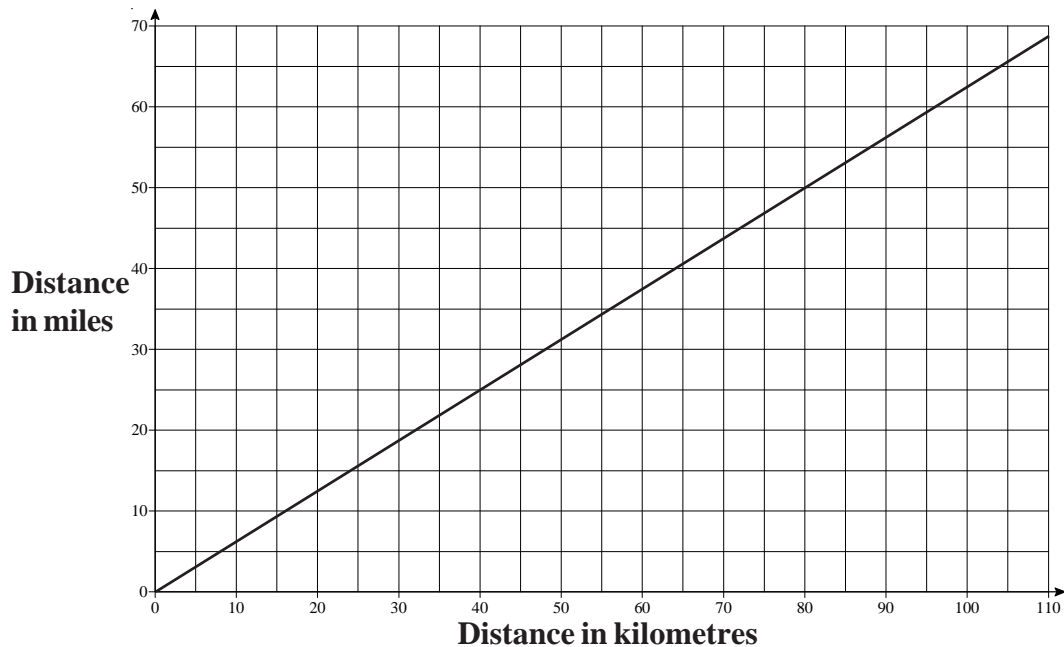
1) Use the graph to convert:

- a) 11 gallons to litres
- b) 40 litres to gallons
- c) 15 gallons to litres
- d) 25 litres to gallons



2) The conversion graph below converts between kilometres and miles.

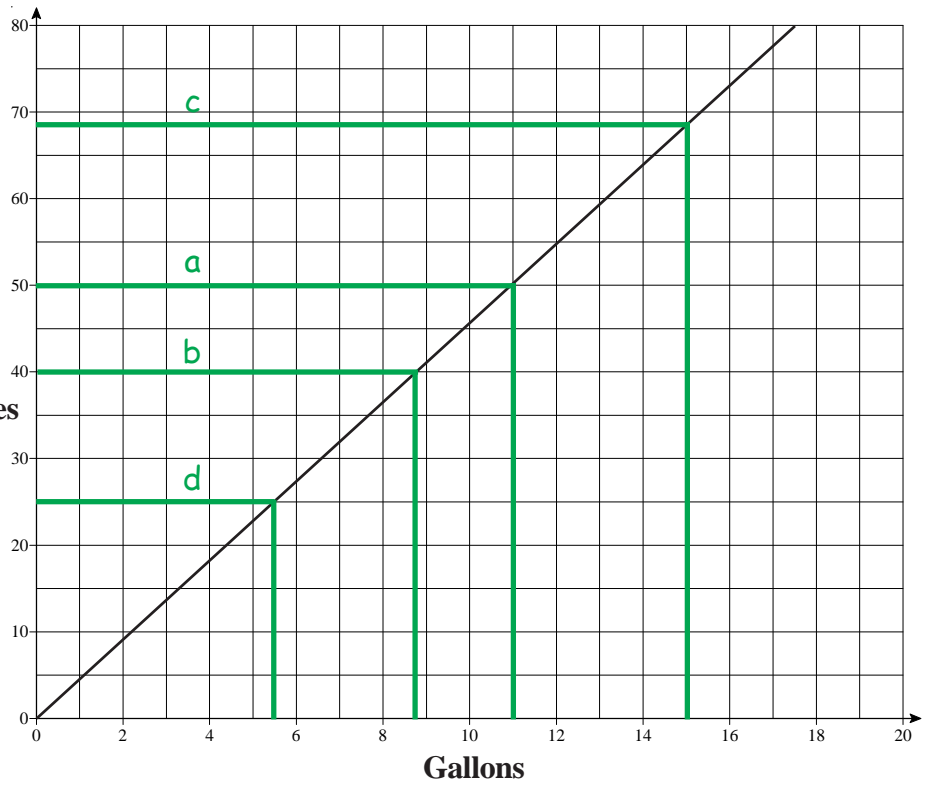
- a) Bob travels 50 miles.
What is this distance in kilometres?
- b) Terry travels 100 kilometres.
What is this distance in miles?
- c) The distance between the surgery and the hospital is 25 kilometres.
What is this distance in miles?
- d) Bill completes a 10 mile run.
How far is this in kilometres?



Conversion Graphs

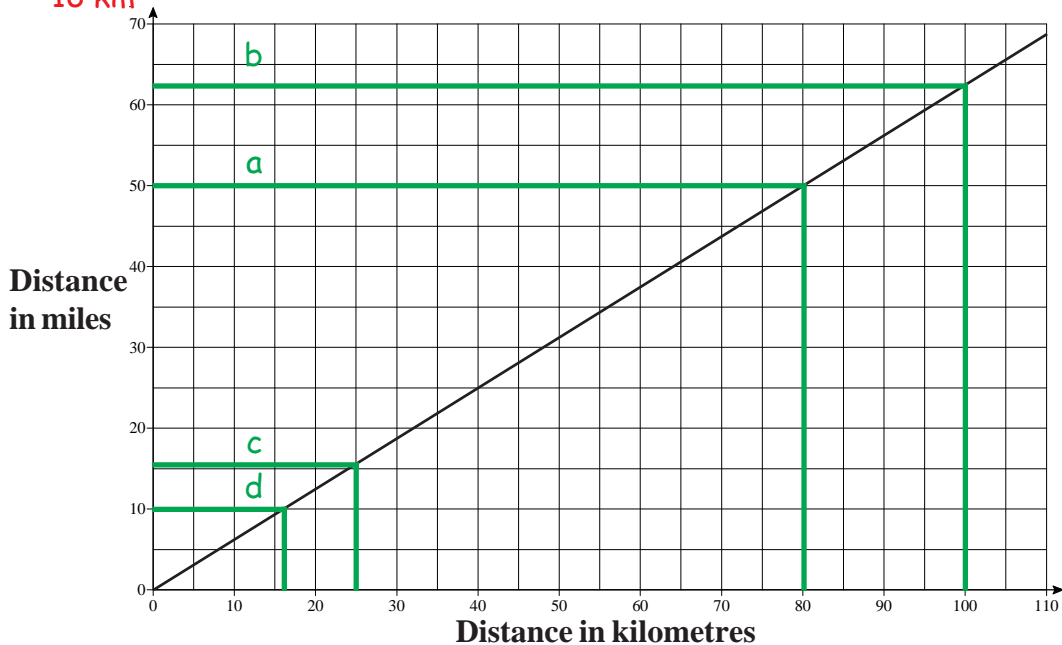
1) Use the graph to convert:

- a) 11 gallons to litres
50 litres
- b) 40 litres to gallons
8.8 gallons
- c) 15 gallons to litres
68 litres
- d) 25 litres to gallons
5.5 gallons



2) The conversion graph below converts between kilometres and miles.

- a) Bob travels 50 miles.
What is this distance in kilometres?
80 km
- b) Terry travels 100 kilometres.
What is this distance in miles?
62 miles
- c) The distance between the surgery and the hospital is 25 kilometres.
What is this distance in miles?
16 miles
- d) Bill completes a 10 mile run.
How far is this in kilometres?
16 km



1) Write the factors of

- a) 6 b) 16 c) 18 d) 30

2) In a pupil's book the factors of 12 are listed as

1 2 3 4 5 12

The above list contains a mistake.

Cross it out from the list and replace it with the correct number.

3) The factors of 30 and 40 are listed

30: 1, 2, 3, 5, 6, 10, 15, 30

40: 1, 2, 4, 5, 8, 10, 20, 40

Write the common factors of 30 and 40 (the numbers that are factors of 30 and 40).

4) Write the first four multiples of

- a) 3 b) 5 c) 10 d) 15

5) In a pupil's book the first 7 multiples of 8 are listed as

8 16 22 32 40 48 54

The above list contains 2 mistakes.

Cross them out and replace them with the correct numbers.

6) The first five multiples of 4 and 10 are listed

4: 4, 8, 12, 16, 20

10: 10, 20, 30, 40, 50

From the two lists above, write the common multiple of 4 and 10.

7) List the first five prime numbers

8) Using just this list of numbers:

11 18 1 4 21 24 9 3 12 2 19

find the following:

- a) The prime numbers
b) The factors of 18
c) The multiples of 3

1) Write the factors of

a) 6

1, 2, 3, 6

b) 16

1, 2, 4, 8, 16

c) 18

1, 2, 3, 6, 9, 18

d) 30

1, 2, 3, 5, 6, 10, 15, 30

2) In a pupil's book the factors of 12 are listed as

1 2 3 4 ~~8~~ 12
6

The above list contains a mistake.

Cross it out from the list and replace it with the correct number.

3) The factors of 30 and 40 are listed

30: 1, 2, 3, 5, 6, 10, 15, 30

40: 1, 2, 4, 5, 8, 10, 20, 40

Write the common factors of 30 and 40 (the numbers that are factors of 30 and 40).

1, 2, 5, 10

4) Write the first four multiples of

a) 3

3, 6, 9, 12

b) 5

5, 10, 15, 20

c) 10

10, 20, 30, 40

d) 15

15, 30, 45, 60

5) In a pupil's book the first 7 multiples of 8 are listed as

8 16 ~~20~~ 32 40 48 ~~54~~
24 **56**

The above list contains 2 mistakes.

Cross them out and replace them with the correct numbers.

6) The first five multiples of 4 and 10 are listed

4: 4, 8, 12, 16, 20

10: 10, 20, 30, 40, 50

From the two lists above, write the common multiple of 4 and 10.

20

7) List the first five prime numbers

2, 3, 5, 7, 11

8) Using just this list of numbers:

11 18 1 4 21 24 9 3 12 2 19

find the following:

a) The prime numbers **2, 3, 11, 19**

b) The factors of 18 **1, 2, 3, 9, 18**

c) The multiples of 3 **3, 9, 12, 18, 21, 24**

1. Evaluate

a) 7^2

b) 2^4

c) 5^2

d) 3^3

e) 1^6

2. Work out the square of

a) 1

b) 2

c) 4

d) 6

e) 11

3. Work out

a) 3^2

b) 9^2

c) 10^2

d) 12^2

e) 100^2

4. Work out the cube of

a) 1

b) 3

c) 5

d) 6

e) 100

5. Work out

a) 2^3

b) 4^3

c) 10^3

6. Work out the square root of

a) 1

b) 9

c) 81

7. Work out

a) $\sqrt{25}$

b) $\sqrt{49}$

c) $\sqrt{121}$

8. Work out the cube root of

a) 27

b) 1

c) 125

9. From the following numbers

4 27 8 64 16 19 100 360 45 3

Find

a) The square numbers

b) The cube numbers

c) The square root of 64

d) The cube root of 27

10. Match together cards with the same answer

9^2

$\sqrt{9}$

81

5^3

2^5

125

32

3

1. Evaluate

a) 7^2 **49**
 $7 \times 7 = 49$

b) 2^4 **16**
 $2 \times 2 \times 2 \times 2 = 16$

c) 5^2 **25**
 $5 \times 5 = 25$

d) 3^3 **27**
 $3 \times 3 \times 3 = 27$

e) 1^6 **1**
 $1 \times 1 \times 1 \times 1 \times 1 \times 1 = 1$

2. Work out the square of

a) 1 **1**
 $1^2 = 1$

b) 2 **4**
 $2^2 = 4$

c) 4 **16**
 $4^2 = 16$

d) 6 **36**
 $6^2 = 36$

e) 11 **121**
 $11^2 = 121$

3. Work out

a) 3^2 **9**
 $3 \times 3 = 9$

b) 9^2 **81**
 $9 \times 9 = 81$

c) 10^2 **100**
 $10 \times 10 = 100$

d) 12^2 **144**
 $12 \times 12 = 144$

e) 100^2 **10 000**
 $100 \times 100 = 10 000$

4. Work out the cube of

a) 1 **1**
 $1^3 = 1$

b) 3 **27**
 $3^3 = 27$

c) 5 **125**
 $5^3 = 125$

d) 6 **216**
 $6^3 = 216$

e) 100 **1 000 000**
 $100^3 = 1 000 000$

5. Work out

a) 2^3 **8**
 $2 \times 2 \times 2 = 8$

b) 4^3 **64**
 $4 \times 4 \times 4 = 64$

c) 10^3 **1 000**
 $10 \times 10 \times 10 = 1 000$

6. Work out the square root of

a) 1 **1**
 $1 \times 1 = 1$

b) 9 **3**
 $3 \times 3 = 9$

c) 81 **9**
 $9 \times 9 = 81$

7. Work out

a) $\sqrt{25}$ **5**
 $5^2 = 25$

b) $\sqrt{49}$ **7**
 $7^2 = 49$

c) $\sqrt{121}$ **11**
 $11^2 = 121$

8. Work out the cube root of

a) 27 **3**
 $3^3 = 27$

b) 1 **1**
 $1^3 = 1$

c) 125 **5**
 $5^3 = 125$

9. From the following numbers

4 27 8 64 16 19 100 360 45 3

Find

a) The square numbers

4 64 16 100 $2^2 = 4$, $8^2 = 64$, $4^2 = 16$, $10^2 = 100$

b) The cube numbers

27 8 64 $3^3 = 27$, $2^3 = 8$, $4^3 = 64$

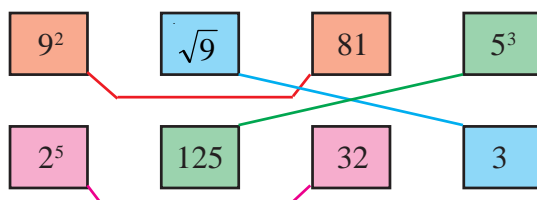
c) The square root of 64

8 $8^2 = 64$

d) The cube root of 27

3 $3^3 = 27$

10. Match together cards with the same answer



Equivalent Fractions, Simplifying and Ordering Fractions

1) Write down three equivalent fractions for each of these

a) $\frac{3}{4}$

b) $\frac{2}{5}$

c) $\frac{7}{8}$

2) Match together equivalent fractions

$\frac{10}{15}$

$\frac{3}{5}$

$\frac{18}{21}$

$\frac{21}{35}$

$\frac{2}{3}$

$\frac{6}{7}$

$\frac{30}{50}$

3) Find the missing values in these equivalent fractions

a) $\frac{1}{4} = \frac{\square}{8} = \frac{4}{\square} = \frac{\square}{40}$

c) $\frac{4}{5} = \frac{12}{\square} = \frac{20}{\square} = \frac{\square}{35} = \frac{\square}{60}$

b) $\frac{6}{9} = \frac{\square}{3} = \frac{\square}{90} = \frac{48}{\square} = \frac{66}{\square}$

d) $\frac{4}{10} = \frac{24}{\square} = \frac{\square}{5} = \frac{48}{\square} = \frac{\square}{200}$

4) Write these fractions in their simplest form

a) $\frac{24}{48}$

b) $\frac{8}{20}$

c) $\frac{45}{63}$

d) $\frac{39}{45}$

e) $\frac{72}{104}$

5) Write these fractions in order of size (smallest first)

a) $\frac{3}{8}, \frac{9}{16}, \frac{1}{4}, \frac{5}{16}$

c) $\frac{5}{8}, \frac{4}{6}, \frac{3}{24}, \frac{7}{12}$

b) $\frac{2}{3}, \frac{7}{12}, \frac{3}{4}, \frac{5}{6}$

d) $\frac{6}{10}, \frac{4}{5}, \frac{5}{12}, \frac{16}{30}$

6) Ben spent his pocket money this way:

$\frac{7}{20}$ on magazines;

$\frac{4}{10}$ on chocolates;

$\frac{1}{4}$ on games.

Order the items Ben bought by value (largest first).

Show all working

Equivalent Fractions, Simplifying and Ordering Fractions

1) Write down three equivalent fractions for each of these

a) $\frac{3}{4}$ $\frac{6}{8}$ $\frac{9}{12}$ $\frac{12}{16}$ etc...
 b) $\frac{2}{5}$ $\frac{4}{10}$ $\frac{6}{15}$ $\frac{8}{20}$ etc...
 c) $\frac{7}{8}$ $\frac{14}{16}$ $\frac{21}{24}$ $\frac{28}{32}$ etc...

2) Match together equivalent fractions

$\frac{10}{15}$	$\frac{3}{5}$	$\frac{18}{21}$	$\frac{21}{35}$	$\frac{2}{3}$	$\frac{6}{7}$	$\frac{30}{50}$
A	B	C	B	A	C	B

3) Find the missing values in these equivalent fractions

a) $\frac{1}{4} = \frac{2}{8} = \frac{4}{16} = \frac{10}{40}$
 c) $\frac{4}{5} = \frac{12}{15} = \frac{20}{25} = \frac{28}{35} = \frac{48}{60}$

b) $\frac{6}{9} = \frac{2}{3} = \frac{60}{90} = \frac{48}{72} = \frac{66}{99}$
 d) $\frac{4}{10} = \frac{24}{60} = \frac{2}{5} = \frac{48}{120} = \frac{80}{200}$

4) Write these fractions in their simplest form

a) $\frac{24}{48} = \frac{1}{2}$
 b) $\frac{8}{20} = \frac{2}{5}$
 c) $\frac{45}{63} = \frac{5}{7}$
 d) $\frac{39}{45} = \frac{13}{15}$
 e) $\frac{72}{104} = \frac{9}{13}$

5) Write these fractions in order of size (smallest first)

a) $\frac{3}{8}$ $\frac{9}{16}$ $\frac{1}{4}$ $\frac{5}{16}$ $\frac{1}{4}$ $\frac{5}{16}$ $\frac{3}{8}$ $\frac{9}{16}$
 c) $\frac{5}{8}$ $\frac{4}{6}$ $\frac{3}{24}$ $\frac{7}{12}$ $\frac{3}{24}$ $\frac{7}{12}$ $\frac{5}{8}$ $\frac{4}{6}$

$\frac{6}{16}$ $\frac{9}{16}$ $\frac{4}{16}$ $\frac{5}{16}$
 $\frac{15}{24}$ $\frac{16}{24}$ $\frac{3}{24}$ $\frac{14}{24}$

b) $\frac{2}{3}$ $\frac{7}{12}$ $\frac{3}{4}$ $\frac{5}{6}$ $\frac{7}{12}$ $\frac{2}{3}$ $\frac{3}{4}$ $\frac{5}{6}$
 d) $\frac{6}{10}$ $\frac{4}{5}$ $\frac{5}{12}$ $\frac{16}{30}$ $\frac{5}{12}$ $\frac{16}{30}$ $\frac{6}{10}$ $\frac{4}{5}$

$\frac{8}{12}$ $\frac{7}{12}$ $\frac{9}{12}$ $\frac{10}{12}$
 $\frac{36}{60}$ $\frac{48}{60}$ $\frac{25}{60}$ $\frac{32}{60}$

6) Ben spent his pocket money this way:

$\frac{7}{20}$ on magazines; $\frac{7}{20}$

$\frac{4}{10}$ on chocolates; $\frac{8}{20}$

$\frac{1}{4}$ on games. $\frac{5}{20}$

Order the items Ben bought by value (largest first). **chocolates, magazines, games**
 Show all working

Value for Money

- 1) Which of the following offer better value for money?

Working must be shown

*Without a calculator,
please, for question 1.*

a) 200ml of toothpaste for 50p or 400ml of toothpaste for 90p

b) 600g of bananas for 70p or 200g of bananas for 22p

c) 2 litres of paint for £1.60 or 5 litres of paint for £3.50

d) 60 teabags for £1.62 or 40 teabags for £0.96

- 2) Which of these is the best buy?

Working must be shown

20 exercise books
for £4.00

35 exercise books
for £7.80

- 3) Hamza needs to buy 2 litres of paint.

At the shop he gets two choices:

500ml for £2.55 or 1 litre for £4.79.

*Without a calculator,
please, for question 3.*

a) Work out which of these would be the best buy for Hamza.

b) How much does he save if he buys the 'best buy' rather than the 'worst buy'.

You must show all your working.

- 4) Honey pots are sold in two sizes.

A small pot costs 45p and weighs 450g.

A large pot costs 80p and weighs 850g.

Which pot of honey is better value for money?

You must show all your working.

Value for Money

- 1) Which of the following offer better value for money?

Without a calculator, please, for question 1.

Working must be shown

- a) 200ml of toothpaste for 50p or 400ml of toothpaste for 90p

$$400\text{ml of toothpaste for } \overset{\times 2}{\text{£1.00}}$$

- b) 600g of bananas for 70p or 200g of bananas for 22p

$$600\text{g of bananas for } \overset{\times 3}{\text{66p}}$$

- c) 2 litres of paint for £1.60 or 5 litres of paint for £3.50

$$1 \text{ litre of paint for } \overset{\div 2}{\text{80p}} \text{ or } 1 \text{ litre of paint for } \overset{\div 5}{\text{70p}}$$

- d) 60 teabags for £1.62 or 40 teabags for £0.96

$$120 \text{ teabags for } \overset{\times 2}{\text{£3.24}} \text{ or } 120 \text{ teabags for } \overset{\times 3}{\text{£2.88}}$$

- 2) Which of these is the best buy?

Working must be shown

<p>20 exercise books for £4.00</p>
--

$$400 \div 20 = 20$$

20p per book

<p>35 exercise books for £7.80</p>
--

$$780 \div 35 = 22.3$$

22p per book

- 3) Hamza needs to buy 2 litres of paint.

At the shop he gets two choices:

500ml for £2.55 or 1 litre for £4.79.

Without a calculator, please, for question 3.

$$1 \text{ litre of paint for } \overset{\times 2}{\text{£5.10}}$$

- a) Work out which of these would be the best buy for Hamza.

1 litre of paint for **£4.79**

- b) How much does he save if he buys the 'best buy' rather than the 'worst buy'.

£0.31 or 31p

You must show all your working.

$$\begin{array}{r} \text{£5.10} \\ - \text{£4.79} \\ \hline \text{£0.31} \end{array}$$

- 4) Honey pots are sold in two sizes.

A small pot costs 45p and weighs 450g.

$$45 \div 450 = 0.1\text{p per g}$$

A large pot costs 80p and weighs 850g.

$$80 \div 850 = 0.09\text{p per g}$$

Which pot of honey is better value for money?

Large pot at 80p for 850g

You must show all your working.

Find a Percentage with a Calculator

- 1) Work out
- a) 21% of 340
b) 9% of 2700
c) 17.5% of 420
- d) 3.5% of 78.6
e) 80.5% of 3200
f) 117.5% of 35
- 2) Work out the total cost (including VAT) of the following items.

Trainers
£45.50
plus 17.5% VAT

Tennis racquet
£28.99
plus 17.5% VAT

Football boots
£57
plus 17.5% VAT

- 3) 850 people attended a festival.
16% of the people were children.
Work out the number of children at the festival.
-

Find a Percentage Without a Calculator

- 1) Work out (i) 10% and (ii) 5% and (iii) 15% of:
- a) 200 b) 30 c) 450 d) 54
- 2) Work out
- a) 30% of 280
b) 80% of 3500
c) 15% of 540
- d) 17.5% of 300
e) 55% of 700
f) 17.5% of 180
- 3) Work out the total cost (including VAT) of the following items.

Video recorder
£200 + 17.5% VAT

Tape player
£60 + 17.5% VAT

Laptop
£1200 + 17.5% VAT

- 4) There are 1300 students at MathsWatch College.
45% of these students are boys.
Work out the number of boys.

Find a Percentage with a Calculator

1) Work out

- | | | | |
|-----------------|-------------|------------------|---------------|
| a) 21% of 340 | 71.4 | d) 3.5% of 78.6 | 2.751 |
| b) 9% of 2700 | 243 | e) 80.5% of 3200 | 2576 |
| c) 17.5% of 420 | 73.5 | f) 117.5% of 35 | 41.125 |

2) Work out the total cost (including VAT) of the following items.

Trainers
£45.50
plus 17.5% VAT

£53.46

Tennis racquet
£28.99
plus 17.5% VAT

£34.06

Football boots
£57
plus 17.5% VAT

£66.98

3) 850 people attended a festival.

16% of the people were children.

Work out the number of children at the festival. **136 children**

Find a Percentage Without a Calculator

1) Work out (i) 10% and (ii) 5% and (iii) 15% of:

- | | | | | | | | |
|--------|-----------------|-------|------------------|--------|-------------------|-------|------------------|
| a) 200 | (i) 20 | b) 30 | (i) 3 | c) 450 | (i) 45 | d) 54 | (i) 5.4 |
| | (ii) 10 | | (ii) 1.5 | | (ii) 22.5 | | (ii) 2.7 |
| | (iii) 30 | | (iii) 4.5 | | (iii) 67.5 | | (iii) 8.1 |

2) Work out

- | | | | |
|----------------|-------------|-----------------|-------------|
| a) 30% of 280 | 84 | d) 17.5% of 300 | 52.5 |
| b) 80% of 3500 | 2800 | e) 55% of 700 | 385 |
| c) 15% of 540 | 81 | f) 17.5% of 180 | 31.5 |

3) Work out the total cost (including VAT) of the following items.

100 % + 10 % + 5 % + 2.5 %	200 + 20 + 10 + 5 <hr style="border: 0; border-top: 1px solid black; margin: 0;"/> 235	Video recorder £200 + 17.5% VAT £235	60 + 6 + 3 + 1.5 <hr style="border: 0; border-top: 1px solid black; margin: 0;"/> 70.5	Tape player £60 + 17.5% VAT £70.50	1200 + 120 + 60 + 30 <hr style="border: 0; border-top: 1px solid black; margin: 0;"/> 1410	Laptop £1200 + 17.5% VAT £1410
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4) There are 1300 students at MathsWatch College.

45% of these students are boys.

Work out the number of boys. **585 boys**

$$10\% = 130$$

$$40\% = 130 \times 4 = 520$$

$$5\% = 130 \div 2 = 65$$

$$520 + 65 = 585$$

Change to a Percentage With a Calculator

- 1) In a class of 37 pupils, 22 are boys.
 - a) What percentage of the class are boys?
 - b) What percentage of the class are girls?
- 2) Sarah sat a mock examination and gained the following marks:

Subject	Mark
English	$\frac{82}{94}$
Maths	$\frac{79}{123}$
Science	$\frac{38}{46}$

- a) Write each of Sarah's marks as a percentage.
 - b) Which is Sarah's best subject in terms of percentage score?
- 3) A brand new car costs £16 500.
A discount of £2 227.50 is negotiated with the dealer.
What is the percentage discount?

Change to a Percentage Without a Calculator

- 1) Write the following as percentages:
 - a) 13 out of 50
 - b) 6 out of 20
 - c) 17 out of 25
 - d) 34 out of 40
 - e) 12 out of 80
 - f) 27 out of 60
- 2) In a football tournament, Team A won 16 of the 20 games they played, whilst team B won 19 of their 25 games.
What percentage of their games did they each win?
- 3) 60 participants were invited to a conference.
36 of the participants were females.
 - a) Work out the percentage of female participants.
 - b) What is the percentage of male participants?
- 4) A company has 800 employees.
440 of these 800 employees are males.
176 of these 800 employees are under 25 years old.
 - a) What percentages of males are employed in this company?
 - b) What percentage of employees are under 25?

Change to a Percentage With a Calculator

1) In a class of 37 pupils, 22 are boys.

a) What percentage of the class are boys? **59.5%** $\frac{22}{37} \times 100 = 59.5\%$

b) What percentage of the class are girls? **40.5%** $\frac{15}{37} \times 100 = 40.5\%$

2) Sarah sat a mock examination and gained the following marks:

Subject	Mark
English	$\frac{82}{94}$
Maths	$\frac{79}{123}$
Science	$\frac{38}{46}$

87.2% $\frac{82}{94} \times 100 = 87.2\%$

64.2% $\frac{79}{123} \times 100 = 64.2\%$

82.6% $\frac{38}{46} \times 100 = 82.6\%$

a) Write each of Sarah's marks as a percentage.

b) Which is Sarah's best subject in terms of percentage score? **English**

3) A brand new car costs £16 500.

A discount of £2 227.50 is negotiated with the dealer. $\frac{2227.5}{16500} \times 100 = 13.5\%$

What is the percentage discount? **13.5%**

Change to a Percentage Without a Calculator

1) Write the following as percentages:

a) 13 out of 50 **26%** $\frac{13}{50} \times 2 = \frac{26}{100}$

b) 6 out of 20 **30%** $\frac{6}{20} \times 5 = \frac{30}{100}$

c) 17 out of 25 **68%** $\frac{17}{25} \times 4 = \frac{68}{100}$

d) 34 out of 40 **85%** $\frac{34}{40} \div 2 = \frac{17}{20} \times 5 = \frac{85}{100}$

e) 12 out of 80 **15%** $\frac{12}{80} \div 4 = \frac{3}{20} \times 5 = \frac{15}{100}$

f) 27 out of 60 **45%** $\frac{27}{60} \div 3 = \frac{9}{20} \times 5 = \frac{45}{100}$

2) In a football tournament, Team A won 16 of the 20 games they played, whilst team B won 19 of their 25 games.

What percentage of their games did they each win?

Team A: 80% Team B: 76%

Team A $\frac{16}{20} = \frac{80}{100}$ 80% **Team B** $\frac{19}{25} = \frac{76}{100}$ 76%

3) 60 participants were invited to a conference.

36 of the participants were females.

a) Work out the percentage of female participants. **60%**

$\frac{36}{60} = \frac{12}{20} = \frac{60}{100}$

b) What is the percentage of male participants? **40%**

$100\% - 60\% = 40\%$

4) A company has 800 employees.

440 of these 800 employees are males.

176 of these 800 employees are under 25 years old.

a) What percentages of males are employed in this company? **55%** $\frac{440}{800} = \frac{55}{100}$

b) What percentage of employees are under 25? **22%** $\frac{176}{800} = \frac{22}{100}$

1. Work out these amounts.

a) $\frac{3}{4}$ of £20

b) $\frac{2}{3}$ of 60 kg

c) $\frac{3}{8} \times 24$

d) $150 \times \frac{2}{3}$

e) $\frac{2}{9}$ of 180 cm

f) $49 \times \frac{4}{7}$

g) $60 \times \frac{1}{4}$

h) $\frac{5}{8}$ of £48

i) $4000 \times \frac{7}{8}$

2. There are 600 apples on a tree and there are maggots in $\frac{3}{5}$ of them.

How many apples have maggots in them?

3. Liz and Lee are travelling in a car from Glasgow to Poole (770 km).

At midday they had already travelled $\frac{5}{7}$ of the total distance.

What distance, in km, had they travelled by midday?

4. A digital camera that cost £49 was sold on eBay for $\frac{3}{7}$ of the original price.

What was the selling price?

5. Yesterday Thomas travelled a total of 175 miles.

He travelled $\frac{2}{5}$ of this distance in the morning.

How many miles did he travel during the rest of the day?

6. Debra received her £15 pocket money on Saturday.

She spent $\frac{1}{3}$ of her pocket money on magazines.

She spent $\frac{2}{5}$ of her pocket money on a necklace.

How much of the £15 did she have left?

1. Work out these amounts.

a) $\frac{3}{4}$ of £20 **£15** b) $\frac{2}{3}$ of 60 kg **40 kg** c) $\frac{3}{8} \times 24$ **9**

d) $150 \times \frac{2}{3}$ **100** e) $\frac{2}{9}$ of 180 cm **40 cm** f) $49 \times \frac{4}{7}$ **28**

g) $60 \times \frac{1}{4}$ **15** h) $\frac{5}{8}$ of £48 **£30** i) $4000 \times \frac{7}{8}$ **3 500**

2. There are 600 apples on a tree and there are maggots in $\frac{3}{5}$ of them.

How many apples have maggots in them? **360 apples**

3. Liz and Lee are travelling in a car from Glasgow to Poole (770 km).

At midday they had already travelled $\frac{5}{7}$ of the total distance.

What distance, in km, had they travelled by midday? **550 km**

4. A digital camera that cost £49 was sold on eBay for $\frac{3}{7}$ of the original price.

What was the selling price? **£21**

5. Yesterday Thomas travelled a total of 175 miles.

He travelled $\frac{2}{5}$ of this distance in the morning.

How many miles did he travel during the rest of the day? **105 miles**

$$\frac{2}{5} \text{ of } 175 \text{ miles is } 70 \text{ miles}$$

$$175 - 70 = 105$$

6. Debra received her £15 pocket money on Saturday.

She spent $\frac{1}{3}$ of her pocket money on magazines.

She spent $\frac{2}{5}$ of her pocket money on a necklace.

How much of the £15 did she have left? **£4**

$$\frac{1}{3} \text{ of } £15 \text{ is } £5$$

$$\frac{2}{5} \text{ of } £15 \text{ is } £6$$

$$15 - 5 - 6 = 4$$

1. Work out the following giving your answer as a fraction in its simplest form

a) $\frac{3}{5} + \frac{1}{5}$ b) $\frac{3}{7} + \frac{2}{7}$ c) $\frac{5}{8} - \frac{3}{8}$ d) $\frac{7}{13} - \frac{4}{13}$

2. Work out the following giving your answer as a fraction in its simplest form

a) $\frac{3}{5} + \frac{2}{10}$ b) $\frac{1}{3} + \frac{2}{9}$ c) $\frac{13}{20} - \frac{3}{5}$ d) $\frac{9}{12} - \frac{1}{3}$

3. Change the following to mixed numbers

a) $\frac{8}{5}$ b) $\frac{14}{3}$ c) $\frac{35}{6}$ d) $\frac{17}{5}$

4. Change the following to top heavy (or improper) fractions

a) $1\frac{2}{5}$ b) $3\frac{1}{4}$ c) $6\frac{1}{5}$ d) $2\frac{5}{9}$

5. Work out the following giving your answer as a fraction in its simplest form

a) $1\frac{2}{5} + 6\frac{1}{5}$ b) $2\frac{3}{4} + 1\frac{1}{5}$ c) $4\frac{1}{6} - 3\frac{1}{3}$ d) $7\frac{4}{9} - 2\frac{5}{9}$

6. Work out the following giving your answer as a fraction in its simplest form

a) $\frac{3}{4} - \frac{1}{5}$ b) $\frac{5}{11} + \frac{3}{11}$ c) $5\frac{1}{2} - \frac{2}{3}$ d) $\frac{7}{12} + \frac{3}{4}$

e) $2\frac{4}{5} + 9\frac{2}{5}$ f) $\frac{2}{7} + \frac{1}{2}$ g) $9\frac{1}{4} - 5\frac{2}{5}$ h) $\frac{12}{15} - \frac{7}{15}$

7. Ted received his pocket money on Friday.

He spent $\frac{3}{5}$ of his pocket money on games.

He spent $\frac{1}{10}$ of his pocket money on magazines.

What fraction of his pocket money did he have left?

8. Maisie buys a bag of flour.

She uses $\frac{1}{4}$ to bake a cake and $\frac{2}{5}$ to make a loaf.

a) What fraction of the bag of flour was used?

b) What fraction of the bag of flour is left?

9. Work out the total length of this shape.
Give your answer as a mixed number.

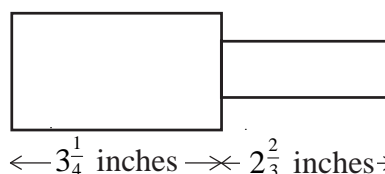


Diagram **NOT**
accurately drawn

1. Work out the following giving your answer as a fraction in its simplest form

a) $\frac{3}{5} + \frac{1}{5} = \frac{4}{5}$ b) $\frac{3}{7} + \frac{2}{7} = \frac{5}{7}$ c) $\frac{5}{8} - \frac{3}{8} = \frac{1}{4}$ d) $\frac{7}{13} - \frac{4}{13} = \frac{3}{13}$

2. Work out the following giving your answer as a fraction in its simplest form

a) $\frac{3}{5} + \frac{2}{10} = \frac{4}{5}$ b) $\frac{1}{3} + \frac{2}{9} = \frac{5}{9}$ c) $\frac{13}{20} - \frac{3}{5} = \frac{1}{20}$ d) $\frac{9}{12} - \frac{1}{3} = \frac{5}{12}$

3. Change the following to mixed numbers

a) $\frac{8}{5} = 1\frac{3}{5}$ b) $\frac{14}{3} = 4\frac{2}{3}$ c) $\frac{35}{6} = 5\frac{5}{6}$ d) $\frac{17}{5} = 3\frac{2}{5}$

4. Change the following to top heavy (or improper) fractions

a) $1\frac{2}{5} = \frac{7}{5}$ b) $3\frac{1}{4} = \frac{13}{4}$ c) $6\frac{1}{5} = \frac{31}{5}$ d) $2\frac{5}{9} = \frac{23}{9}$

5. Work out the following giving your answer as a fraction in its simplest form

a) $1\frac{2}{5} + 6\frac{1}{5} = 7\frac{3}{5}$ b) $2\frac{3}{4} + 1\frac{1}{5} = 3\frac{19}{20}$ c) $4\frac{1}{6} - 3\frac{1}{3} = \frac{5}{6}$ d) $7\frac{4}{9} - 2\frac{5}{9} = 4\frac{8}{9}$

6. Work out the following giving your answer as a fraction in its simplest form

a) $\frac{3}{4} - \frac{1}{5} = \frac{11}{20}$ b) $\frac{5}{11} + \frac{3}{11} = \frac{8}{11}$ c) $5\frac{1}{2} - \frac{2}{3} = 4\frac{5}{6}$ d) $\frac{7}{12} + \frac{3}{4} = 1\frac{1}{3}$

e) $2\frac{4}{5} + 9\frac{2}{5} = 12\frac{1}{5}$ f) $\frac{2}{7} + \frac{1}{2} = \frac{11}{14}$ g) $9\frac{1}{4} - 5\frac{2}{5} = 3\frac{17}{20}$ h) $\frac{12}{15} - \frac{7}{15} = \frac{1}{3}$

7. Ted received his pocket money on Friday.

He spent $\frac{3}{5}$ of his pocket money on games.

$$\frac{3}{5} + \frac{1}{10} = \frac{7}{10}$$

He spent $\frac{1}{10}$ of his pocket money on magazines.

$$1 - \frac{7}{10} = \frac{3}{10}$$

What fraction of his pocket money did he have left? $\frac{3}{10}$

8. Maisie buys a bag of flour.

She uses $\frac{1}{4}$ to bake a cake and $\frac{2}{5}$ to make a loaf.

- a) What fraction of the bag of flour was used? $\frac{13}{20}$
 b) What fraction of the bag of flour is left? $\frac{7}{20}$

9. Work out the total length of this shape. $5\frac{11}{12}$ inches
 Give your answer as a mixed number.

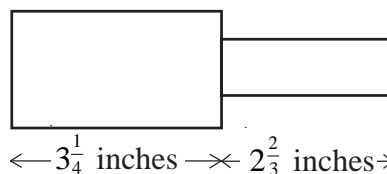


Diagram NOT accurately drawn

Work out the following giving your answer as a fraction in its simplest form.

1) $\frac{4}{5} \times \frac{1}{3}$

2) $\frac{3}{4} \times \frac{2}{3}$

3) $\frac{3}{10} \times \frac{4}{9}$

4) $\frac{3}{7} \times \frac{5}{6}$

5) $\frac{6}{25} \times \frac{15}{18}$

6) $\frac{4}{15} \times \frac{3}{16}$

7) $2\frac{2}{3} \times 3\frac{3}{4}$

8) $1\frac{2}{3} \times 3\frac{3}{10}$

9) $4\frac{2}{3} \times \frac{5}{7}$

10) $\frac{3}{5} \times 12\frac{1}{2}$

11) $\frac{1}{3} \div \frac{5}{6}$

12) $\frac{2}{7} \div \frac{10}{21}$

13) $\frac{4}{5} \div 8$

14) $\frac{4}{11} \div \frac{4}{11}$

15) $\frac{4}{5} \div \frac{8}{9}$

16) $\frac{5}{8} \div \frac{10}{19}$

17) $1\frac{2}{3} \div 2\frac{1}{2}$

18) $3\frac{1}{5} \div 2\frac{2}{3}$

19) $25 \div 2\frac{1}{7}$

20) $\frac{2}{3} \div 2\frac{2}{9}$

Work out the following giving your answer as a fraction in its simplest form.

1) $\frac{4}{5} \times \frac{1}{3} = \frac{4}{15}$

2) $\frac{3}{4} \times \frac{2}{3} = \frac{1}{2}$

3) $\frac{3}{10} \times \frac{4}{9} = \frac{2}{15}$

4) $\frac{3}{7} \times \frac{5}{6} = \frac{5}{14}$

5) $\frac{6}{25} \times \frac{15}{18} = \frac{1}{5}$

6) $\frac{4}{15} \times \frac{3}{16} = \frac{1}{20}$

7) $2\frac{2}{3} \times 3\frac{3}{4} = 9$

8) $1\frac{2}{3} \times 3\frac{3}{10} = 5\frac{1}{2}$

9) $4\frac{2}{3} \times \frac{5}{7} = 3\frac{1}{3}$

10) $\frac{3}{5} \times 12\frac{1}{2} = 7\frac{1}{2}$

11) $\frac{1}{3} \div \frac{5}{6} = \frac{2}{5}$

12) $\frac{2}{7} \div \frac{10}{21} = \frac{3}{5}$

13) $\frac{4}{5} \div 8 = \frac{1}{10}$

14) $\frac{4}{11} \div \frac{4}{11} = 1$

15) $\frac{4}{5} \div \frac{8}{9} = \frac{9}{10}$

16) $\frac{5}{8} \div \frac{10}{19} = 1\frac{3}{16}$

17) $1\frac{2}{3} \div 2\frac{1}{2} = \frac{2}{3}$

18) $3\frac{1}{5} \div 2\frac{2}{3} = 1\frac{1}{5}$

19) $25 \div 2\frac{1}{7} = 11\frac{2}{3}$

20) $\frac{2}{3} \div 2\frac{2}{9} = \frac{3}{10}$

Write the following fractions as decimals

1) $\frac{3}{10}$

2) $\frac{7}{10}$

3) $\frac{9}{100}$

4) $\frac{1}{2}$

5) $\frac{3}{4}$

6) $\frac{2}{5}$

7) $\frac{7}{20}$

8) $\frac{1}{3}$

9) $\frac{1}{8}$

10) $\frac{5}{8}$

Change a Fraction to a Decimal

Write the following fractions as decimals

1) $\frac{3}{10}$ 0.3 $10 \overline{) 30}$

2) $\frac{7}{10}$ 0.7

3) $\frac{9}{100}$ 0.09

4) $\frac{1}{2}$ 0.5

5) $\frac{3}{4}$ 0.75

6) $\frac{2}{5}$ 0.4

7) $\frac{7}{20}$ 0.35

8) $\frac{1}{3}$ $0.\dot{3}$

9) $\frac{1}{8}$ 0.125

10) $\frac{5}{8}$ 0.625

Work out

1) $6 \times 5 + 2$

2) $2 + 6 \times 5$

3) $35 - 4 \times 3$

4) $48 \div (14 - 2)$

5) $27 \div (3 + 6)$

6) $27 \div 3 + 6$

7) $(9 + 2) \times 2 + 5$

8) $4 \times (1 + 4) - 6$

9) $6 \times 4 - 3 \times 5$

10) $\frac{9+3}{4+2}$

11) $\frac{23+9}{7-3}$

12) $\frac{7-2^2}{4^2-15}$

13) $\frac{5^2+3}{2 \times 7}$

14) $\frac{5 \times 6 - 4}{13}$

15) $\frac{8 \times 2 - 4}{3 + 1^2}$

16) $\frac{12 - 3 \times 2}{14 \div 7}$

17) $\frac{20 - 3^2}{10 - (5 + 4)}$

18) $\frac{3 + 9 \times 8}{1 + 6 \times 4}$

Work out

1) $6 \times 5 + 2 = 32$

$30 + 2 = 32$

2) $2 + 6 \times 5 = 32$

$2 + 30 = 32$

3) $35 - 4 \times 3 = 23$

$35 - 12 = 23$

4) $48 \div (14 - 2) = 4$

$48 \div 12 = 4$

5) $27 \div (3 + 6) = 3$

$27 \div 9 = 3$

6) $27 \div 3 + 6 = 15$

$9 + 6 = 15$

7) $(9 + 2) \times 2 + 5 = 27$

$11 \times 2 + 5$, $22 + 5 = 27$

8) $4 \times (1 + 4) - 6 = 14$

$4 \times 5 - 6$, $20 - 6 = 14$

9) $6 \times 4 - 3 \times 5 = 9$

$24 - 15 = 9$

10) $\frac{9+3}{4+2} = 2$

$\frac{12}{6} = 2$

11) $\frac{23+9}{7-3} = 8$

$\frac{32}{4} = 8$

12) $\frac{7-2^2}{4^2-15} = 3$

$\frac{7-4}{16-15}$, $\frac{3}{1} = 3$

13) $\frac{5^2+3}{2 \times 7} = 2$

$\frac{25+3}{14}$, $\frac{28}{14} = 2$

14) $\frac{5 \times 6 - 4}{13} = 2$

$\frac{30-4}{13}$, $\frac{26}{13} = 2$

15) $\frac{8 \times 2 - 4}{3 + 1^2} = 3$

$\frac{16-4}{3+1}$, $\frac{12}{4} = 3$

16) $\frac{12 - 3 \times 2}{14 \div 7} = 3$

$\frac{12-6}{2}$, $\frac{6}{2} = 3$

17) $\frac{20 - 3^2}{10 - (5 + 4)} = 11$

$\frac{20-9}{10-9}$, $\frac{11}{1} = 11$

18) $\frac{3 + 9 \times 8}{1 + 6 \times 4} = 3$

$\frac{3+72}{1+24}$, $\frac{75}{25} = 3$

1. Work out

a) 7×4.3

b) 5×3.16

c) 2.3×1.2

d) 7.2×42.5

e) 12.5×0.59

f) 0.652×0.37

g) 5.62×9

h) 26.7×4.9

i) 1.56×0.059

2. David buys 5 books for £8.75 each.

How much does he pay?

3. A DVD costs £12.25.

Work out the cost of 9 of these DVDs.

4. John takes 27 boxes out of his van.

The weight of each box is 41.7 kg.

Work out the total weight of the 27 boxes.

5. Nina bought 43 teddy bears at £9.35 each.

Work out the total amount she paid.

6. Elliott goes shopping.

He buys

0.5 kg of pears at £0.84 per kg.

2.5 kg of grapes at £1.89 per kg.

6 kg of potatoes at £0.25 per kg.

How much does he pay?

7. Brian hires a car for 3 days.

Tariffs are:

£44.80 for the first day and

£37.50 for each extra day.

How much does he pay?

1. Work out

a) 7×4.3 **30.1** b) 5×3.16 **15.8** c) 2.3×1.2 **2.76**

d) 7.2×42.5 **306** e) 12.5×0.59 **7.375** f) 0.652×0.37 **0.24124**

g) 5.62×9 **50.58** h) 26.7×4.9 **130.83** i) 1.56×0.059 **0.09204**

2. David buys 5 books for £8.75 each.

How much does he pay? **£43.75**

3. A DVD costs £12.25.

Work out the cost of 9 of these DVDs. **£110.25**

4. John takes 27 boxes out of his van.

The weight of each box is 41.7 kg.

Work out the total weight of the 27 boxes. **1 125.9 kg**

5. Nina bought 43 teddy bears at £9.35 each.

Work out the total amount she paid. **£402.05**

6. Elliott goes shopping.

He buys

0.5 kg of pears at £0.84 per kg. **£0.42**

2.5 kg of grapes at £1.89 per kg. **£4.73**

6 kg of potatoes at £0.25 per kg. **+ £1.50**

How much does he pay? **£6.65**

7. Brian hires a car for 3 days.

Tariffs are:

£44.80 for the first day and **£44.80**

£37.50 for each extra day. **£37.50**

+ £37.50

How much does he pay? **£119.80**

1. Write the following ratios in their simplest form

a) $6 : 9$

b) $10 : 5$

c) $7 : 21$

d) $4 : 24$

e) $12 : 40$

f) $18 : 27$

g) $4 : 2 : 8$

h) $18 : 63 : 9$

2. Complete the missing value in these equivalent ratios

a) $3 : 5 = 12 : \square$

b) $4 : 9 = \square : 27$

c) $\square : 7 = 16 : 14$

d) $2 : 3 = 3 : \square$

3. Match together cards with equivalent ratios:

3 : 4	10 : 5	50 : 100	2 : 1
5 : 2	15 : 20	15 : 6	1 : 2

4. The ratio of girls to boys in a class is $4 : 5$.

a) What fraction of the class are girls?

b) What fraction of the class are boys?

5. A model of a plane is made using a scale of $1 : 5$.

a) If the real length of the plane is 20m, what is the length of the model in metres?

b) If the wings of the model are 100cm long, what is the real length of the wings in metres?

6. Share out £250 in the following ratios:

a) $1 : 4$

b) $2 : 3$

c) $7 : 3$

d) $9 : 12 : 4$

7. Share out £80 between Tom and Jerry in the ratio $3 : 2$.

8. A box of chocolates has 3 milk chocolates for every 2 white chocolates.

There are 60 chocolates in the box.

Work out how many white chocolates are in the box.

9. In a bracelet, the ratio of silver beads to gold beads is $5 : 2$.

The bracelet has 25 silver beads.

How many gold beads are in the bracelet?

10. To make mortar you mix 1 shovel of cement with 5 shovels of sand.

How much sand do you need to make 30 shovels of mortar?

1. Write the following ratios in their simplest form

a) $6 : 9$
 $2 : 3$

b) $10 : 5$
 $2 : 1$

c) $7 : 21$
 $1 : 3$

d) $4 : 24$
 $1 : 6$

e) $12 : 40$
 $3 : 10$

f) $18 : 27$
 $2 : 3$

g) $4 : 2 : 8$
 $2 : 1 : 4$

h) $18 : 63 : 9$
 $2 : 7 : 1$

2. Complete the missing value in these equivalent ratios

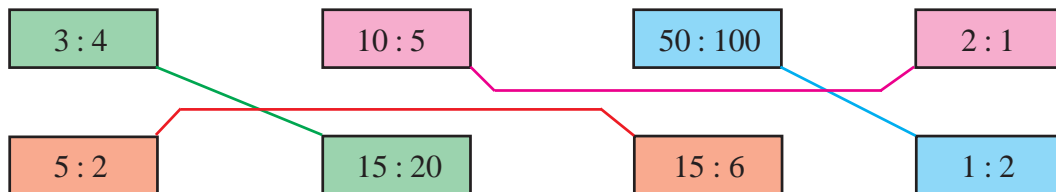
a) $3 : 5 = 12 : \boxed{20}$

b) $4 : 9 = \boxed{12} : 27$

c) $\boxed{8} : 7 = 16 : 14$

d) $2 : 3 = 3 : \boxed{4.5}$

3. Match together cards with equivalent ratios:



4. The ratio of girls to boys in a class is $4 : 5$.

a) What fraction of the class are girls? $\frac{4}{9}$

b) What fraction of the class are boys? $\frac{5}{9}$

5. A model of a plane is made using a scale of $1 : 5$.

a) If the real length of the plane is 20m, what is the length of the model in metres? 4m

b) If the wings of the model are 100cm long, what is the real length of the wings in metres? 5m

6. Share out £250 in the following ratios:

a) $1 : 4$
 $£50 \text{ and } £200$

b) $2 : 3$
 $£100 \text{ and } £150$

c) $7 : 3$
 $£175 \text{ and } £75$

d) $9 : 12 : 4$
 $£90 \text{ and } £120 \text{ and } £40$

7. Share out £80 between Tom and Jerry in the ratio $3 : 2$. **Tom gets £48, Jerry gets £32**

$3 + 2 = 5$ $80 \div 5 = 16$ $3 \times 16 = 48$ $2 \times 16 = 32$

8. A box of chocolates has 3 milk chocolates for every 2 white chocolates.

There are 60 chocolates in the box.

Work out how many white chocolates are in the box. **24 white chocolates**

$3 + 2 = 5$ $60 \div 5 = 12$ $2 \times 12 = 24$

9. In a bracelet, the ratio of silver beads to gold beads is $5 : 2$.

The bracelet has 25 silver beads.

How many gold beads are in the bracelet? **10 gold beads**

$$\begin{array}{cc} 5 & 6 \\ \times 5 \left(\begin{array}{c} 5 \\ 25 \end{array} \right) & \left(\begin{array}{c} 6 \\ ? \end{array} \right) \times 5 \end{array}$$

10. To make mortar you mix 1 shovel of cement with 5 shovels of sand.

How much sand do you need to make 30 shovels of mortar? **25 shovels of sand**

$1 + 5 = 6$

$30 \div 6 = 5$

$5 \times 5 = 25$

- 1) Here are the ingredients for making a vegetable soup for 6 people:

2 carrots
1 onion
800ml stock
50g lentils
4g thyme

Work out the amount of each ingredient for

- a) 12 people
- b) 9 people
- c) 30 people.
- 2) Here are the ingredients for making apple crumble for 4 people:

80g plain flour
60g ground almonds
90g sugar
60g butter
4 apples

Work out the amount of each ingredient for

- a) 2 people
- b) 6 people
- c) 18 people.
- 3) Here are the ingredients for making 1500 ml of parsnip soup:

450g parsnips
300g leeks
150g bramley apples
3 onions
 $1\frac{1}{2}$ pints of chicken stock

Work out the amount of each ingredient for

- a) 500 ml of soup
- b) 1000 ml of soup
- c) 2500 ml of soup.

Recipe Type Ratio Questions

- 1) Here are the ingredients for making a vegetable soup for 6 people:

2 carrots
1 onion
800ml stock
50g lentils
4g thyme

Work out the amount of each ingredient for

- | | | | |
|---------------|--------------------------------|-------------------------------|---------------------------------|
| a) 12 people | a) For 12 people:
4 carrots | b) For 9 people:
3 carrots | c) For 30 people:
10 carrots |
| b) 9 people | 2 onions
1600ml stock | 1½ onions
1200ml stock | 5 onions
4000ml stock |
| c) 30 people. | 100g lentils
8g thyme | 75g lentils
6g thyme | 250g lentils
20g thyme |

- 2) Here are the ingredients for making apple crumble for 4 people:

80g plain flour
60g ground almonds
90g sugar
60g butter
4 apples

Work out the amount of each ingredient for

- | | | | |
|---------------|-------------------------------------|--------------------------------------|---------------------------------------|
| a) 2 people | a) For 2 people:
40g plain flour | b) For 6 people:
120g plain flour | c) For 18 people:
360g plain flour |
| b) 6 people | 30g ground almonds
45g sugar | 90g ground almonds
135g sugar | 270g ground almonds
405g sugar |
| c) 18 people. | 30g butter
2 apples | 90g butter
6 apples | 270g butter
18 apples |

- 3) Here are the ingredients for making 1500 ml of parsnip soup:

450g parsnips
300g leeks
150g bramley apples
3 onions
1½ pints of chicken stock

- a) For 500ml:
 150g parsnips
 100g leeks
 50g bramley apples
 1 onion
 ½ pint of chicken stock

Work out the amount of each ingredient for

- | | | |
|---------------------|---------------------------------|---------------------------------|
| a) 500 ml of soup | b) For 1000ml:
300g parsnips | c) For 2500ml:
750g parsnips |
| b) 1000 ml of soup | 200g leeks | 500g leeks |
| c) 2500 ml of soup. | 100g bramley apples
2 onions | 250g bramley apples
5 onions |
| | 1 pint of chicken stock | 2½ pints of chicken stock |

Hard Calculator Questions

1) Find the value of the following:

(write down all the figures on your calculator display)

a) $(0.3 + 2.8)^2$ b) $2.7^2 + 3.9^2$ c) $4.5^2 - \sqrt{53}$ d) $6 \times \sqrt{(37 \div 4)}$

2) Find the value of the following:

(write your answers correct to 1 decimal place)

a) $5.6^3 + 11.2$ b) $87.4 \div (\sqrt{39} + 3)$ c) $\frac{\sqrt{3412}}{4.3^2}$ d) $\frac{15^2 - 12^2}{\sqrt{9.6 - 3.87}}$

3) Work out

$$\sqrt{16.75} + 1.53^2$$

a) Write down all the figures on your calculator display.

b) Write your answer to part (a) correct to 1 decimal place.

4) Work out

$$(2.4 \times 1.9)^2 \times 2.03$$

Write down all the figures on your calculator display.

5) Use your calculator to work out the value of

$$\frac{7.34 \times 4.71}{5.63 + 11.89}$$

a) Write down all the figures on your calculator display.

b) Write your answer to part (a) to an appropriate degree of accuracy.

1) Find the value of the following:

(write down all the figures on your calculator display)

a) $(0.3 + 2.8)^2$

9.61

b) $2.7^2 + 3.9^2$

22.5

c) $4.5^2 - \sqrt{53}$

12.96989011

d) $6 \times \sqrt{(37 \div 4)}$

18.24828759

2) Find the value of the following:

(write your answers correct to 1 decimal place)

a) $5.6^3 + 11.2$

186.8

186.816

b) $87.4 \div (\sqrt{39} + 3)$

9.5

9.453760835

c) $\frac{\sqrt{3412}}{4.3^2}$

3.2

3.159130745

d) $\frac{15^2 - 12^2}{\sqrt{9.6} - 3.87}$

33.8

33.83823544

3) Work out

$\sqrt{16.75} + 1.53^2$

a) Write down all the figures on your calculator display. **6.433576386**

b) Write your answer to part (a) correct to 1 decimal place. **6.4**

4) Work out

$(2.4 \times 1.9)^2 \times 2.03$ **42.211008**

Write down all the figures on your calculator display.

5) Use your calculator to work out the value of

$\frac{7.34 \times 4.71}{5.63 + 11.89}$

a) Write down all the figures on your calculator display. **1.973253425**

b) Write your answer to part (a) to an appropriate degree of accuracy. **1.97 or 2.0**

Real-Life Money Questions

- 1) Lance goes on holiday to France.
The exchange rate is $\text{£}1 = 1.40$ Euros.
He changes $\text{£}350$ into Euros.
- a) How many Euros should he get?
- In France, Lance buys a digital camera for 126 Euros.
- b) Work out the cost of the camera in pounds.
- 2) Whilst on holiday in Spain, Gemma bought a pair of sunglasses for 77 Euros.
In England, an identical pair of sunglasses costs $\text{£}59.99$.
The exchange rate is $\text{£}1 = 1.40$ Euros.
- In which country were the glasses the cheapest, and by how much?
Show all your working.
- 3) Luke buys a pair of trainers in Switzerland.
He can pay either 86 Swiss Francs or 56 Euros.
The exchange rates are:
 $\text{£}1 = 2.10$ Swiss Francs
 $\text{£}1 = 1.40$ Euros
- Which currency should he choose to get the best price, and how much would he save?
Give your answer in pounds (£).
- 4) The total cost of 5 kg of potatoes and 2 kg of carrots is $\text{£}4.88$.
3 kg of potatoes cost $\text{£}1.98$.
- Work out the cost of 1 kg of carrots.
- 5) The cost of 4 kg of bananas is $\text{£}5.80$.
The total cost of 3 kg of bananas and 1.5 kg of pears is $\text{£}5.61$.
- Work out the cost of 1 kg of pears.

Real-Life Money Questions

- 1) Lance goes on holiday to France.
The exchange rate is £1 = 1.40 Euros.

He changes £350 into Euros.

a) How many Euros should he get? **€490** $350 \times 1.40 = 490$

In France, Lance buys a digital camera for 126 Euros.

b) Work out the cost of the camera in pounds. **£90** $126 \div 1.40 = 90$

- 2) Whilst on holiday in Spain, Gemma bought a pair of sunglasses for 77 Euros.
In England, an identical pair of sunglasses costs £59.99.
The exchange rate is £1 = 1.40 Euros.

In which country were the glasses the cheapest, and by how much?

Show all your working. **Spain, by £4.99**

$$77 \div 1.40 = 55 \quad 59.99 - 55.00 = 4.99$$

- 3) Luke buys a pair of trainers in Switzerland.
He can pay either 86 Swiss Francs or 56 Euros.
The exchange rates are:
£1 = 2.10 Swiss Francs
£1 = 1.40 Euros

Which currency should he choose to get the best price, and how much would he save?

Give your answer in pounds (£). **Euros, saving £0.95**

$$86 \div 2.10 = 40.95 \quad 56 \div 1.40 = 40$$

- 4) The total cost of 5 kg of potatoes and 2 kg of carrots is £4.88.
3 kg of potatoes cost £1.98.

Work out the cost of 1 kg of carrots. **£0.79**

$$1.98 \div 3 = 0.66 \quad 5 \times 0.66 = 3.30 \quad 4.88 - 3.30 = 1.58 \quad 1.58 \div 2 = 0.79$$

- 5) The cost of 4 kg of bananas is £5.80.
The total cost of 3 kg of bananas and 1.5 kg of pears is £5.61.

Work out the cost of 1 kg of pears. **£0.84**

$$\begin{aligned} 5.80 \div 4 &= 1.45 \\ 3 \times 1.45 &= 4.35 \\ 5.61 - 4.35 &= 1.26 \\ 1.26 \div 1.5 &= 0.84 \end{aligned}$$

1. Write down the first 5 terms and the 10th term of the following sequences:

eg. $2n + 1$ 3, 5, 7, 9, 11.....21

a) $2n + 2$

d) $7n$

b) $3n + 1$

e) $3n - 1$

c) $n + 3$

f) $7n - 3$

2. Find the n^{th} term of the following sequences:

a) 5, 10, 15, 20...

d) 22, 18, 14, 10...

b) 5, 8, 11, 14...

e) -3, 3, 9, 15...

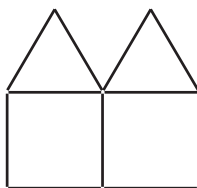
c) 1, 8, 15, 22...

f) 4, -1, -6, -11...

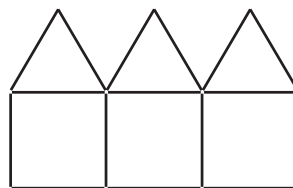
3. Here are some patterns made from sticks.



Pattern 1



Pattern 2



Pattern 3

a) Draw pattern 4 in the space, below..

b) How many sticks are used in

(i) pattern 10

(ii) pattern 20

(iii) pattern 50

c) Find an expression, in terms of n , for the number of sticks in pattern number n .

d) Which pattern number can be made using 301 sticks?

1. Write down the first 5 terms and the 10th term of the following sequences:

eg. $2n + 1$ 3, 5, 7, 9, 11.....21

a) $2n + 2$ **4, 6, 8, 10, 12, ... 22** d) $7n$ **7, 14, 21, 28, 35, ... 70**

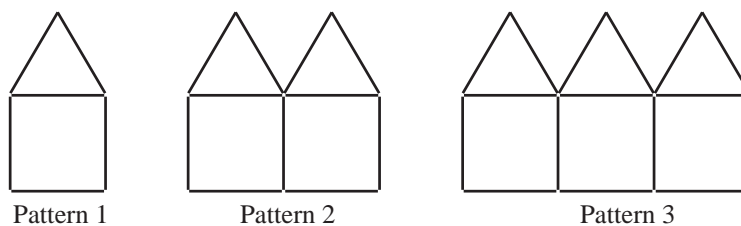
b) $3n + 1$ **4, 7, 10, 13, 16, ... 31** e) $3n - 1$ **2, 5, 8, 11, 14, ... 29**

c) $n + 3$ **4, 5, 6, 7, 8, ... 13** f) $7n - 3$ **4, 11, 18, 25, 32, ... 67**

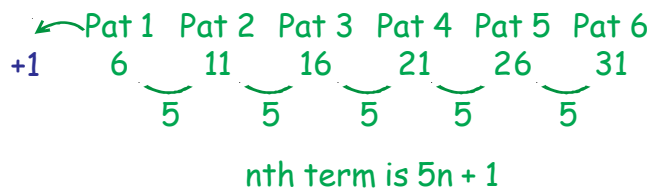
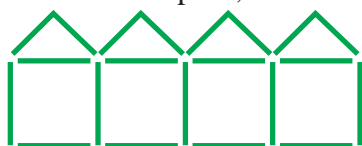
2. Find the n^{th} term of the following sequences:

0	a) 5, 10, 15, 20...	5n	+26	d) 22, 18, 14, 10...	-4n + 26
	$\underbrace{\quad}_5 \quad \underbrace{\quad}_5 \quad \underbrace{\quad}_5$			$\underbrace{\quad}_{-4} \quad \underbrace{\quad}_{-4} \quad \underbrace{\quad}_{-4}$	
+2	b) 5, 8, 11, 14...	3n + 2	-9	e) -3, 3, 9, 15...	6n - 9
	$\underbrace{\quad}_3 \quad \underbrace{\quad}_3 \quad \underbrace{\quad}_3$			$\underbrace{\quad}_6 \quad \underbrace{\quad}_6 \quad \underbrace{\quad}_6$	
-6	c) 1, 8, 15, 22...	7n - 6	+9	f) 4, -1, -6, -11...	-5n + 9
	$\underbrace{\quad}_7 \quad \underbrace{\quad}_7 \quad \underbrace{\quad}_7$			$\underbrace{\quad}_{-5} \quad \underbrace{\quad}_{-5} \quad \underbrace{\quad}_{-5}$	

3. Here are some patterns made from sticks.



a) Draw pattern 4 in the space, below..



b) How many sticks are used in

- (i) pattern 10 **51 sticks**
- (ii) pattern 20 **101 sticks**
- (iii) pattern 50 **251 sticks**

c) Find an expression, in terms of n , for the number of sticks in pattern number n . **$5n + 1$**

d) Which pattern number can be made using 301 sticks? **Pattern 60**

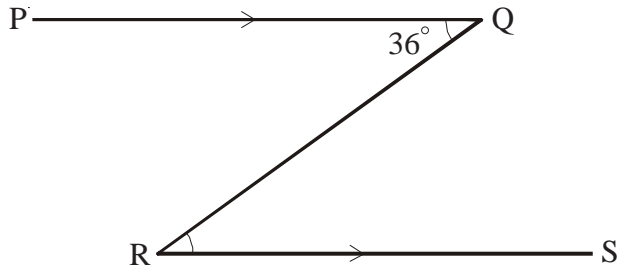
Substitution

- 1) Work out the value of $5x$ when
 - a) $x = 2$
 - b) $x = 6$
 - c) $x = 10$
- 2) Work out the value of $3x$ when
 - a) $x = -2$
 - b) $x = 10$
 - c) $x = -12$
- 3) Work out the value of x^2 when
 - a) $x = 3$
 - b) $x = -4$
 - c) $x = -10$
- 4) Work out the value of $2x^2$ when
 - a) $x = 5$
 - b) $x = -4$
 - c) $x = 10$
- 5) Work out the value of $3x + 5$ when
 - a) $x = 2$
 - b) $x = 6$
 - c) $x = -1$
- 6) Work out the value of $4 + 2x$ when
 - a) $x = 7$
 - b) $x = -1$
 - c) $x = -3$
- 7) Work out the value of $3x + 2y$ when
 - a) $x = 1$ and $y = 2$
 - b) $x = 4$ and $y = 3$
 - c) $x = 5$ and $y = -4$
- 8) Work out the value of $6x - 3y$ when
 - a) $x = 2$ and $y = 1$
 - b) $x = 1$ and $y = -2$
 - c) $x = -3$ and $y = 4$
- 9) Work out the value of $3x^2 + 4y$ when
 - a) $x = 1$ and $y = 5$
 - b) $x = -2$ and $y = 2$
 - c) $x = 3$ and $y = -2$
- 10) Using the formula $P = H \times R$, where P is the total pay, H is the number of hours worked, and R is the hourly rate of pay.
Work out the total pay (P) of the following people:
 - a) Betty worked 10 hours at £7 per hour
 - b) John worked 15 hours and is paid £9 per hour
 - c) Mike worked for 90 minutes at £16 an hour.
- 11) The equation of a straight line is given as $y = 3x + 2$
 - a) Work out the value of y when
 - (i) $x = 0$
 - (ii) $x = 1$
 - (iii) $x = 2$
 - b) What is the value of x when $y = 17$?

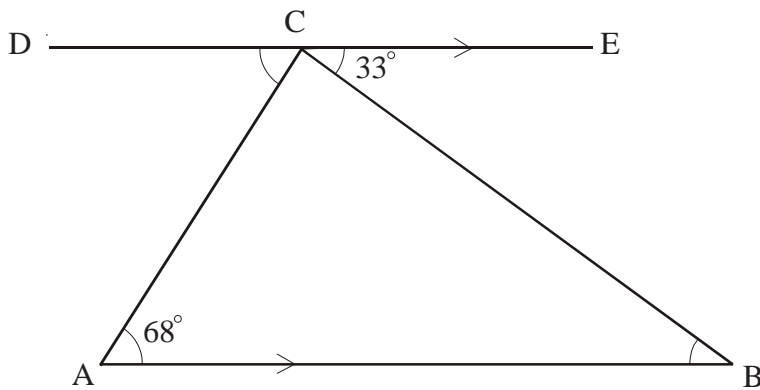
Substitution

- 1) Work out the value of $5x$ when
- a) $x = 2$ **10**
 5×2
- b) $x = 6$ **30**
 5×6
- c) $x = 10$ **50**
 5×10
- 2) Work out the value of $3x$ when
- a) $x = -2$ **-6**
 $3 \times (-2)$
- b) $x = 10$ **30**
 3×10
- c) $x = -12$ **-36**
 $3 \times (-12)$
- 3) Work out the value of x^2 when
- a) $x = 3$ **9**
 3×3
- b) $x = -4$ **16**
 $(-4) \times (-4)$
- c) $x = -10$ **100**
 $(-10) \times (-10)$
- 4) Work out the value of $2x^2$ when
- a) $x = 5$ **50**
 2×5^2
- b) $x = -4$ **32**
 $2 \times (-4)^2$
- c) $x = 10$ **200**
 2×10^2
- 5) Work out the value of $3x + 5$ when
- a) $x = 2$ **11**
 $3 \times 2 + 5$
- b) $x = 6$ **23**
 $3 \times 6 + 5$
- c) $x = -1$ **2**
 $3 \times (-1) + 5$
- 6) Work out the value of $4 + 2x$ when
- a) $x = 7$ **18**
 $4 + 2 \times 7$
- b) $x = -1$ **2**
 $4 + 2 \times (-1)$
- c) $x = -3$ **-2**
 $4 + 2 \times (-3)$
- 7) Work out the value of $3x + 2y$ when
- a) $x = 1$ and $y = 2$ **7**
 $3 \times 1 + 2 \times 2$
- b) $x = 4$ and $y = 3$ **18**
 $3 \times 4 + 2 \times 3$
- c) $x = 5$ and $y = -4$ **7**
 $3 \times 5 + 2 \times (-4)$
- 8) Work out the value of $6x - 3y$ when
- a) $x = 2$ and $y = 1$ **9**
 $6 \times 2 - 3 \times 1$
- b) $x = 1$ and $y = -2$ **12**
 $6 \times 1 - 3 \times (-2)$
- c) $x = -3$ and $y = 4$ **-30**
 $6 \times (-3) - 3 \times 4$
- 9) Work out the value of $3x^2 + 4y$ when
- a) $x = 1$ and $y = 5$ **23**
 $3 \times 1^2 + 4 \times 5$
- b) $x = -2$ and $y = 2$ **20**
 $3 \times (-2)^2 + 4 \times 2$
- c) $x = 3$ and $y = -2$ **19**
 $3 \times 3^2 + 4 \times (-2)$
- 10) Using the formula $P = H \times R$, where P is the total pay, H is the number of hours worked, and R is the hourly rate of pay.
- Work out the total pay (P) of the following people:
- a) Betty worked 10 hours at £7 per hour **£70** $P = 10 \times 7$
- b) John worked 15 hours and is paid £9 per hour **£135** $P = 15 \times 9$
- c) Mike worked for 90 minutes at £16 an hour. **£24** $P = 1.5 \times 16$
- 11) The equation of a straight line is given as $y = 3x + 2$
- a) Work out the value of y when
- (i) $x = 0$ **$y = 2$** $y = 3 \times 0 + 2$
- (ii) $x = 1$ **$y = 5$** $y = 3 \times 1 + 2$
- (iii) $x = 2$ **$y = 8$** $y = 3 \times 2 + 2$
- b) What is the value of x when $y = 17$? **$x = 5$** $17 = 3x + 2$
 $17 - 2 = 3 \times x$
 $\frac{15}{3} = x$
5

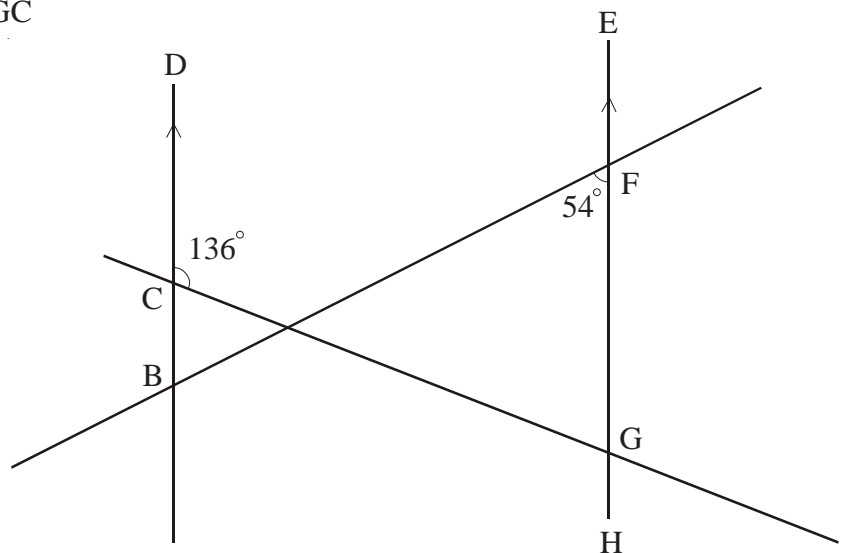
- 1) Line PQ is parallel to line RS
 If angle PQR is equal to 36°
 a) What is the size of angle QRS?
 b) Give a reason for your answer.



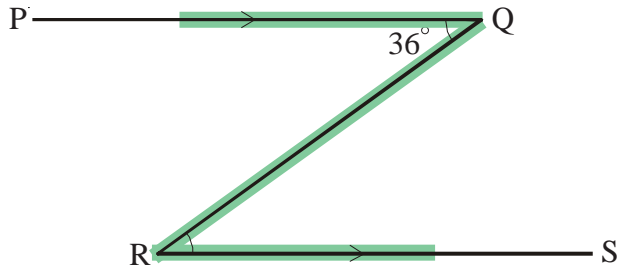
- 2) Line DCE is parallel to line AB
 a) Find the size of angle ABC
 b) Find the size of angle DCA
 c) Calculate the size of angle ACB



- 3) a) Find the size of angle DBF
 b) Find the size of angle HGC

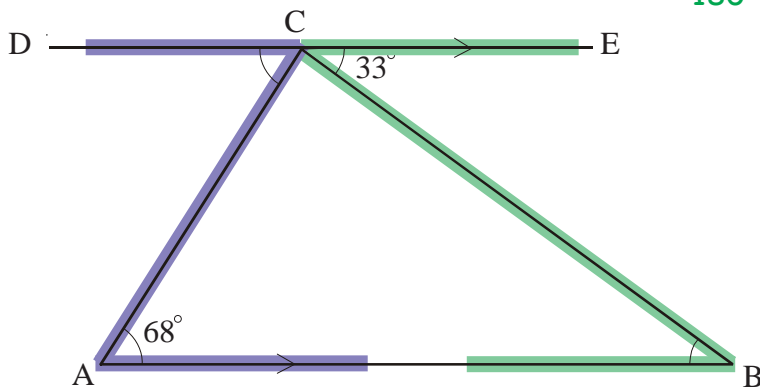


- 1) Line PQ is parallel to line RS
 If angle PQR is equal to 36°
 a) What is the size of angle QRS? 36°
 b) Give a reason for your answer. *Alternate angles*

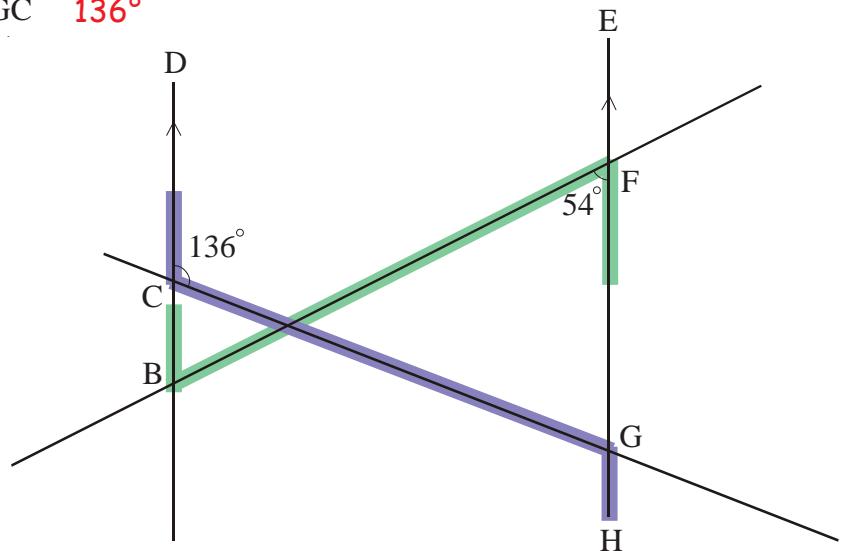


- 2) Line DCE is parallel to line AB
 a) Find the size of angle ABC 33°
 b) Find the size of angle DCA 68°
 c) Calculate the size of angle ACB 79°

*DCE is straight line
 $180^\circ - 68^\circ - 33^\circ = 79^\circ$*

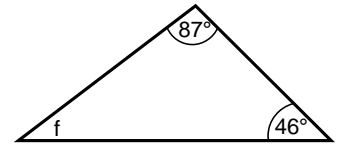
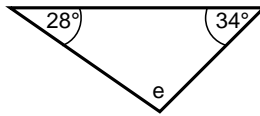
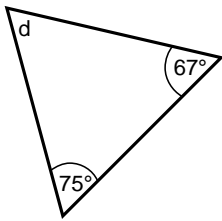
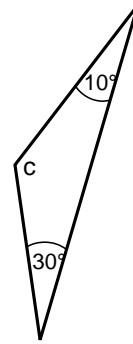
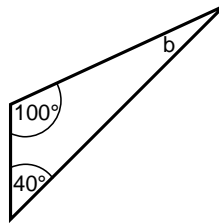
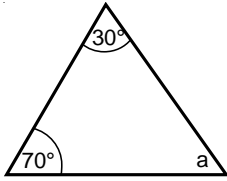


- 3) a) Find the size of angle DBF 54°
 b) Find the size of angle HGC 136°

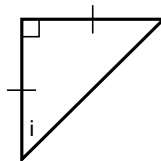
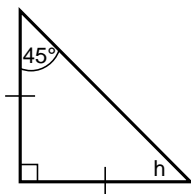
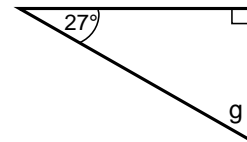
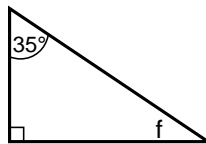
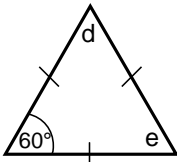
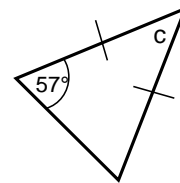
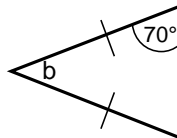
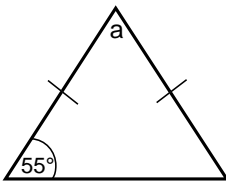


Angle Sum of Triangles - 1 of 2

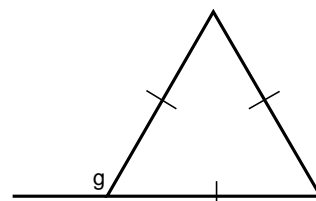
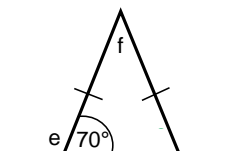
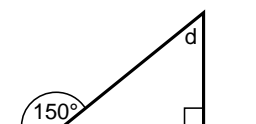
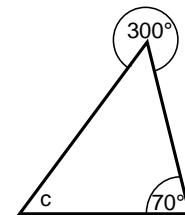
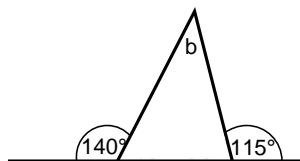
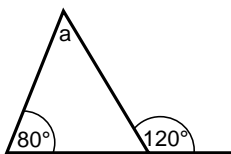
1) Work out the size of the angles marked with letters.



2) Work out the size of the angles marked with letters.

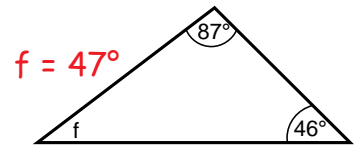
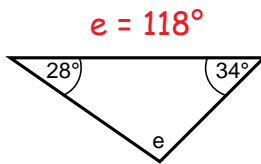
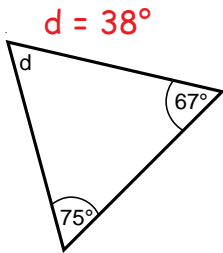
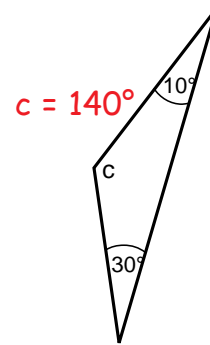
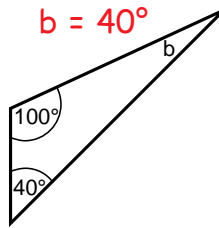
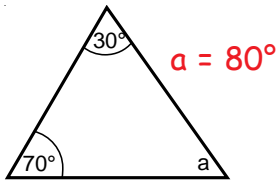


3) Work out the size of the angles marked with letters.

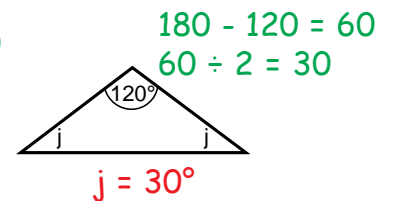
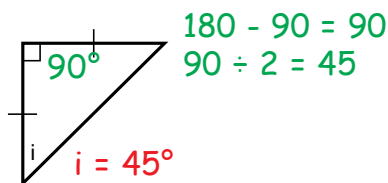
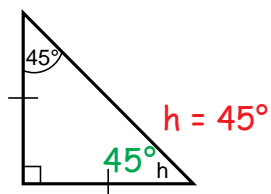
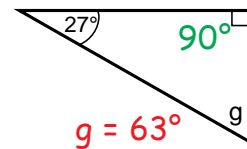
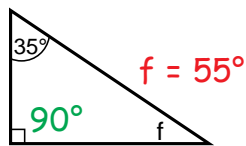
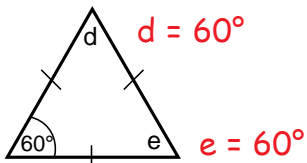
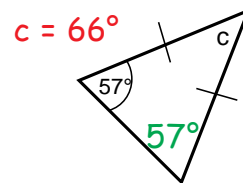
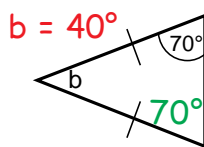
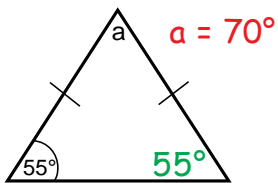


Angle Sum of Triangles - 1 of 2

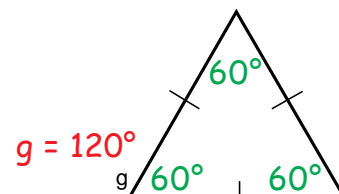
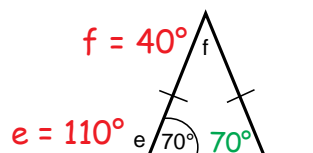
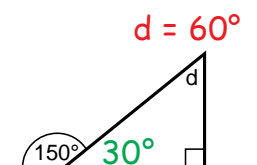
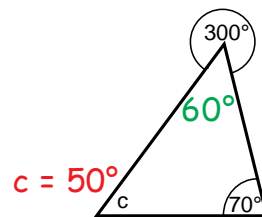
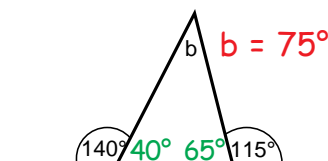
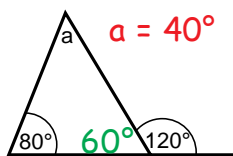
1) Work out the size of the angles marked with letters.



2) Work out the size of the angles marked with letters.



3) Work out the size of the angles marked with letters.



Angle Sum of Triangles - 2 of 2

- 1) ABC is a triangle.
- Find the size of angle A .
 - Triangle ABC is equilateral.
Explain why.

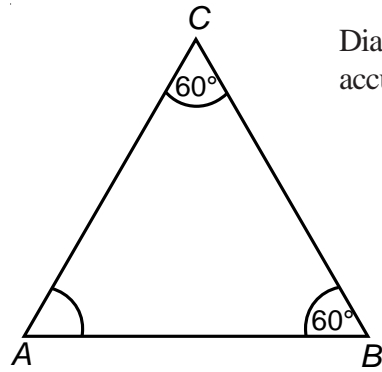


Diagram **NOT** accurately drawn

- 2) BCD is a triangle.
 ABC is a straight line.
Angle $CBD = 70^\circ$.
 $BD = CD$.
- Work out the value of x .
 - Give a reason for your answer.
 - Work out the value of y .
 - Give reasons for your answer.

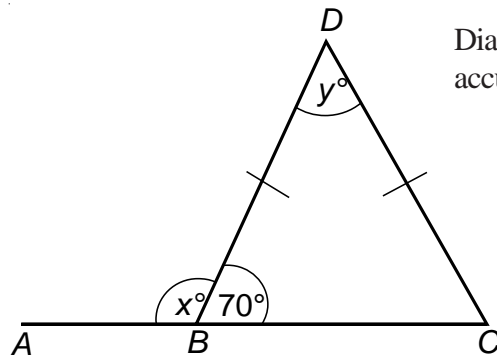


Diagram **NOT** accurately drawn

- 3) The diagram shows a 5-sided shape.
All the sides of the shape are equal in length.
- Find the value of x .
 - Give a reason for your answer.
 - Work out the value of y .
 - Explain your answer.

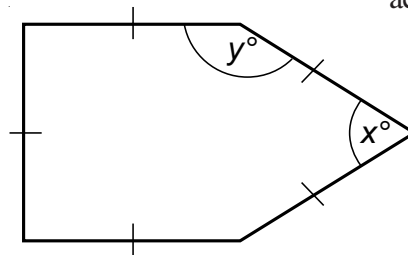


Diagram **NOT** accurately drawn

- 1) ABC is a triangle.
 a) Find the size of angle A . $180 - 60 - 60$
Angle A is 60°

- b) Triangle ABC is equilateral.

Explain why.

Triangle ABC is equilateral because all three angles are 60° .

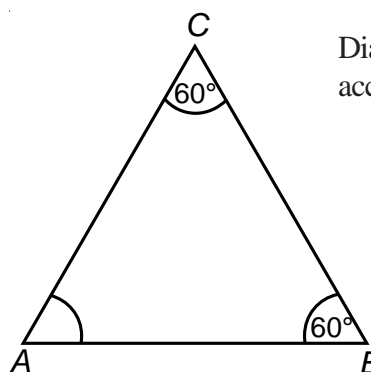


Diagram **NOT** accurately drawn

- 2) BCD is a triangle.
 ABC is a straight line.

Angle $CBD = 70^\circ$.

$BD = CD$.

- a) (i) Work out the value of x .
 $x = 110^\circ$ $180 - 70$

- (ii) Give a reason for your answer.

Angles on a straight line add up to 180° .

- b) (i) Work out the value of y .
 $y = 40^\circ$ $180 - 70 - 70$

- (ii) Give reasons for your answer.

**Base angles of an isosceles triangle are equal.
 180° in a triangle.**

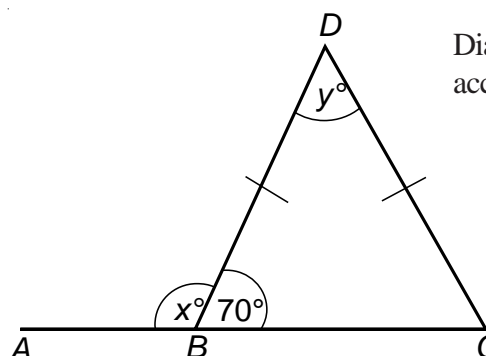


Diagram **NOT** accurately drawn

- 3) The diagram shows a 5-sided shape.
 All the sides of the shape are equal in length.

- a) (i) Find the value of x .
 $x = 60^\circ$

- (ii) Give a reason for your answer.
The triangle in the diagram is equilateral.

- b) (i) Work out the value of y .
 $y = 150^\circ$

- (ii) Explain your answer.

Angle y is made up of the angle in the square and the angle in the equilateral triangle. This is $90^\circ + 60^\circ = 150^\circ$.

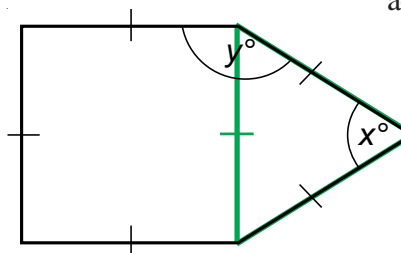
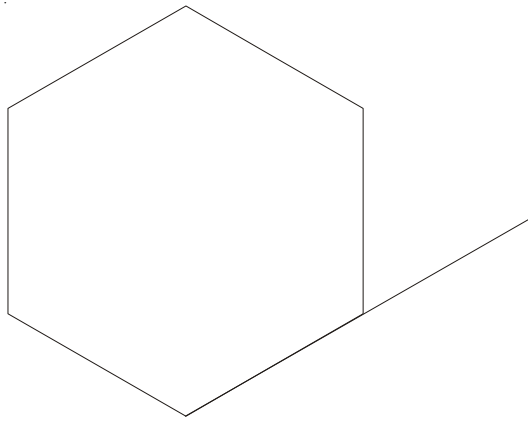


Diagram **NOT** accurately drawn

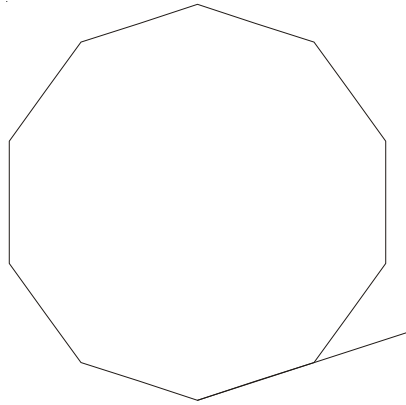
Angles of Regular Polygons

1)



- a) Work out the size of an **exterior** angle of a regular hexagon.
- b) Work out the size of an **interior** angle of a regular hexagon.

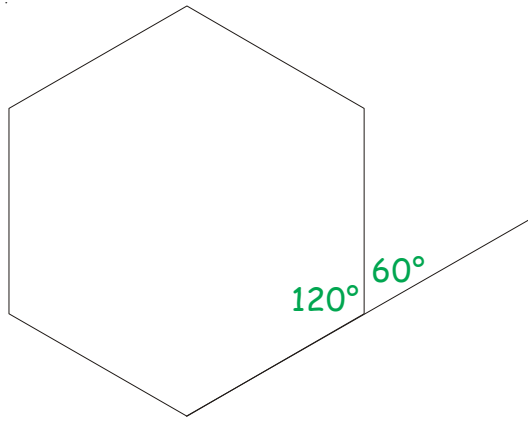
2)



- a) Name the regular polygon, above.
 - b) Work out the size of an **exterior** angle and of an **interior** angle for this polygon.
- 3) The size of each **exterior** angle of a regular polygon is 90° .
Work out the number of sides of the regular polygon.
 - 4) The size of each **exterior** angle of a regular polygon is 40° .
Work out the number of sides of the regular polygon.
 - 5) The size of each **interior** angle of a regular polygon is 120° .
Work out the number of sides of the regular polygon.
 - 6) The size of each **interior** angle of a regular polygon is 150° .
Work out the number of sides of the regular polygon.

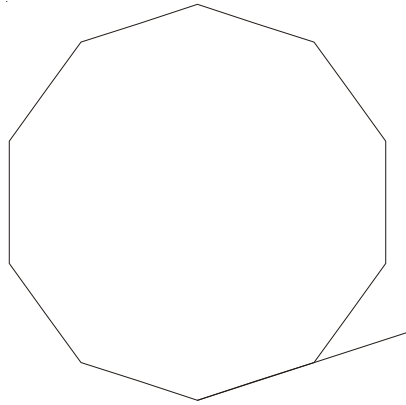
Angles of Regular Polygons

1)



- a) Work out the size of an **exterior** angle of a regular hexagon. 60° $360 \div 6$
 b) Work out the size of an **interior** angle of a regular hexagon. 120° $180 - 60$

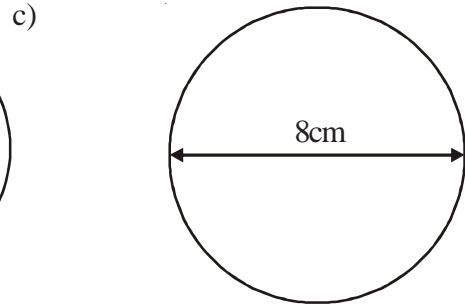
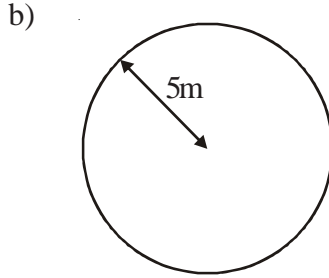
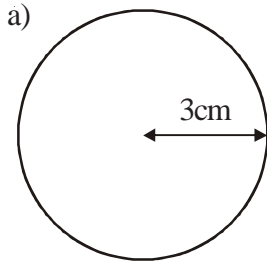
2)



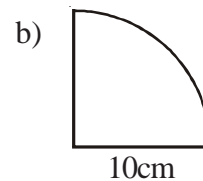
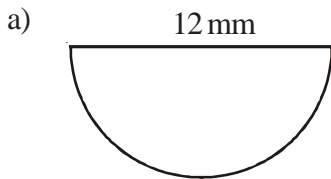
- a) Name the regular polygon, above. **Decagon**
 b) Work out the size of an **exterior** angle and of an **interior** angle for this polygon.
Exterior angle = 36° **Interior angle = 144°**
 $360 \div 10$ $180 - 36$
- 3) The size of each **exterior** angle of a regular polygon is 90° .
 Work out the number of sides of the regular polygon. **4 sides** $360 \div ? = 90$
- 4) The size of each **exterior** angle of a regular polygon is 40° .
 Work out the number of sides of the regular polygon. **9 sides** $360 \div ? = 40$
- 5) The size of each **interior** angle of a regular polygon is 120° .
 Work out the number of sides of the regular polygon. **6 sides**
Interior angle = 120, exterior angle = 60, $360 \div ? = 60$
- 6) The size of each **interior** angle of a regular polygon is 150° .
 Work out the number of sides of the regular polygon. **12 sides**
Interior angle = 150, exterior angle = 30, $360 \div ? = 30$

Diagrams **NOT** accurately drawn

- 1) Find the areas of the following shapes.
Take π to be 3.14

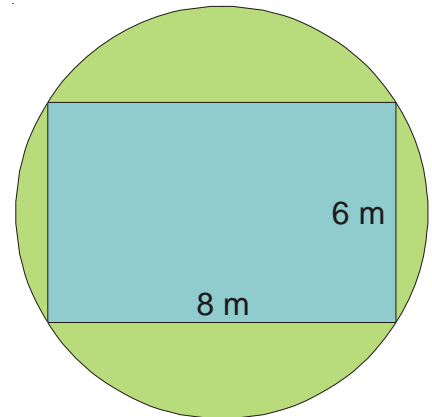


- 2) Work out the areas of the following shapes.



- 3) The diagram shows a circular garden comprising a rectangular pond enclosed by grass. The circular garden has a diameter of 10 m. The rectangular pond measures 8 m by 6 m.

Work out the area of the garden covered in grass.
Take π to be 3.14 and give your answer to the nearest m^2 .

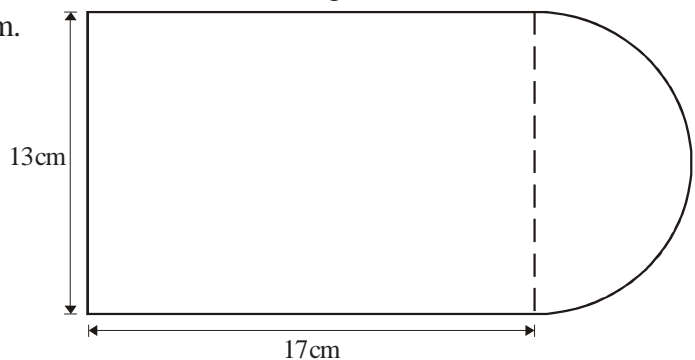


- 4) The **radius** of the top of a circular table is 60 cm. The table also has a circular base with **diameter** 30 cm.
- a) Work out the area of the top of the table.
- b) Work out the area of the base of the table.



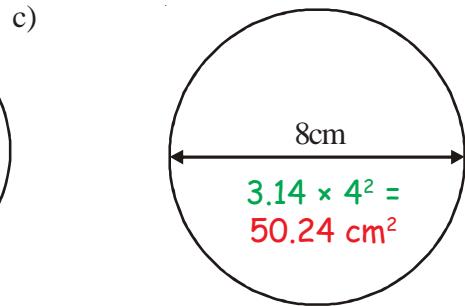
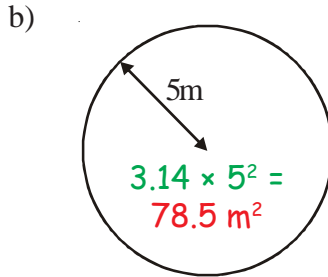
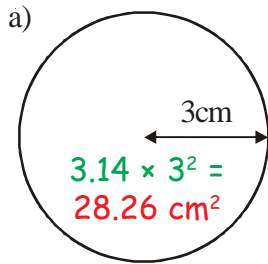
- 5) The diagram shows a shape, made from a semi-circle and a rectangle. The diameter of the semi-circle is 13 cm. The length of the rectangle is 17 cm.

Calculate the area of the shape.
Give your answer correct to 3 significant figures.

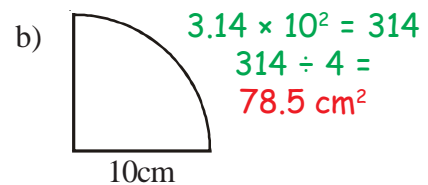
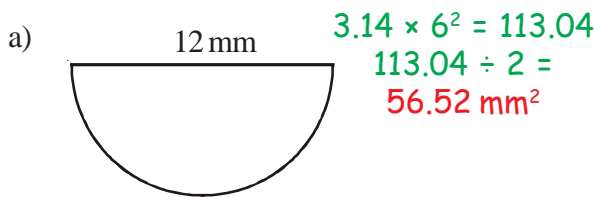


Diagrams **NOT** accurately drawn

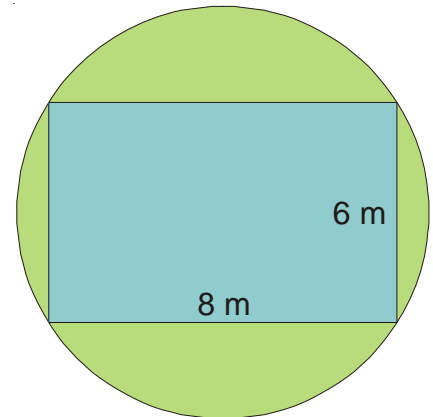
- 1) Find the areas of the following shapes.
Take π to be 3.14



- 2) Work out the areas of the following shapes.



- 3) The diagram shows a circular garden comprising a rectangular pond enclosed by grass. The circular garden has a diameter of 10 m. The rectangular pond measures 8 m by 6 m.



Work out the area of the garden covered in grass.

Take π to be 3.14 and give your answer to the nearest m^2 .

31 m^2 to the nearest m^2

Circular garden area: $3.14 \times 5^2 = 78.5$

Rectangular pond area: $8 \times 6 = 48$

$78.5 - 48 = 30.5$

- 4) The **radius** of the top of a circular table is 60 cm. The table also has a circular base with **diameter** 30 cm.

a) Work out the area of the top of the table. 3.14×60^2
11 304 cm^2

b) Work out the area of the base of the table. 3.14×15^2
706.5 cm^2



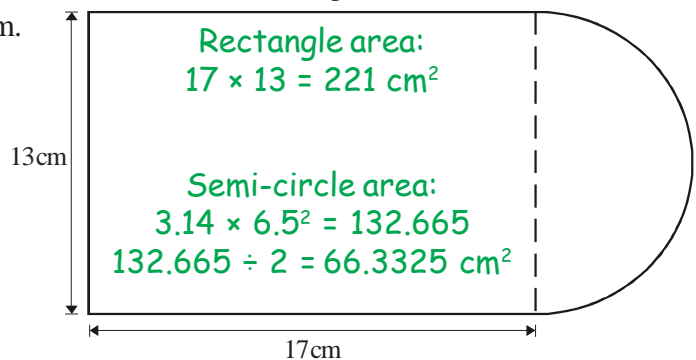
- 5) The diagram shows a shape, made from a semi-circle and a rectangle. The diameter of the semi-circle is 13 cm. The length of the rectangle is 17 cm.

Calculate the area of the shape.

Give your answer correct to

3 significant figures. **287 cm^2**

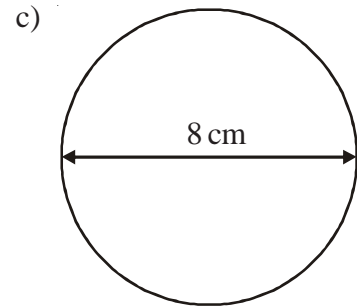
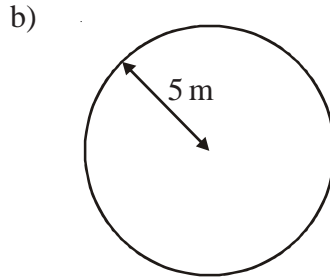
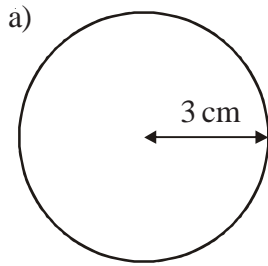
$221 + 66.3325 = 287.3325$



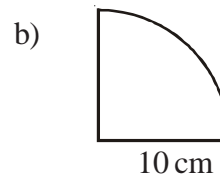
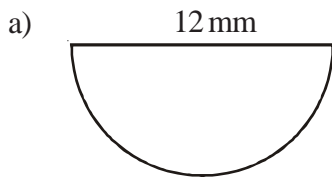
Circumference of Circles

Diagrams **NOT** accurately drawn

- 1) Find the circumference of the following shapes.
Take π to be 3.14.



- 2) Work out the perimeter of the following shapes, taking π to be 3.14.



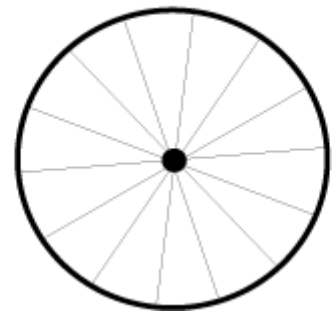
- 3) The **radius** of the top of a circular table is 60 cm.
The table also has a circular base with **diameter** 30 cm.
- a) Work out the circumference of the top of the table.
Let π be 3.14
- b) Work out the circumference of the base of the table.
Let π be 3.14



- 4) The diameter of a wheel on Kyle's bicycle is 0.75 m.
- a) Calculate the circumference of the wheel.
Give your answer correct to 2 decimal places.

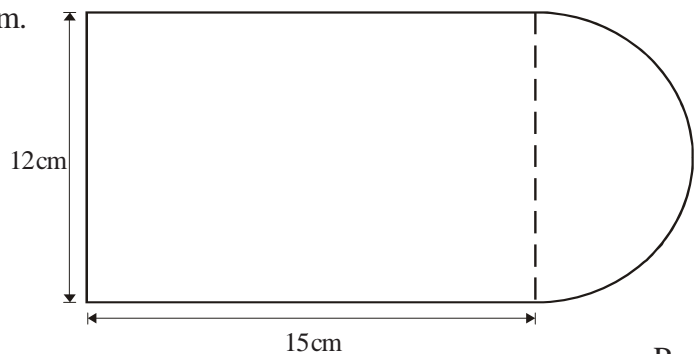
Kyle cycles 2000 metres.

- b) Using your answer in (a), calculate the number of complete turns the wheel makes.



- 5) The diagram shows a shape, made from a semi-circle and a rectangle.
The diameter of the semi-circle is 12 cm.
The length of the rectangle is 15 cm.

Calculate the perimeter of the shape.
Give your answer correct to 3 significant figures.

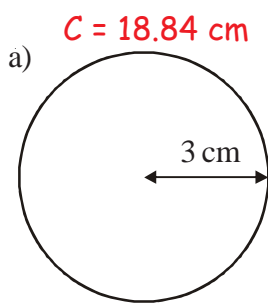


Circumference of Circles

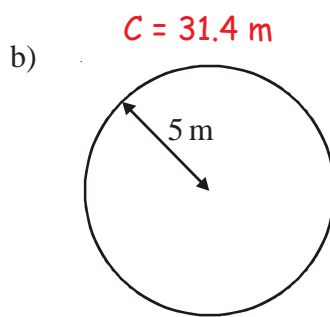
Diagrams **NOT** accurately drawn

- 1) Find the circumference of the following shapes.

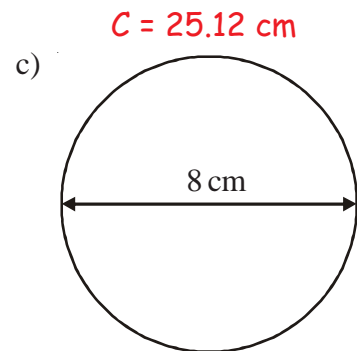
Take π to be 3.14.



$C = 2 \times 3.14 \times 3$

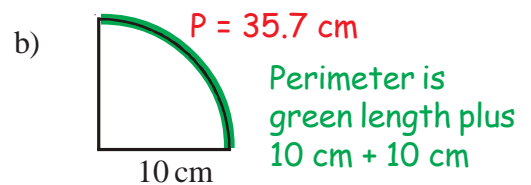
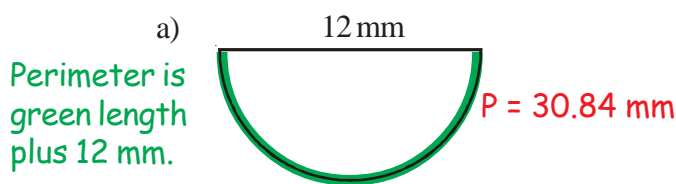


$C = 2 \times 3.14 \times 5$



$C = 2 \times 3.14 \times 4$

- 2) Work out the perimeter of the following shapes, taking π to be 3.14.



$C = 2 \times 3.14 \times 60$

- 3) The **radius** of the top of a circular table is 60 cm. The table also has a circular base with **diameter** 30 cm.

- a) Work out the circumference of the top of the table.

Let π be 3.14 $C = 376.8 \text{ cm}$

- b) Work out the circumference of the base of the table.

Let π be 3.14 $C = 94.2 \text{ cm}$



$C = 2 \times 3.14 \times 15$

- 4) The diameter of a wheel on Kyle's bicycle is 0.75 m. $C = 2 \times 3.14 \times 0.375$

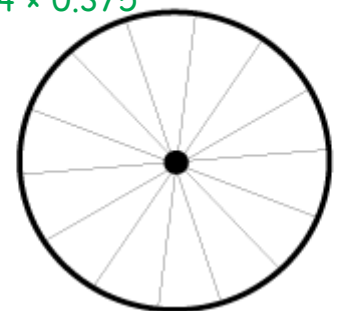
- a) Calculate the circumference of the wheel. $C = 2.36 \text{ m}$

Give your answer correct to 2 decimal places.

Kyle cycles 2000 metres.

$\text{Turns} = 2000 \div 2.36$

- b) Using your answer in (a), calculate the number of complete turns the wheel makes. $847 \text{ complete turns}$



- 5) The diagram shows a shape, made from a semi-circle and a rectangle.

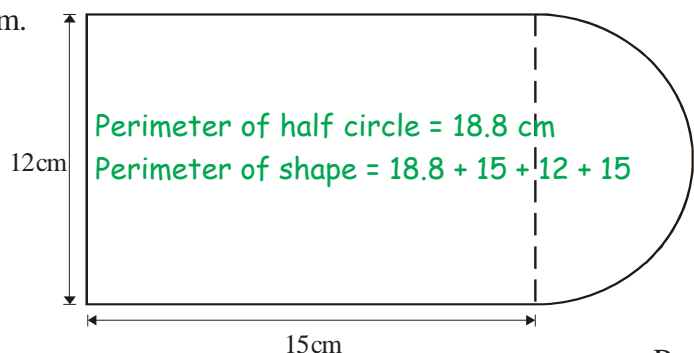
The diameter of the semi-circle is 12 cm.

The length of the rectangle is 15 cm.

Calculate the perimeter of the shape.

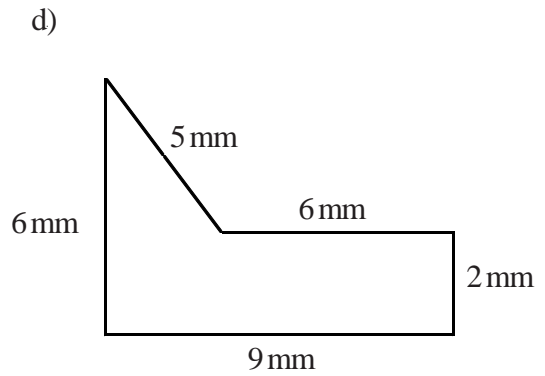
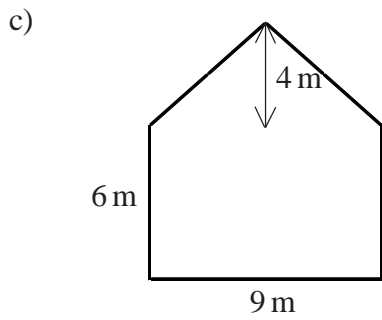
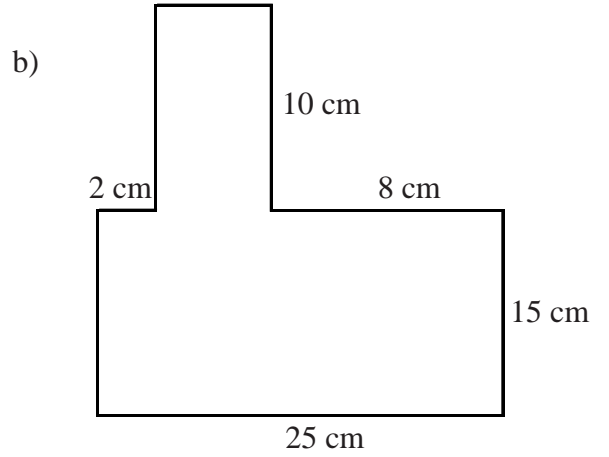
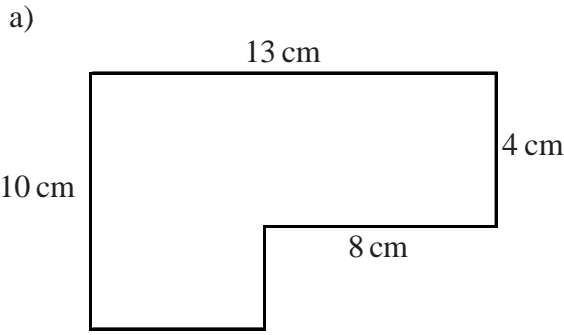
Give your answer correct to

3 significant figures. $P = 60.8 \text{ cm}$

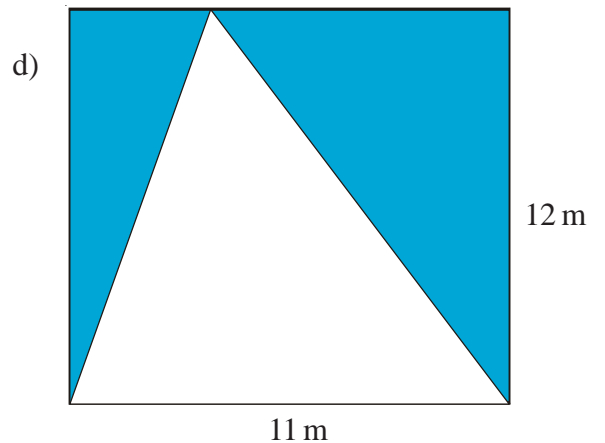
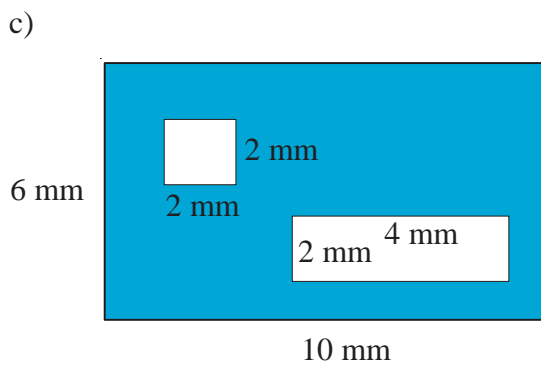
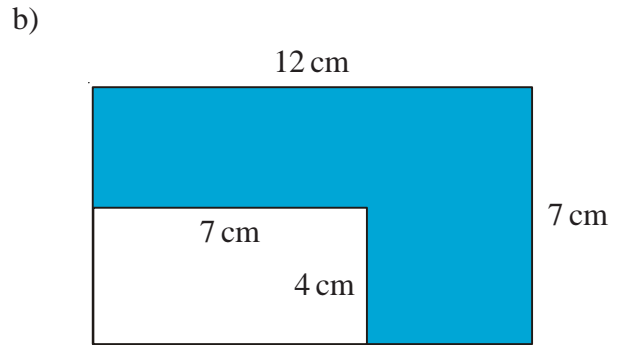
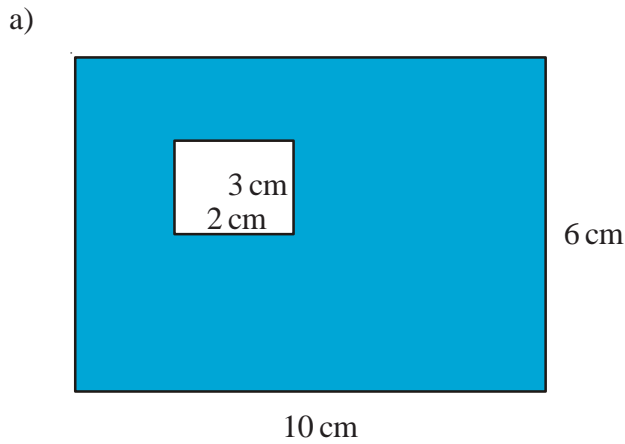


Area of Compound Shapes

1) Find the area of each shape.

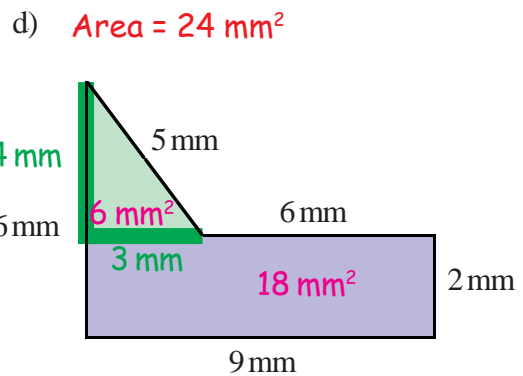
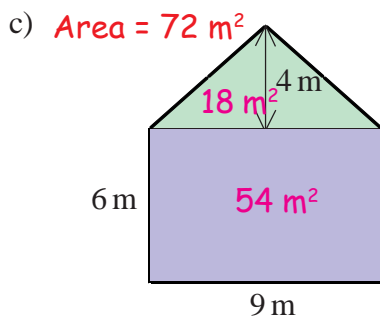
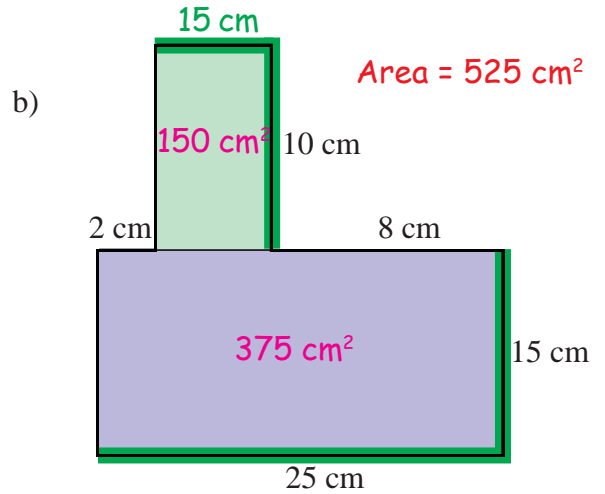
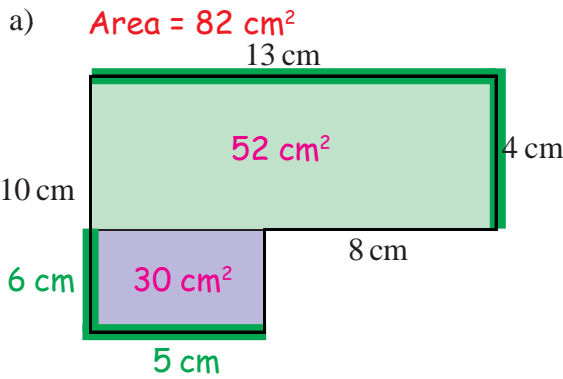


2) Find the shaded area of each shape.

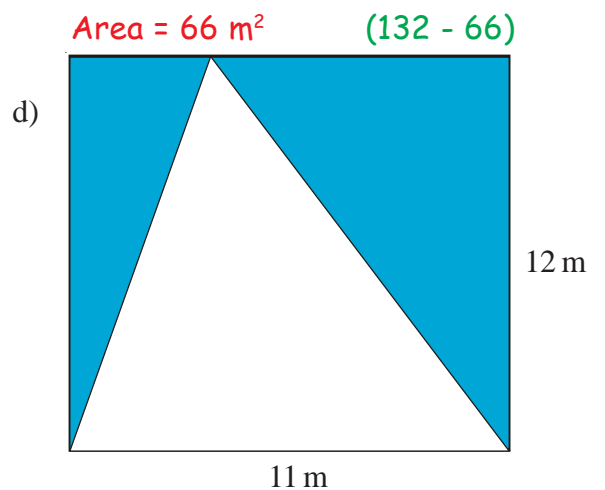
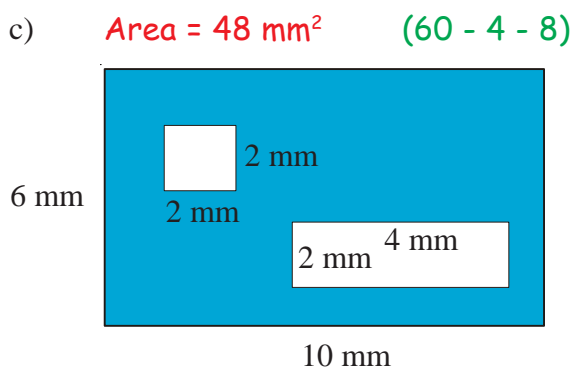
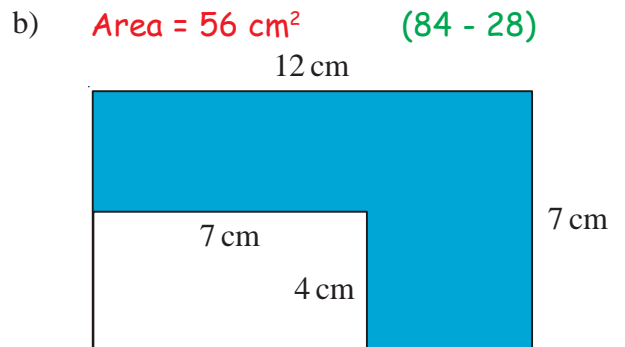
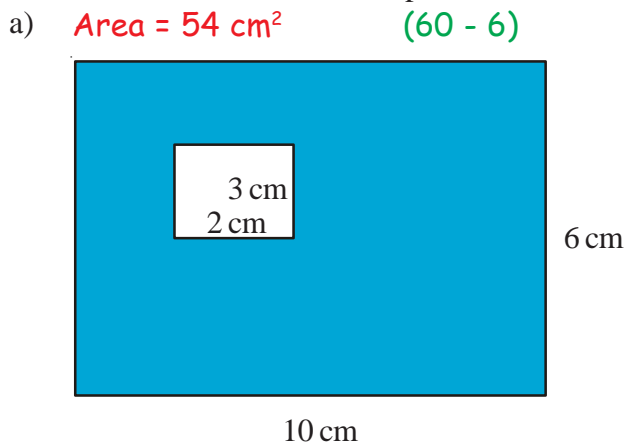


Area of Compound Shapes

1) Find the area of each shape.

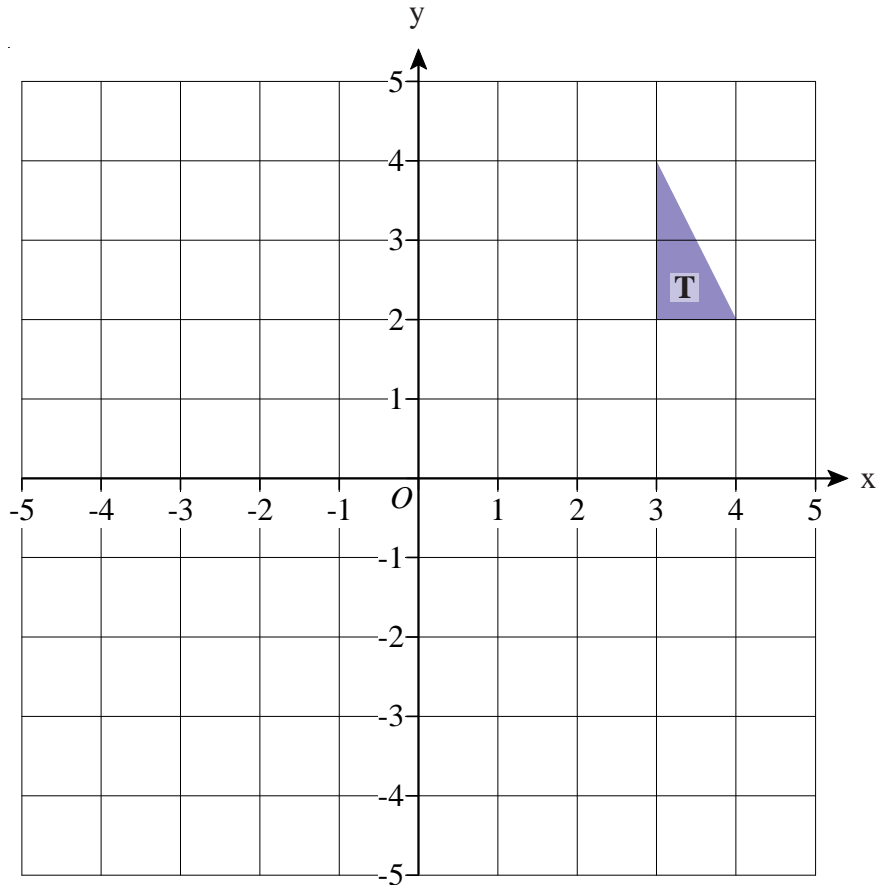


2) Find the shaded area of each shape.

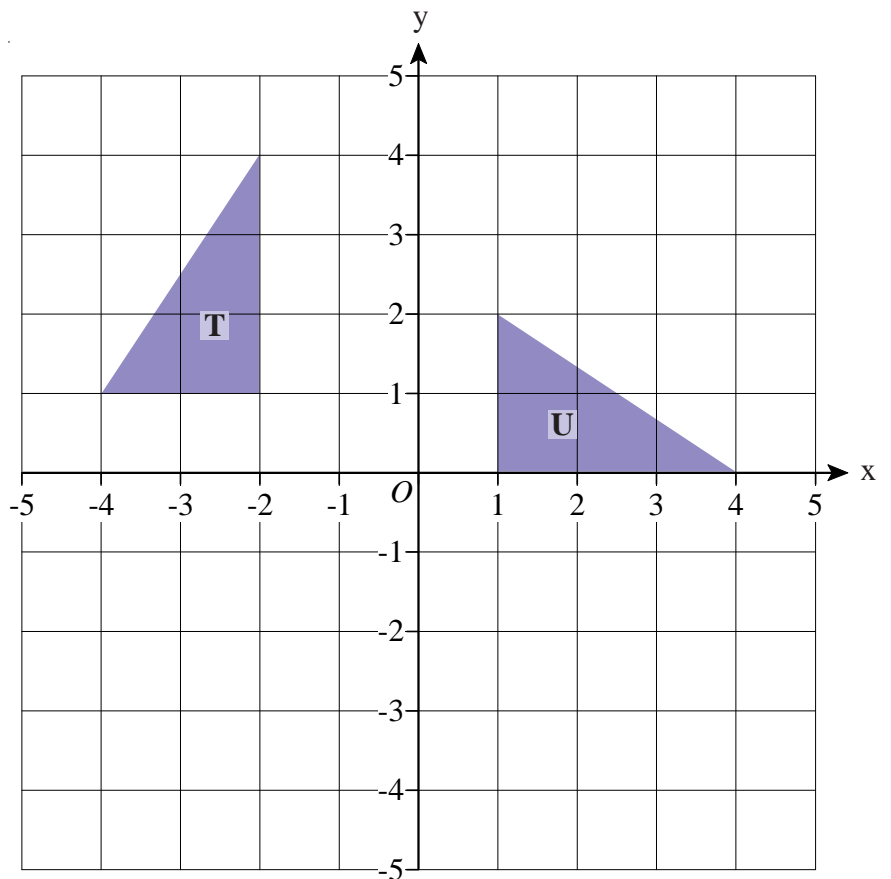


Rotations

- 1) a) Rotate triangle T 90° anti-clockwise about the point $(0, 0)$.
Label your new triangle U
- b) Rotate triangle T 180° about the point $(2, 0)$.
Label your new triangle V

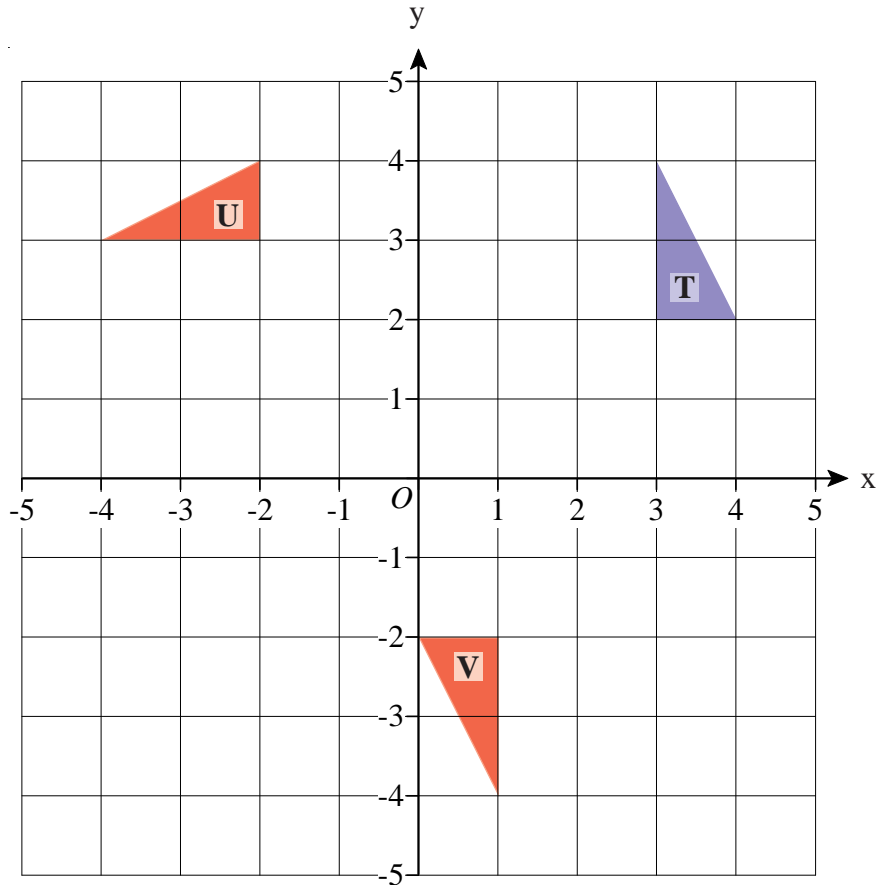


- 2) Describe fully the single transformation which maps triangle T to triangle U.

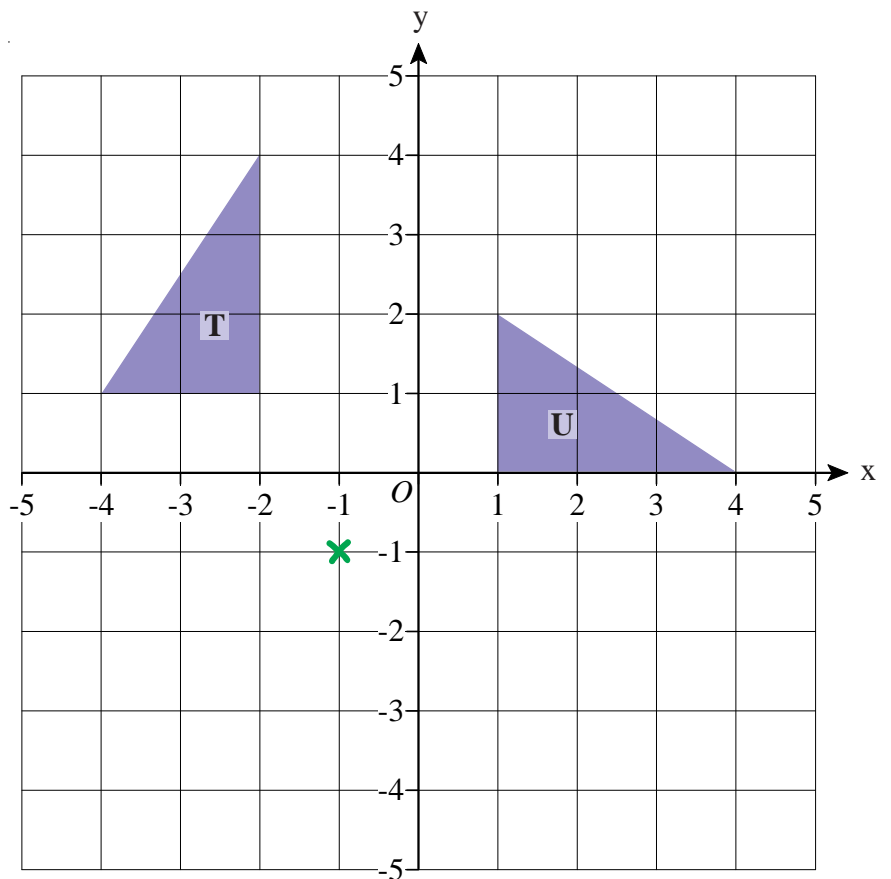


Rotations

- 1) a) Rotate triangle T 90° anti-clockwise about the point (0, 0).
Label your new triangle U
- b) Rotate triangle T 180° about the point (2, 0).
Label your new triangle V



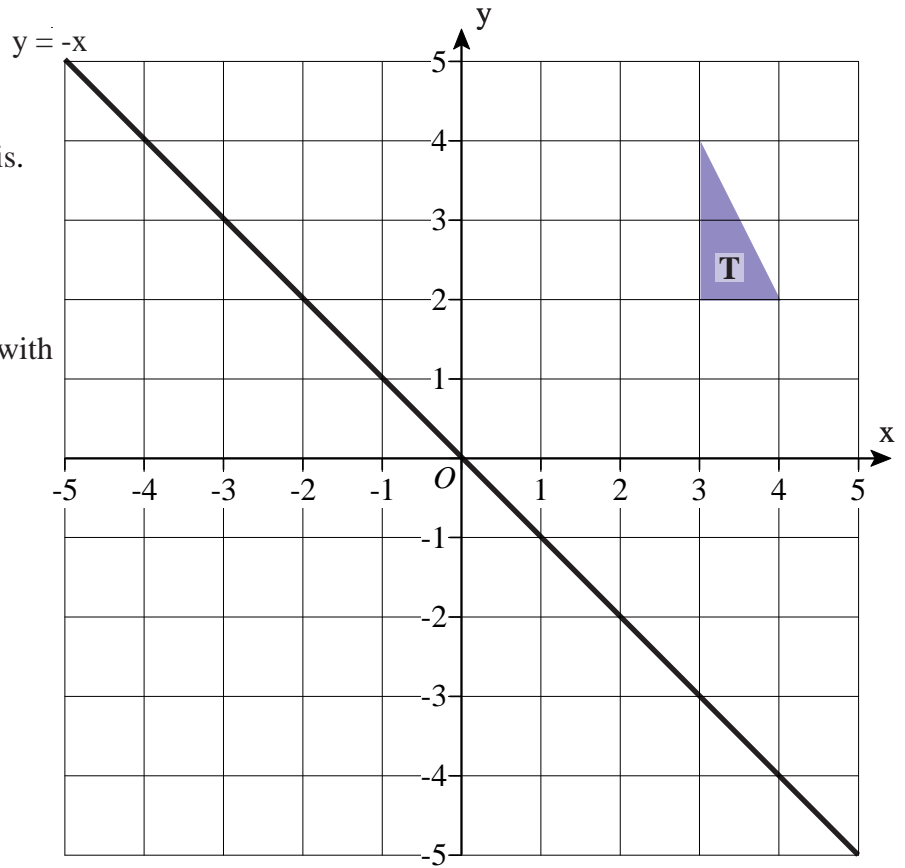
- 2) Describe fully the single transformation which maps triangle T to triangle U.
Rotation,
 90° clockwise,
centre of rotation (-1, -1)



Reflections

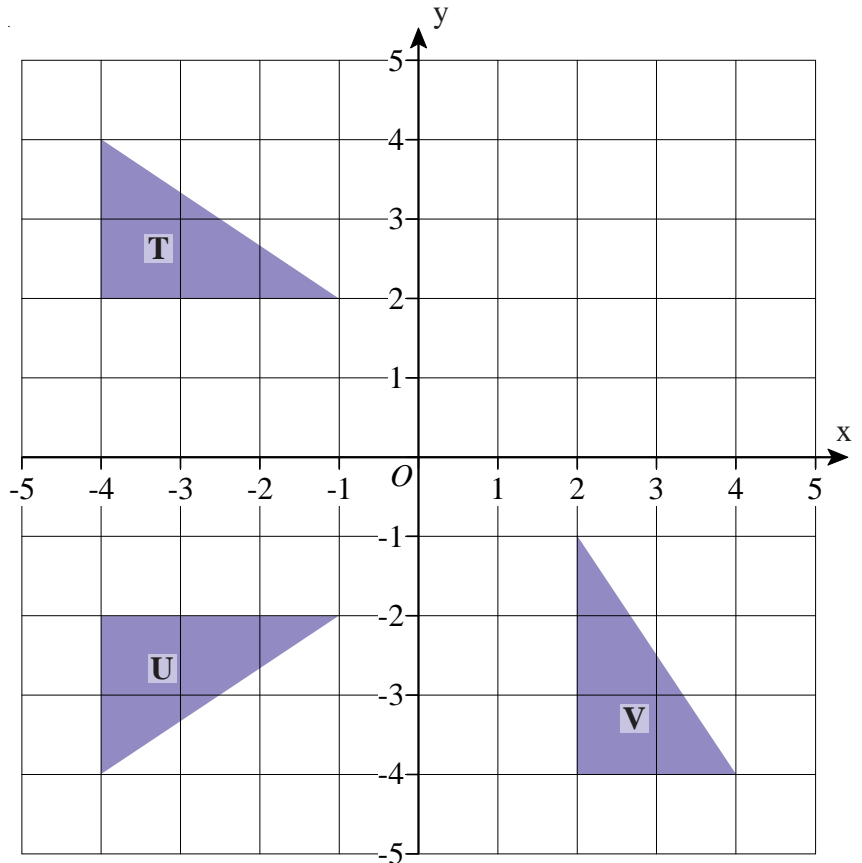
- 1) a) Reflect triangle T in the x axis.
Label your new triangle U.

- b) Reflect triangle T in the line with equation $y = -x$.
Label your new triangle V.



- 2) a) Describe fully the single transformation which maps triangle T to triangle U.

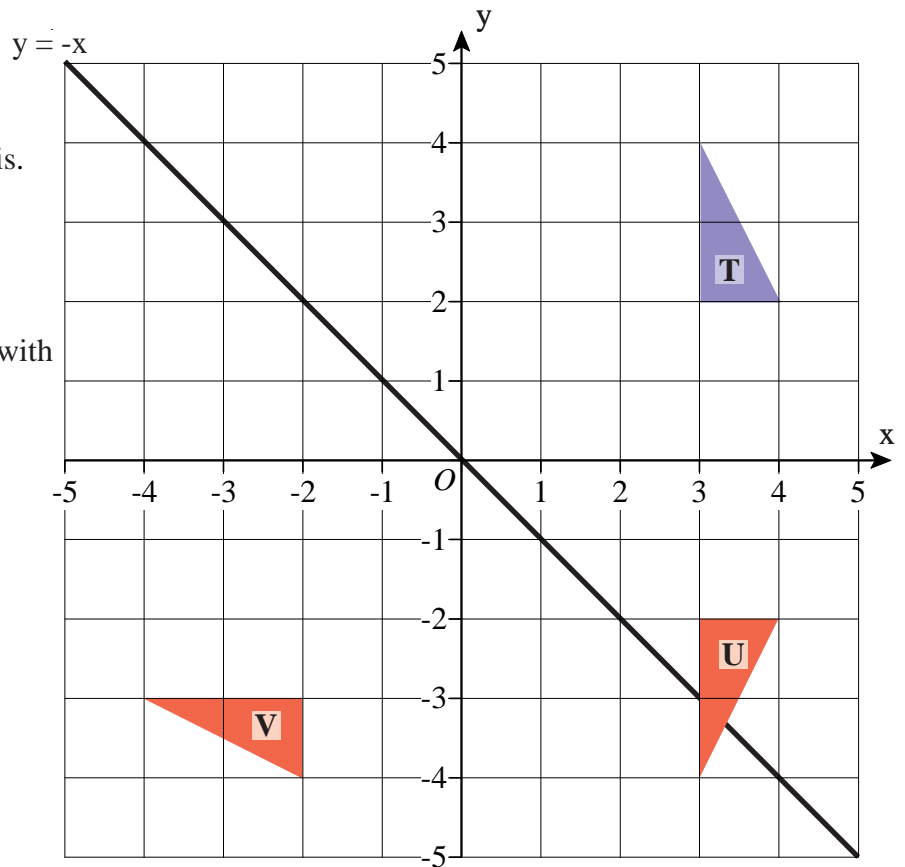
- b) Describe fully the single transformation which maps triangle T to triangle V.



Reflections

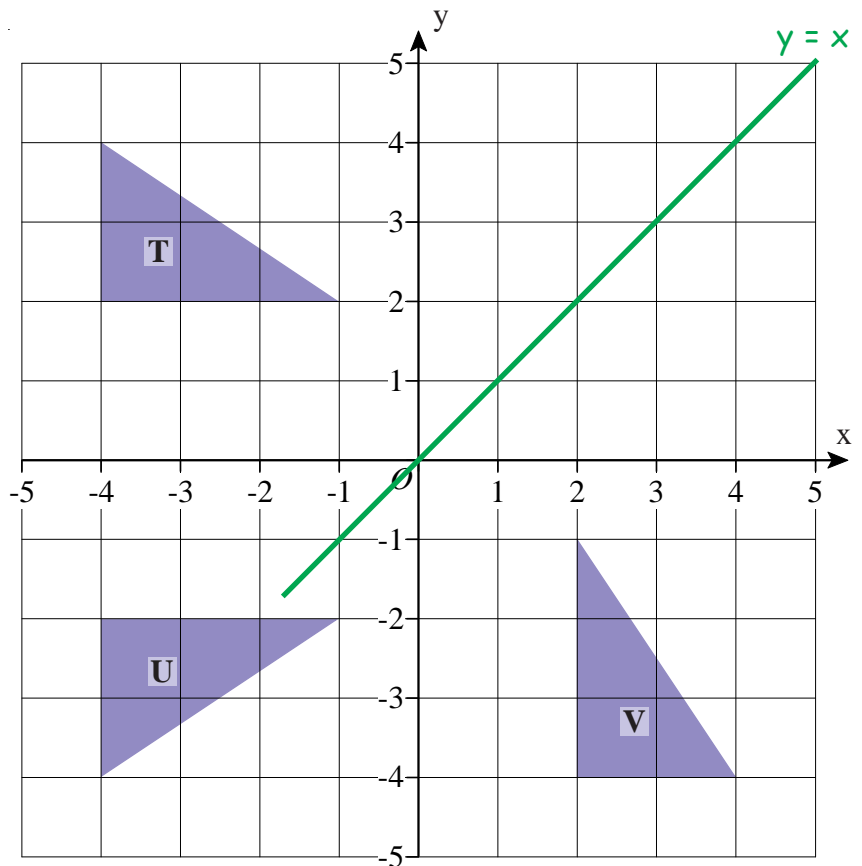
- 1) a) Reflect triangle T in the x axis.
Label your new triangle U.

- b) Reflect triangle T in the line with equation $y = -x$.
Label your new triangle V.



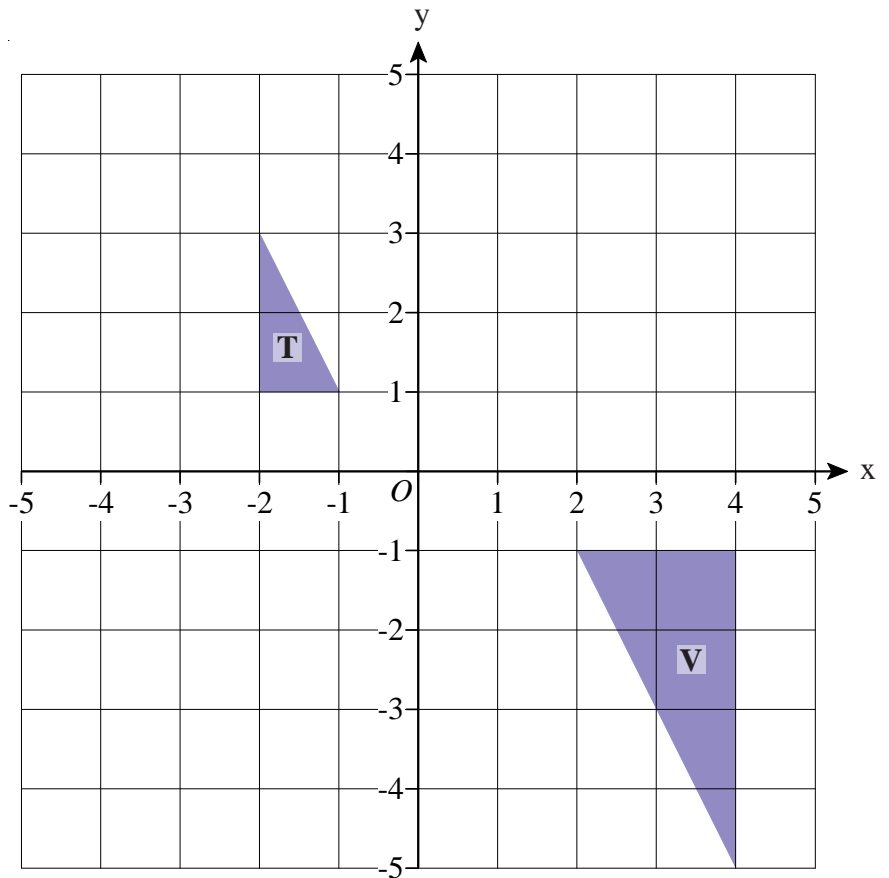
- 2) a) Describe fully the single transformation which maps triangle T to triangle U.
Reflection in the x axis.

- b) Describe fully the single transformation which maps triangle T to triangle V.
Reflection in the $y = x$ line.

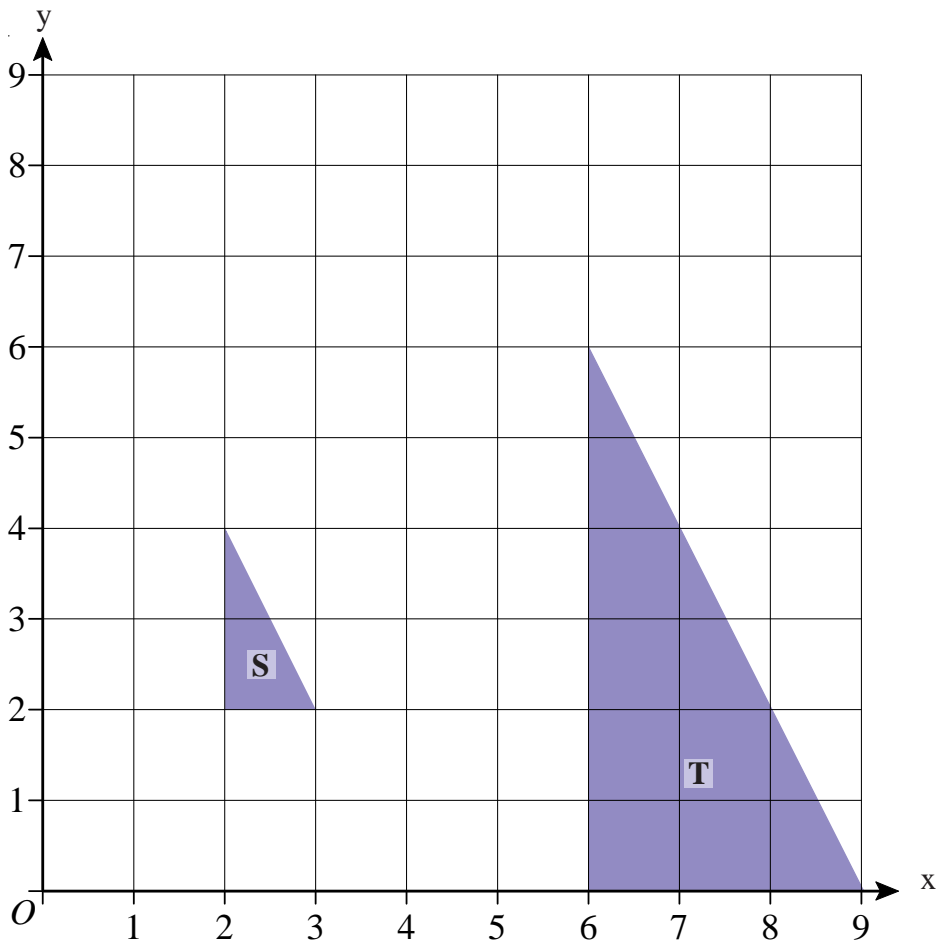


Enlargements

- 1) a) Enlarge triangle T by scale factor 2 using point $(-5, 2)$ as the centre of enlargement.
Label your new triangle U.
- b) Enlarge triangle V by scale factor a half using the point $(-2, -3)$ as the centre of enlargement.
Label your new triangle W.

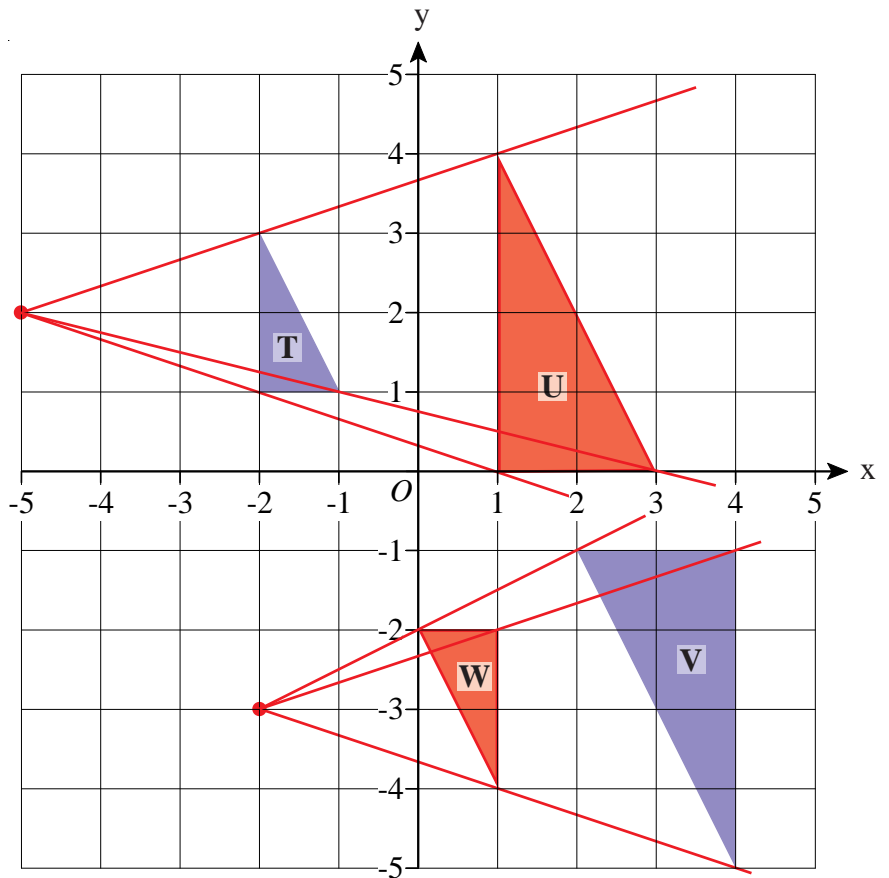


- 2) Describe fully the single transformation which maps triangle S to triangle T

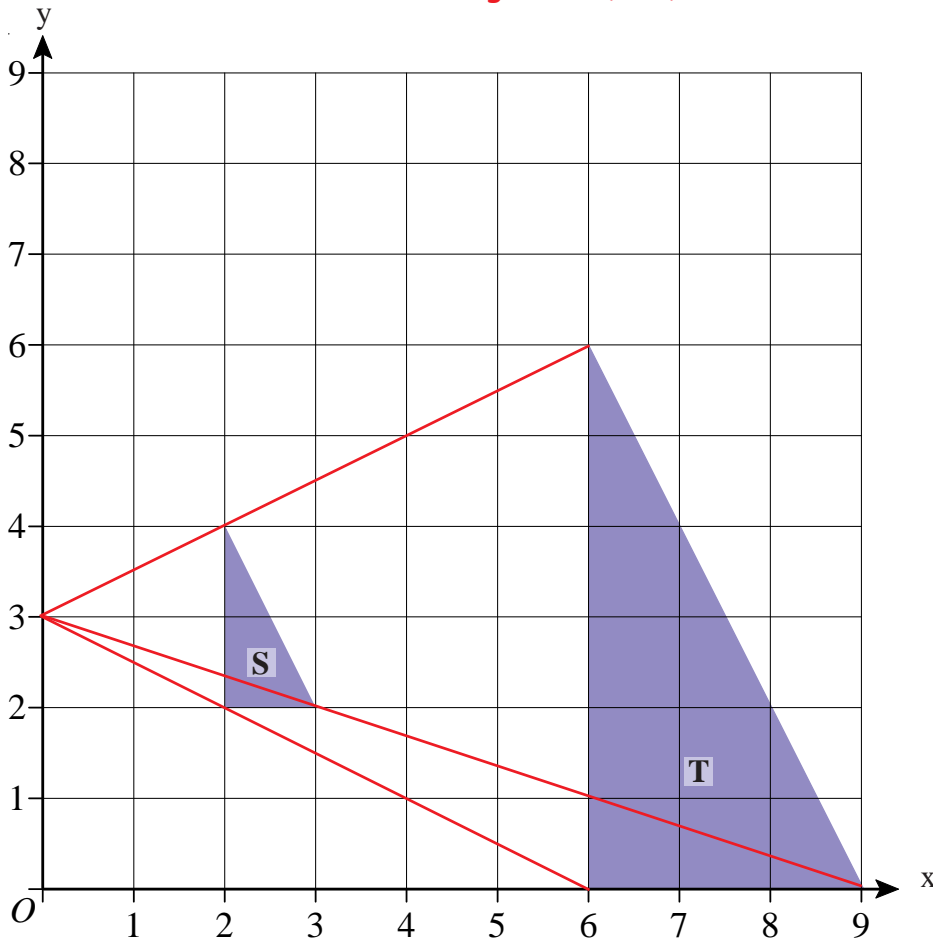


Enlargements

- 1) a) Enlarge triangle T by scale factor 2 using point $(-5, 2)$ as the centre of enlargement. Label your new triangle U.
- b) Enlarge triangle V by scale factor a half using the point $(-2, -3)$ as the centre of enlargement. Label your new triangle W.



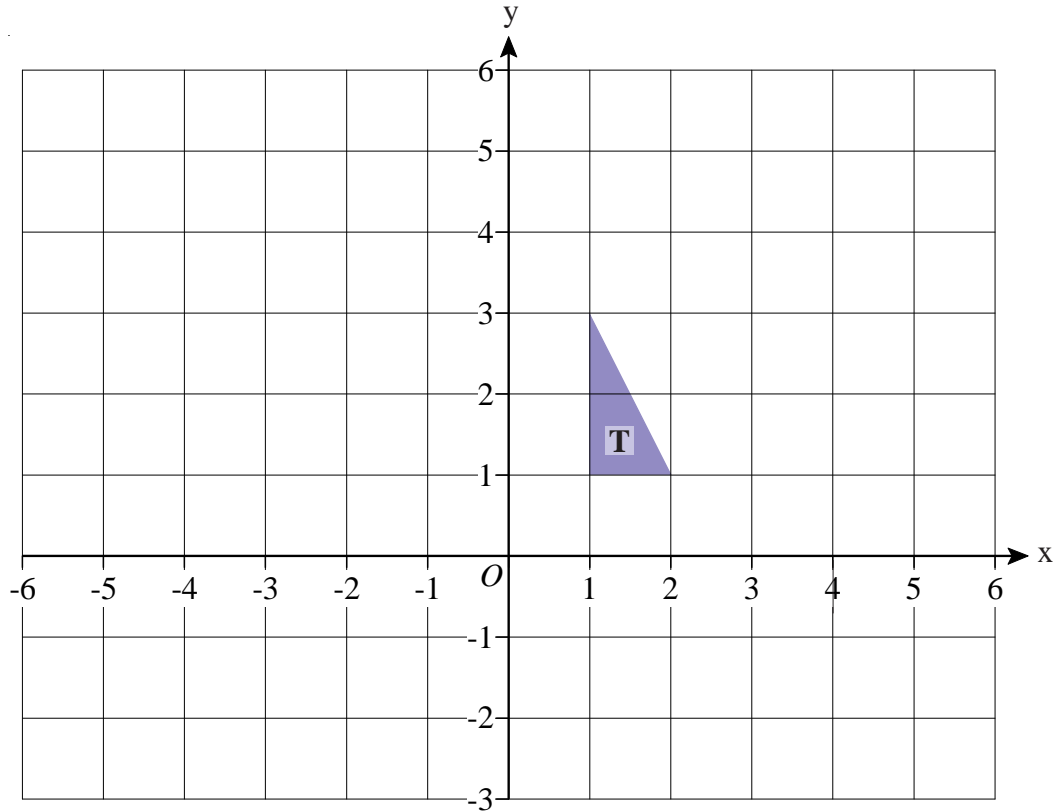
- 2) Describe fully the single transformation which maps triangle S to triangle T
Enlargement, scale factor 3, centre of enlargement $(0, 3)$.



Translations

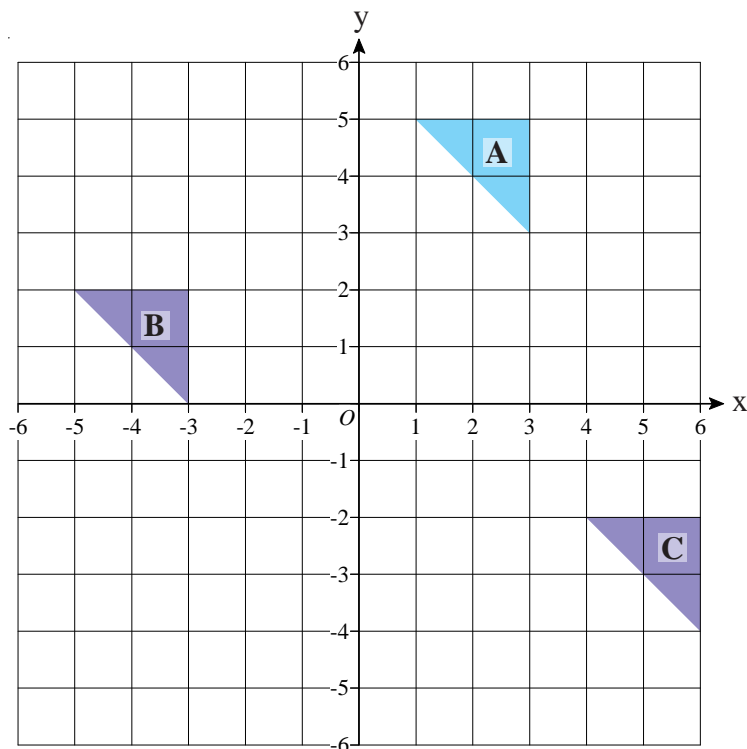
1) a) Translate triangle T by vector $\begin{bmatrix} -4 \\ 2 \end{bmatrix}$ and label it U

b) Translate triangle T by vector $\begin{bmatrix} 3 \\ -2 \end{bmatrix}$ and label it V



2) a) Describe fully the single transformation which maps triangle A to triangle B.

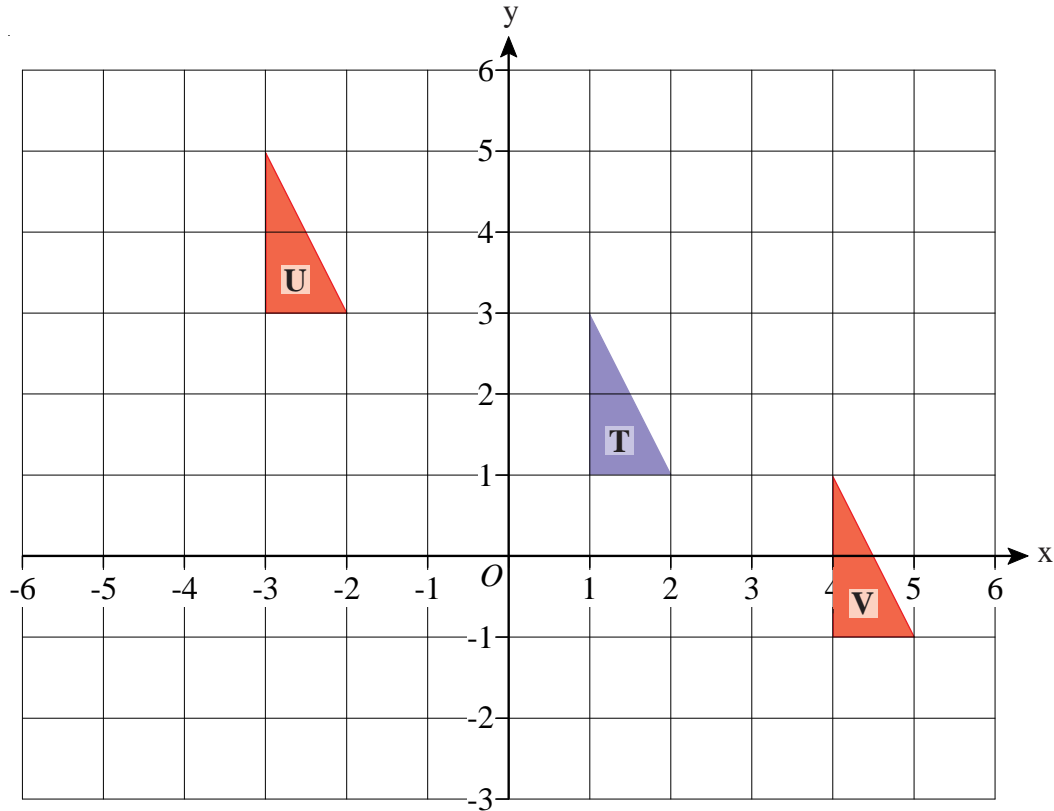
b) Describe fully the single transformation which maps triangle A to triangle C.



Translations

1) a) Translate triangle T by vector $\begin{bmatrix} -4 \\ 2 \end{bmatrix}$ and label it U

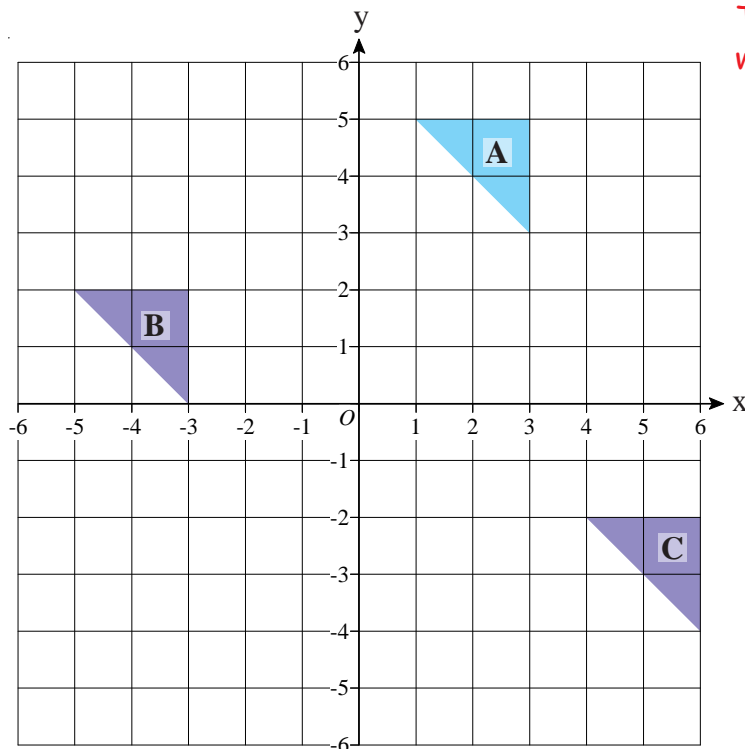
b) Translate triangle T by vector $\begin{bmatrix} 3 \\ -2 \end{bmatrix}$ and label it V



Translation with vector $\begin{bmatrix} -6 \\ -3 \end{bmatrix}$

2) a) Describe fully the single transformation which maps triangle A to triangle B.

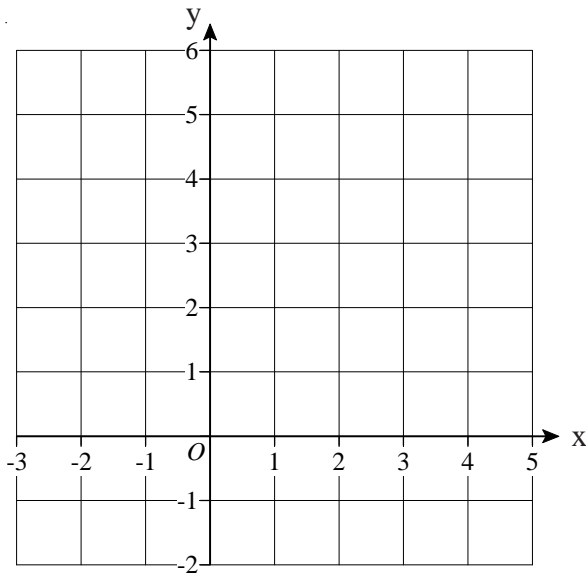
b) Describe fully the single transformation which maps triangle A to triangle C.



Translation with vector $\begin{bmatrix} 3 \\ -7 \end{bmatrix}$

Find the Mid-Point of a Line

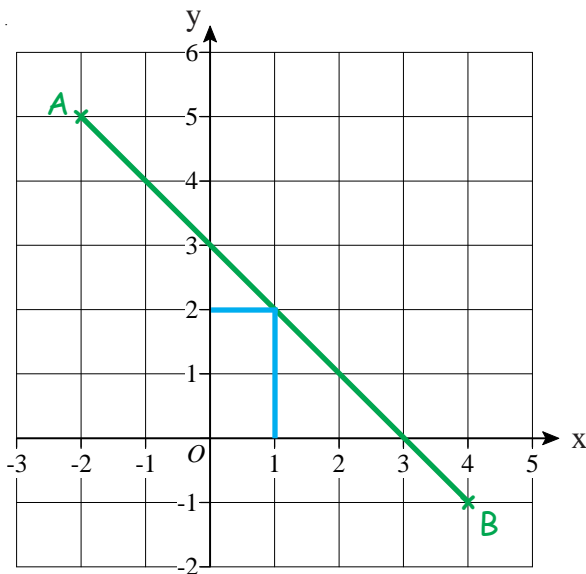
- 1) Find the midpoint of A and B where A has coordinates $(-2, 5)$ and B has coordinates $(4, -1)$.



- 2) Find the midpoint of A and B where A has coordinates $(2, 0)$ and B has coordinates $(8, 6)$.
- 3) Find the midpoint of A and B where A has coordinates $(-4, -2)$ and B has coordinates $(2, 4)$.
- 4) Find the midpoint of A and B where A has coordinates $(-3, -2)$ and B has coordinates $(7, 5)$.
- 5) Find the midpoint of A and B where A has coordinates $(2, -5)$ and B has coordinates $(7, 4)$.
- 6) Find the midpoint of A and B where A has coordinates $(-7, -4)$ and B has coordinates $(-2, -1)$.
- 7) The midpoint of A and B is at $(1, 3)$.
The coordinates of A are $(-2, 4)$.
Work out the coordinates of B.
- 8) The midpoint of A and B is at $(3.5, 2.5)$.
The coordinates of A are $(2, 5)$.
Work out the coordinates of B.

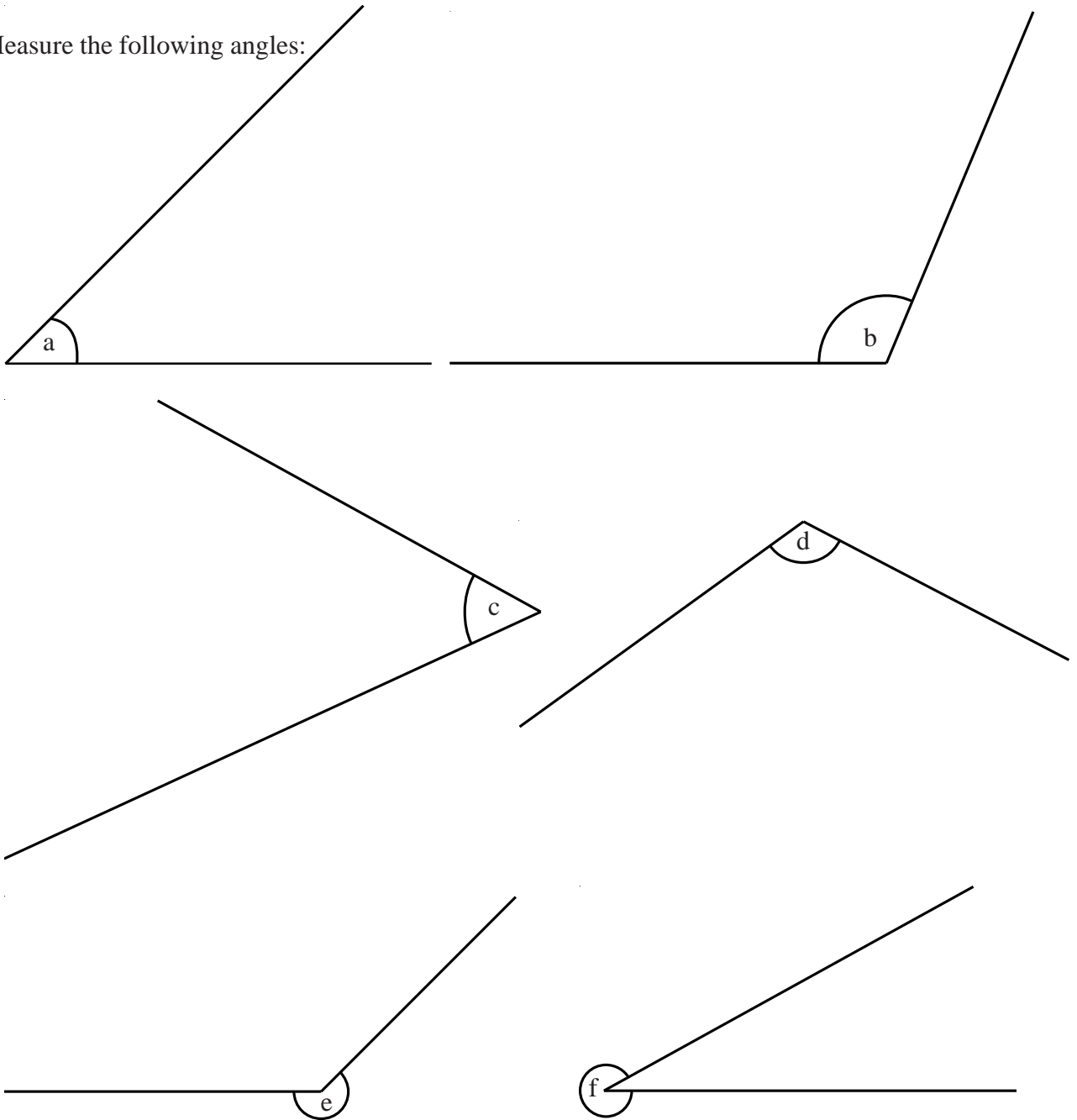
Find the Mid-Point of a Line

- 1) Find the midpoint of A and B where A has coordinates (-2, 5) and B has coordinates (4, -1). **Midpoint at (1, 2)**



- 2) Find the midpoint of A and B where A has coordinates (2, 0) and B has coordinates (8, 6). **Midpoint at (5, 3)**
- $$\begin{array}{l} x \quad (2 + 8) \div 2 = 5 \\ y \quad (0 + 6) \div 2 = 3 \end{array}$$
- 3) Find the midpoint of A and B where A has coordinates (-4, -2) and B has coordinates (2, 4). **Midpoint at (-1, 1)**
- $$\begin{array}{l} x \quad (-4 + 2) \div 2 = -1 \\ y \quad (-2 + 4) \div 2 = 1 \end{array}$$
- 4) Find the midpoint of A and B where A has coordinates (-3, -2) and B has coordinates (7, 5). **Midpoint at (2, 1.5)**
- $$\begin{array}{l} x \quad (-3 + 7) \div 2 = 2 \\ y \quad (-2 + 5) \div 2 = 1.5 \end{array}$$
- 5) Find the midpoint of A and B where A has coordinates (2, -5) and B has coordinates (7, 4). **Midpoint at (4.5, -0.5)**
- $$\begin{array}{l} x \quad (2 + 7) \div 2 = 4.5 \\ y \quad (-5 + 4) \div 2 = -0.5 \end{array}$$
- 6) Find the midpoint of A and B where A has coordinates (-7, -4) and B has coordinates (-2, -1). **Midpoint at (-4.5, -2.5)**
- $$\begin{array}{l} x \quad (-7 + -2) \div 2 = -4.5 \\ y \quad (-4 + -1) \div 2 = -2.5 \end{array}$$
- 7) The midpoint of A and B is at (1, 3).
The coordinates of A are (-2, 4).
Work out the coordinates of B. **(4, 2)**
- $$\begin{array}{l} x \quad (-2 + ?) \div 2 = 1 \\ y \quad (4 + ?) \div 2 = 3 \end{array}$$
- 8) The midpoint of A and B is at (3.5, 2.5).
The coordinates of A are (2, 5).
Work out the coordinates of B. **(5, 0)**
- $$\begin{array}{l} x \quad (2 + ?) \div 2 = 3.5 \\ y \quad (5 + ?) \div 2 = 2.5 \end{array}$$

1) Measure the following angles:

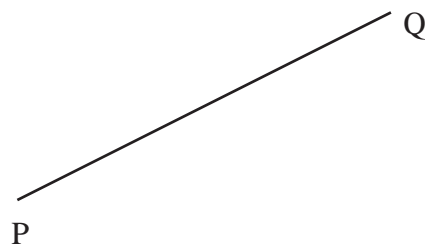


2) Draw the following angles:

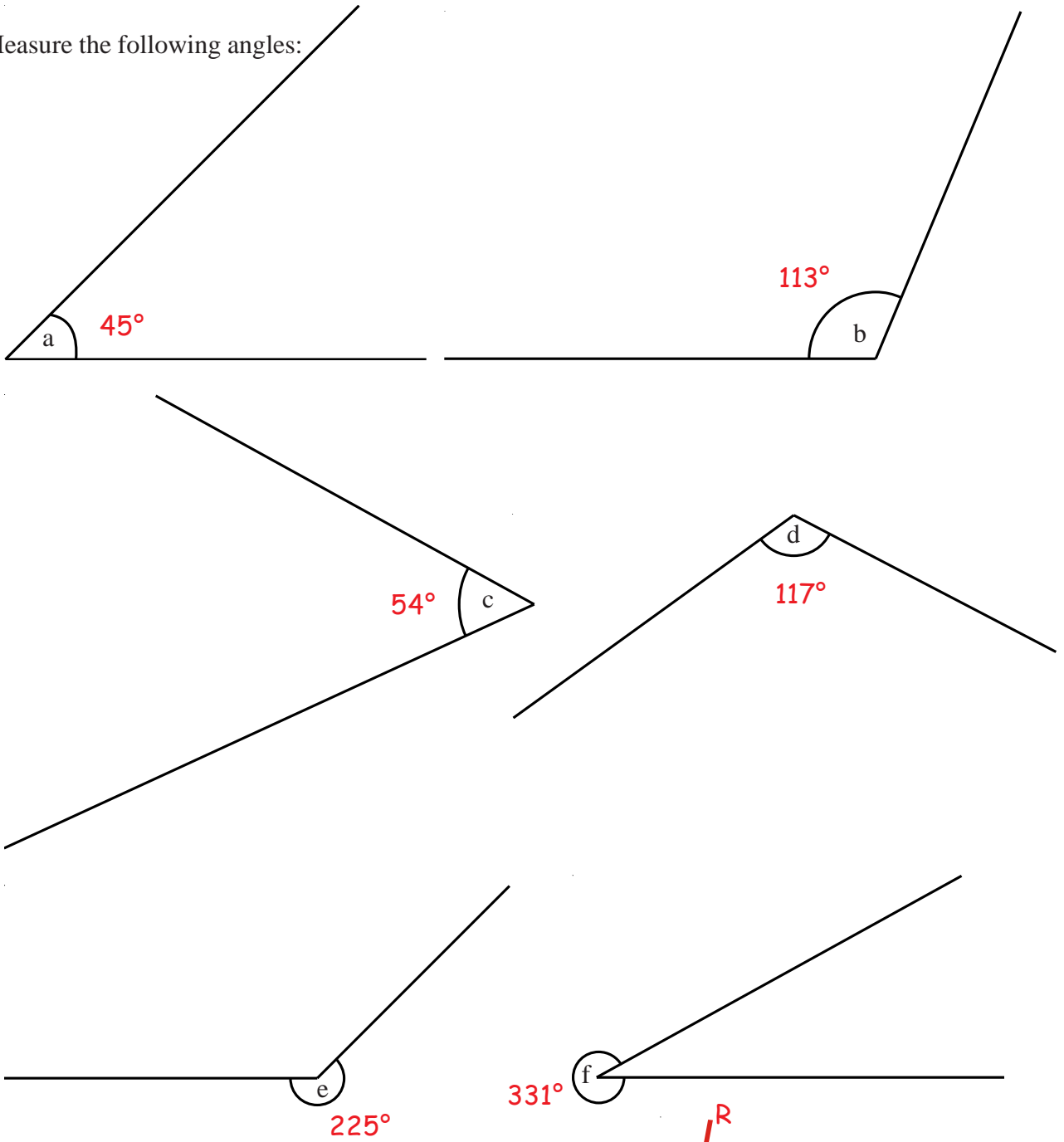
a) angle $ABC = 60^\circ$

b) angle $PQR = 127^\circ$

c) angle $XYZ = 275^\circ$

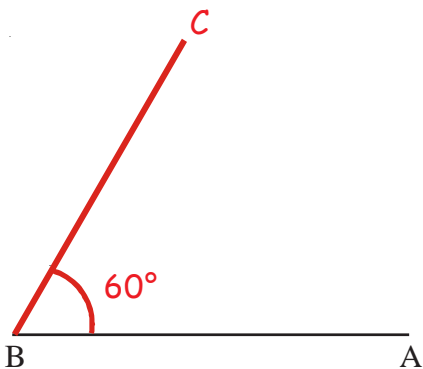


1) Measure the following angles:

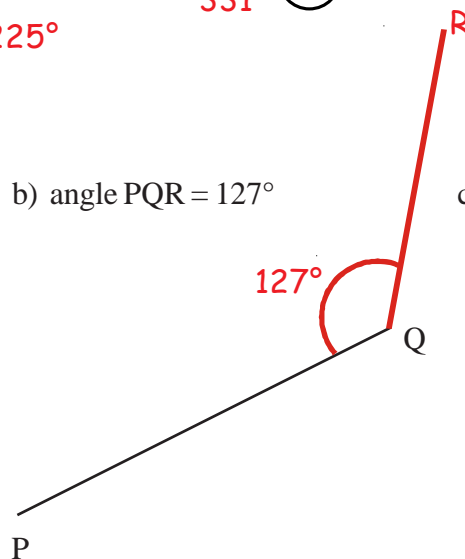


2) Draw the following angles:

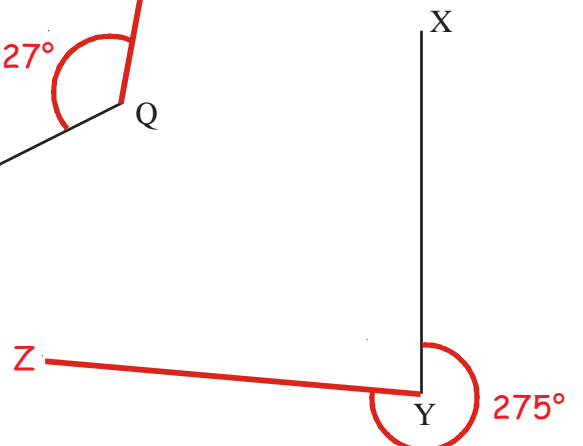
a) angle ABC = 60°



b) angle PQR = 127°

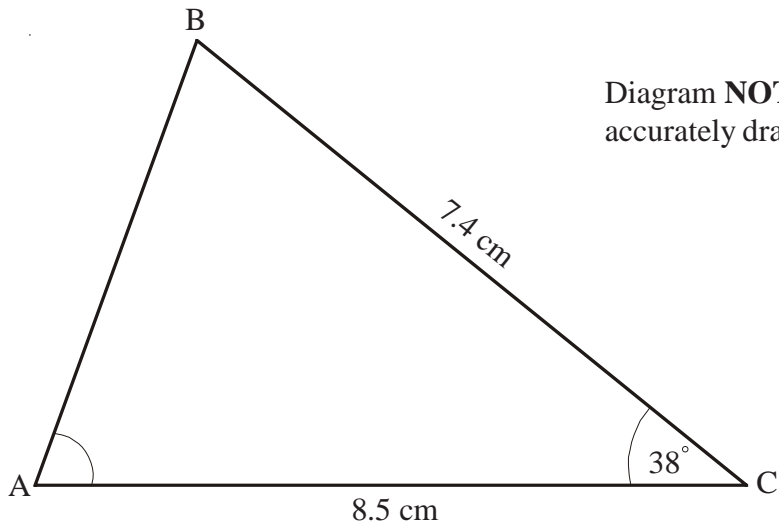


c) angle XYZ = 275°



Drawing Triangles

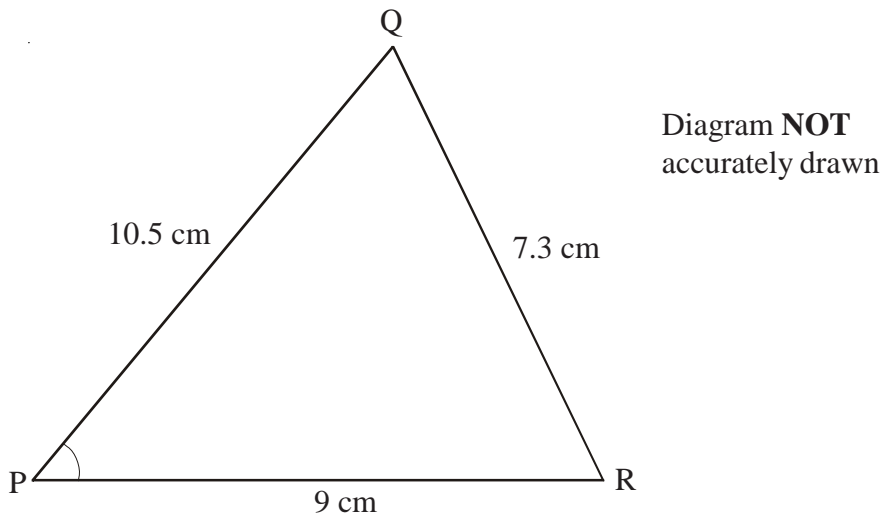
- 1) The diagram shows the sketch of triangle ABC.



BC = 7.4 cm
 AC = 8.5 cm
 Angle C = 38°

- a) Make an accurate drawing of triangle ABC.
 - b) Measure the size of angle A on your diagram.
- 2) Use ruler and compasses to **construct** an equilateral triangle with sides of length 6 centimetres.
 You must show all construction lines.

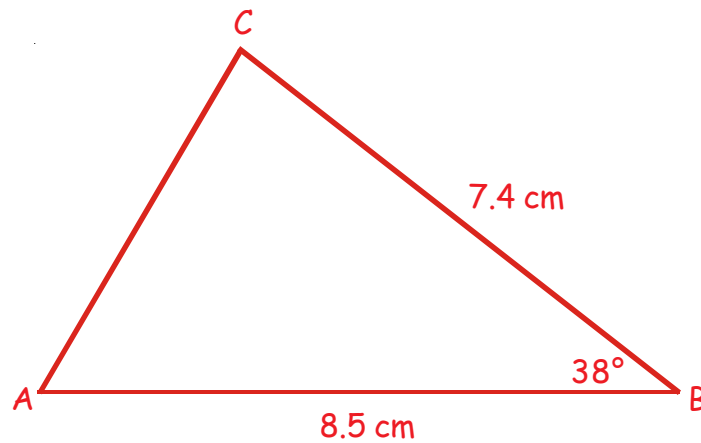
- 3) The diagram shows the sketch of triangle PQR.



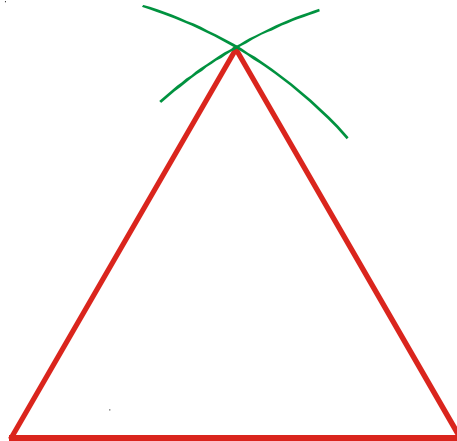
- a) Use ruler and compasses to make an accurate drawing of triangle PQR.
- b) Measure angle P.

Drawing Triangles

- 1) The diagram shows the sketch of triangle ABC.

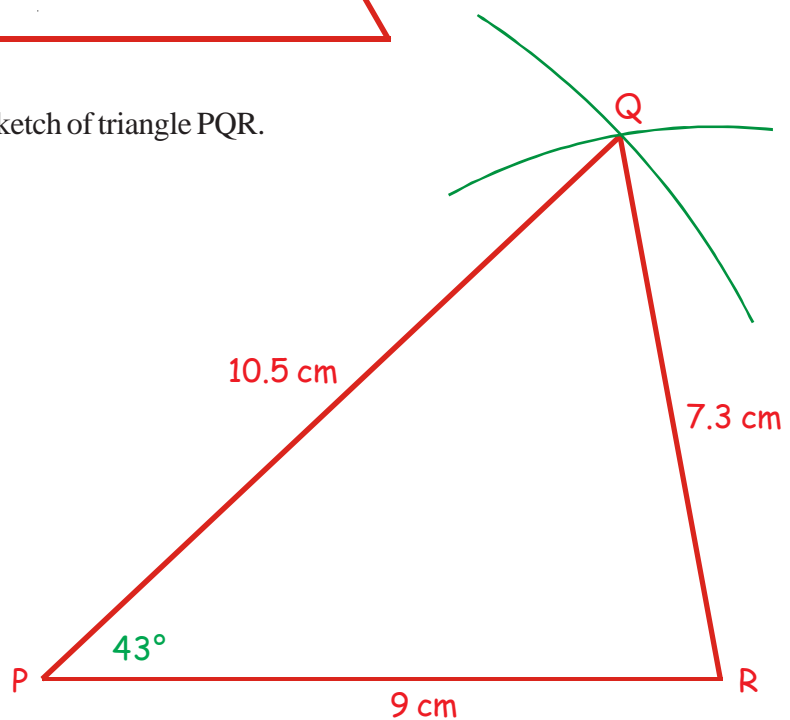


- a) Make an accurate drawing of triangle ABC.
b) Measure the size of angle A on your diagram. **Angle A = 59°**
- 2) Use ruler and compasses to **construct** an equilateral triangle with sides of length 6 centimetres.

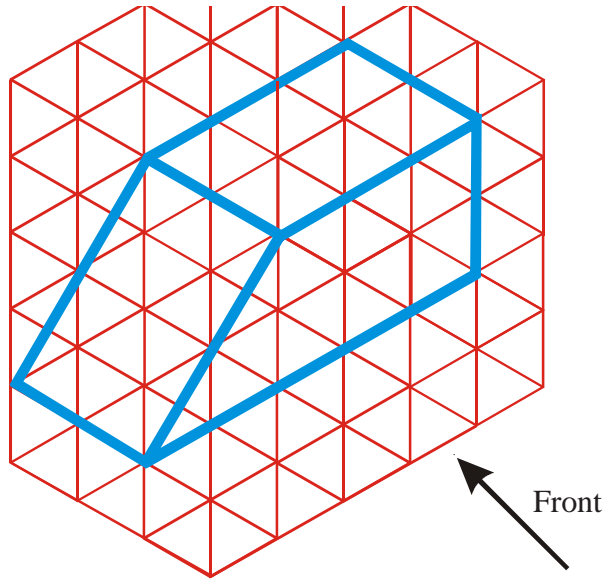


- 3) The diagram shows the sketch of triangle PQR.

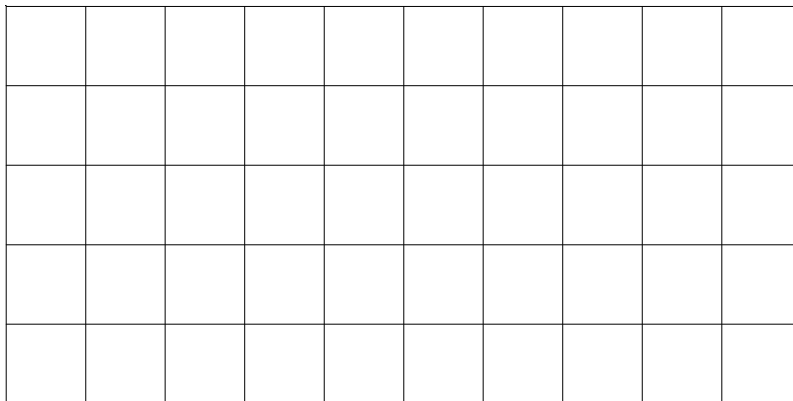
Angle P = 43°



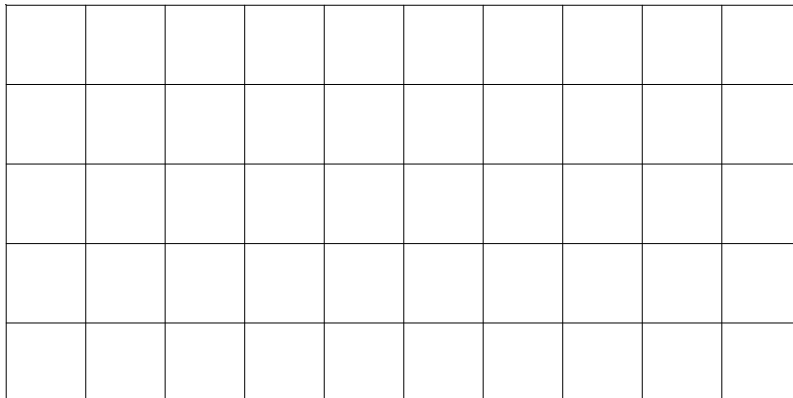
The diagram shows a prism drawn on an isometric grid.



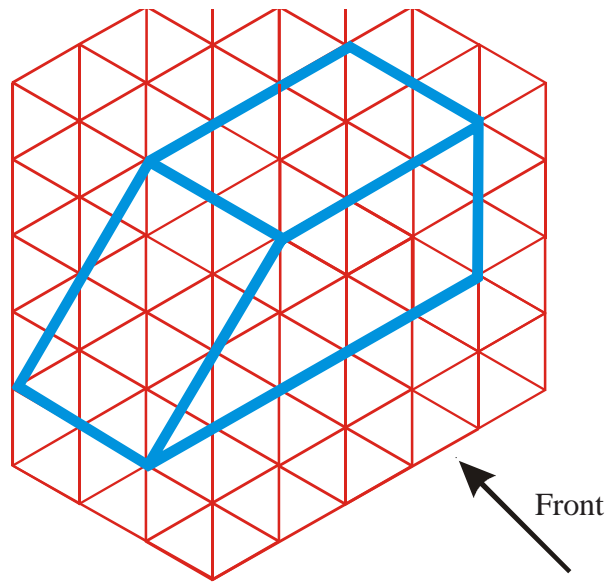
- a) On the grid below, draw the front elevation of the prism from the direction marked by the arrow.



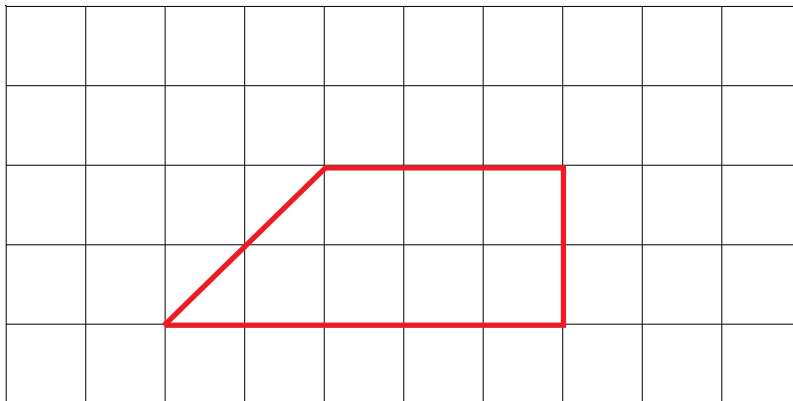
- b) On the grid below draw a plan of the prism.



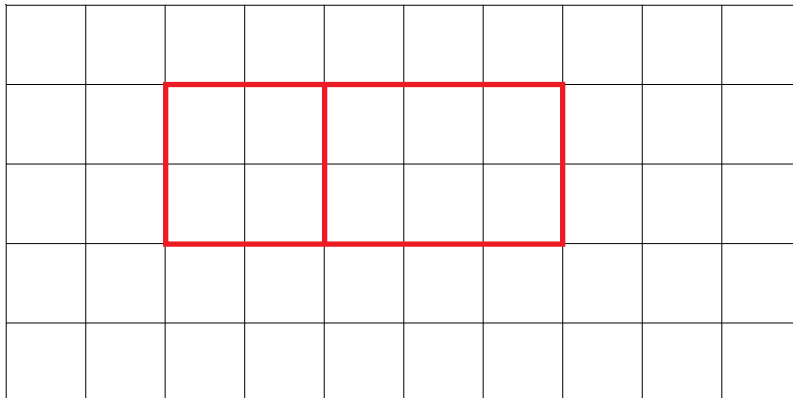
The diagram shows a prism drawn on an isometric grid.



- a) On the grid below, draw the front elevation of the prism from the direction marked by the arrow.



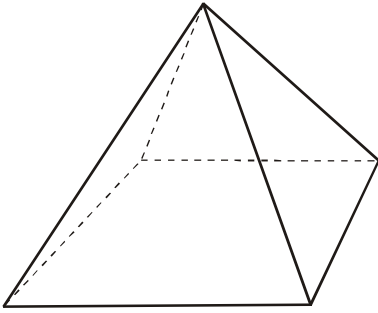
- b) On the grid below draw a plan of the prism.



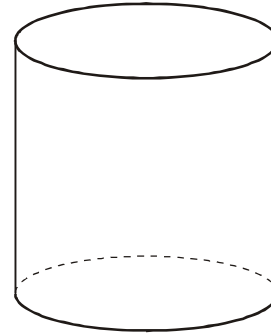
Nets

1) Sketch nets of these solids.

a)



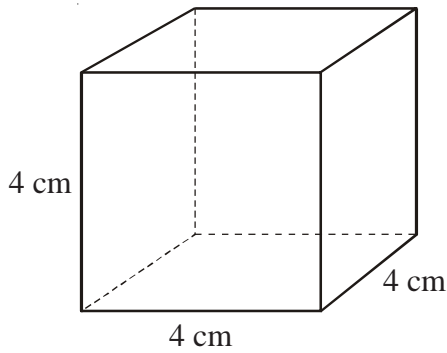
b)



2) On squared paper draw accurate nets of these solids.

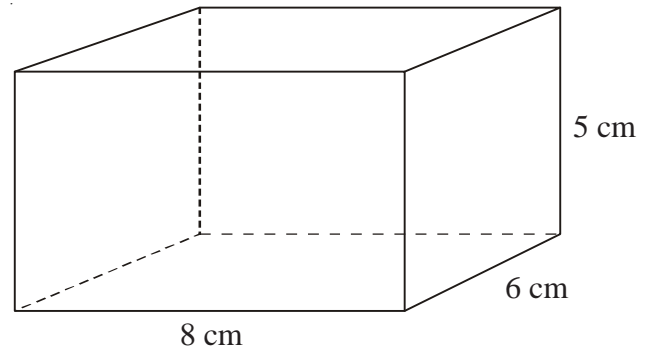
a)

Cube



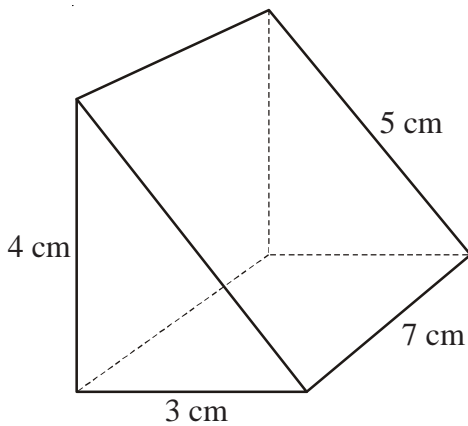
b)

Cuboid



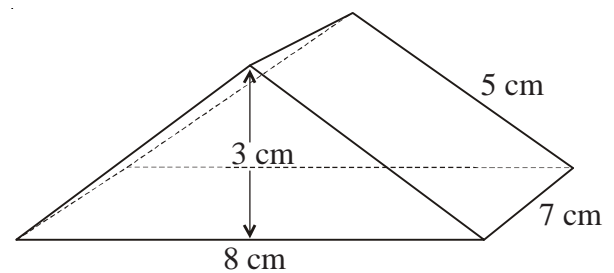
c)

Right-angled triangular prism



d)

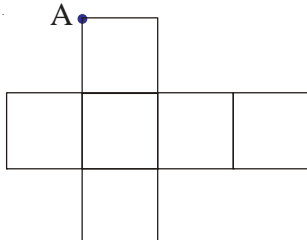
Triangular prism



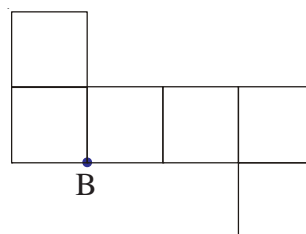
3) The two nets, below, are folded to make cubes.

Two other vertices will meet at the the dot, A. Mark them with As.
One other vertex will meet the dot B. Mark it with B.

a)

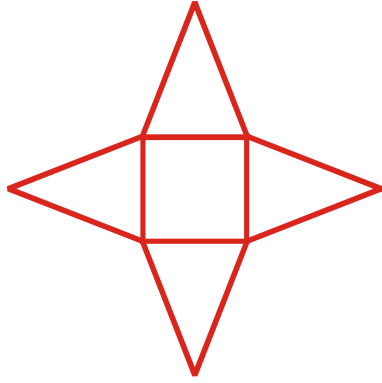
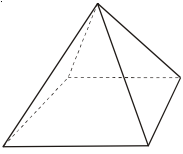


b)

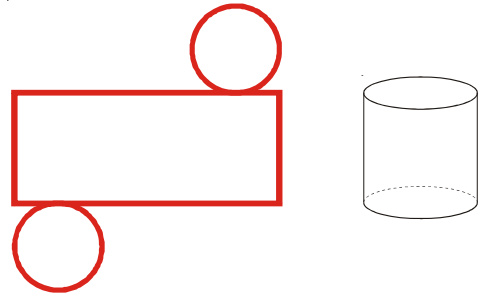


1) Sketch nets of these solids.

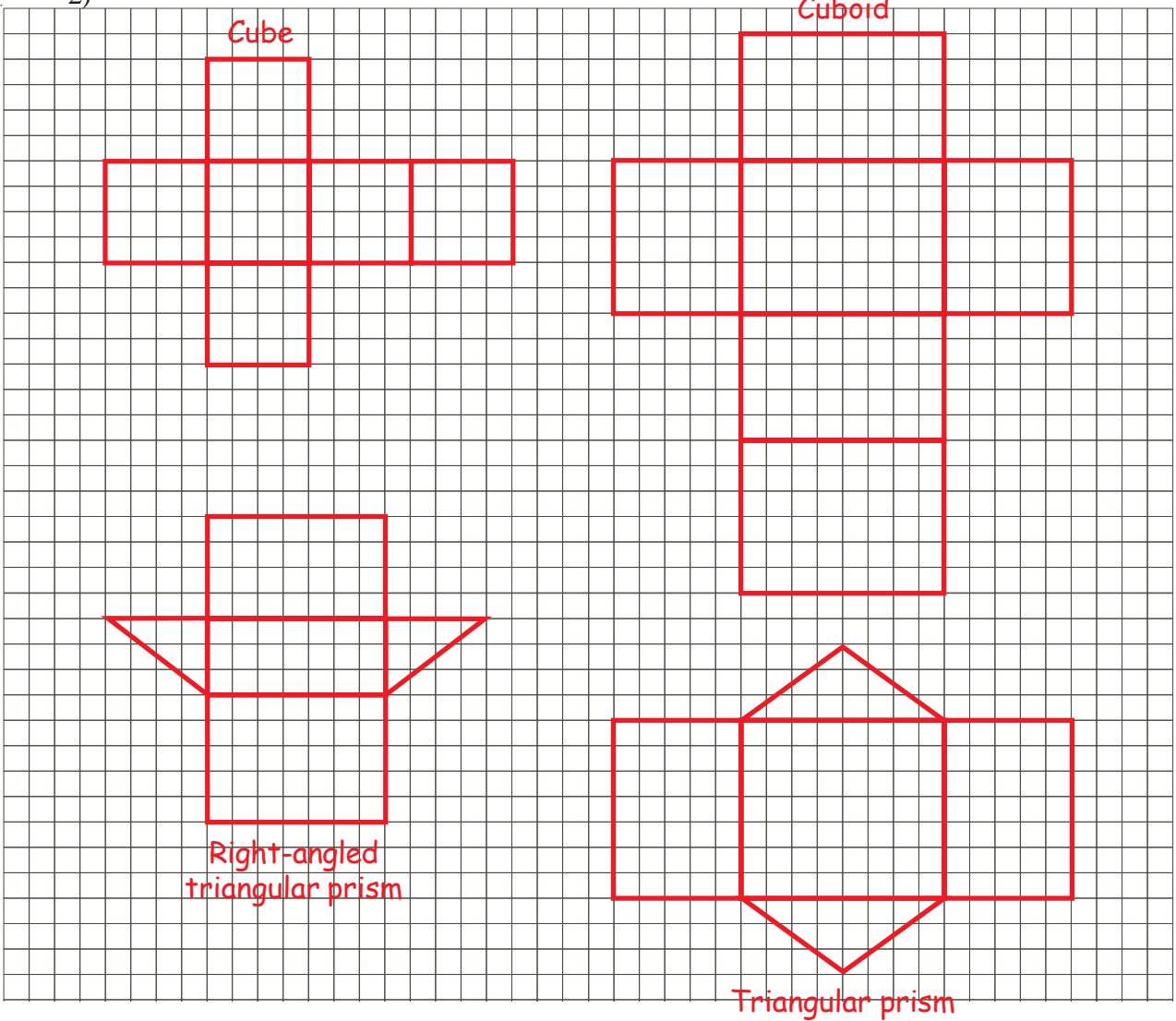
a)



b)



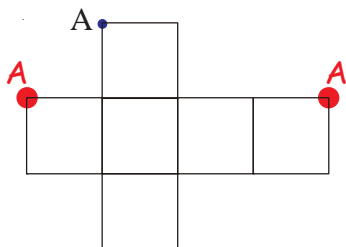
2)



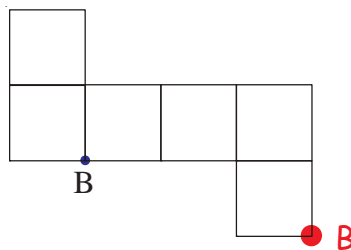
3) The two nets, below, are folded to make cubes.

Two other vertices will meet at the the dot, A. Mark them with As.
 One other vertex will meet at the dot B. Mark it with B.

a)

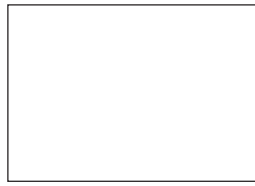
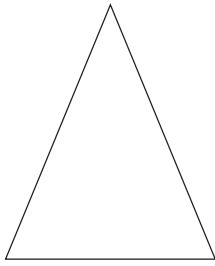


b)

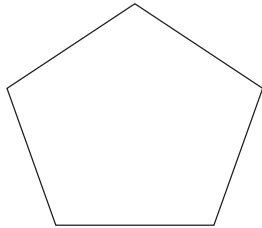


Symmetries

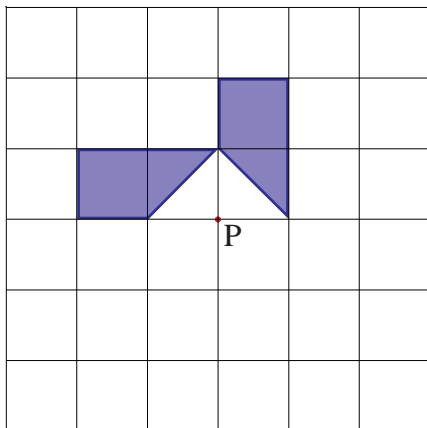
- 1) Draw all the lines of symmetry on the triangle and the rectangle.



- 2) What is the order of rotational symmetry of the two shapes below.



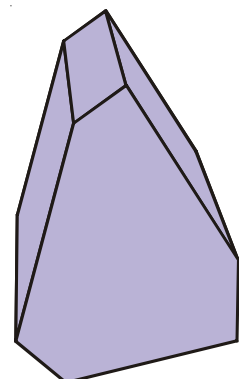
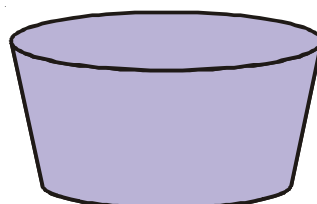
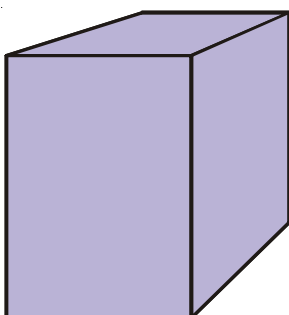
- 3) The diagram below, shows part of a shape.



The shape has rotational symmetry of order 4 about point P.

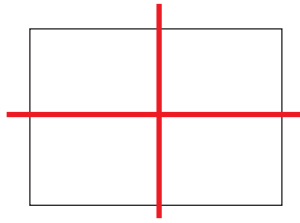
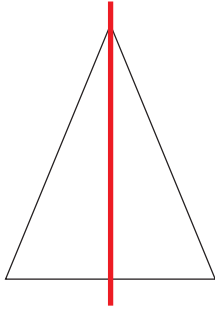
Complete the shape.

- 4) On each of the shapes below, draw one plane of symmetry.

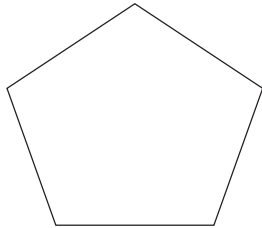


Symmetries

- 1) Draw all the lines of symmetry on the triangle and the rectangle.



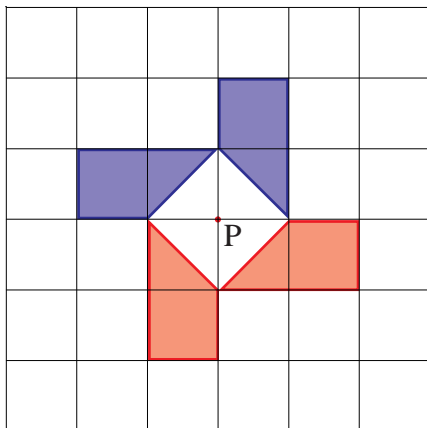
- 2) What is the order of rotational symmetry of the two shapes below.



Rotational symmetry order 5

Rotational symmetry order 2

- 3) The diagram below, shows part of a shape.

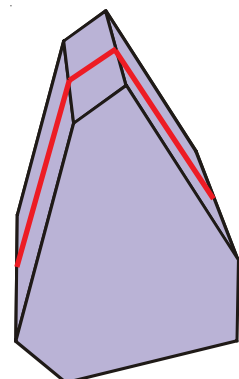
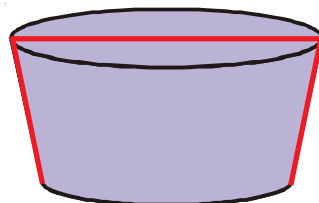
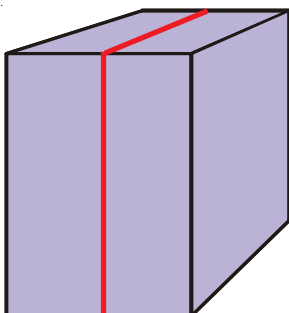


The shape has rotational symmetry of order 4 about point P.

Complete the shape.

- 4) On each of the shapes below, draw one plane of symmetry.

There are other answers for these two questions.



- 1) Claire wants to find how much time pupils spend on their homework. She hands out a questionnaire with the question
How much time do you spend on your homework?

A lot Not much

- a) Write down two things that are wrong with this question

- b) Design a suitable question she could use.
You should include response boxes.

- 2) Tony wants to know which type of programme pupils in his class like watching on TV.
Design a suitable data collection sheet he could use to gather the information.

- 3) Emma asked 20 people what was their favourite pet.
Here are their answers.

cat	cat	hamster	cat
mouse	hamster	cat	dog
dog	dog	snake	hamster
cat	cat	hamster	dog
cat	hamster	snake	cat

Design and complete a suitable data collection sheet that Emma could have used to collect and show this information.

- 1) Claire wants to find how much time pupils spend on their homework. She hands out a questionnaire with the question
How much time do you spend on your homework?

A lot Not much

- a) Write down two things that are wrong with this question

No mention of time. Does it mean 'per night', 'per week', etc.
'A lot' and 'Not much' are not specific enough. They mean different things to different people.

- b) Design a suitable question she could use.

You should include response boxes.

How much time do you spend on homework per night?

Less than 15 mins Between 15 and 30 mins More than 30 mins

- 2) Tony wants to know which type of programme pupils in his class like watching on TV. Design a suitable data collection sheet he could use to gather the information.

Type of programme	Tally	Frequency
Soap opera		
Reality TV		
Films		
Situation comedy		
Documentary		

- 3) Emma asked 20 people what was their favourite pet. Here are their answers.

cat	cat	hamster	cat
mouse	hamster	cat	dog
dog	dog	snake	hamster
cat	cat	hamster	dog
cat	hamster	snake	cat

Design and complete a suitable data collection sheet that Emma could have used to collect and show this information.

Favourite pet	Tally	Frequency
Cat	### III	8
Hamster	###	5
Mouse	I	1
Dog	IIII	4
Snake	II	2

Two-Way Tables

1. Billy has been carrying out a survey.
He asked 100 people the type of water they like to drink (still, sparkling or both).
Here are part of his results:

	Still	Sparkling	Both	Total
Male	26			53
Female		20	10	
Total			16	100

- a) Complete the two-way table.
- b) How many males were in the survey?
- c) How many females drink only still water?
- d) How many people drink only sparkling water?
2. 90 students each study one of three languages.
The two-way table shows some information about these students.

	French	German	Spanish	Total
Female				
Male		7		
Total	20	18		90

- 50 of the 90 students are male.
29 of the 50 male students study Spanish.

- a) Complete the two-way table.
- b) How many females study French?
- c) How many people study Spanish?

Two-Way Tables

1. Billy has been carrying out a survey.
He asked 100 people the type of water they like to drink (still, sparkling or both).
Here are part of his results:

	Still	Sparkling	Both	Total
Male	26	21	6	53
Female	17	20	10	47
Total	43	41	16	100

- a) Complete the two-way table.
- b) How many males were in the survey? **53**
- c) How many females drink only still water? **17**
- d) How many people drink only sparkling water? **41**
2. 90 students each study one of three languages.
The two-way table shows some information about these students.

	French	German	Spanish	Total
Female	6	11	23	40
Male	14	7	29	50
Total	20	18	52	90

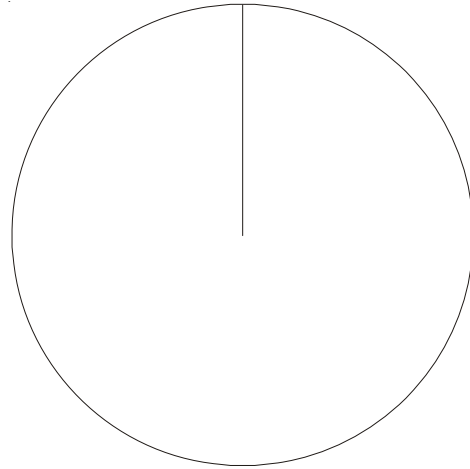
- 50 of the 90 students are male.
29 of the 50 male students study Spanish.
- a) Complete the two-way table.
- b) How many females study French? **6**
- c) How many people study Spanish? **52**

Pie Charts

- 1) Patrick asked some of his colleagues which was their favourite holiday destination.
The table shows the results.

City	Frequency
Alicante	8
Paris	7
Ibiza	15
St Lucia	1
Biarritz	9

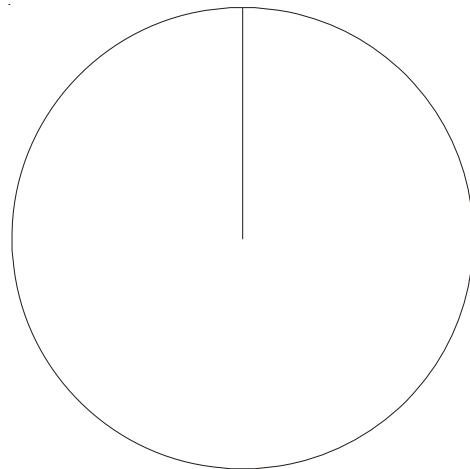
Draw a pie chart to illustrate the information.



- 2) Brian asked 60 people which region their favourite rugby team came from.
The table shows the results.

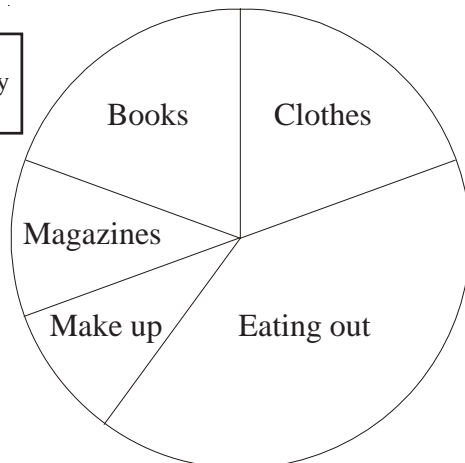
Region	Frequency
Southern England	9
London	23
Midlands	16
Northern England	12
Total	60

Draw a pie chart to illustrate the information.



- 3) Sophie represents her monthly expenses using a pie chart.

Diagram accurately drawn



Numbers from her table have been rubbed out by mistake.

Use the pie chart to complete the table.

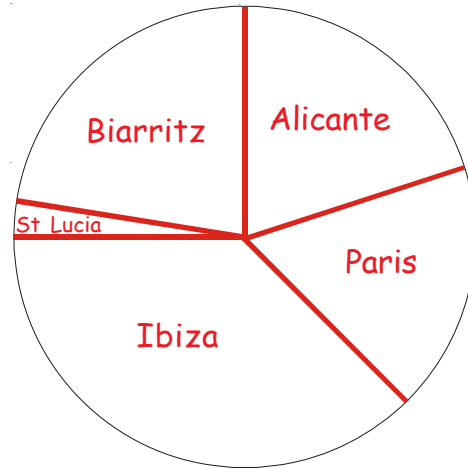
		Angle
Clothes	£35	
Eating out		
Make up	£17	34°
Magazines		
Books		
Total	£180	

Pie Charts

- 1) Patrick asked some of his colleagues which was their favourite holiday destination. The table shows the results.

City	Frequency	Angle
Alicante	8 × 9	72°
Paris	7 × 9	63°
Ibiza	15 × 9	135°
St Lucia	1 × 9	9°
Biarritz	9 × 9	81°
	40	360°

Draw a pie chart to illustrate the information.

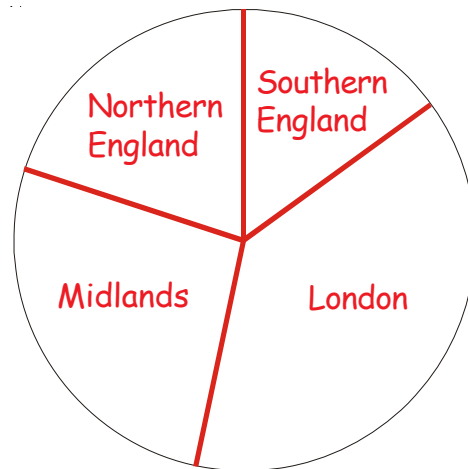


360 ÷ ?
360 ÷ 40 = 9

- 2) Brian asked 60 people which region their favourite rugby team came from. The table shows the results.

Region	Frequency	Angle
Southern England	9 × 6	54°
London	23 × 6	138°
Midlands	16 × 6	96°
Northern England	12 × 6	72°
Total	60	360°

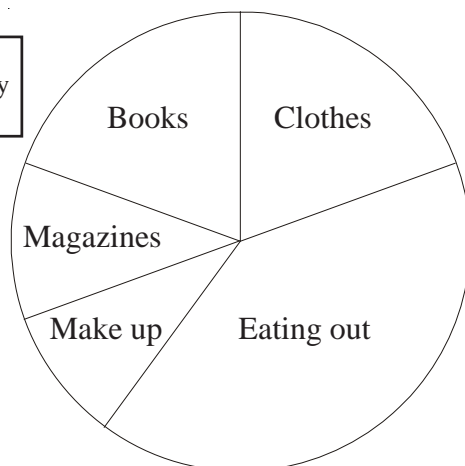
Draw a pie chart to illustrate the information.



360 ÷ ?
360 ÷ 60 = 6

- 3) Sophie represents her monthly expenses using a pie chart.

Diagram accurately drawn



Numbers from her table have been rubbed out by mistake.

Use the pie chart to complete the table.

		Angle
Clothes	£35	70°
Eating out	£73	146°
Make up	£17	34°
Magazines	£20	40°
Books	£35	70°
Total	£180	360°

Scatter Graphs

- 1) The scatter graph shows some information about the marks of six students. It shows each student's marks in Maths and Science.

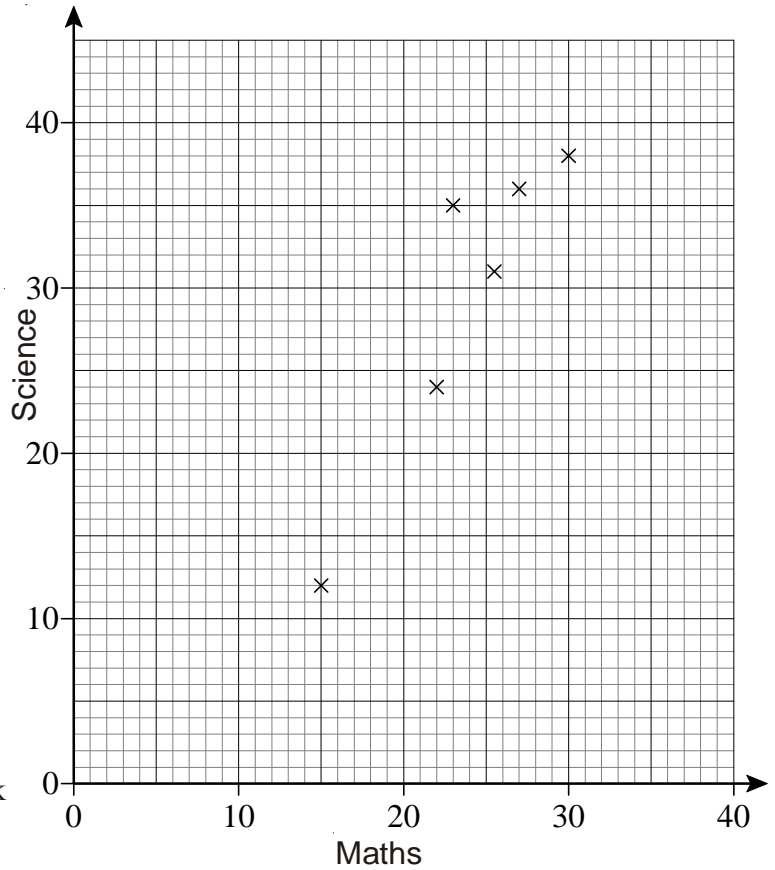
The table below shows the marks for four more students.

Maths	22	8	17	26
Science	30	12	24	24

- On the scatter graph, plot the information from the table.
- Draw a line of best fit.
- Describe the correlation between the marks in Maths and the marks in Science.

Another student has a mark of 18 in Science.

- Use the line of best fit to estimate the mark in Maths of this student.

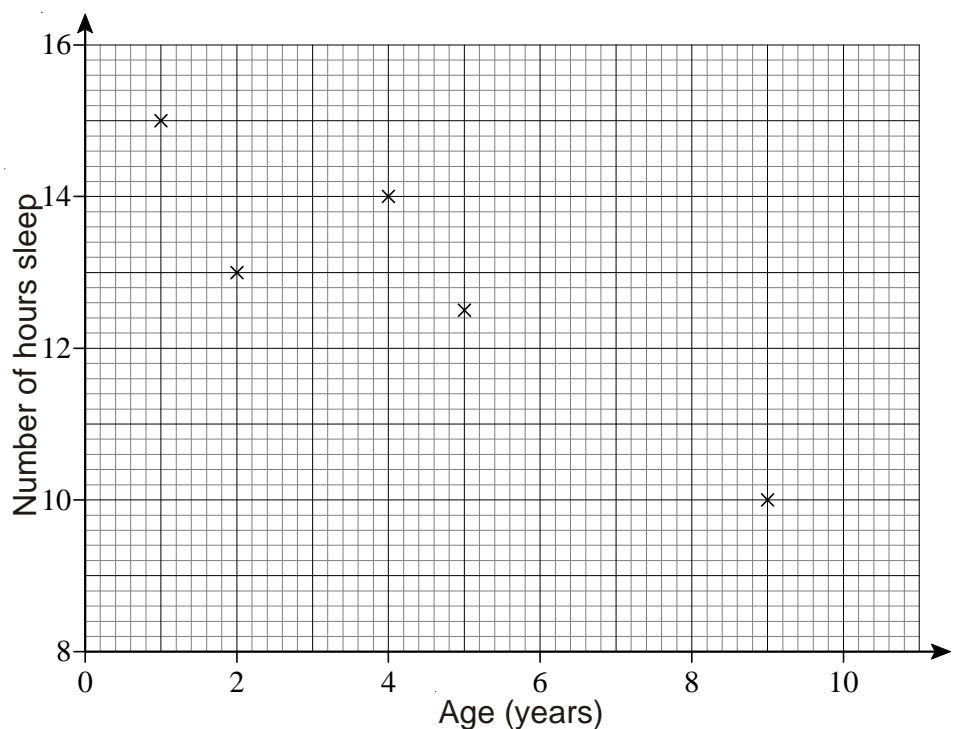


- 2) The table below shows the average daily number of hours sleep of 10 children.

Age (years)	4	2	5	1	9	6	8	7	10	1.5
Number of hours sleep	14	13	12.5	15	10	12.5	10.8	12	11	14

The first five results have been plotted on the scatter diagram.

- Plot the next five points.
- Draw a line of best fit.
- Describe the relationship between the age of the children and their number of hours sleep per day.
- Use your scatter graph to estimate the number of hours sleep for a 3 year old child.

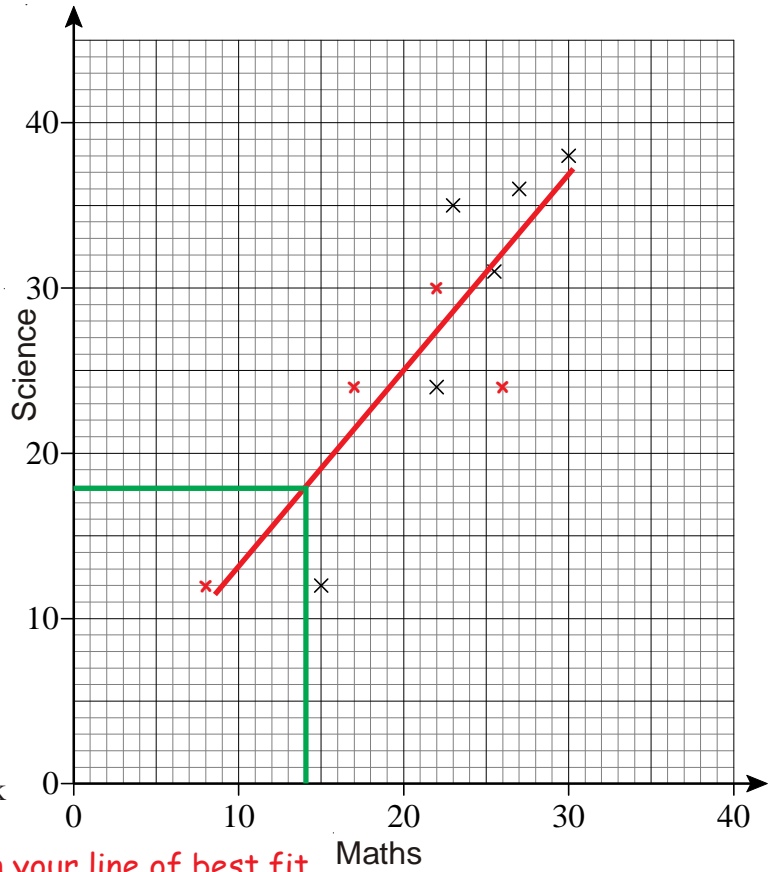


Scatter Graphs

- 1) The scatter graph shows some information about the marks of six students. It shows each student's marks in Maths and Science.

The table below shows the marks for four more students.

Maths	22	8	17	26
Science	30	12	24	24



- On the scatter graph, plot the information from the table.
- Draw a line of best fit.
- Describe the correlation between the marks in Maths and the marks in Science.

There is a positive correlation

Another student has a mark of 18 in Science.

- Use the line of best fit to estimate the mark in Maths of this student.

My answer is 14. Yours will depend on your line of best fit.

- 2) The table below shows the average daily number of hours sleep of 10 children.

Age (years)	4	2	5	1	9	6	8	7	10	1.5
Number of hours sleep	14	13	12.5	15	10	12.5	10.8	12	11	14

The first five results have been plotted on the scatter diagram.



- Plot the next five points.
- Draw a line of best fit.

- Describe the relationship between the age of the children and their number of hours sleep per day.

A negative correlation.

- Use your scatter graph to estimate the number of hours sleep for a 3 year old child.

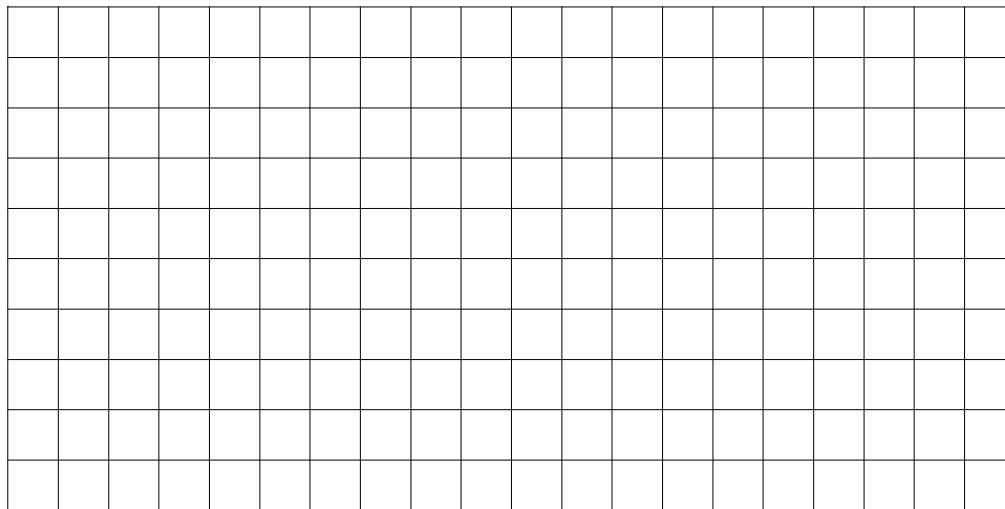
**My answer is 13.6
Yours will depend on your line of best fit.**

Frequency Diagrams

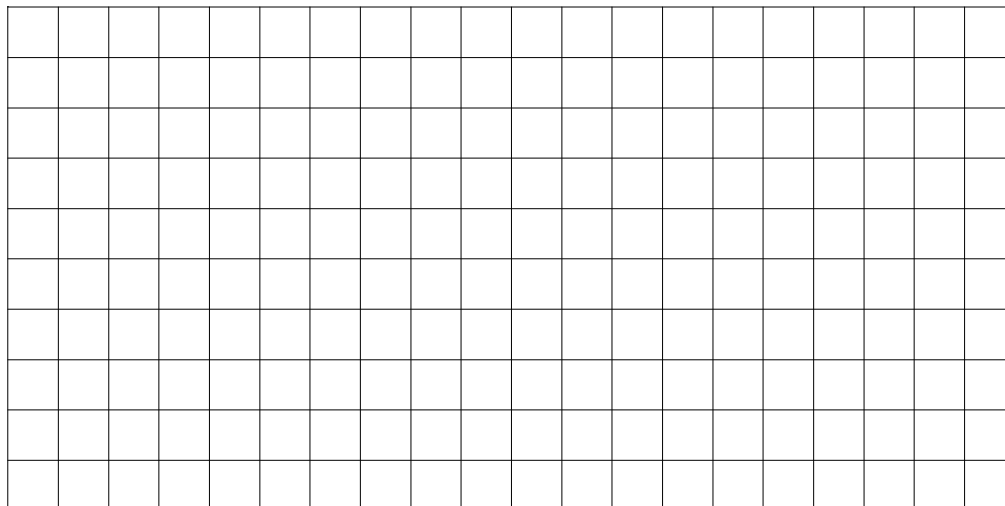
A class of pupils is asked to solve a puzzle.
 The frequency table below shows the times taken by the pupils to solve the puzzle.

Time (t) in min	Frequency
$0 < t \leq 5$	3
$5 < t \leq 10$	4
$10 < t \leq 15$	5
$15 < t \leq 20$	7
$20 < t \leq 25$	5

a) Draw a frequency diagram to show this information.



b) Draw a frequency polygon to show this information.

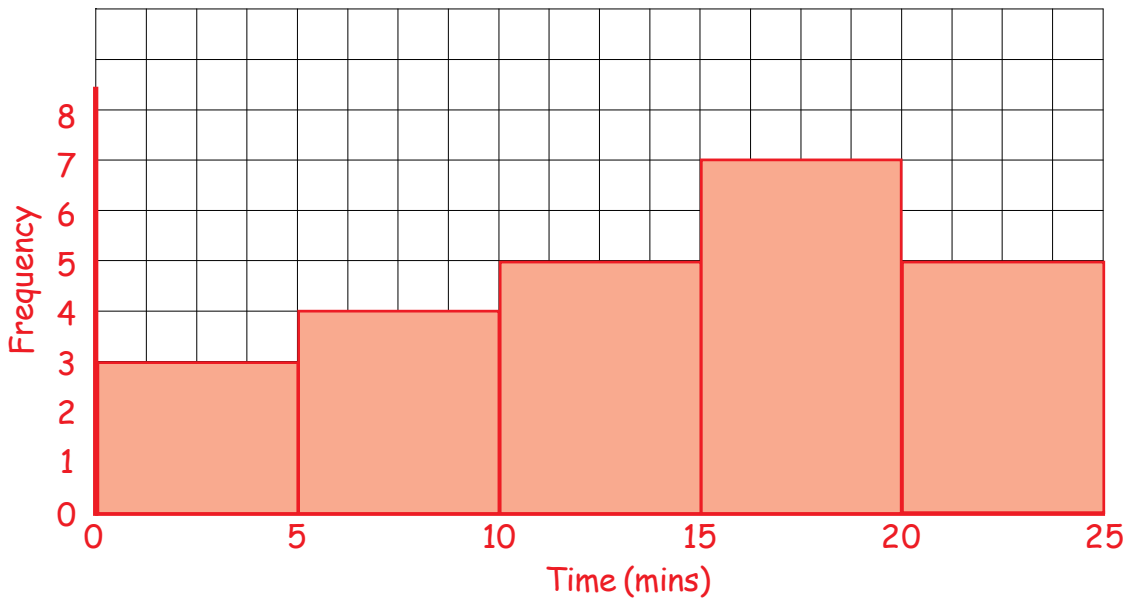


Frequency Diagrams

A class of pupils is asked to solve a puzzle.
 The frequency table below shows the times taken by the pupils to solve the puzzle.

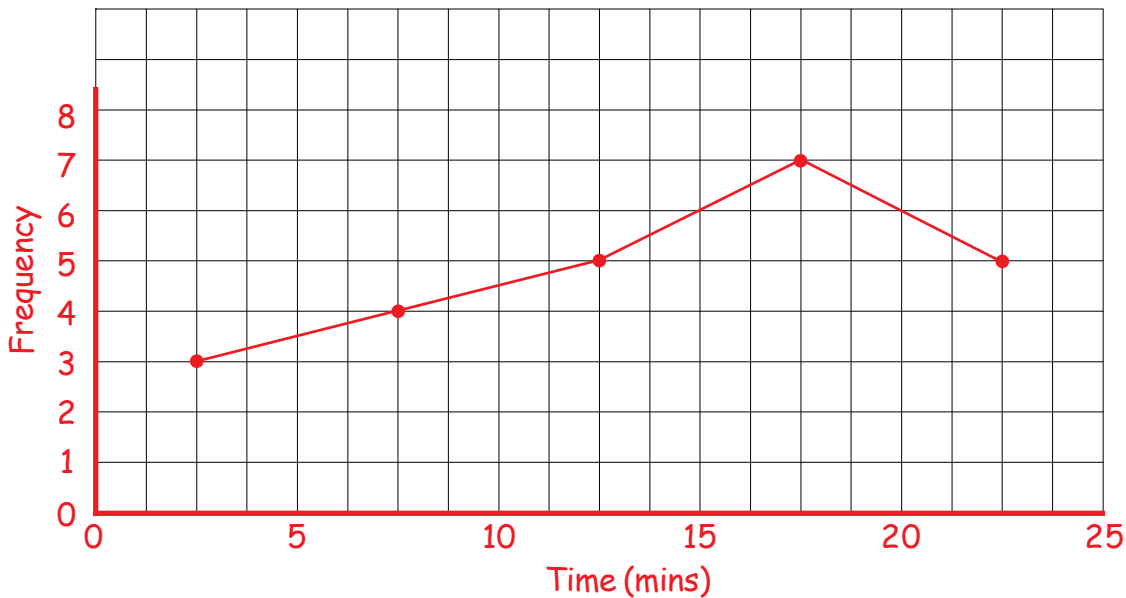
Time (t) in min	Frequency
$0 < t \leq 5$	3
$5 < t \leq 10$	4
$10 < t \leq 15$	5
$15 < t \leq 20$	7
$20 < t \leq 25$	5

a) Draw a frequency diagram to show this information.



It is OK to use a different scale.

b) Draw a frequency polygon to show this information.



- 1) 16 students sat a Maths test.

Here are their marks:

64	72	39	45	49	67	73	50
73	44	55	77	51	62	64	79

Draw a stem and leaf diagram to show this information.

- 2) Pat is carrying out a survey on how tall pupils in her class are.

Here are their heights in cm:

173	162	170	169	163	173	156
159	161	168	177	182	170	169

Draw a stem and leaf diagram to show this information.

- 3) The stem and leaf diagram below, shows information about the times, in minutes, it takes a group of people to eat their breakfast.

0		5	7	9		
1		0	0	5	8	8
2		0	2	3	5	7
3		2	5			

Key: 1|0 represents 10 minutes.

- How many people are in the group?
- How many people spend 15 minutes or more eating their breakfast?
- Find the median time that it took to eat breakfast.

Stem and Leaf Diagrams

- 1) 16 students sat a Maths test.

Here are their marks:

64 72 39 45 49 67 73 50
73 44 55 77 51 62 64 79

39, 44, 45, 49, 50, 51, 55, 62, 64, 64, 67, 72, 73, 73, 77, 79

Draw a stem and leaf diagram to show this information.

```

3 | 9
4 | 4 5 9
5 | 0 1 5
6 | 2 4 4 7
7 | 2 3 3 7 9

```

Key: 3|9 means 39 marks

- 2) Pat is carrying out a survey on how tall pupils in her class are.

Here are their heights in cm:

173 162 170 169 163 173 156
159 161 168 177 182 170 169

156, 159, 161, 162, 163, 168, 169, 169, 170, 170, 173, 173, 177, 182

Draw a stem and leaf diagram to show this information.

```

15 | 6 9
16 | 1 2 3 8 9 9
17 | 0 0 3 3 7
18 | 2

```

Key: 15|6 means 156 cm

- 3) The stem and leaf diagram below, shows information about the times, in minutes, it takes a group of people to eat their breakfast.

```

0 | 5 7 9
1 | 0 0 5 8 8
2 | 0 2 3 5 7
3 | 2 5

```

Key: 1|0 represents 10 minutes.

- a) How many people are in the group? **15 people**
- b) How many people spend 15 minutes or more eating their breakfast? **10 people**
- c) Find the median time that it took to eat breakfast. **18 minutes**

- 1) Three coins are flipped.
 - a) How many possible outcomes are there?
 - b) List all the possible outcomes.

- 2) Two coins are flipped and a dice is rolled.
 - a) How many possible outcomes are there?
 - b) List all the possible outcomes.

Mutually Exclusive Events

- 1) If the probability of passing a driving test is 0.54, what is the probability of failing it?

- 2) The probability that a football team will win their next game is $\frac{2}{11}$. The probability they will lose is $\frac{3}{11}$. What is the probability the game will be a draw?

- 3) On the school dinner menu there is only ever one of four options. Some of the options are more likely to be on the menu than others. The table shows the options available on any day, together with three of the probabilities.

Food	Curry	Sausages	Fish	Casserole
Probability	0.36	0.41		0.09

- a) Work out the probability of the dinner option being Fish.
 - b) Which option is most likely?
 - c) Work out the probability that it is a Curry or Sausages on any particular day.
 - d) Work out the probability that it is **not** Casserole.
-
- 4) Julie buys a book every week. Her favourite types are Novel, Drama, Biography and Romance. The table shows the probability that Julie chooses a particular type of book.

Type of book	Novel	Drama	Biography	Romance
Probability	0.24	0.16	x	x

- a) Work out the probability that she will choose a Novel or a Drama.
- b) Work out the probability that she will choose a Biography or a Romance.

The probability that she will choose a Biography is the same as the probability she will choose a Romance.

- c) Work out the probability that she will choose a Biography.

- 1) Three coins are flipped.
- a) How many possible outcomes are there? a) 8 possible outcomes ($2 \times 2 \times 2$)
- b) List all the possible outcomes. b) HHH, HHT, HTH, HTT, TTT, TTH, THT, THH.
- 2) Two coins are flipped and a dice is rolled.
- a) How many possible outcomes are there? 24 possible outcomes ($2 \times 2 \times 6$)
- b) List all the possible outcomes. HH1, HH2, HH3, HH4, HH5, HH6, HT1, HT2, HT3, HT4, HT5, HT6, TH1, TH2, TH3, TH4, TH5, TH6, TT1, TT2, TT3, TT4, TT5, TT6.

Mutually Exclusive Events

- 1) If the probability of passing a driving test is 0.54, what is the probability of failing it? $1 - 0.54 = 0.46$
- 2) The probability that a football team will win their next game is $\frac{2}{11}$. The probability they will lose is $\frac{3}{11}$. What is the probability the game will be a draw? $\frac{6}{11}$ $\frac{2}{11} + \frac{3}{11} = \frac{5}{11}$ $1 - \frac{5}{11} = \frac{6}{11}$
- 3) On the school dinner menu there is only ever one of four options. Some of the options are more likely to be on the menu than others. The table shows the options available on any day, together with three of the probabilities.
- | Food | Curry | Sausages | Fish | Casserole |
|-------------|-------|----------|------|-----------|
| Probability | 0.36 | 0.41 | | 0.09 |
- $1 - 0.36 - 0.41 - 0.09 = 0.14$
- a) Work out the probability of the dinner option being Fish. 0.14
- b) Which option is most likely? Sausages
- c) Work out the probability that it is a Curry or Sausages on any particular day. $0.36 + 0.41 = 0.77$
- d) Work out the probability that it is **not** Casserole. $1 - 0.09 = 0.91$
- 4) Julie buys a book every week. Her favourite types are Novel, Drama, Biography and Romance. The table shows the probability that Julie chooses a particular type of book.
- | Type of book | Novel | Drama | Biography | Romance |
|--------------|-------|-------|-----------|---------|
| Probability | 0.24 | 0.16 | x | x |
- a) Work out the probability that she will choose a Novel or a Drama. $0.24 + 0.16 = 0.4$
- b) Work out the probability that she will choose a Biography or a Romance. $1 - 0.4 = 0.6$
- The probability that she will choose a Biography is the same as the probability she will choose a Romance.
- c) Work out the probability that she will choose a Biography. $0.6 \div 2 = 0.3$

With a calculator

- 1) Find the following to the nearest penny:
- 23% of £670
 - 12% of £580
 - 48% of £64
 - 13% of £7.50
 - 87% of £44
 - 15.7% of £7000
 - 23.8% of £980
 - 34% of £16.34
 - 48.6% of £971.26
 - 78.24% of £12.82
 - 42.15% of £7876.42
 - 0.57% of £60000

Without a calculator

- 2) Find the following:
- 10% of £700
 - 10% of £400
 - 10% of £350
 - 10% of £530
 - 10% of £68
 - 10% of £46
 - 10% of £6.50
 - 10% of £12.20
 - 20% of £600
 - 30% of £900
 - 60% of £800
 - 20% of £650
 - 40% of £320
 - 15% of £300
 - 15% of £360
 - 65% of £12000
 - 45% of £64
 - 85% of £96
 - 17.5% of £800
 - 17.5% of £40
 - 17.5% of £8.80

With a calculator

- 3) Change the following to percentages:
- 6 out of 28
 - 18 out of 37
 - 42 out of 83
 - 24 out of 96
 - 73 out of 403
 - 234 out of 659
 - 871 out of 903
 - 4.7 out of 23
 - 6.9 out of 79
 - 14.8 out of 23.6
 - 65.8 out of 203.7
 - 12 out of 2314

Without a calculator

- 4) Change the following to percentages:
- 46 out of 100
 - 18 out of 50
 - 7 out of 25
 - 23 out of 25
 - 9 out of 20
 - 16 out of 20
 - 7 out of 10
 - 9.5 out of 10
 - 10 out of 40
 - 16 out of 40
 - 30 out of 40
 - 12 out of 40
 - 28 out of 80
 - 32 out of 80
 - 60 out of 80
 - 3 out of 5
 - 4 out of 5
 - 15 out of 75
 - 24 out of 75
 - 30 out of 75

No calculator

- 5) A shop gives a discount of 20% on a magazine that usually sells for £2.80. Work out the discount in pence.

With a calculator

- 6) A television costs £595 plus VAT at 17.5%. Work out the cost of the television including VAT.

With a calculator

- 7) Peter has 128 trees in his garden. 16 of the trees are pear trees. What percentage of the trees in his garden are pear trees?

With a calculator

- 8) A battery operated car travels for 10m when it is first turned on. Each time it is turned on it travels 90% of the previous distance as the battery starts to run out. How many times does the car travel at least 8 metres?

With a calculator

- 9) Jane scored 27 out of 42 in a Maths test and 39 out of 61 in a Science test. What were her percentages in both subjects to 1 decimal place?

No calculator

- 10) In class 7A there are 7 girls and 18 boys. What percentage of the class are girls?

No calculator

- 11) A shop decides to reduce all the prices by 15%. The original price of a pair of trainers was £70. How much are they after the reduction?

No calculator

- 12) VAT at 17.5% is added to the price of a car. Before the VAT is added it cost £18000. How much does it cost with the VAT?

With a calculator

- 1) Find the following to the nearest penny:
- a) 23% of £670 **£154.10**
 - b) 12% of £580 **£69.60**
 - c) 48% of £64 **£30.72**
 - d) 13% of £7.50 **£0.98**
 - e) 87% of £44 **£38.28**
 - f) 15.7% of £7000 **£1099**
 - g) 23.8% of £980 **£233.24**
 - h) 34% of £16.34 **£5.56**
 - i) 48.6% of £971.26 **£472.03**
 - j) 78.24% of £12.82 **£10.03**
 - k) 42.15% of £7876.42 **£3319.91**
 - l) 0.57% of £60000 **£342**

Without a calculator

- 2) Find the following:
- a) 10% of £700 **£70**
 - b) 10% of £400 **£40**
 - c) 10% of £350 **£35**
 - d) 10% of £530 **£53**
 - e) 10% of £68 **£6.80**
 - f) 10% of £46 **£4.60**
 - g) 10% of £6.50 **£0.65**
 - h) 10% of £12.20 **£1.22**
 - i) 20% of £600 **£120**
 - j) 30% of £900 **£270**
 - k) 60% of £800 **£480**
 - l) 20% of £650 **£130**
 - m) 40% of £320 **£128**
 - n) 15% of £300 **£45**
 - o) 15% of £360 **£54**
 - p) 65% of £12000 **£7800**
 - q) 45% of £64 **£28.80**
 - r) 85% of £96 **£81.60**
 - s) 17.5% of £800 **£140**
 - t) 17.5% of £40 **£7**
 - u) 17.5% of £8.80 **£1.54**

With a calculator

- 3) Change the following to percentages:
- a) 6 out of 28 **21.4%**
 - b) 18 out of 37 **48.6%**
 - c) 42 out of 83 **50.6%**
 - d) 24 out of 96 **25%**
 - e) 73 out of 403 **18.1%**
 - f) 234 out of 659 **35.5%**
 - g) 871 out of 903 **96.5%**
 - h) 4.7 out of 23 **20.4%**
 - i) 6.9 out of 79 **8.7%**
 - j) 14.8 out of 23.6 **62.7%**
 - k) 65.8 out of 203.7 **32.3%**
 - l) 12 out of 2314 **0.5%**

Without a calculator

- 4) Change the following to percentages:
- a) 46 out of 100 **46%**
 - b) 18 out of 50 **36%**
 - c) 7 out of 25 **28%**
 - d) 23 out of 25 **92%**
 - e) 9 out of 20 **45%**
 - f) 16 out of 20 **80%**
 - g) 7 out of 10 **70%**
 - h) 9.5 out of 10 **95%**
 - i) 10 out of 40 **25%**
 - j) 16 out of 40 **40%**
 - k) 30 out of 40 **75%**
 - l) 12 out of 40 **30%**
 - m) 28 out of 80 **35%**
 - n) 32 out of 80 **40%**
 - o) 60 out of 80 **75%**
 - p) 3 out of 5 **60%**
 - q) 4 out of 5 **80%**
 - r) 15 out of 75 **20%**
 - s) 24 out of 75 **32%**
 - t) 30 out of 75 **40%**

No calculator

- 5) A shop gives a discount of 20% on a magazine that usually sells for £2.80. Work out the discount in pence. **56p**

With a calculator

- 6) A television costs £595 plus VAT at 17.5%.

Work out the cost of the television including VAT. **£699.13**

With a calculator

- 7) Peter has 128 trees in his garden. 16 of the trees are pear trees. What percentage of the trees in his garden are pear trees? **12.5%**

With a calculator

- 8) A battery operated car travels for 10m when it is first turned on. Each time it is turned on it travels 90% of the previous distance as the battery starts to run out. How many times does the car travel at least 8 metres? **3**

With a calculator

- 9) Jane scored 27 out of 42 in a Maths test and 39 out of 61 in a Science test. What were her percentages in both subjects to 1 decimal place? **Maths 64.3%**
Sci 63.9%

No calculator

- 10) In class 7A there are 7 girls and 18 boys. What percentage of the class are girls? **28%**

No calculator

- 11) A shop decides to reduce all the prices by 15%. The original price of a pair of trainers was £70. How much are they after the reduction? **£59.50**

No calculator

- 12) VAT at 17.5% is added to the price of a car. Before the VAT is added it cost £18000. How much does it cost with the VAT? **£21150**

Increase/Decrease by a Percentage

Non-Calculator

- 1) Increase:
- a) 500 by 10% $10\% = 50$
 $500 + 50$
550
- b) 320 by 10% $10\% = 32$
 $320 + 32$
352
- c) 80 by 15% $10\% = 8, 5\% = 4$
 $80 + 8 + 4$
92
- d) 75 by 20% $10\% = 7.5, 20\% = 15$
 $75 + 15$
90
- 2) Decrease:
- a) 400 by 10% $10\% = 40$
 $400 - 40$
360
- b) 380 by 10% $10\% = 38$
 $380 - 38$
342
- c) 140 by 15% $10\% = 14, 5\% = 7$
 $140 - 14 - 7$
119
- d) 35 by 20% $10\% = 3.5, 20\% = 7$
 $35 - 7$
28
- 3) The price of laptop is increased by 15%. $10\% = 30, 5\% = 15$
 The old price of the laptop was £300. $300 + 30 + 15 = 345$
 Work out the new price. **£345**
- 4) The price of a £6800 car is reduced by 10%. $10\% = 680$
 What is the new price? **£6 120** $6800 - 680 = 6120$

Calculator

- 5) Increase:
- a) 65 by 12% **72.8** $\frac{112}{100} \times 65$
- b) 120 by 23% **147.6** $\frac{123}{100} \times 120$
- c) 600 by 17.5% **705** $\frac{117.5}{100} \times 600$
- d) 370 by 17.5% **434.75** $\frac{117.5}{100} \times 370$
- 6) Decrease:
- a) 42 by 15% **35.7** $\frac{85}{100} \times 42$
- b) 79 by 12% **69.52** $\frac{88}{100} \times 79$
- c) 52 by 8.5% **47.58** $\frac{91.5}{100} \times 52$
- d) 8900 by 18% **7 298** $\frac{82}{100} \times 8900$
- 7) The price of a mobile phone is £78.40 plus VAT.
 VAT is charged at a rate of 17.5%.
 What is the total price of the mobile phone? **£92.12** $\frac{117.5}{100} \times 78.40$
- 8) In a sale, normal prices are reduced by 7%.
 The normal price of a camera is £89.
 Work out the sale price of the camera. **£82.77** $\frac{93}{100} \times 89$
- 9) A car dealer offers a discount of 20% off the normal price of a car, for cash.
 Peter intends to buy a car which usually costs £6800.
 He intends to pay by cash.
 Work out how much he will pay. **£5 440** $\frac{80}{100} \times 6800$
- 10) A month ago, John weighed 97.5 kg.
 He now weighs 4.5% more.
 Work out how much John now weighs. **101.9 kg** $\frac{104.5}{100} \times 97.5$
 Give your answer to 1 decimal place.

1. Write the following ratios in their simplest form

a) $6 : 9$

b) $10 : 5$

c) $7 : 21$

d) $4 : 24$

e) $12 : 40$

f) $18 : 27$

g) $4 : 2 : 8$

h) $18 : 63 : 9$

2. Complete the missing value in these equivalent ratios

a) $3 : 5 = 12 : \square$

b) $4 : 9 = \square : 27$

c) $\square : 7 = 16 : 14$

d) $2 : 3 = 3 : \square$

3. Match together cards with equivalent ratios:

$3 : 4$

$10 : 5$

$50 : 100$

$2 : 1$

$5 : 2$

$15 : 20$

$15 : 6$

$1 : 2$

4. The ratio of girls to boys in a class is $4 : 5$.

a) What fraction of the class are girls?

b) What fraction of the class are boys?

5. A model of a plane is made using a scale of $1 : 5$.

a) If the real length of the plane is 20m, what is the length of the model in metres?

b) If the wings of the model are 100cm long, what is the real length of the wings in metres?

6. Share out £250 in the following ratios:

a) $1 : 4$

b) $2 : 3$

c) $7 : 3$

d) $9 : 12 : 4$

7. Share out £80 between Tom and Jerry in the ratio $3 : 2$.

8. A box of chocolates has 3 milk chocolates for every 2 white chocolates.

There are 60 chocolates in the box.

Work out how many white chocolates are in the box.

9. In a bracelet, the ratio of silver beads to gold beads is $5 : 2$.

The bracelet has 25 silver beads.

How many gold beads are in the bracelet?

10. To make mortar you mix 1 shovel of cement with 5 shovels of sand.

How much sand do you need to make 30 shovels of mortar?

1. Write the following ratios in their simplest form

a) $6 : 9$
 $2 : 3$

b) $10 : 5$
 $2 : 1$

c) $7 : 21$
 $1 : 3$

d) $4 : 24$
 $1 : 6$

e) $12 : 40$
 $3 : 10$

f) $18 : 27$
 $2 : 3$

g) $4 : 2 : 8$
 $2 : 1 : 4$

h) $18 : 63 : 9$
 $2 : 7 : 1$

2. Complete the missing value in these equivalent ratios

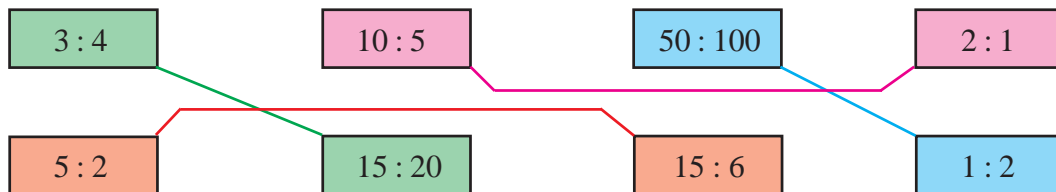
a) $3 : 5 = 12 : \boxed{20}$

b) $4 : 9 = \boxed{12} : 27$

c) $\boxed{8} : 7 = 16 : 14$

d) $2 : 3 = 3 : \boxed{4.5}$

3. Match together cards with equivalent ratios:



4. The ratio of girls to boys in a class is $4 : 5$.

a) What fraction of the class are girls? $\frac{4}{9}$

b) What fraction of the class are boys? $\frac{5}{9}$

5. A model of a plane is made using a scale of $1 : 5$.

a) If the real length of the plane is 20m, what is the length of the model in metres? 4m

b) If the wings of the model are 100cm long, what is the real length of the wings in metres? 5m

6. Share out £250 in the following ratios:

a) $1 : 4$
 $£50 \text{ and } £200$

b) $2 : 3$
 $£100 \text{ and } £150$

c) $7 : 3$
 $£175 \text{ and } £75$

d) $9 : 12 : 4$
 $£90 \text{ and } £120 \text{ and } £40$

7. Share out £80 between Tom and Jerry in the ratio $3 : 2$. **Tom gets £48, Jerry gets £32**

$3 + 2 = 5$ $80 \div 5 = 16$ $3 \times 16 = 48$ $2 \times 16 = 32$

8. A box of chocolates has 3 milk chocolates for every 2 white chocolates.

There are 60 chocolates in the box.

Work out how many white chocolates are in the box. **24 white chocolates**

$3 + 2 = 5$ $60 \div 5 = 12$ $2 \times 12 = 24$

9. In a bracelet, the ratio of silver beads to gold beads is $5 : 2$.

The bracelet has 25 silver beads.

How many gold beads are in the bracelet? **10 gold beads**

$$\begin{array}{cc} 5 & 6 \\ \times 5 \left(\begin{array}{c} 5 \\ 25 \end{array} \right) & \left(\begin{array}{c} 2 \\ ? \end{array} \right) \times 5 \end{array}$$

10. To make mortar you mix 1 shovel of cement with 5 shovels of sand.

How much sand do you need to make 30 shovels of mortar? **25 shovels of sand**

$1 + 5 = 6$

$30 \div 6 = 5$

$5 \times 5 = 25$

- 1) List the first seven prime numbers.
 - 2) Express the following number as the product of their prime factors:
 - a) 30
 - b) 60
 - c) 360
 - d) 220
 - 3) Express the following number as the product of **powers** of their prime factors:
 - a) 24
 - b) 64
 - c) 192
 - d) 175
 - 4) The number 96 can be written as $2^m \times n$, where m and n are prime numbers. Find the value of m and the value of n .
 - 5) The number 75 can be written as $5^x \times y$, where x and y are prime numbers. Find the value of x and the value of y .
-

- 1) Find the Highest Common Factor (HCF) of each of these pairs of numbers.
 - a) 16 and 24
 - b) 21 and 28
 - c) 60 and 150
 - d) 96 and 108
- 2) Find the Least (or Lowest) Common Multiple (LCM) of each of these pairs of numbers.
 - a) 16 and 24
 - b) 21 and 28
 - c) 60 and 150
 - d) 96 and 108
- 3)
 - a) Write 42 and 63 as products of their prime factors.
 - b) Work out the HCF of 42 and 63.
 - c) Work out the LCM of 42 and 63.
- 4)
 - a) Write 240 and 1500 as products of their prime factors.
 - b) Work out the HCF of 240 and 1500.
 - c) Work out the LCM of 240 and 1500.

1) Change the following to normal (or ordinary) numbers.

a) 4.3×10^4

c) 7.03×10^3

e) 1.01×10^4

b) 6.79×10^6

d) 9.2034×10^2

f) 4×10^5

2) Change the following to normal (or ordinary) numbers.

a) 4.3×10^{-4}

c) 7.03×10^{-3}

e) 1.01×10^{-4}

b) 6.79×10^{-6}

d) 9.2034×10^{-2}

f) 4×10^{-5}

3) Change the following to standard form.

a) 360

c) 520 000

e) 1 003

b) 8 900

d) 62 835

f) 6 450 000

4) Change the following to standard form.

a) 0.71

c) 0.00076

e) 0.00009

b) 0.0008

d) 0.0928

f) 0.00000173

5) Work out the following, giving your answer in standard form.

a) $3\,000 \times 5\,000$

d) $5 \times 4 \times 10^3$

g) $7 \times 10^2 \times 3 \times 10^{-4}$

b) 240×0.0002

e) $\frac{8 \times 10^4}{4 \times 10^2}$

h) $2 \times 3.6 \times 10^{-5}$

c) $9 \times 1.1 \times 10^7$

f) $9 \times 10^2 \times 2 \times 10^{-5}$

i) $6 \times 4.1 \times 10^3$

1) Change the following to normal (or ordinary) numbers.

a) 4.3×10^4
43 000

c) 7.03×10^3
7 030

e) 1.01×10^4
10 100

b) 6.79×10^6
6 790 000

d) 9.2034×10^2
920.34

f) 4×10^5
400 000

2) Change the following to normal (or ordinary) numbers.

a) 4.3×10^{-4}
0.00043

c) 7.03×10^{-3}
0.00703

e) 1.01×10^{-4}
0.000101

b) 6.79×10^{-6}
0.00000679

d) 9.2034×10^{-2}
0.092034

f) 4×10^{-5}
0.00004

3) Change the following to standard form.

a) 360
 3.6×10^2

c) 520 000
 5.2×10^5

e) 1 003
 1.003×10^3

b) 8 900
 8.9×10^3

d) 62 835
 6.2835×10^4

f) 6 450 000
 6.45×10^6

4) Change the following to standard form.

a) 0.71
 7.1×10^{-1}

c) 0.00076
 7.6×10^{-4}

e) 0.00009
 9×10^{-5}

b) 0.0008
 8×10^{-4}

d) 0.0928
 9.28×10^{-2}

f) 0.00000173
 1.73×10^{-6}

5) Work out the following, giving your answer in standard form.

a) $3\,000 \times 5\,000$ 15 000 000
 1.5×10^7

d) $5 \times 4 \times 10^3$ 20×10^3
 2×10^4

g) $7 \times 10^2 \times 3 \times 10^{-4}$
 2.1×10^{-1} 21×10^{-2}

b) 240×0.0002 0.048
 4.8×10^{-2}

e) $\frac{8 \times 10^4}{4 \times 10^2}$
 2×10^2

h) $2 \times 3.6 \times 10^{-5}$
 7.2×10^{-5}

c) $9 \times 1.1 \times 10^7$
 9.9×10^7

f) $9 \times 10^2 \times 2 \times 10^{-5}$ 18×10^{-3}
 1.8×10^{-2}

i) $6 \times 4.1 \times 10^3$ 24.6×10^3
 2.46×10^4

Recurring Decimals into Fractions

- 1) Write each recurring decimal as an exact fraction, in its lowest terms.

a) $0.\dot{5}$

b) $0.\dot{7}$

c) $0.\dot{4}$

d) $0.\dot{2}\dot{4}$

e) $0.\dot{7}\dot{5}$

f) $0.\dot{8}\dot{2}$

g) $0.\dot{6}\dot{1}\dot{7}$

h) $0.\dot{2}\dot{1}\dot{6}$

i) $0.\dot{7}\dot{1}\dot{4}$

j) $0.\dot{3}\dot{2}\dot{4}$

k) $0.\dot{7}235\dot{7}$

l) $0.\dot{6}521\dot{4}$

- 1) Write each recurring decimal as an exact fraction, in its lowest terms.

$$\text{a) } 0.\dot{5} \quad \frac{5}{9}$$

$$\text{b) } 0.\dot{7} \quad \frac{7}{9}$$

$$\text{c) } 0.\dot{4} \quad \frac{4}{9}$$

$$\text{d) } 0.\dot{2}\dot{4} \quad \frac{24}{99} \quad \frac{8}{33}$$

$$\text{e) } 0.\dot{7}\dot{5} \quad \frac{75}{99} \quad \frac{25}{33}$$

$$\text{f) } 0.\dot{8}\dot{2} \quad \frac{82}{99}$$

$$\text{g) } 0.\dot{6}\dot{1}\dot{7} \quad \frac{617}{999}$$

$$\text{h) } 0.\dot{2}\dot{1}\dot{6} \quad \frac{216}{999} \quad \frac{8}{37}$$

$$\text{i) } 0.\dot{7}\dot{1}\dot{4} \quad \frac{714}{999} \quad \frac{238}{333}$$

$$\text{j) } 0.\dot{3}\dot{2}\dot{4} \quad \frac{324}{999} \quad \frac{12}{37}$$

$$\text{k) } 0.\dot{7}\dot{2}\dot{3}\dot{5}\dot{7} \quad \frac{72357}{99999} \quad \frac{89}{123}$$

$$\text{l) } 0.\dot{6}\dot{5}\dot{2}\dot{1}\dot{4} \quad \frac{65214}{99999} \quad \frac{7246}{11111}$$

Four Rules of Negatives

Work out the following without a calculator

a) $6 - 9 =$

b) $4 \times -3 =$

c) $-10 \div -5 =$

d) $-7 - -6 =$

e) $25 \div -5 =$

f) $-2 + -6 =$

g) $7 - -3 =$

h) $6 \times -9 =$

i) $5 + -11 =$

j) $-8 \times 4 =$

k) $12 + -3 =$

l) $5 + 9 - 3 =$

m) $-3 \times -2 \times 4 =$

n) $-6 - -5 - 8 =$

o) $-5 \times -6 \times -2 =$

p) $8 \div -4 \times -5 =$

q) $2 + -8 + -7 =$

r) $13 + -13 =$

s) $16 \div -2 \times 4 =$

t) $11 - 3 + -9 - -5 =$

u) $-7 \times -2 \times -3 =$

v) $-1 + -3 + 2 =$

Division by Two-Digit Decimals

1) Work out the following without a calculator

a) $350 \div 0.2$

b) $2 \div 0.25$

c) $0.45 \div 0.9$

d) $2.42 \div 0.4$

e) $30.66 \div 2.1$

f) $5.886 \div 0.9$

g) $38.08 \div 1.7$

h) $98.8 \div 0.08$

2) Sam is filling a jug that can hold 1.575 litres, using a small glass.

The small glass holds 0.035 litres.

How many of the small glasses will he need?

Four Rules of Negatives

Work out the following without a calculator

a) $6 - 9 = -3$

b) $4 \times -3 = -12$

c) $-10 \div -5 = 2$

d) $-7 - -6 = -1$

e) $25 \div -5 = -5$

f) $-2 + -6 = -8$

g) $7 - -3 = 10$

h) $6 \times -9 = -54$

i) $5 + -11 = -6$

j) $-8 \times 4 = -32$

k) $12 + -3 = 9$

l) $5 + 9 - 3 = 11$

m) $-3 \times -2 \times 4 = 24$

n) $-6 - -5 - 8 = -9$

o) $-5 \times -6 \times -2 = -60$

p) $8 \div -4 \times -5 = 10$

q) $2 + -8 + -7 = -13$

r) $13 + -13 = 0$

s) $16 \div -2 \times 4 = -32$

t) $11 - 3 + -9 - -5 = 4$

u) $-7 \times -2 \times -3 = -42$

v) $-1 + -3 + 2 = -2$

Division by Two-Digit Decimals

1) Work out the following without a calculator

a) $350 \div 0.2 = 1750$ $3500 \div 2 = 1750$

b) $2 \div 0.25 = 8$ $200 \div 25 = 8$

c) $0.45 \div 0.9 = 0.5$ $4.5 \div 9 = 0.5$

d) $2.42 \div 0.4 = 6.05$ $24.2 \div 4 = 6.05$

e) $30.66 \div 2.1 = 14.6$ $306.6 \div 21 = 14.6$

f) $5.886 \div 0.9 = 6.54$ $58.86 \div 9 = 6.54$

g) $38.08 \div 1.7 = 22.4$ $380.8 \div 17 = 22.4$

h) $98.8 \div 0.08 = 1235$ $9880 \div 8 = 1235$

2) Sam is filling a jug that can hold 1.575 litres, using a small glass.

The small glass holds 0.035 litres.

How many of the small glasses will he need? 45

$1575 \div 35 = 45$

$$\begin{array}{r} 45 \\ 35 \overline{) 1575} \\ \underline{140} \\ 175 \\ \underline{175} \\ 0000 \end{array}$$

1. Work out an estimate for the value of

a)
$$\frac{547}{4.8 \times 9.7}$$

b)
$$\frac{69 \times 398}{207}$$

c)
$$\frac{7.5 \times 2.79}{2.71 + 3.19}$$

d)
$$\frac{409 \times 5.814}{0.19}$$

2. a) Work out an estimate for

$$\frac{19.6 \times 31.7}{7.9 \times 5.2}$$

b) Use your answer to part (a) to find an estimate for

$$\frac{196 \times 317}{79 \times 52}$$

3. a) Work out an estimate for

$$\frac{6.13 \times 9.68}{3.79 \times 2.56}$$

b) Use your answer to part (a) to find an estimate for

$$\frac{613 \times 968}{379 \times 256}$$

1. Work out an estimate for the value of

a) $\frac{547}{4.8 \times 9.7}$ 10

$$\frac{500}{5 \times 10} \quad \frac{500}{50}$$

b) $\frac{69 \times 398}{207}$ 140

$$\frac{70 \times 400}{200} \quad \frac{28\,000}{200}$$

c) $\frac{7.5 \times 2.79}{2.71 + 3.19}$ 4

$$\frac{8 \times 3}{3 + 3} \quad \frac{24}{6}$$

d) $\frac{409 \times 5.814}{0.19}$ 12 000

$$\frac{400 \times 6}{0.2} \quad \frac{2\,400}{0.2}$$

2. a) Work out an estimate for

$$\frac{19.6 \times 31.7}{7.9 \times 5.2} \quad 15$$

$$\frac{20 \times 30}{8 \times 5} \quad \frac{600}{40}$$

b) Use your answer to part (a) to find an estimate for

$$\frac{196 \times 317}{79 \times 52} \quad 15$$

3. a) Work out an estimate for

$$\frac{6.13 \times 9.68}{3.79 \times 2.56} \quad 5$$

$$\frac{6 \times 10}{4 \times 3} \quad \frac{60}{12}$$

b) Use your answer to part (a) to find an estimate for

$$\frac{613 \times 968}{379 \times 256} \quad 5$$

1) Simplify

- a) $x + x$
 b) $x \times x$
 c) $3x + 2x$
 d) $3x \times 2x$
 e) $2x^2y^3 + 4x^2y^3$
 f) $2x^2y \times 3xy^3$

2) Simplify

- a) $x + y + x + y$
 b) $3x + 2y + x + 5y$
 c) $6y + 2x - 2y - 3x$
 d) $5p - 3q + p + 2q$

3) Expand and simplify

- a) $2(x + y) + 3(x + y)$
 b) $3(2x + y) + 2(5x + 3y)$
 c) $5(x + y) + 3(2x - y)$
 d) $3(2c + d) - 2(c + d)$
 e) $4(2p + q) - 3(2p - q)$
 f) $3(4x - 2y) + 2(x + 2y)$
 g) $6(x - 3y) - 2(2x - 5y)$

4) Expand and simplify

- a) $5(3p + 2) - 2(4p - 3)$
 b) $4(2x + 3) - (x - 2)$

5) a) Simplify $pq + 2pq$ b) Simplify $5x + 3y - x - 4y$ 6) a) Simplify $6a + 5b - 3b + a$ b) Simplify $x^4 + x^4$ 7) a) Simplify $x + y + x + y + x$ b) Simplify $t^2 + t^2 + t^2$ 8) a) Simplify $a^3 \times a^3$ b) Simplify $3x^2y \times 4xy^3$ 9) a) Simplify $3d + e - d + 4e$ b) Simplify $3x^2 - x^2$ c) Simplify $5t + 8d - 2t - 3d$ d) Simplify $4t \times 2q$

10) The table shows some expressions.

$2(p + p)$	$2p \times p$	$3p + 2p$	$2 + 2p$	$2p + 2p$

Two of the expressions **always** have the same value as $4p$.
 Tick the boxes underneath the **two** expressions.

11) Expand and simplify

(i) $4(x + 5) + 3(x - 6)$ (ii) $3(2x - 1) - 2(x - 4)$ (iii) $5(2y + 2) - (y + 3)$

1) Simplify

a) $x + x$ $2x$

b) $x \times x$ x^2

c) $3x + 2x$ $5x$

d) $3x \times 2x$ $6x^2$

e) $2x^2y^3 + 4x^2y^3$ $6x^2y^3$

f) $2x^2y \times 3xy^3$ $6x^3y^4$

2) Simplify

a) $x + y + x + y$ $2x + 2y$

b) $3x + 2y + x + 5y$ $4x + 7y$

c) $6y + 2x - 2y - 3x$ $4y - x$

d) $5p - 3q + p + 2q$ $6p - q$

3) Expand and simplify

a) $2(x + y) + 3(x + y)$
 $5x + 5y$

b) $3(2x + y) + 2(5x + 3y)$
 $16x + 9y$

c) $5(x + y) + 3(2x - y)$
 $11x + 2y$

d) $3(2c + d) - 2(c + d)$
 $4c + d$

e) $4(2p + q) - 3(2p - q)$
 $2p + 7q$

f) $3(4x - 2y) + 2(x + 2y)$
 $14x - 2y$

g) $6(x - 3y) - 2(2x - 5y)$
 $2x - 8y$

4) Expand and simplify

a) $5(3p + 2) - 2(4p - 3)$
 $7p + 16$

b) $4(2x + 3) - (x - 2)$
 $7x + 14$

5) a) Simplify $pq + 2pq$ $3pq$

b) Simplify $5x + 3y - x - 4y$ $4x - y$

6) a) Simplify $6a + 5b - 3b + a$ $7a + 2b$

b) Simplify $x^4 + x^4$ $2x^4$

7) a) Simplify $x + y + x + y + x$ $3x + 2y$

b) Simplify $t^2 + t^2 + t^2$ $3t^2$

8) a) Simplify $a^3 \times a^3$ a^6

b) Simplify $3x^2y \times 4xy^3$ $12x^3y^4$

9) a) Simplify $3d + e - d + 4e$ $2d + 5e$

b) Simplify $3x^2 - x^2$ $2x^2$

c) Simplify $5t + 8d - 2t - 3d$ $3t + 5d$

d) Simplify $4t \times 2q$ $8tq$

10) The table shows some expressions.

$2(p + p)$	$2p \times p$	$3p + 2p$	$2 + 2p$	$2p + 2p$
✓				✓

Two of the expressions **always** have the same value as $4p$.
Tick the boxes underneath the **two** expressions.

11) Expand and simplify

(i) $4(x + 5) + 3(x - 6)$ $7x + 2$

(ii) $3(2x - 1) - 2(x - 4)$ $4x + 5$

(iii) $5(2y + 2) - (y + 3)$ $9y + 7$

- 1) Expand these brackets
 - a) $2(x + 3)$
 - b) $3(2x + 4)$
 - c) $5(3p - 2q)$
 - d) $4(x^2 + 2y^2)$
 - e) $r(r - r^2)$

- 2) Expand and simplify
 - a) $(x + 1)(x + 2)$
 - b) $(x + 3)(2x + 4)$
 - c) $(2x + 1)(3x + 2)$

- 3) Expand and simplify
 - a) $(x + 3)(x - 2)$
 - b) $(x - 1)(x + 4)$
 - c) $(x - 3)(x - 2)$

- 4) Expand and simplify
 - a) $(2p + 3)(p - 2)$
 - b) $(3t - 2)(2t + 3)$
 - c) $(2x - 5)(3x - 2)$

- 5) Expand and simplify
 - a) $(x + 3y)(x + 4y)$
 - b) $(2p + q)(3p + 2q)$

- 6) Expand and simplify
 - a) $(2x + 1)^2$
 - b) $(3x - 2)^2$
 - c) $(2p + q)^2$

1) Expand these brackets

a) $2(x + 3)$ $2x + 6$

b) $3(2x + 4)$ $6x + 12$

c) $5(3p - 2q)$ $15p - 10q$

d) $4(x^2 + 2y^2)$ $4x^2 + 8y^2$

e) $r(r - r^2)$ $r^2 - r^3$

2) Expand and simplify

a) $(x + 1)(x + 2)$ $x^2 + 3x + 2$ $x^2 + 1x + 2x + 2$

b) $(x + 3)(2x + 4)$ $2x^2 + 10x + 12$ $2x^2 + 6x + 4x + 12$

c) $(2x + 1)(3x + 2)$ $6x^2 + 7x + 2$ $6x^2 + 3x + 4x + 2$

3) Expand and simplify

a) $(x + 3)(x - 2)$ $x^2 + x - 6$ $x^2 + 3x - 2x - 6$

b) $(x - 1)(x + 4)$ $x^2 + 3x - 4$ $x^2 - 1x + 4x - 4$

c) $(x - 3)(x - 2)$ $x^2 - 5x + 6$ $x^2 - 3x - 2x + 6$

4) Expand and simplify

a) $(2p + 3)(p - 2)$ $2p^2 - p - 6$ $2p^2 + 3p - 4p - 6$

b) $(3t - 2)(2t + 3)$ $6t^2 + 5t - 6$ $6t^2 - 4t + 9t - 6$

c) $(2x - 5)(3x - 2)$ $6x^2 - 19x + 10$ $6x^2 - 15x - 4x + 10$

5) Expand and simplify

a) $(x + 3y)(x + 4y)$ $x^2 + 7xy + 12y^2$ $x^2 + 3xy + 4xy + 12y^2$

b) $(2p + q)(3p + 2q)$ $6p^2 + 7pq + 2q^2$ $6p^2 + 3pq + 4pq + 2q^2$

6) Expand and simplify

a) $(2x + 1)^2$ $4x^2 + 4x + 1$ $(2x + 1)(2x + 1) = 4x^2 + 2x + 2x + 1$

b) $(3x - 2)^2$ $9x^2 - 12x + 4$ $(3x - 2)(3x - 2) = 9x^2 - 6x - 6x + 4$

c) $(2p + q)^2$ $4p^2 + 4pq + q^2$ $(2p + q)(2p + q) = 4p^2 + 2pq + 2pq + q^2$

1) Factorise

a) $2x + 4$

b) $2y + 10$

c) $3x + 12$

d) $3x - 6$

e) $5x - 15$

2) Factorise

a) $p^2 + 7p$

b) $x^2 + 4x$

c) $y^2 - 2y$

d) $p^2 - 5p$

e) $x^2 + x$

3) Factorise

a) $2x^2 + 6x$

b) $2y^2 - 8y$

c) $5p^2 + 10p$

d) $7c^2 - 21c$

e) $6x^2 + 9x$

4) Factorise

a) $2x^2 - 4xy$

b) $2t^2 + 10tu$

c) $6x^2 - 8xy$

d) $3x^2y^2 + 9xy$

1) Factorise

a) $2x + 4$ $2(x + 2)$

b) $2y + 10$ $2(y + 5)$

c) $3x + 12$ $3(x + 4)$

d) $3x - 6$ $3(x - 2)$

e) $5x - 15$ $5(x - 3)$

2) Factorise

a) $p^2 + 7p$ $p(p + 7)$

b) $x^2 + 4x$ $x(x + 4)$

c) $y^2 - 2y$ $y(y - 2)$

d) $p^2 - 5p$ $p(p - 5)$

e) $x^2 + x$ $x(x + 1)$

3) Factorise

a) $2x^2 + 6x$ $2x(x + 3)$

b) $2y^2 - 8y$ $2y(y - 4)$

c) $5p^2 + 10p$ $5p(p + 2)$

d) $7c^2 - 21c$ $7c(c - 3)$

e) $6x^2 + 9x$ $3x(2x + 3)$

4) Factorise

a) $2x^2 - 4xy$ $2x(x - 2y)$

b) $2t^2 + 10tu$ $2t(t + 5u)$

c) $6x^2 - 8xy$ $2x(3x - 4y)$

d) $3x^2y^2 + 9xy$ $3xy(xy + 3)$

Solve the following equations

1) $2p - 1 = 13$

2) $4y + 1 = 21$

3) $6x - 7 = 32$

4) $x + x + x + x = 20$

5) $x + 3x = 40$

6) $5(t - 1) = 20$

7) $4(5y - 2) = 52$

8) $4(y + 3) = 24$

9) $20x - 15 = 18x - 7$

10) $4y + 3 = 2y + 10$

11) $2x + 17 = 5x - 4$

12) $2x + 7 = 16 - 4x$

13) $5(x + 3) = 2(x + 6)$

14) $4(2y + 1) = 2(12 - y)$

15) $7 - 3x = 2(x + 1)$

16) $\frac{x - 3}{2} = 5$

17) $\frac{2x + 4}{3} = 7$

18) $\frac{40 - x}{3} = 4 + x$

Solve the following equations

$$\begin{aligned}
 1) \quad 2p - 1 &= 13 & p &= 7 \\
 2p &= 13 + 1 \\
 2p &= 14 \\
 p &= 7
 \end{aligned}$$

$$\begin{aligned}
 2) \quad 4y + 1 &= 21 & y &= 5 \\
 4y &= 21 - 1 \\
 4y &= 20 \\
 y &= 5
 \end{aligned}$$

$$\begin{aligned}
 3) \quad 6x - 7 &= 32 & x &= 6.5 \\
 6x &= 32 + 7 \\
 6x &= 39 \\
 x &= 6.5
 \end{aligned}$$

$$\begin{aligned}
 4) \quad x + x + x + x &= 20 & x &= 5 \\
 4x &= 20 \\
 x &= 5
 \end{aligned}$$

$$\begin{aligned}
 5) \quad x + 3x &= 40 & x &= 10 \\
 4x &= 40 \\
 x &= 10
 \end{aligned}$$

$$\begin{aligned}
 6) \quad 5(t - 1) &= 20 & t &= 5 \\
 5t - 5 &= 20 \\
 5t &= 20 + 5 \\
 5t &= 25 \\
 t &= 5
 \end{aligned}$$

$$\begin{aligned}
 7) \quad 4(5y - 2) &= 52 & y &= 3 \\
 20y - 8 &= 52 \\
 20y &= 52 + 8 \\
 20y &= 60 \\
 y &= 3
 \end{aligned}$$

$$\begin{aligned}
 8) \quad 4(y + 3) &= 24 & y &= 3 \\
 4y + 12 &= 24 \\
 4y &= 24 - 12 \\
 4y &= 12 \\
 y &= 3
 \end{aligned}$$

$$\begin{aligned}
 9) \quad 20x - 15 &= 18x - 7 & x &= 4 \\
 20x - 18x &= -7 + 15 \\
 2x &= 8 \\
 x &= 4
 \end{aligned}$$

$$\begin{aligned}
 10) \quad 4y + 3 &= 2y + 10 & y &= 3.5 \\
 4y - 2y &= 10 - 3 \\
 2y &= 7 \\
 y &= 3.5
 \end{aligned}$$

$$\begin{aligned}
 11) \quad 2x + 17 &= 5x - 4 & x &= 7 \\
 4 + 17 &= 5x - 2x \\
 21 &= 3x \\
 7 &= x
 \end{aligned}$$

$$\begin{aligned}
 12) \quad 2x + 7 &= 16 - 4x & x &= 1.5 \\
 2x + 4x &= 16 - 7 \\
 6x &= 9 \\
 x &= 1.5
 \end{aligned}$$

$$\begin{aligned}
 13) \quad 5(x + 3) &= 2(x + 6) & x &= -1 \\
 5x + 15 &= 2x + 12 \\
 5x - 2x &= 12 - 15 \\
 3x &= -3 \\
 x &= -1
 \end{aligned}$$

$$\begin{aligned}
 14) \quad 4(2y + 1) &= 2(12 - y) & y &= 2 \\
 8y + 4 &= 24 - 2y \\
 8y + 2y &= 24 - 4 \\
 10y &= 20 \\
 y &= 2
 \end{aligned}$$

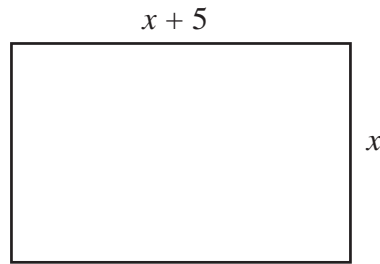
$$\begin{aligned}
 15) \quad 7 - 3x &= 2(x + 1) & x &= 1 \\
 7 - 3x &= 2x + 2 \\
 7 - 2 &= 2x + 3x \\
 5 &= 5x \\
 1 &= x
 \end{aligned}$$

$$\begin{aligned}
 16) \quad \frac{x - 3}{2} &= 5 & x &= 13 \\
 x - 3 &= 5 \times 2 \\
 x - 3 &= 10 \\
 x &= 13
 \end{aligned}$$

$$\begin{aligned}
 17) \quad \frac{2x + 4}{3} &= 7 & x &= 8.5 \\
 2x + 4 &= 21 \\
 2x &= 17 \\
 x &= 8.5
 \end{aligned}$$

$$\begin{aligned}
 18) \quad \frac{40 - x}{3} &= 4 + x & x &= 7 \\
 40 - x &= (4 + x) \times 3 \\
 40 - x &= 12 + 3x \\
 40 - 12 &= 3x + x \\
 28 &= 4x \\
 7 &= x
 \end{aligned}$$

- 1) The width of a rectangle is x centimetres.
The length of the rectangle is $(x + 5)$ centimetres.

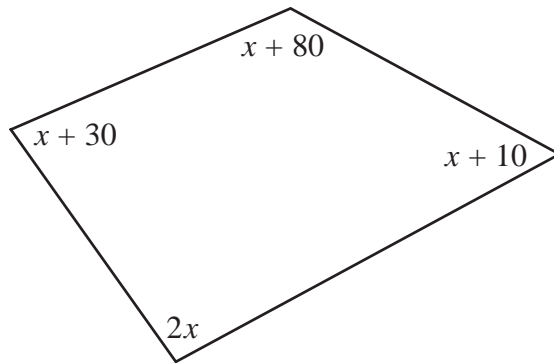


- a) Find an expression, in terms of x , for the perimeter of the rectangle.
Give your answer in its simplest form.

The perimeter of the rectangle is 38 centimetres.

- b) Work out the length of the rectangle.

2)



*Diagram NOT
accurately drawn*

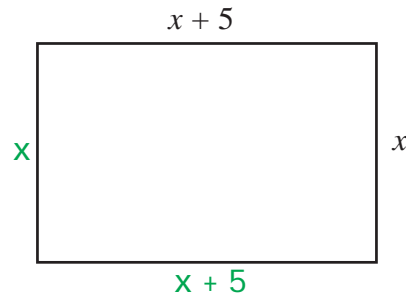
The sizes of the angles, in degrees, of the quadrilateral are

$x + 10$
 $2x$
 $x + 80$
 $x + 30$

- a) Use this information to write down an equation in terms of x .
- b) Use your answer to part (a) to work out the size of the smallest angle of the quadrilateral.
- 3) Sarah buys 6 cups and 6 mugs
A cup costs $\pounds x$
A mug costs $\pounds(x + 3)$
- a) Write down an expression, in terms of x , for the total cost, in pounds, of 6 cups and 6 mugs.
- b) If the total cost of 6 cups and 6 mugs is $\pounds 48$, write an equation in terms of x .
- c) Solve your equation to find the cost of a cup and the cost of a mug.

Forming Equations

- 1) The width of a rectangle is x centimetres.
The length of the rectangle is $(x + 5)$ centimetres.



$$P = x + 5 + x + x + 5 + x$$

$$P = 4x + 10$$

- a) Find an expression, in terms of x , for the perimeter of the rectangle.
Give your answer in its simplest form. $4x + 10$

The perimeter of the rectangle is 38 centimetres.

$$4x + 10 = 38$$

$$4x = 28$$

$$x = 7$$

- b) Work out the length of the rectangle. **Length is 12 cm**

2)

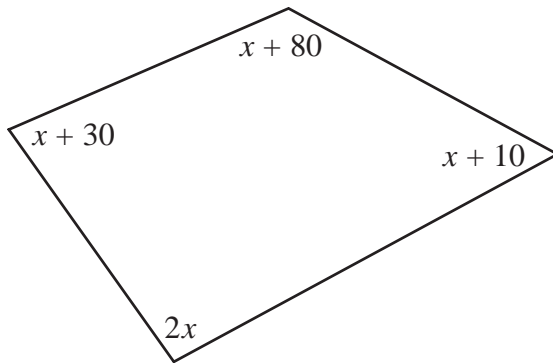


Diagram NOT accurately drawn

The sizes of the angles, in degrees, of the quadrilateral are

$$x + 10$$

$$2x$$

$$x + 80$$

$$x + 30$$

Angles of a quadrilateral add up to 360°

$$x + 80 + x + 10 + 2x + x + 30 = 360$$

$$5x + 120 = 360$$

- a) Use this information to write down an equation in terms of x . $5x + 120 = 360$

- b) Use your answer to part (a) to work out the size of the smallest angle of the quadrilateral. **Smallest angle is 58°**
- $$5x + 120 = 360$$
- $$5x = 240$$
- $$x = 48$$

3) Sarah buys 6 cups and 6 mugs

A cup costs $\pounds x$

A mug costs $\pounds(x + 3)$

- a) Write down an expression, in terms of x , for the total cost, in pounds, of 6 cups and 6 mugs. $12x + 18$
- b) If the total cost of 6 cups and 6 mugs is $\pounds 48$, write an equation in terms of x . $12x + 18 = 48$
- c) Solve your equation to find the cost of a cup and the cost of a mug.
A cup costs $\pounds 2.50$ and a mug costs $\pounds 5.50$

- 1) Make c the subject of the formula.

$$a = b + cd$$

- 2) Make t the subject of the formula.

$$u = v + 2t$$

- 3) Make n the subject of the formula.

$$M = 3n + 5$$

- 4) Make z the subject of the formula.

$$x = 3y + z$$

- 5) $r = 5s + 3t$

a) Make t the subject of the formula.

b) Make s the subject of the formula.

- 6) Rearrange $y = 3x + 1$ to make x the subject.

- 7) Rearrange $y = \frac{1}{2}x + 2$ to make x the subject.

- 8) Rearrange $y = \frac{1}{3}x + 1$ to make x the subject.

Changing the Subject of a Formula

- 1) Make c the subject of the formula.

$$a = b + cd \quad c = \frac{a - b}{d}$$

- 2) Make t the subject of the formula.

$$u = v + 2t \quad t = \frac{u - v}{2}$$

- 3) Make n the subject of the formula.

$$M = 3n + 5 \quad n = \frac{M - 5}{3}$$

- 4) Make z the subject of the formula.

$$x = 3y + z \quad z = x - 3y$$

- 5) $r = 5s + 3t$

a) Make t the subject of the formula. $t = \frac{r - 5s}{3}$

b) Make s the subject of the formula. $s = \frac{r - 3t}{5}$

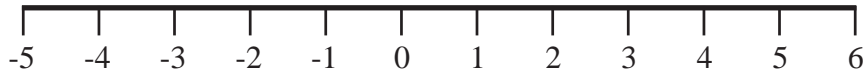
6) Rearrange $y = 3x + 1$ to make x the subject. $x = \frac{y - 1}{3}$

7) Rearrange $y = \frac{1}{2}x + 2$ to make x the subject. $x = 2(y - 2)$ or $x = 2y - 4$

8) Rearrange $y = \frac{1}{3}x + 1$ to make x the subject. $x = 3(y - 1)$ or $x = 3y - 3$

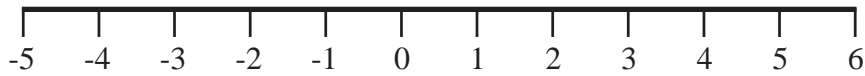
- 1) Represent this inequality on the number line

$$-3 < x \leq 2$$

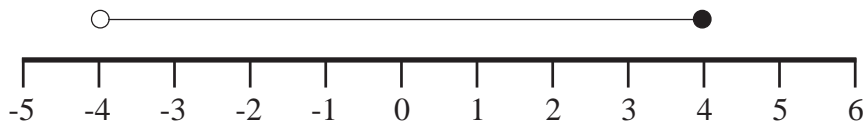


- 2) Represent this inequality on the number line

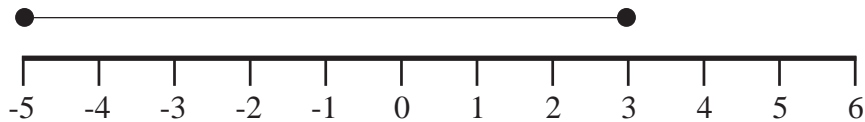
$$-1 < x < 5$$



- 3) Write down the inequality shown



- 4) Write down the inequality shown



- 5) If y is an integer, write down all the possible values of

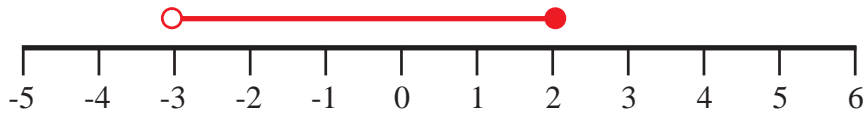
$$-2 < y < 5$$

- 6) If x is an integer, write down all the possible values of

$$-9 < x < -5$$

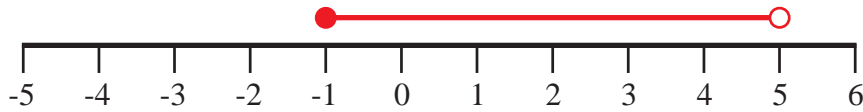
- 1) Represent this inequality on the number line

$$-3 < x \leq 2$$

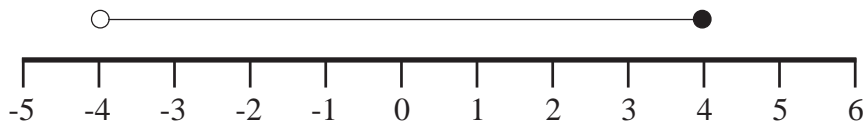


- 2) Represent this inequality on the number line

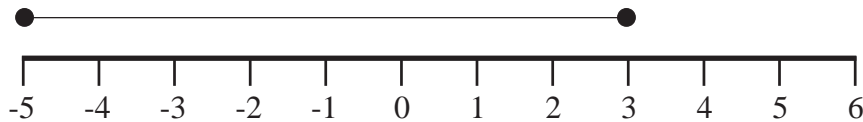
$$-1 < x < 5$$



- 3) Write down the inequality shown $-4 < x < 4$



- 4) Write down the inequality shown $-5 < x < 3$



- 5) If y is an integer, write down all the possible values of

$$-2 < y < 5$$

$-1, 0, 1, 2, 3, 4, 5$

- 6) If x is an integer, write down all the possible values of

$$-9 < x < -5$$

$-8, -7, -6$

1) Solve

a) $3x - 1 > 5$

b) $7y + 2 \leq 30$

c) $\frac{x}{2} - 3 \geq 2$

d) $5 + 2x > 7$

e) $8 < 5p - 2$

f) $\frac{y}{3} + 5 \geq 3$

g) $\frac{2x}{3} - 5 \geq -3$

h) $6x - 5 > 2x + 3$

i) $3p - 9 < 6 - 2p$

j) $5 - 3y < 2y - 10$

2) a) Solve the inequality

$$2z + 2 \geq 7$$

b) Write down the smallest **integer** value of z which satisfies the inequality

$$2z + 2 \geq 7$$

3) $5x + 2y < 10$

x and y are both integers.

Write down two possible pairs of values that satisfy this inequality.

$x = \dots\dots\dots, y = \dots\dots\dots$

and

$x = \dots\dots\dots, y = \dots\dots\dots$

Solving Inequalities

1) Solve

a) $3x - 1 > 5$
 $x > 2$

b) $7y + 2 \leq 30$
 $y < 4$

c) $\frac{x}{2} - 3 \geq 2$
 $x \geq 10$

d) $5 + 2x > 7$
 $x > 1$

e) $8 < 5p - 2$
 $2 < p$

f) $\frac{y}{3} + 5 \geq 3$
 $y \geq -6$

g) $\frac{2x}{3} - 5 \geq -3$
 $x \geq 3$

h) $6x - 5 > 2x + 3$
 $x > 2$

i) $3p - 9 < 6 - 2p$
 $p < 3$

j) $5 - 3y < 2y - 10$
 $3 < y$

a) $3x > 5 + 1$
 $3x > 6$
 $x > \frac{6}{3}$

b) $7y \leq 30 - 2$
 $7y \leq 28$
 $y \leq \frac{28}{7}$

c) $\frac{x}{2} \geq 2 + 3$
 $\frac{x}{2} \geq 5$
 $x \geq 5 \times 2$

d) $2x > 7 - 5$
 $2x > 2$
 $x > \frac{2}{2}$

e) $8 + 2 < 5p$
 $10 < 5p$
 $\frac{10}{5} < p$

f) $\frac{y}{3} \geq 3 - 5$
 $\frac{y}{3} \geq -2$

$y \geq -2 \times 3$

g) $\frac{2x}{3} \geq -3 + 5$
 $\frac{2x}{3} \geq 2$

$x \geq \frac{2 \times 3}{2}$

h) $6x - 2x > 3 + 5$
 $4x > 8$
 $x > \frac{8}{4}$

i) $3p + 2p < 6 + 9$
 $5p < 15$
 $p < \frac{15}{5}$

j) $5 + 10 < 2y + 3y$
 $15 < 5y$
 $\frac{15}{5} < y$

2) a) Solve the inequality

$2z + 2 \geq 7$
 $z \geq 2.5$

$2z \geq 7 - 2$
 $2z \geq 5$
 $z \geq \frac{5}{2}$

b) Write down the smallest **integer** value of z which satisfies the inequality

$2z + 2 \geq 7$
 $z = 3$

3) $5x + 2y < 10$

x and y are both integers.

Write down two possible pairs of values that satisfy this inequality.

$x = \dots 1 \dots, y = \dots 1 \dots$

$5 \times 1 + 2 \times 1 = 7$

and

$x = \dots 1 \dots, y = \dots 2 \dots$

$5 \times 1 + 2 \times 2 = 9$

other pairs of values are possible.

- 1) The equation

$$x^3 - x = 29$$

has a solution between 3 and 4

Use a trial and improvement method to find this solution.

Give your answer correct to 1 decimal place.

You must show **all** your working.

- 2) The equation

$$x^3 - 4x = 25$$

has a solution between 3 and 4

Use a trial and improvement method to find this solution.

Give your answer correct to 1 decimal place.

You must show **all** your working.

- 3) The equation

$$x^3 - 2x = 68$$

has a solution between 4 and 5

Use a trial and improvement method to find this solution.

Give your answer correct to 1 decimal place.

You must show **all** your working.

- 4) The equation

$$x^3 + 4x = 101$$

has one solution which is a positive number.

Use a trial and improvement method to find this solution.

Give your answer correct to 1 decimal place.

You must show **all** your working.

Trial and Improvement

1) The equation

$$x^3 - x = 29$$

has a solution between 3 and 4

Use a trial and improvement method to find this solution.

Give your answer correct to 1 decimal place.

You must show **all** your working.

$$\begin{array}{l} x = 3 \\ x = 4 \\ x = 3.1 \\ x = 3.2 \\ x = 3.15 \end{array}$$

$$\begin{array}{l} x^3 - x = 29 \\ 3^3 - 3 = 24 \quad \text{too low} \\ 4^3 - 4 = 60 \quad \text{too high} \\ 3.1^3 - 3.1 = 26.691 \quad \text{too low} \\ 3.2^3 - 3.2 = 29.568 \quad \text{too high} \\ 3.15^3 - 3.15 = 28.105875 \quad \text{too low} \end{array}$$

Therefore, $x = 3.2$ to 1 decimal place.



2) The equation

$$x^3 - 4x = 25$$

has a solution between 3 and 4

Use a trial and improvement method to find this solution.

Give your answer correct to 1 decimal place.

You must show **all** your working.

$$\begin{array}{l} x = 3 \\ x = 4 \\ x = 3.4 \\ x = 3.3 \\ x = 3.35 \end{array}$$

$$\begin{array}{l} x^3 - 4x = 25 \\ 3^3 - 4 \times 3 = 15 \quad \text{too low} \\ 4^3 - 4 \times 4 = 48 \quad \text{too high} \\ 3.4^3 - 4 \times 3.4 = 25.704 \quad \text{too high} \\ 3.3^3 - 4 \times 3.3 = 22.737 \quad \text{too low} \\ 3.35^3 - 4 \times 3.35 = 24.195375 \quad \text{too low} \end{array}$$

Therefore, $x = 3.4$ to 1 decimal place.



3) The equation

$$x^3 - 2x = 68$$

has a solution between 4 and 5

Use a trial and improvement method to find this solution.

Give your answer correct to 1 decimal place.

You must show **all** your working.

$$\begin{array}{l} x = 4 \\ x = 5 \\ x = 4.2 \\ x = 4.3 \\ x = 4.25 \end{array}$$

$$\begin{array}{l} x^3 - 2x = 68 \\ 4^3 - 2 \times 4 = 56 \quad \text{too low} \\ 5^3 - 2 \times 5 = 115 \quad \text{too high} \\ 4.2^3 - 2 \times 4.2 = 65.688 \quad \text{too low} \\ 4.3^3 - 2 \times 4.3 = 70.907 \quad \text{too high} \\ 4.25^3 - 2 \times 4.25 = 68.265625 \quad \text{too high} \end{array}$$

Therefore, $x = 4.2$ to 1 decimal place.



4) The equation

$$x^3 + 4x = 101$$

has one solution which is a positive number.

Use a trial and improvement method to find this solution.

Give your answer correct to 1 decimal place.

You must show **all** your working.

$$\begin{array}{l} x = 3 \\ x = 4 \\ x = 5 \\ x = 4.2 \\ x = 4.3 \\ x = 4.4 \\ x = 4.35 \end{array}$$

$$\begin{array}{l} x^3 + 4x = 101 \\ 3^3 + 4 \times 3 = 39 \quad \text{too low} \\ 4^3 + 4 \times 4 = 80 \quad \text{too low} \\ 5^3 + 4 \times 5 = 145 \quad \text{too high} \\ 4.2^3 + 4 \times 4.2 = 90.888 \quad \text{too low} \\ 4.3^3 + 4 \times 4.3 = 96.707 \quad \text{too low} \\ 4.4^3 + 4 \times 4.4 = 102.784 \quad \text{too high} \\ 4.35^3 + 4 \times 4.35 = 99.712875 \quad \text{too low} \end{array}$$

Therefore, $x = 4.4$ to 1 decimal place.



1) Write as a power of 8

a) $8^4 \times 8^3$

b) $8^{12} \div 8^7$

2) Write as a power of 3

a) $3^2 \times 3^9$

b) $3^{10} \div 3^3$

3) Simplify

a) $k^5 \times k^2$

b) $x^4 \div x^2$

c) $\frac{k^{11}}{k^6}$

d) $(k^8)^2$

4) Simplify

eg. $(2xy^3)^4 = 2xy^3 \times 2xy^3 \times 2xy^3 \times 2xy^3 = 16x^4y^{12}$

a) $(2xy^5)^3$

b) $(2x^2y^2)^3$

c) $(4xy^4)^2$

d) $(3xy^2)^4$

5) $2^x \times 2^y = 2^{10}$

and

$2^x \div 2^y = 2^2$

Work out the value of x and the value of y .

6) $5^x \times 5^y = 5^{12}$

and

$5^x \div 5^y = 5^6$

Work out the value of x and the value of y .

7) $a = 2^x$, $b = 2^y$

Express in terms of a and b

a) 2^{x+y}

b) 2^{2x}

c) 2^{3y}

d) 2^{x+2y}

1) Write as a power of 8

a) $8^4 \times 8^3$ **8^7** b) $8^{12} \div 8^7$ **8^5**

2) Write as a power of 3

a) $3^2 \times 3^9$ **3^{11}** b) $3^{10} \div 3^3$ **3^7**

3) Simplify

a) $k^5 \times k^2$ **k^7**

b) $x^4 \div x^2$ **x^2**

c) $\frac{k^{11}}{k^6}$ **k^5**

d) $(k^8)^2$ **k^{16}**

4) Simplify

eg. $(2xy^3)^4 = 2xy^3 \times 2xy^3 \times 2xy^3 \times 2xy^3 = 16x^4y^{12}$

a) $(2xy^5)^3$ **$8x^3y^{15}$**

b) $(2x^2y^2)^3$ **$8x^6y^6$**

c) $(4xy^4)^2$ **$16x^2y^8$**

d) $(3xy^2)^4$ **$81x^4y^8$**

5) $2^x \times 2^y = 2^{10}$

and

$2^x \div 2^y = 2^2$

Work out the value of x and the value of y .

$x = 6$ and $y = 4$

6) $5^x \times 5^y = 5^{12}$

and

$5^x \div 5^y = 5^6$

Work out the value of x and the value of y .

$x = 9$ and $y = 3$

7) $a = 2^x$, $b = 2^y$

Express in terms of a and b

a) 2^{x+y} **ab**

b) 2^{2x} **a^2**

c) 2^{3y} **b^3**

d) 2^{x+2y} **ab^2**

1. Write down the first 5 terms and the 10th term of the following sequences:

eg. $2n + 1$ $3, 5, 7, 9, 11, \dots, 21$

a) $2n + 2$

d) $7n$

b) $3n + 1$

e) $3n - 1$

c) $n + 3$

f) $7n - 3$

2. Find the n^{th} term of the following sequences:

a) 5, 10, 15, 20...

d) 22, 18, 14, 10...

b) 5, 8, 11, 14...

e) -3, 3, 9, 15...

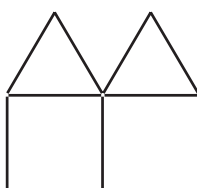
c) 1, 8, 15, 22...

f) 4, -1, -6, -11...

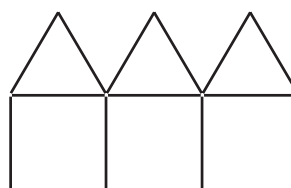
3. Here are some patterns made from sticks.



Pattern 1



Pattern 2



Pattern 3

a) Draw pattern 4 in the space, below..

b) How many sticks are used in

(i) pattern 10

(ii) pattern 20

(iii) pattern 50

c) Find an expression, in terms of n , for the number of sticks in pattern number n .

d) Which pattern number can be made using 301 sticks?

1. Write down the first 5 terms and the 10th term of the following sequences:

eg. $2n + 1$ 3, 5, 7, 9, 11.....21

a) $2n + 2$ 4, 6, 8, 10, 12, ... 22 d) $7n$ 7, 14, 21, 28, 35, ... 70

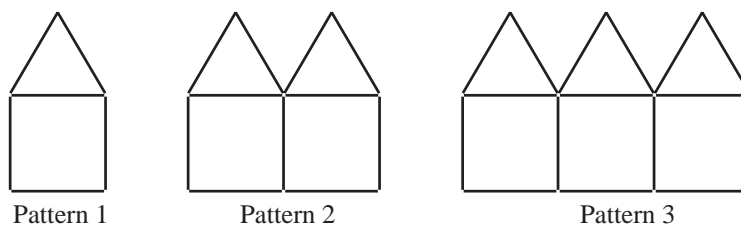
b) $3n + 1$ 4, 7, 10, 13, 16, ... 31 e) $3n - 1$ 2, 5, 8, 11, 14, ... 29

c) $n + 3$ 4, 5, 6, 7, 8, ... 13 f) $7n - 3$ 4, 11, 18, 25, 32, ... 67

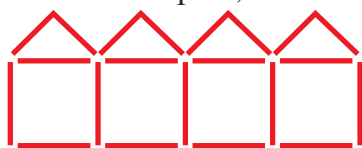
2. Find the n^{th} term of the following sequences:

0	a) 5, 10, 15, 20...	$5n$	+26	d) 22, 18, 14, 10...	$-4n + 26$
	$\underbrace{\quad}_5 \quad \underbrace{\quad}_5 \quad \underbrace{\quad}_5$			$\underbrace{\quad}_{-4} \quad \underbrace{\quad}_{-4} \quad \underbrace{\quad}_{-4}$	
+2	b) 5, 8, 11, 14...	$3n + 2$	-9	e) -3, 3, 9, 15...	$6n - 9$
	$\underbrace{\quad}_3 \quad \underbrace{\quad}_3 \quad \underbrace{\quad}_3$			$\underbrace{\quad}_6 \quad \underbrace{\quad}_6 \quad \underbrace{\quad}_6$	
-6	c) 1, 8, 15, 22...	$7n - 6$	+9	f) 4, -1, -6, -11...	$-5n + 9$
	$\underbrace{\quad}_7 \quad \underbrace{\quad}_7 \quad \underbrace{\quad}_7$			$\underbrace{\quad}_{-5} \quad \underbrace{\quad}_{-5} \quad \underbrace{\quad}_{-5}$	

3. Here are some patterns made from sticks.



a) Draw pattern 4 in the space, below..



	Pat 1	Pat 2	Pat 3	Pat 4	Pat 5	Pat 6
+1	6	11	16	21	26	31
	$\underbrace{\quad}_5$	$\underbrace{\quad}_5$	$\underbrace{\quad}_5$	$\underbrace{\quad}_5$	$\underbrace{\quad}_5$	$\underbrace{\quad}_5$
	$n^{\text{th}} \text{ term is } 5n + 1$					

b) How many sticks are used in

(i) pattern 10 51 sticks

(ii) pattern 20 101 sticks

(iii) pattern 50 251 sticks

c) Find an expression, in terms of n , for the number of sticks in pattern number n . $5n + 1$

d) Which pattern number can be made using 301 sticks? Pattern 60

Drawing Straight Line Graphs

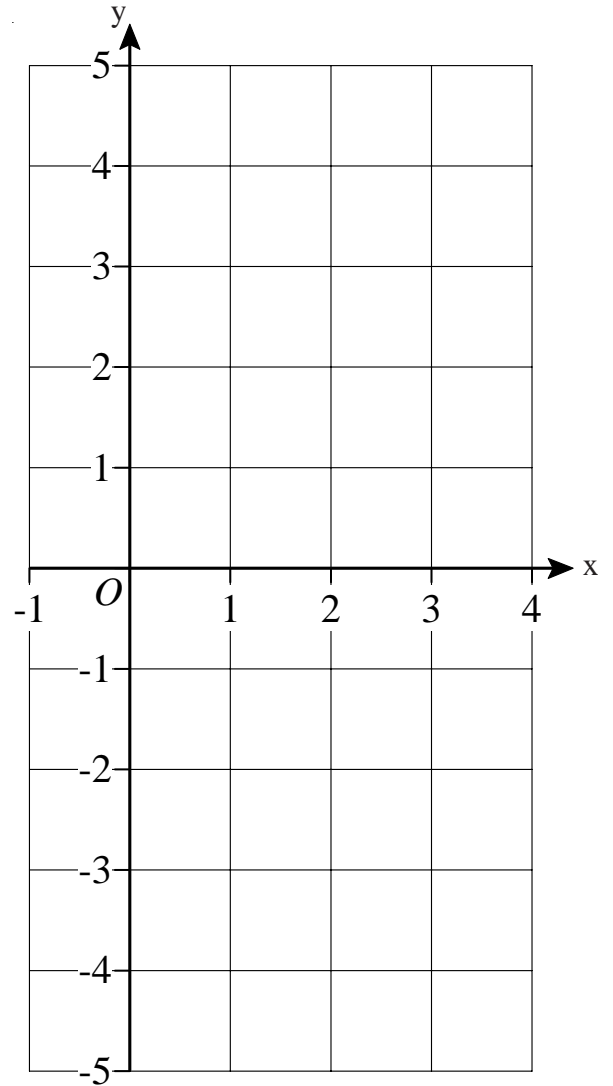
1) a) Complete the table of values for $y = 2x - 3$

x	-1	0	1	2	3	4
y				1		

b) Using the axes on the right draw the graph of $y = 2x - 3$

c) Use your graph to work out the value of y when $x = 2.5$

d) Use your graph to work out the value of x when $y = 4.5$



2) a) Complete the table of values for $y = 2 - x$

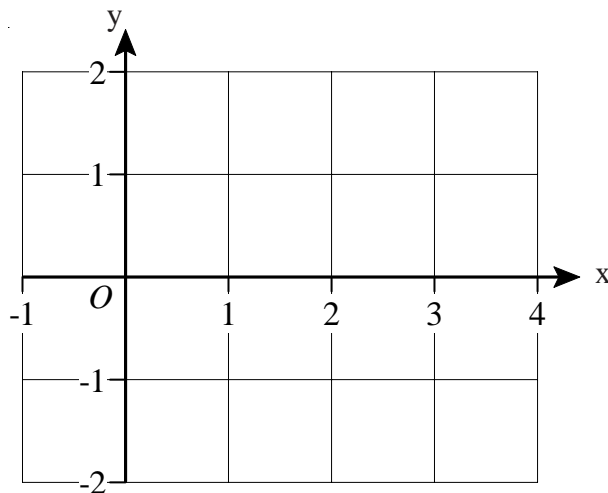
x	-1	0	1	2	3	4
y					-1	

b) Using the axes on the right, again, draw the graph of $y = 2 - x$

3) a) Complete the table of values for $y = \frac{1}{2}x - 1$

x	-1	0	1	2	3	4
y				0		

b) Draw the graph of $y = \frac{1}{2}x - 1$



c) Use your graph to find the value of y when $x = 3.5$

Drawing Straight Line Graphs

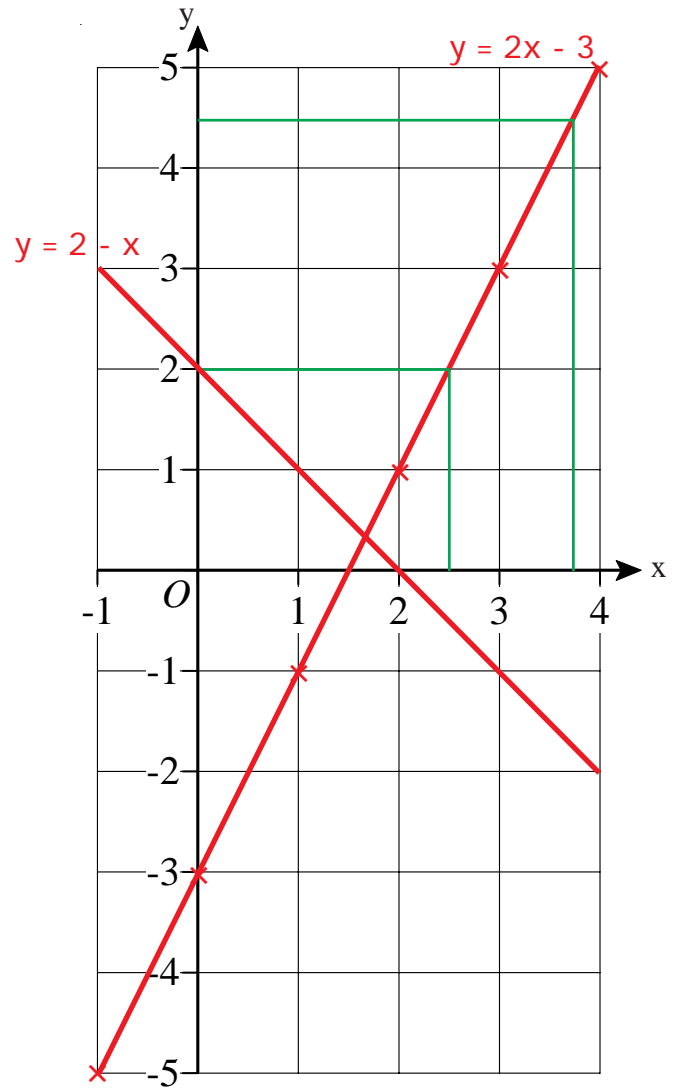
1) a) Complete the table of values for $y = 2x - 3$

x	-1	0	1	2	3	4
y	-5	-3	-1	1	3	5

b) Using the axes on the right draw the graph of $y = 2x - 3$

c) Use your graph to work out the value of y when $x = 2.5$ $y = 2$

d) Use your graph to work out the value of x when $y = 4.5$ $x = 3.75$



2) a) Complete the table of values for $y = 2 - x$

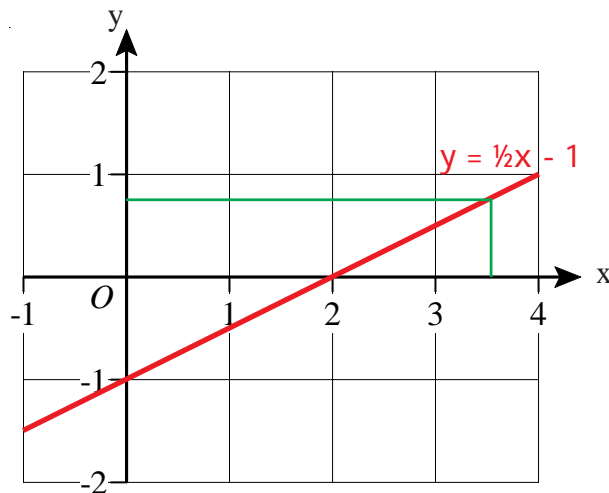
x	-1	0	1	2	3	4
y	3	2	1	0	-1	-2

b) Using the axes on the right, again, draw the graph of $y = 2 - x$

3) a) Complete the table of values for $y = \frac{1}{2}x - 1$

b) Draw the graph of $y = \frac{1}{2}x - 1$

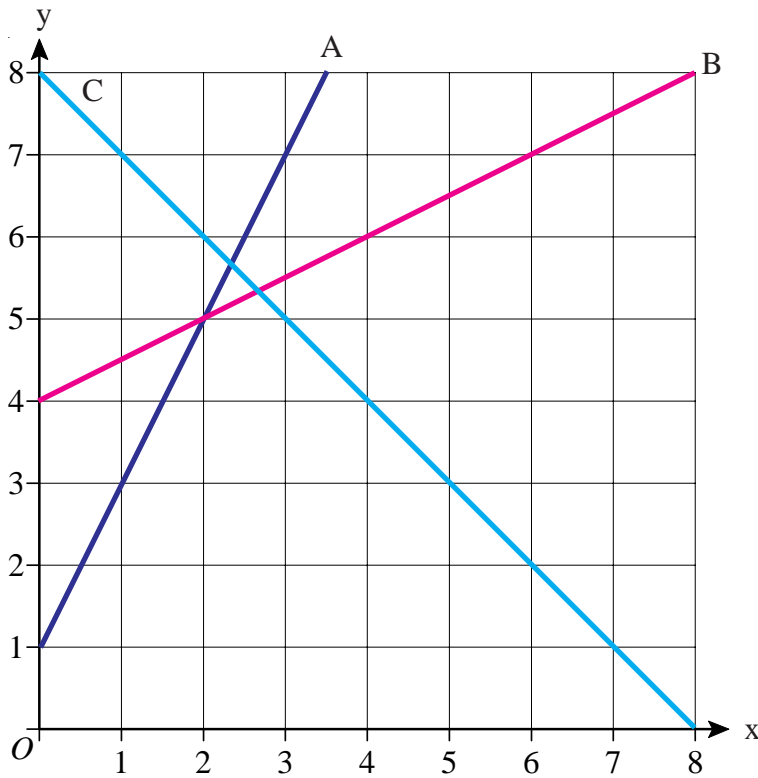
x	-1	0	1	2	3	4
y	-1½	-1	-½	0	½	1



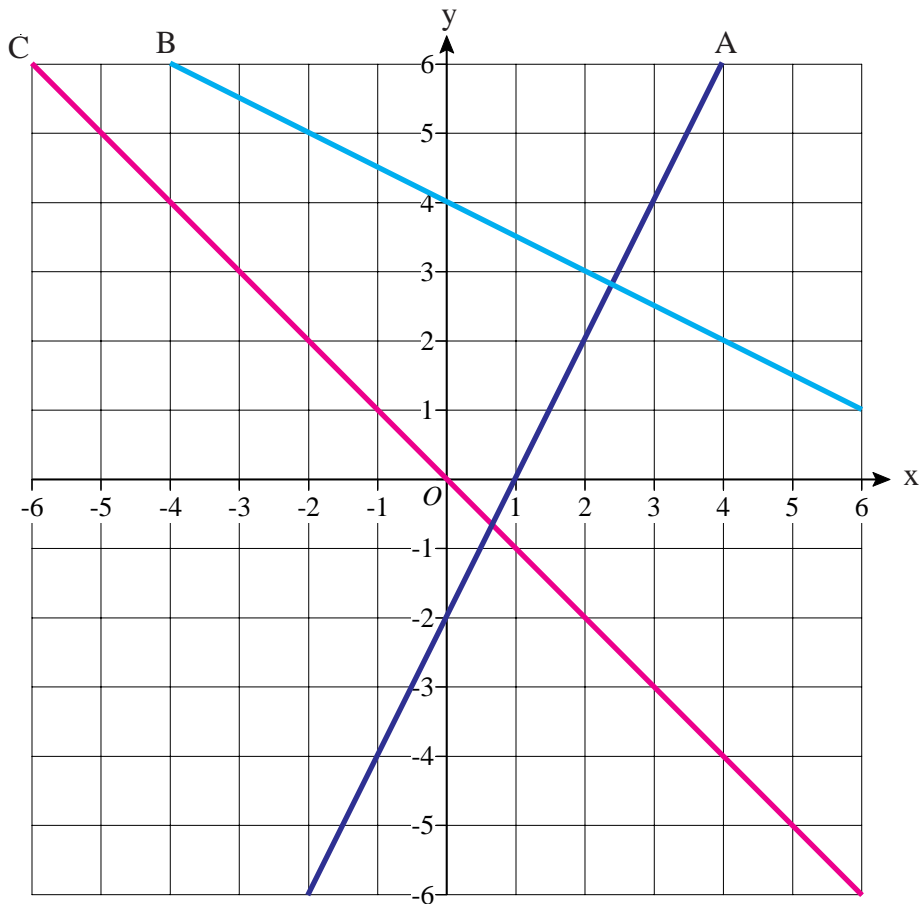
c) Use your graph to find the value of y when $x = 3.5$ $y = 0.75$

Finding the Equation of a Straight Line

1) Find the equations of lines A, B and C on the axes below

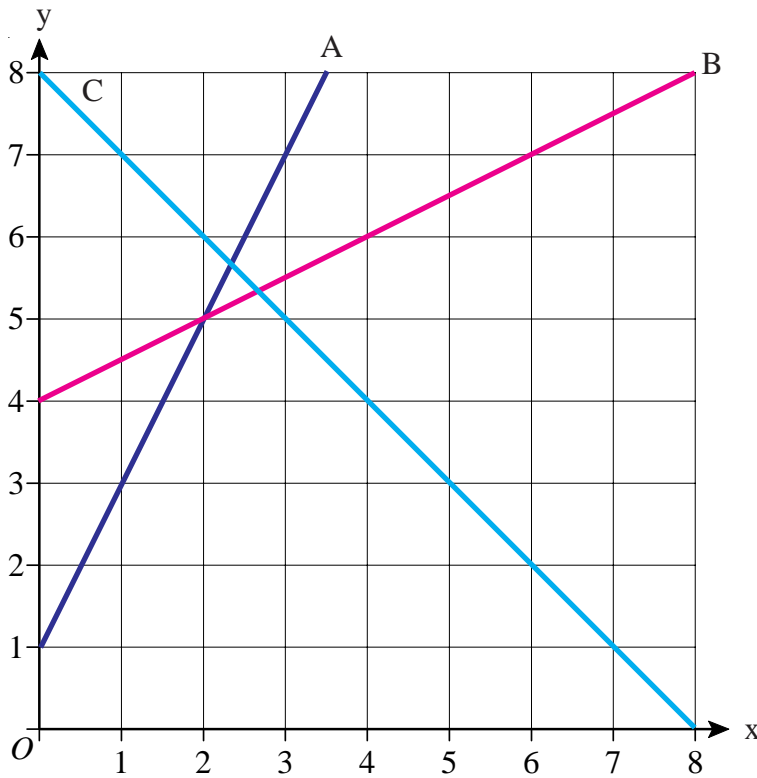


2) Find the equations of lines A, B and C on the axes below



Finding the Equation of a Straight Line

1) Find the equations of lines A, B and C on the axes below



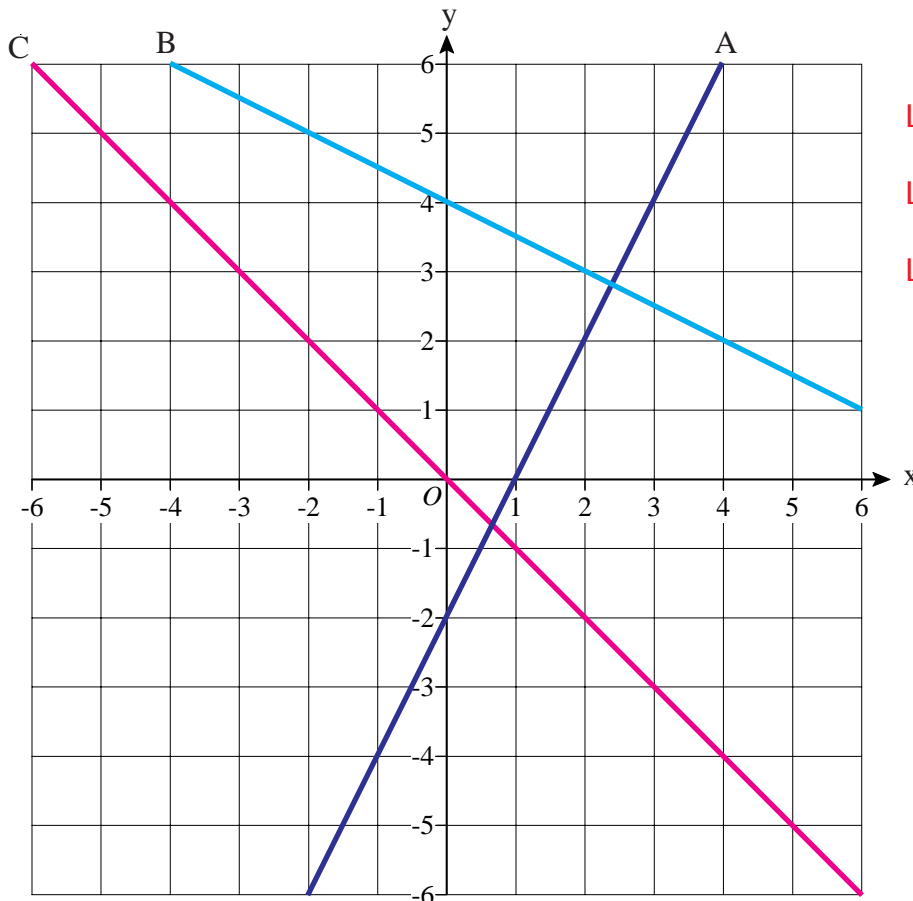
Line A: $y = 2x + 1$

Line B: $y = \frac{1}{2}x + 4$

Line C: $y = -x + 8$

or Line C: $y = 8 - x$

2) Find the equations of lines A, B and C on the axes below



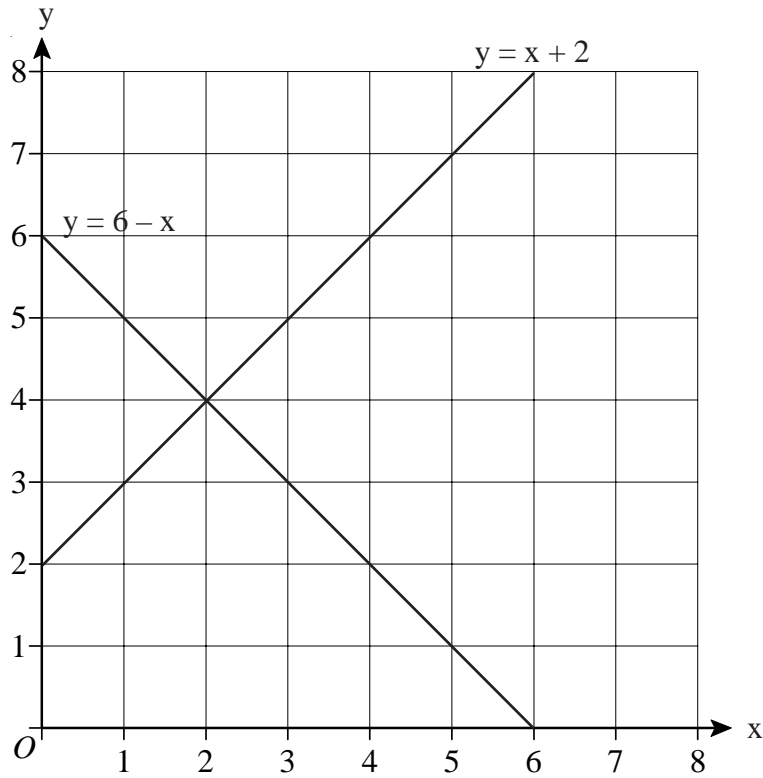
Line A: $y = 2x - 2$

Line B: $y = -\frac{1}{2}x + 4$

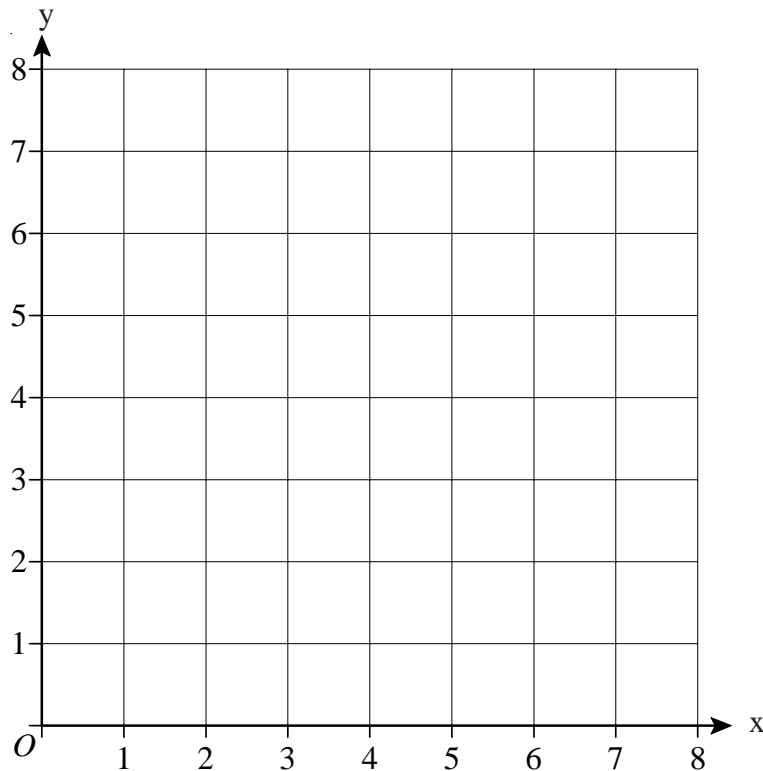
Line C: $y = -x$

Solving Simultaneous Equations Graphically

- 1) On the axes below, the graphs of $y = x + 2$ and $y = 6 - x$ have been drawn.
Use the graphs to solve the simultaneous equations $y = x + 2$ and $y = 6 - x$



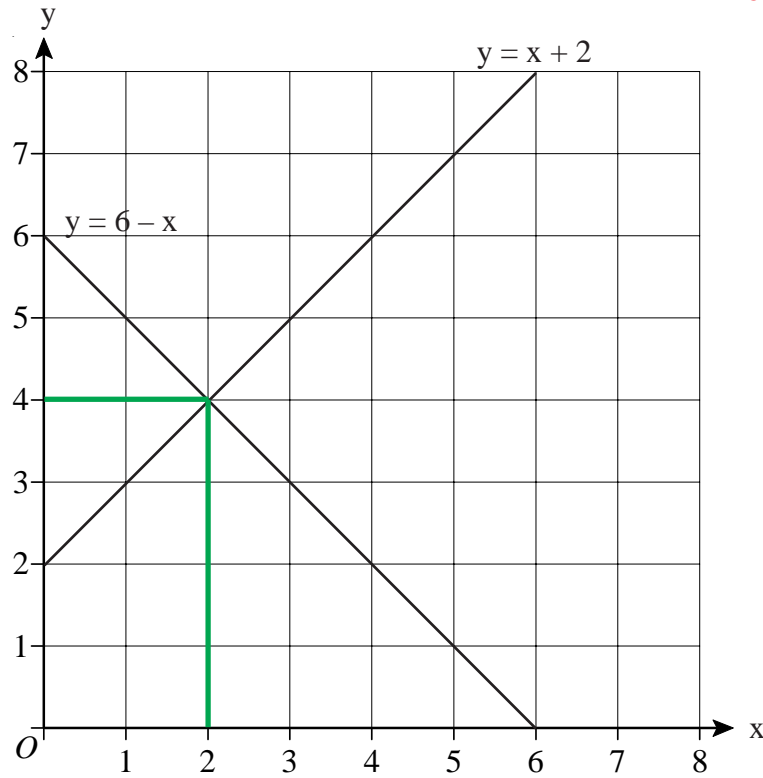
- 2) On the axes below draw the graphs of $y = 2x + 1$ and $y = 7 - x$
Use your graphs to solve the simultaneous equations $y = 2x + 1$ and $y = 7 - x$



Solving Simultaneous Equations Graphically

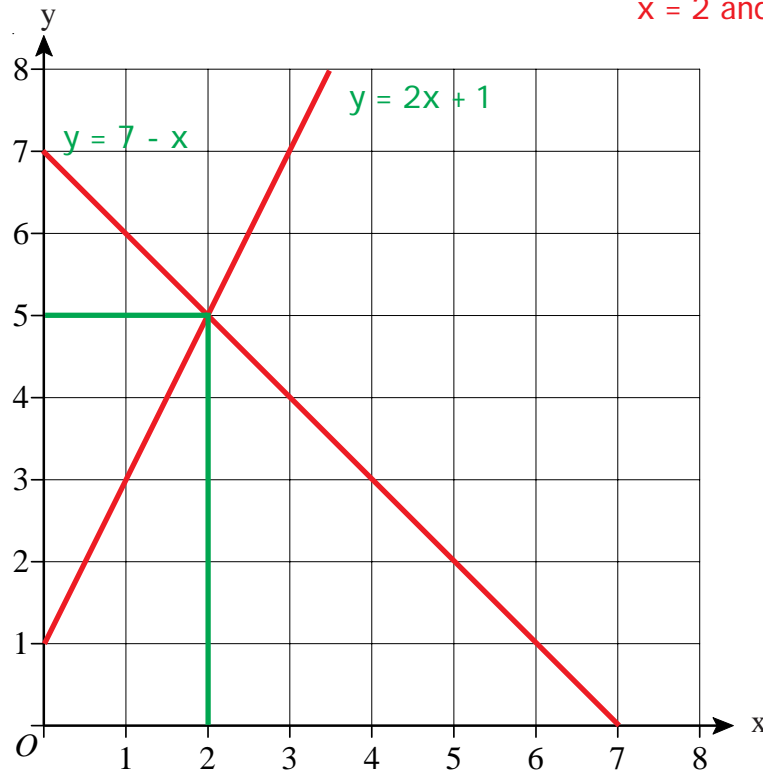
- 1) On the axes below, the graphs of $y = x + 2$ and $y = 6 - x$ have been drawn.
Use the graphs to solve the simultaneous equations $y = x + 2$ and $y = 6 - x$

$x = 2$ and $y = 4$



- 2) On the axes below draw the graphs of $y = 2x + 1$ and $y = 7 - x$
Use your graphs to solve the simultaneous equations $y = 2x + 1$ and $y = 7 - x$

$x = 2$ and $y = 5$

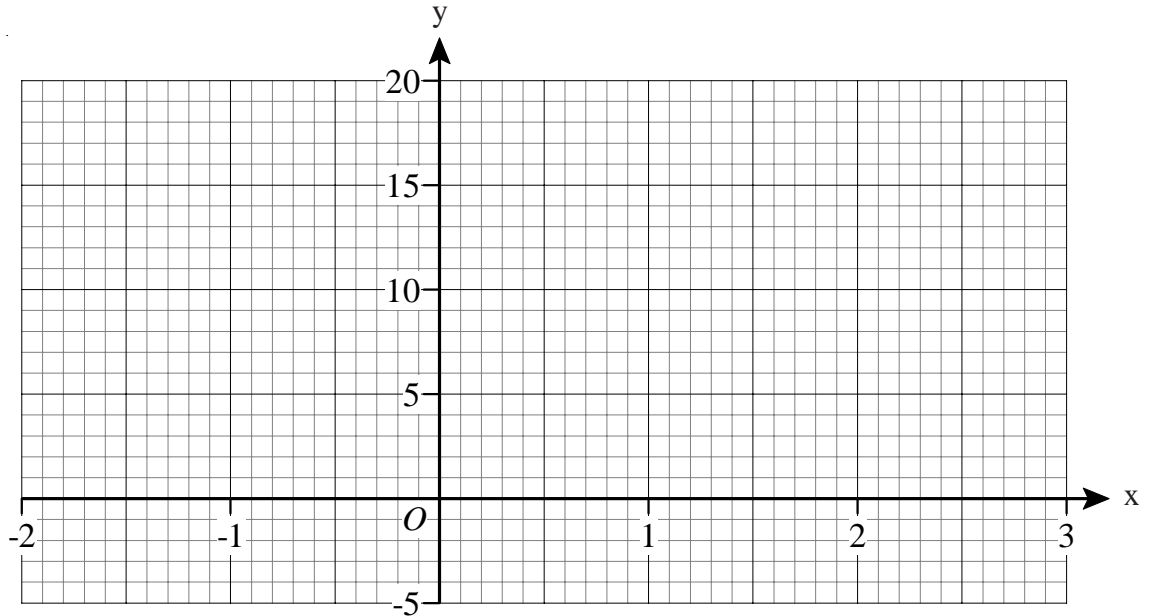


Drawing Quadratic Graphs

- 1) a) Complete the table of values for $y = 2x^2 - 3x$

x	-2	-1	0	1	2	3
y	14		0			9

- b) On the grid, draw the graph of $y = 2x^2 - 3x$ for values of x from -2 to 3

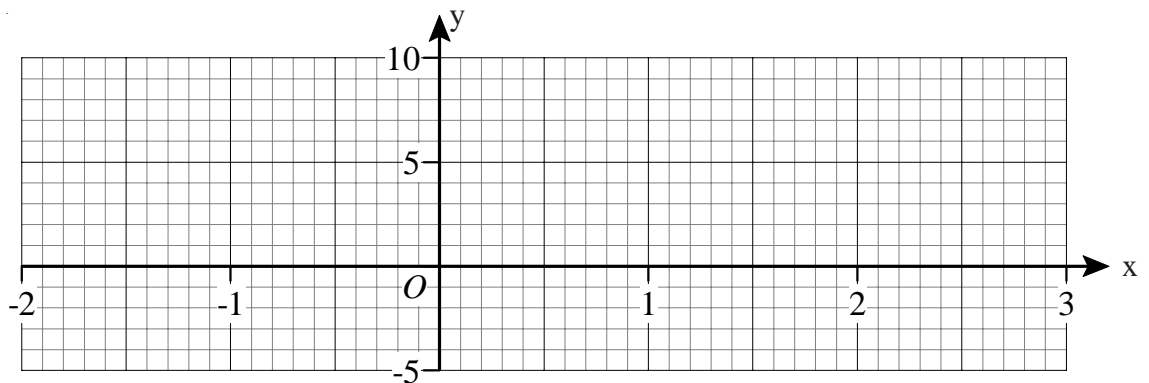


- c) Use the graph to find the value of y when $x = -1.5$
 d) Use the graph to find the values of x when $y = 4$

- 2) a) Complete the table of values for $y = x^2 - 2x$

x	-2	-1	0	1	2	3
y	8		0			

- b) On the grid, draw the graph of $y = x^2 - 2x$ for values of x from -2 to 3



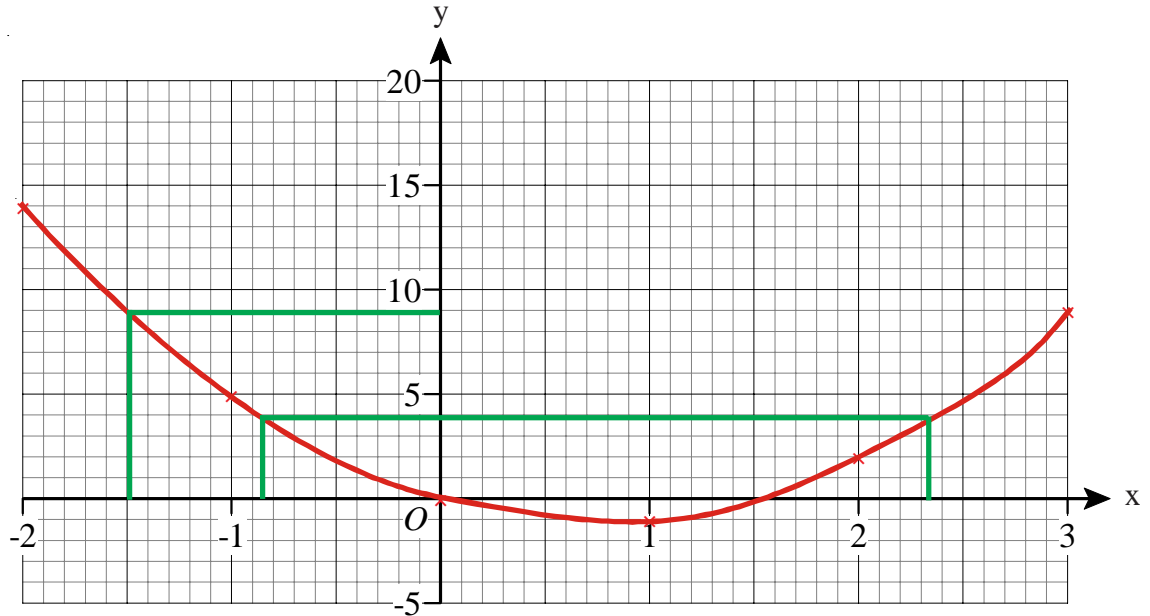
- c) (i) On the same axes draw the straight line $y = 2.5$
 (ii) Write down the values of x for which $x^2 - 2x = 2.5$

Drawing Quadratic Graphs

1) a) Complete the table of values for $y = 2x^2 - 3x$

x	-2	-1	0	1	2	3
y	14	5	0	-1	2	9

b) On the grid, draw the graph of $y = 2x^2 - 3x$ for values of x from -2 to 3



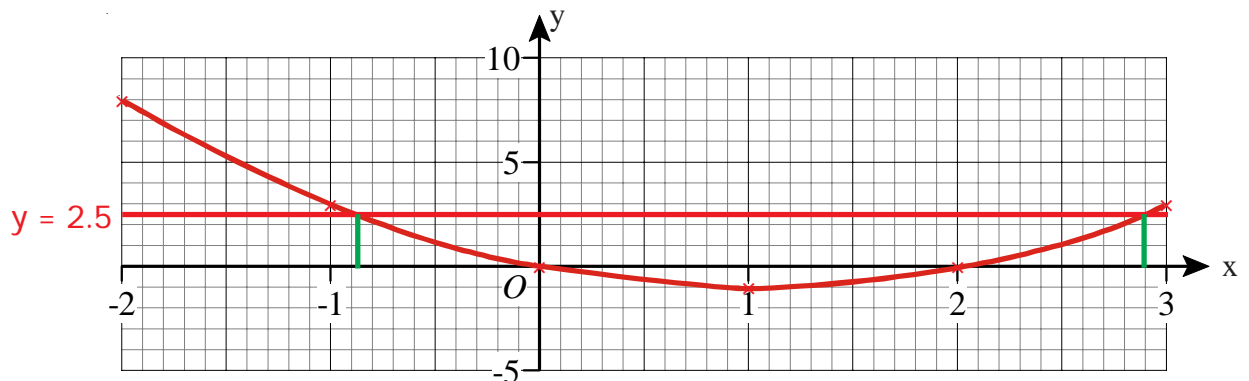
c) Use the graph to find the value of y when $x = -1.5$ $y = 9$

d) Use the graph to find the values of x when $y = 4$ $x = -0.85$ or $x = 2.33$

2) a) Complete the table of values for $y = x^2 - 2x$

x	-2	-1	0	1	2	3
y	8	3	0	-1	0	3

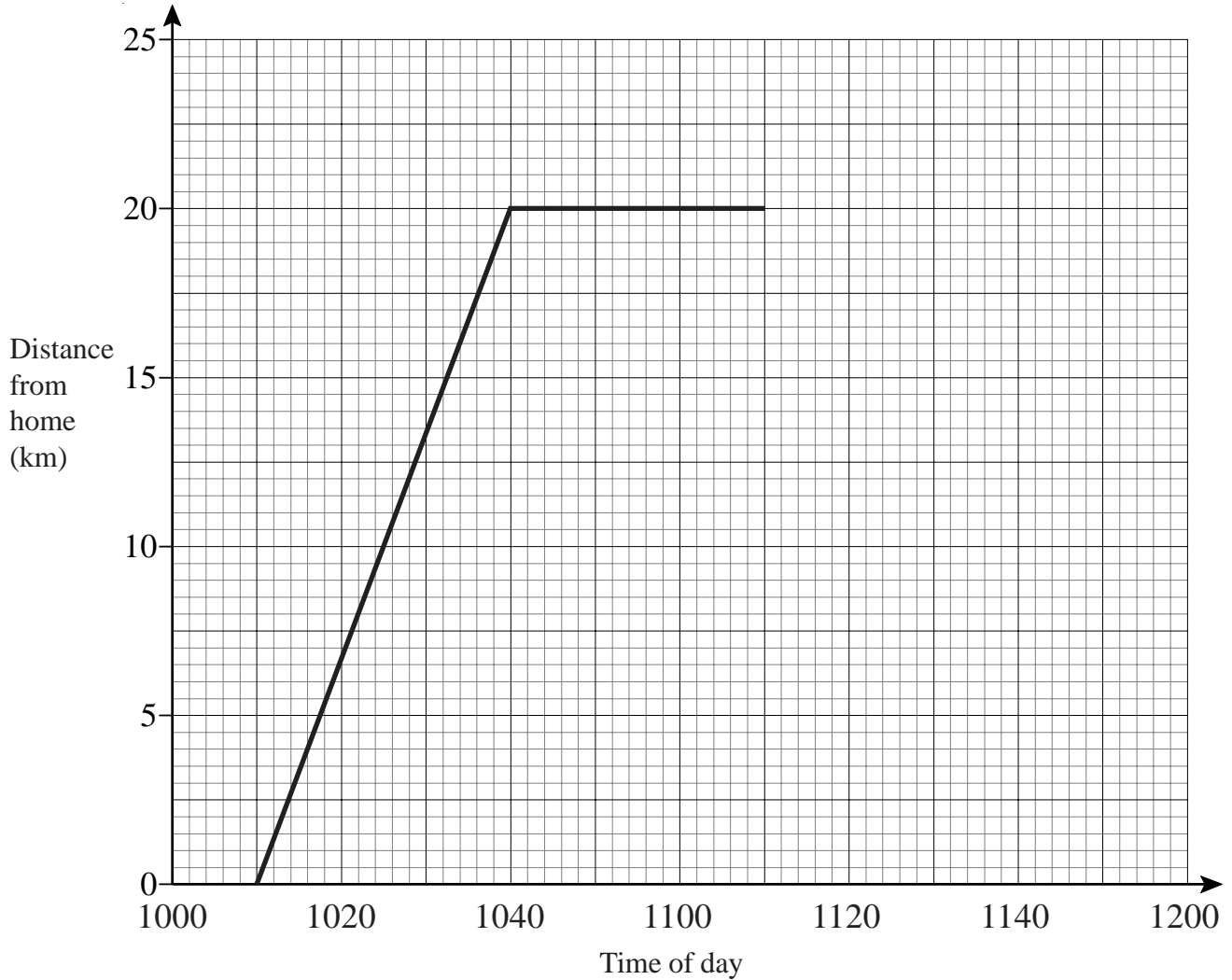
b) On the grid, draw the graph of $y = x^2 - 2x$ for values of x from -2 to 3



c) (i) On the same axes draw the straight line $y = 2.5$

(ii) Write down the values of x for which $x^2 - 2x = 2.5$ $x = -0.89$ or $x = 2.9$

- 1) Sarah travelled 20 km from home to her friend's house. She stayed at her friend's house for some time before returning home. Here is the travel graph for part of Sarah's journey.



- a) At what time did Sarah leave home?
- b) How far was Sarah from home at 1030?

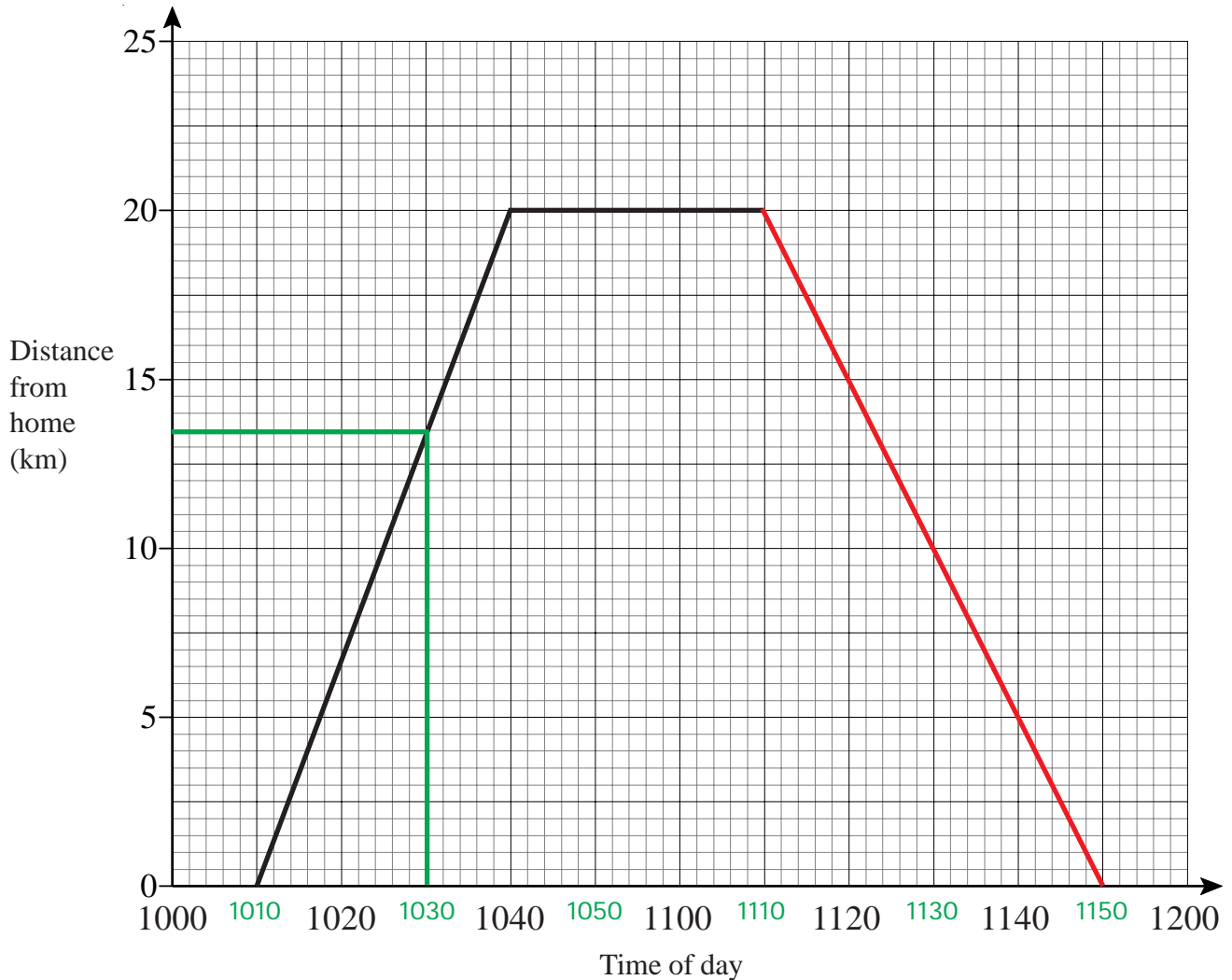
Sarah left her friend's house at 11 10 to return home.

- c) Work out the time in minutes Sarah spent at her friend's house.

Sarah returned home at a steady speed. She arrived home at 11 50

- d) Complete the travel graph.
- e) Work out Sarah's average speed on her journey from her home to her friend's house. Give your answer in kilometres per hour.
- f) Work out Sarah's average speed on her journey home from her friend's house. Give your answer in kilometres per hour.

- 1) Sarah travelled 20 km from home to her friend's house. She stayed at her friend's house for some time before returning home. Here is the travel graph for part of Sarah's journey.



a) At what time did Sarah leave home? **10 10**

b) How far was Sarah from home at 10 30? **13.5 km**

Sarah left her friend's house at 11 10 to return home.

c) Work out the time in minutes Sarah spent at her friend's house. **30 minutes**

Sarah returned home at a steady speed.

She arrived home at 11 50

d) Complete the travel graph.

e) Work out Sarah's average speed on her journey from her home to her friend's house.

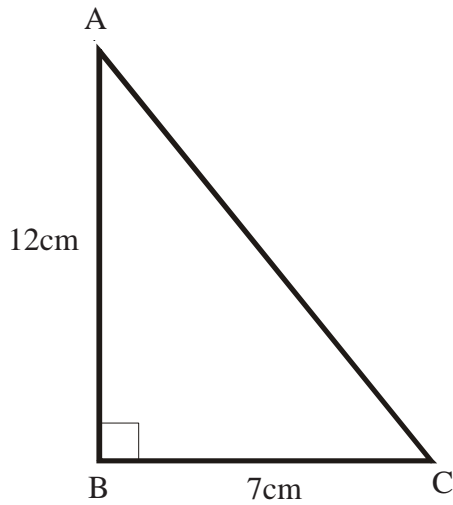
Give your answer in kilometres per hour. **40km/h**

f) Work out Sarah's average speed on her journey home from her friend's house.

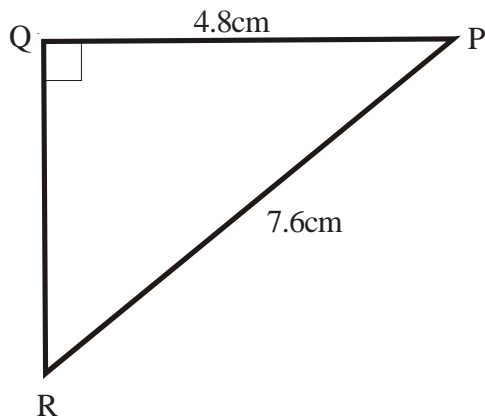
Give your answer in kilometres per hour. **30km/h**

Pythagoras' Theorem

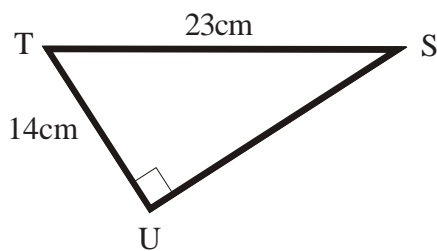
- 1) Find the length of side AC.
Give your answer to 1 decimal place.



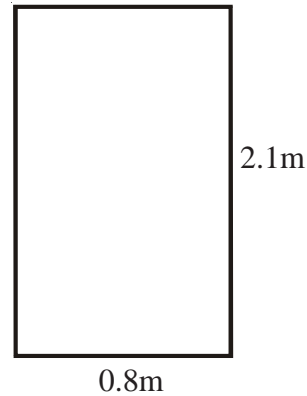
- 2) Find the length of side QR.
Give your answer to 1 decimal place.



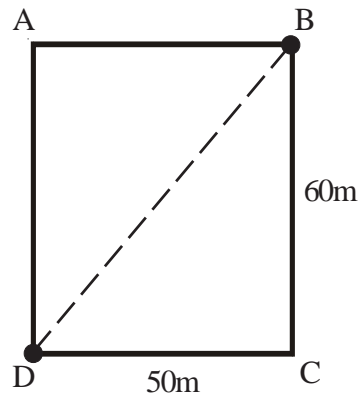
- 3) Find the length of side SU.
Give your answer to 1 decimal place.



- 4) Below is a picture of a doorway.
Find the size of the diagonal of the doorway.
Give your answer to 1 decimal place.

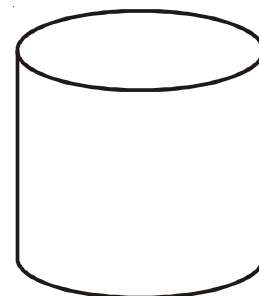


- 5) In the sketch of the rectangular field, below, James wants to walk from B to D.



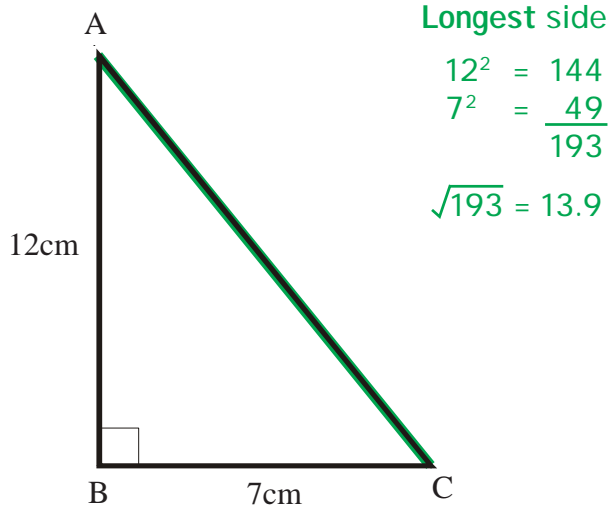
Which of the following routes is shorter and by how much?
From B to C to D or straight across the field from B to D.
Give your answer to the nearest metre.

- 6) Fiona keeps her pencils in a cylindrical beaker as shown below.
The beaker has a diameter of 8cm and a height of 17cm.
Will a pencil of length 19cm fit in the beaker without poking out of the top?
All workings must be shown.

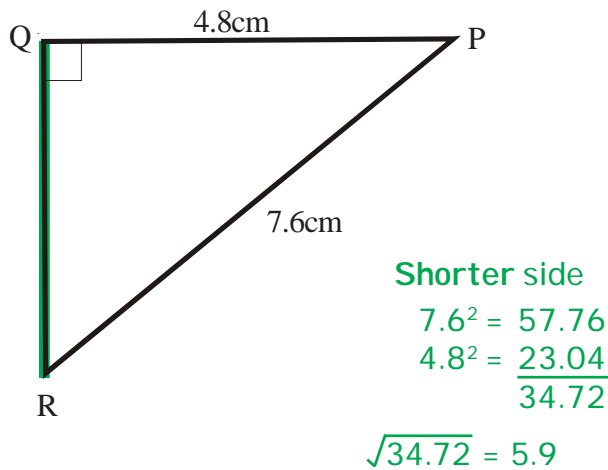


Pythagoras' Theorem

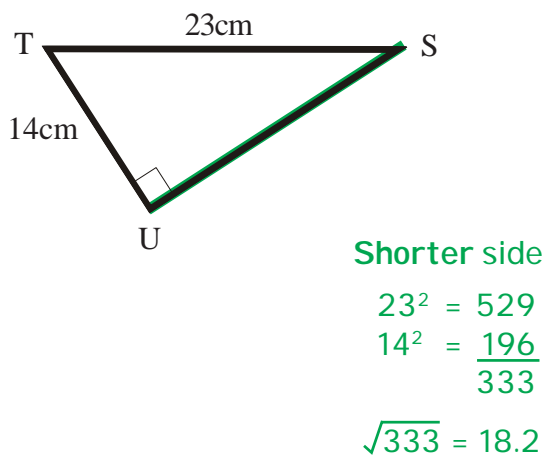
- 1) Find the length of side AC. **13.9cm**
Give your answer to 1 decimal place.



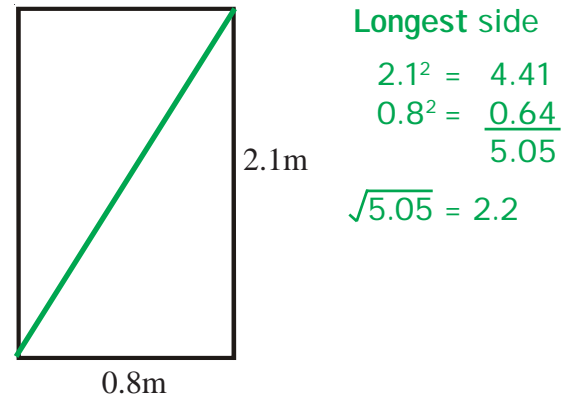
- 2) Find the length of side QR. **5.9cm**
Give your answer to 1 decimal place.



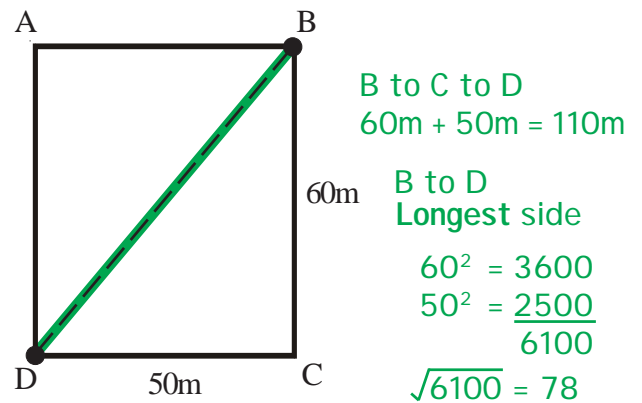
- 3) Find the length of side SU. **18.2cm**
Give your answer to 1 decimal place.



- 4) Below is a picture of a doorway. **2.2m**
Find the size of the diagonal of the doorway.
Give your answer to 1 decimal place.

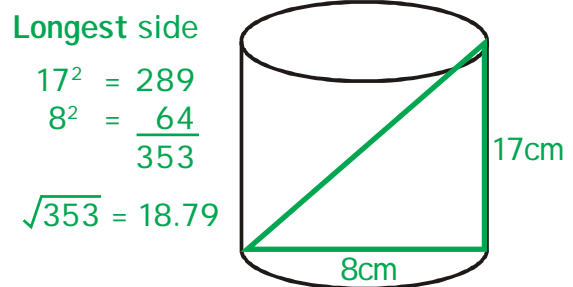


- 5) In the sketch of the rectangular field, below, James wants to walk from B to D.

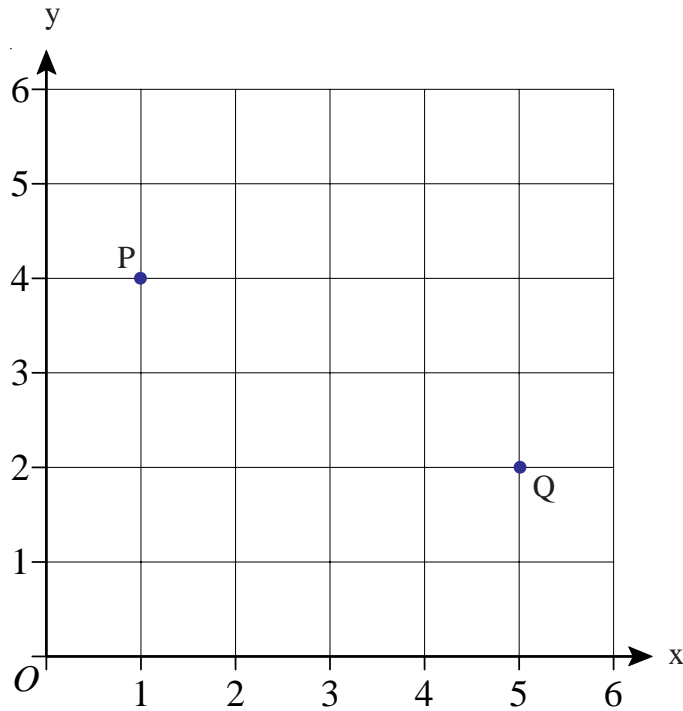


Which of the following routes is shorter and by how much? **B to D by 32m**
From B to C to D or straight across the field from B to D. $110\text{m} - 78\text{m} = 32\text{m}$
Give your answer to the nearest metre.

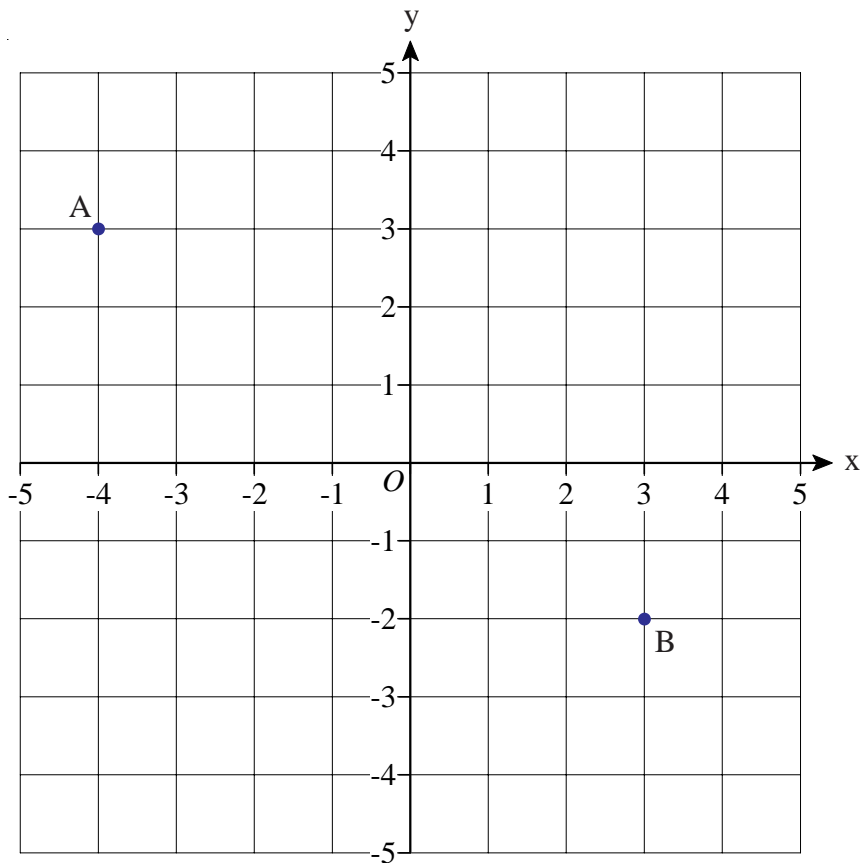
- 6) Fiona keeps her pencils in a cylindrical beaker as shown below.
The beaker has a diameter of 8cm and a height of 17cm.
Will a pencil of length 19cm fit in the beaker without poking out of the top? **No. The diagonal is only 18.8cm.**
All workings must be shown.



- 1) Points P and Q have coordinates (1, 4) and (5, 2).
Calculate the shortest distance between P and Q.
Give your answer correct to 1 decimal place.

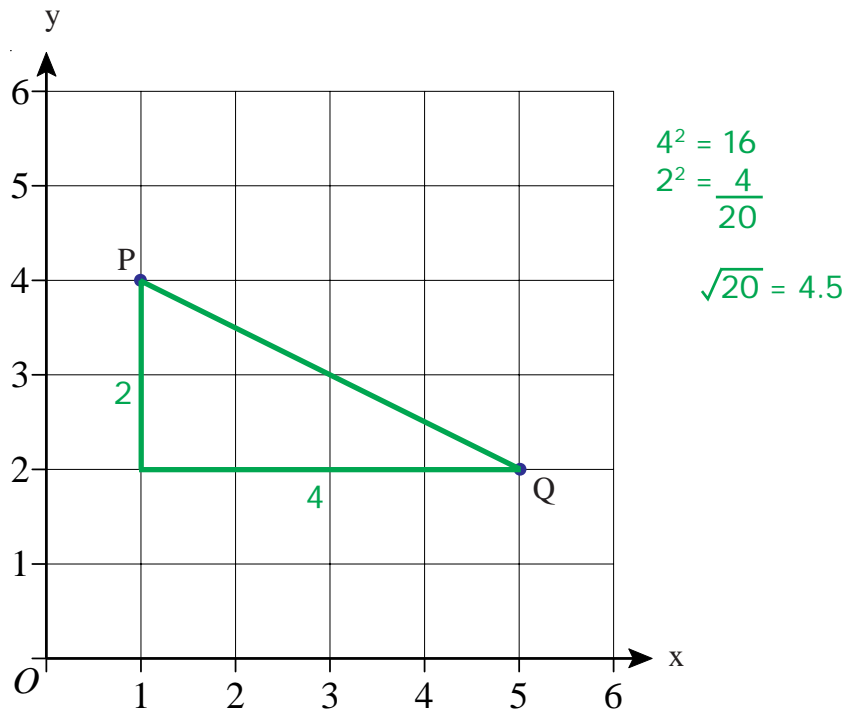


- 2) Points A and B have coordinates (-4, 3) and (3, -2).
Calculate the shortest distance between A and B.
Give your answer correct to 1 decimal place.

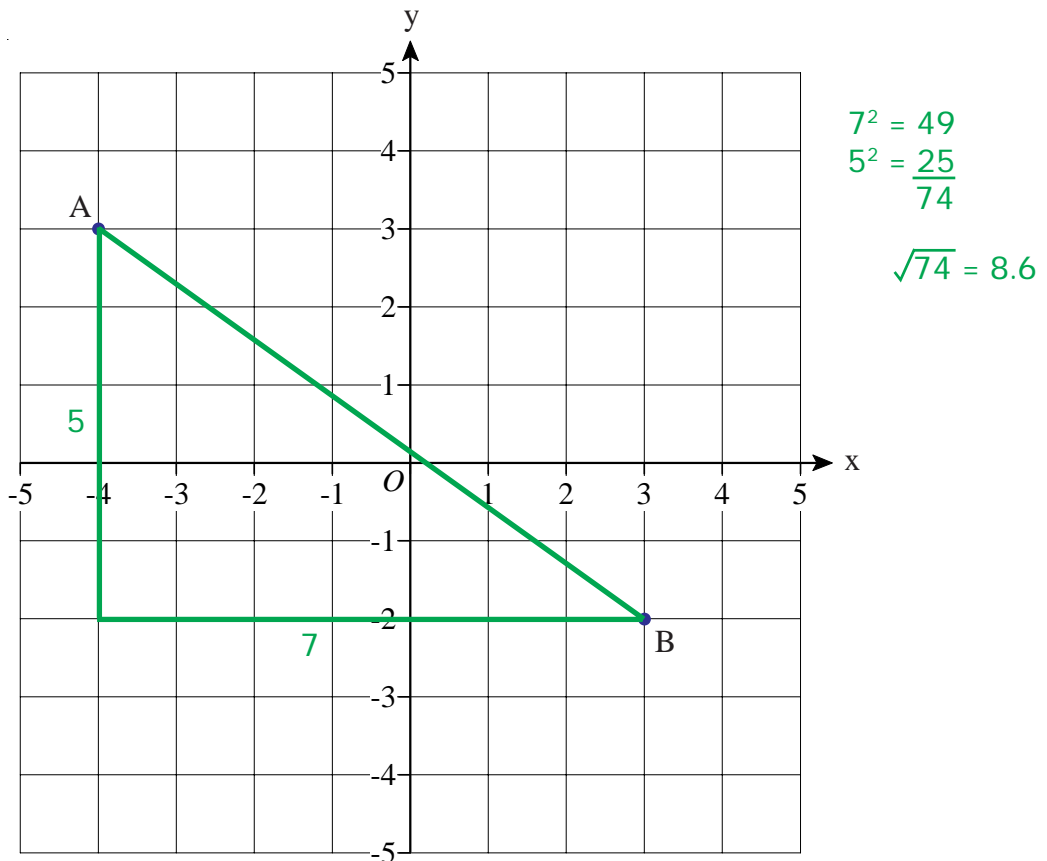


Pythagoras - Line on a Graph

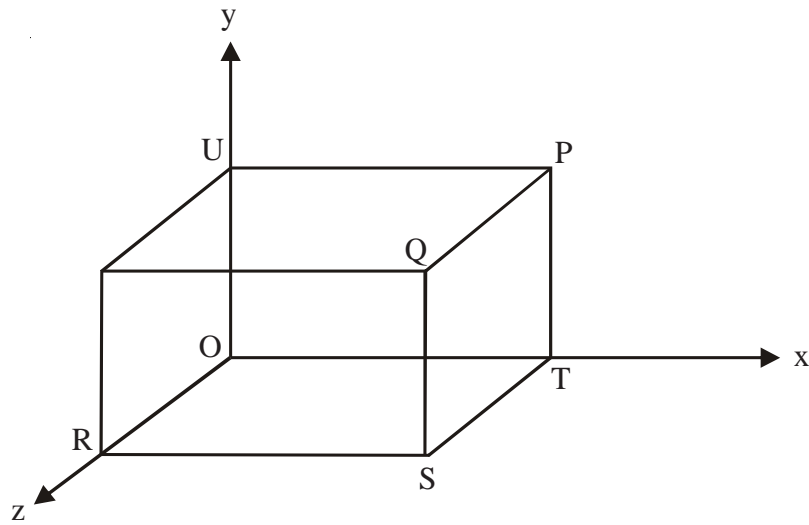
- 1) Points P and Q have coordinates (1, 4) and (5, 2).
Calculate the shortest distance between P and Q.
Give your answer correct to 1 decimal place. **4.5**



- 2) Points A and B have coordinates (-4, 3) and (3, -2).
Calculate the shortest distance between A and B.
Give your answer correct to 1 decimal place. **8.6**



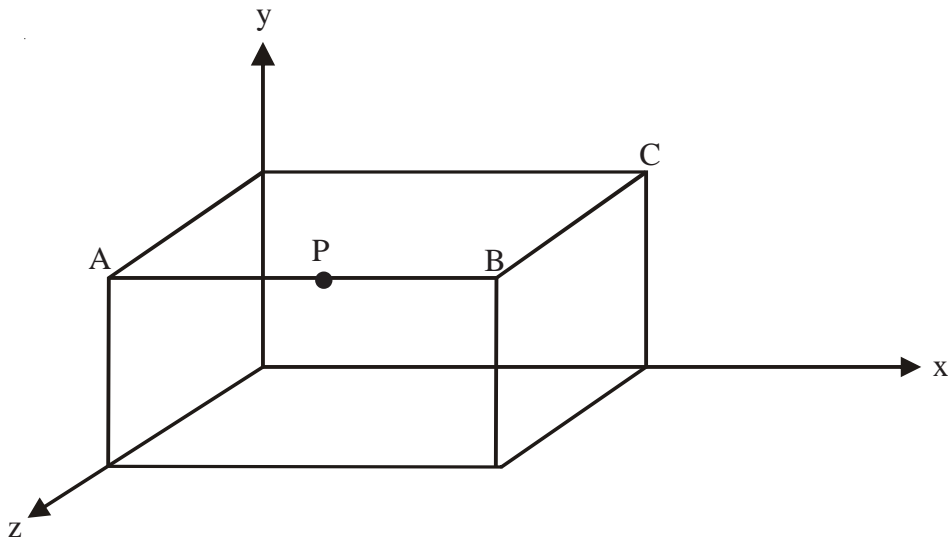
- 1) A cuboid lies on the coordinate axes.



The point Q has coordinates $(5, 3, 4)$

- Write down the coordinates of the point P
- Write down the coordinates of the point T
- Write down the coordinates of the point S
- Write down the coordinates of the point R
- Write down the coordinates of the point U

- 2) A cuboid lies on the coordinate axes.

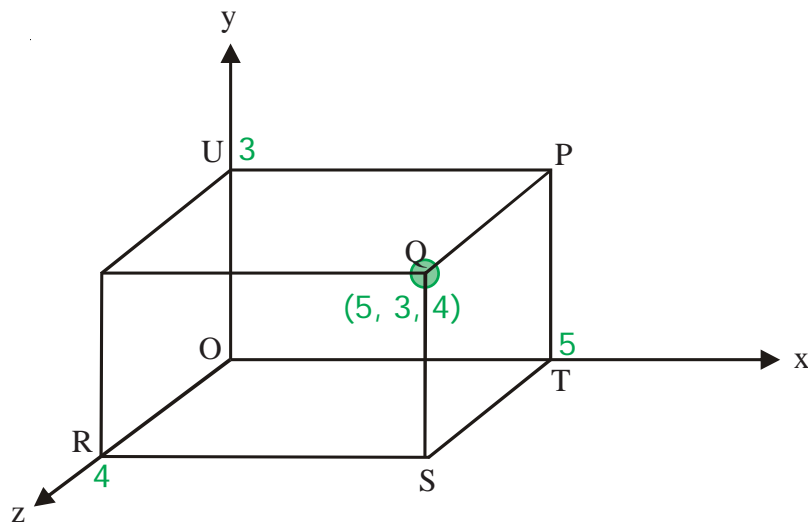


Point P lies half way between A and B and has coordinates $(3, 4, 5)$

- Write down the coordinates of B.
- Write down the coordinates of C.

Coordinates in 3 Dimensions

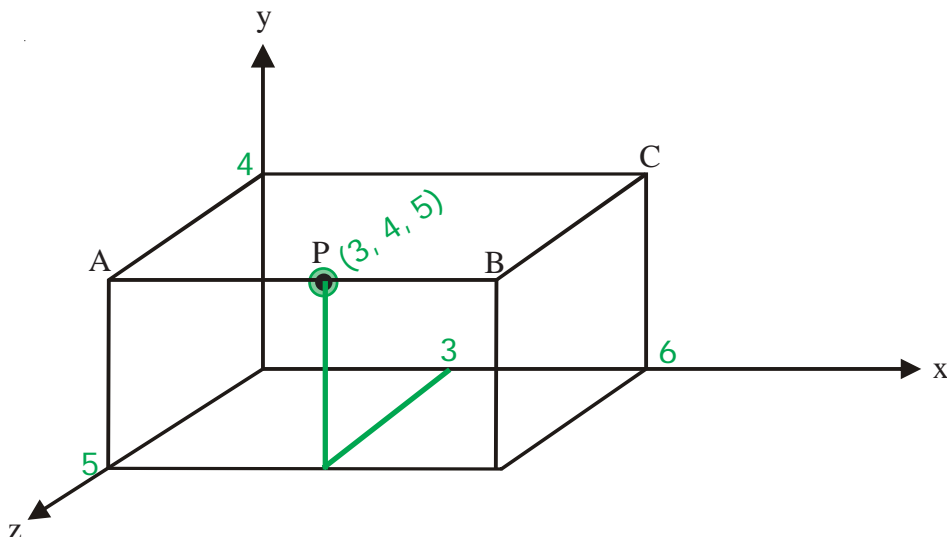
- 1) A cuboid lies on the coordinate axes.



The point Q has coordinates $(5, 3, 4)$

- Write down the coordinates of the point P $(5, 3, 0)$
- Write down the coordinates of the point T $(5, 0, 0)$
- Write down the coordinates of the point S $(5, 0, 4)$
- Write down the coordinates of the point R $(0, 0, 4)$
- Write down the coordinates of the point U $(0, 3, 0)$

- 2) A cuboid lies on the coordinate axes.



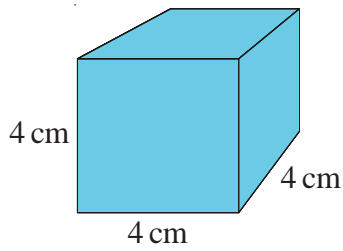
Point P lies half way between A and B and has coordinates $(3, 4, 5)$

- Write down the coordinates of B. $(6, 4, 5)$
- Write down the coordinates of C. $(6, 4, 0)$

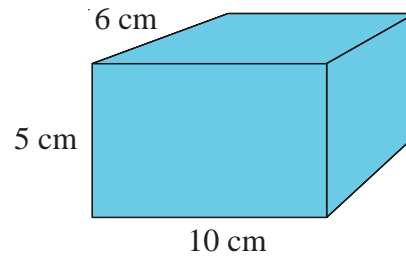
Surface Area of Cuboids

- 1) Find the surface area of this cube and cuboid.

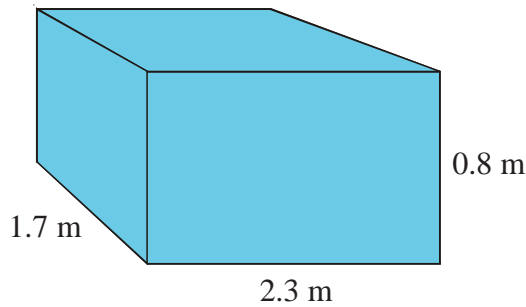
Cube



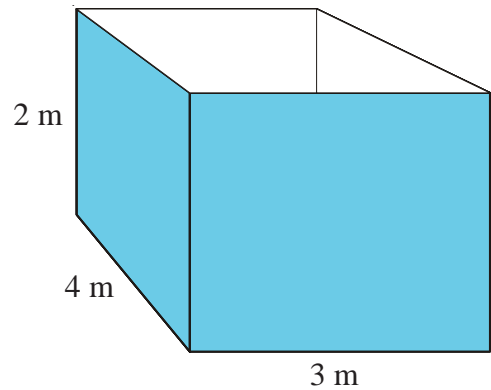
Cuboid



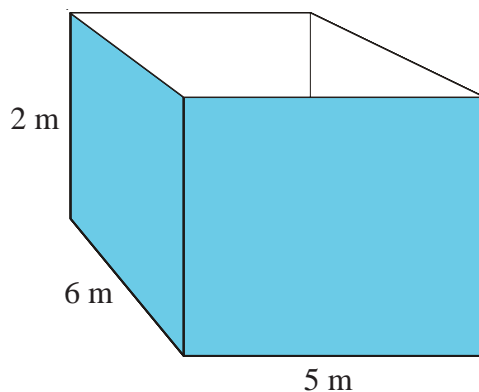
- 2) Find the surface area of this cuboid.



- 3) A water tank measures 2 m by 3 m by 4 m.
It has no top.
The outside of the tank, including the base, has to be painted.
Calculate the surface area which will be painted.

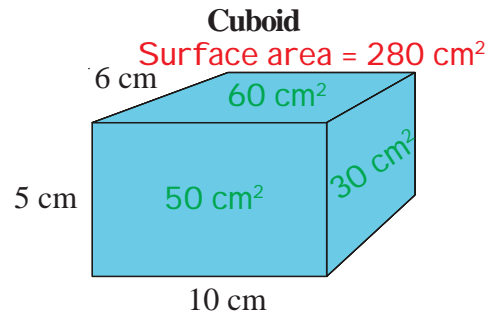
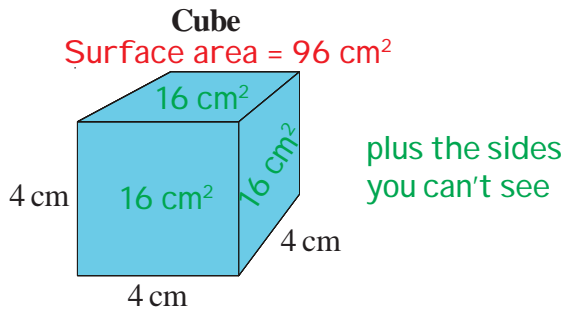


- 4) A water tank measures 2 m by 5 m by 6 m.
It has no top.
The outside of the tank, including the base, has to be painted.
A litre of paint will cover an area of 4.3 m^2 .
Paint is sold in 5 litre tins and each tin costs £13.50.
How much will it cost to paint the tank?
You must show all your working.

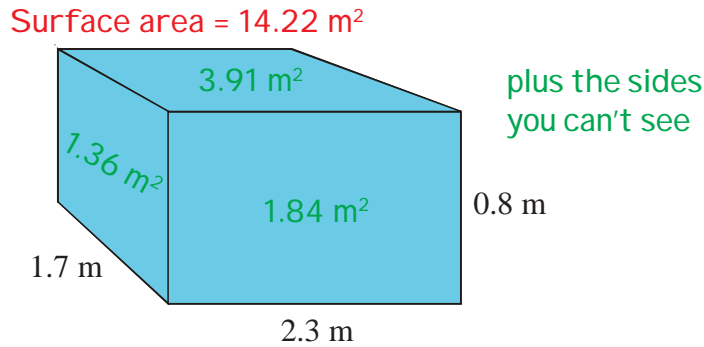


Surface Area of Cuboids

- 1) Find the surface area of this cube and cuboid.

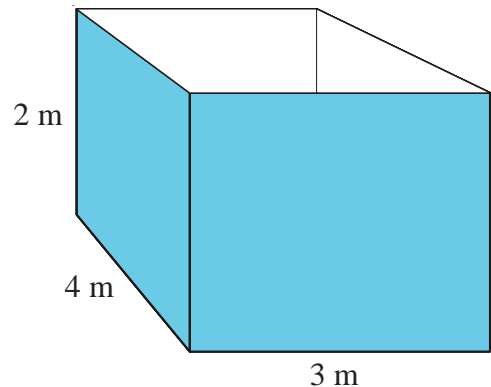


- 2) Find the surface area of this cuboid.

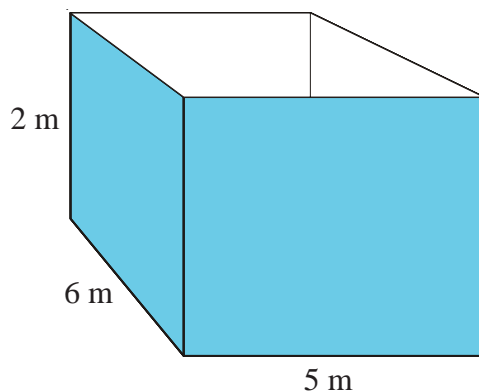


- 3) A water tank measures 2 m by 3 m by 4 m.
It has no top.
The outside of the tank, including the base, has to be painted.
Calculate the surface area which will be painted.

Surface area = 40 m^2



- 4) A water tank measures 2 m by 5 m by 6 m.
It has no top.
The outside of the tank, including the base, has to be painted.
A litre of paint will cover an area of 4.3 m^2 .
Paint is sold in 5 litre tins and each tin costs £13.50.
How much will it cost to paint the tank? **£54**
You must show all your working.



Surface area to be painted:

$$5 \times 2 = 10 \text{ m}^2$$

$$5 \times 2 = 10 \text{ m}^2$$

$$6 \times 2 = 12 \text{ m}^2 \quad \mathbf{74 \text{ m}^2 \text{ in total}}$$

$$6 \times 2 = 12 \text{ m}^2$$

$$6 \times 5 = 30 \text{ m}^2$$

Litres of paint needed:

$$74 \div 4.3 = 17.2 \text{ litres}$$

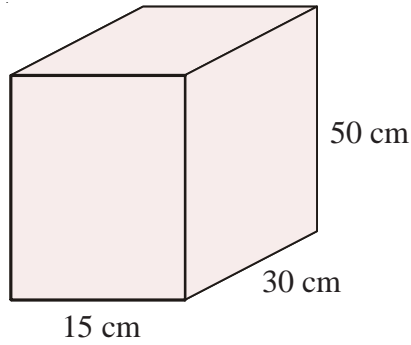
3 tins is only 15 litres
so 4 tins must be bought.

$$4 \times \text{£}13.50 = \text{£}54$$

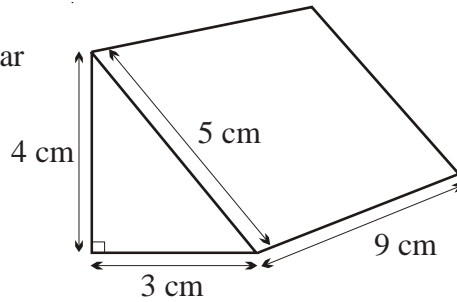
Volume of a Prism

- 1) The diagram shows a cuboid.

Work out the volume of the cuboid.



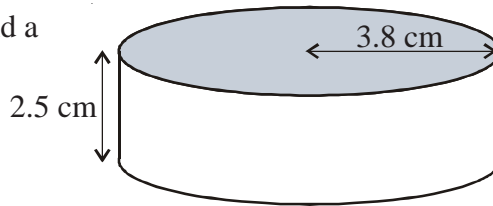
- 2) Calculate the volume of this triangular prism.



- 3) An ice hockey puck is in the shape of a cylinder with a radius of 3.8 cm and a thickness of 2.5 cm.

Take π to be 3.14

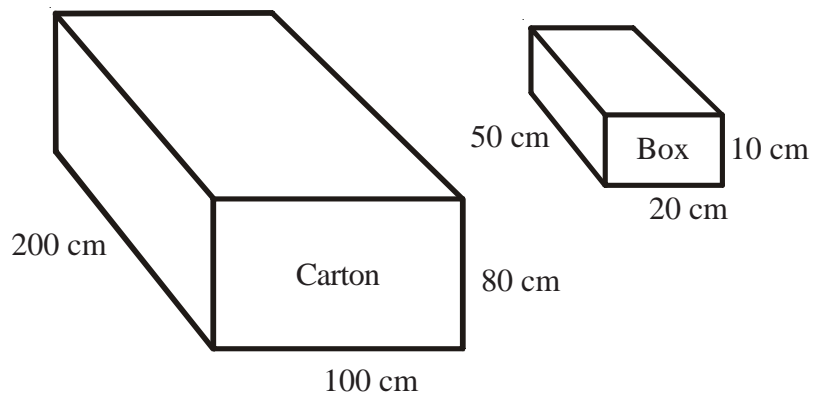
Work out the volume of the puck.



- 4) A cuboid has: a volume of 80cm^3
a length of 5 cm
a width of 2 cm

Work out the height of the cuboid.

- 5) Work out the maximum number of boxes which can fit in the carton.

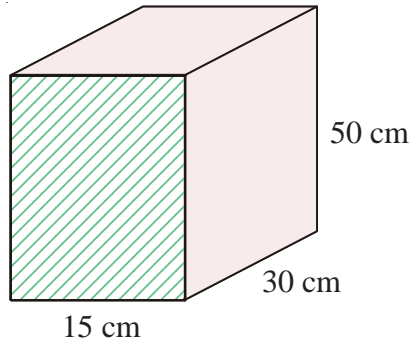


Volume of a Prism

- 1) The diagram shows a cuboid.

Work out the volume of the cuboid.

$V = 22500 \text{ cm}^3$

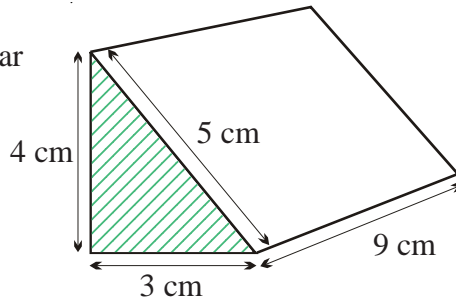


$A = L \times H$
 $A = 15 \times 50$
 $A = 750 \text{ cm}^2$

$V = A \times L$
 $V = 750 \times 30$

- 2) Calculate the volume of this triangular prism.

$V = 54 \text{ cm}^3$



$A = \frac{b \times h}{2}$

$A = \frac{3 \times 4}{2}$

$A = 6 \text{ cm}^2$

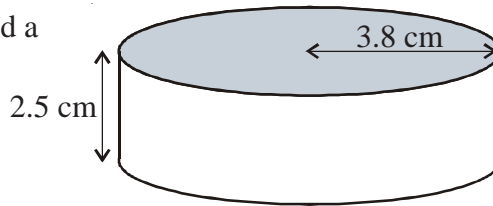
$V = A \times L$
 $V = 6 \times 9$

- 3) An ice hockey puck is in the shape of a cylinder with a radius of 3.8 cm and a thickness of 2.5 cm.

Take π to be 3.14

Work out the volume of the puck.

$V = 113.354 \text{ cm}^3$



$A = \pi r^2$
 $A = 3.14 \times 3.8^2$
 $A = 45.3416 \text{ cm}^2$

$V = A \times L$
 $V = 45.3416 \times 2.5$

- 4) A cuboid has: a volume of 80 cm^3
 a length of 5 cm
 a width of 2 cm

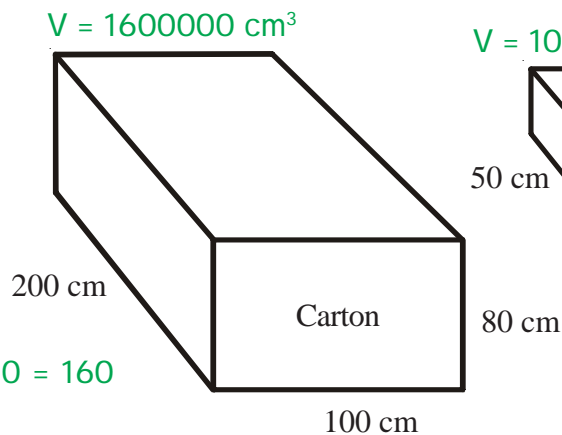
$80 \div 5 \div 2$

Work out the height of the cuboid.

$H = 8 \text{ cm}$

- 5) Work out the maximum number of boxes which can fit in the carton.

160 boxes will fit.



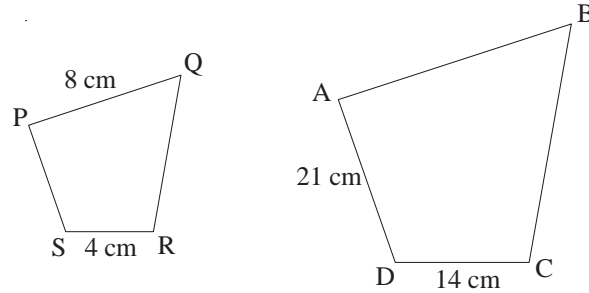
$V = 1600000 \text{ cm}^3$

$V = 10000 \text{ cm}^3$

$1600000 \div 10000 = 160$

Similar Shapes

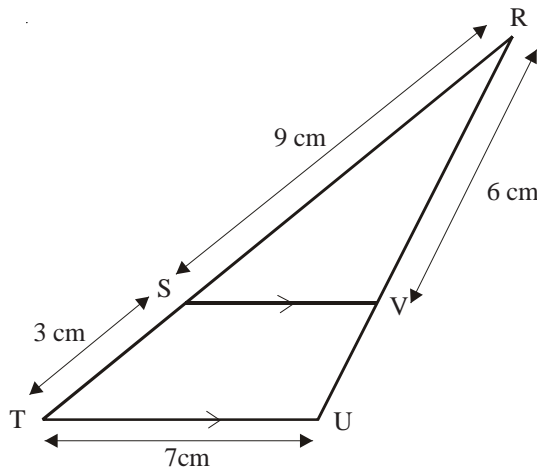
- 1) The diagram shows two quadrilaterals that are mathematically **similar**.



- Calculate the length of AB
- Calculate the length of PS

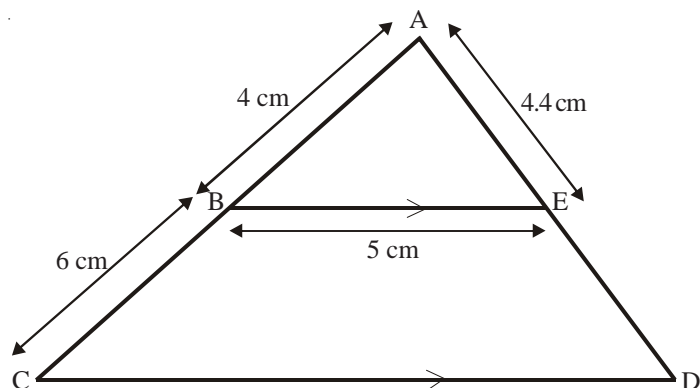
- 2) SV is parallel to TU.
 RST and RVU are straight lines.
 RS = 9 cm, ST = 3 cm, TU = 7 cm, RV = 6 cm

Calculate the length of VU.



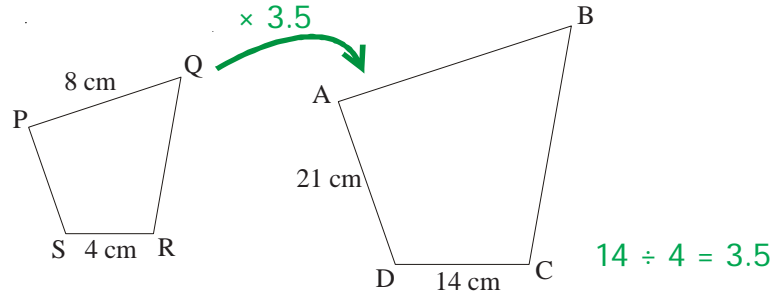
- 3) BE is parallel to CD.
 ABC and AED are straight lines.
 AB = 4 cm, BC = 6 cm, BE = 5 cm, AE = 4.4 cm

- Calculate the length of CD.
- Calculate the length of ED.



Similar Shapes

1) The diagram shows two quadrilaterals that are mathematically **similar**.



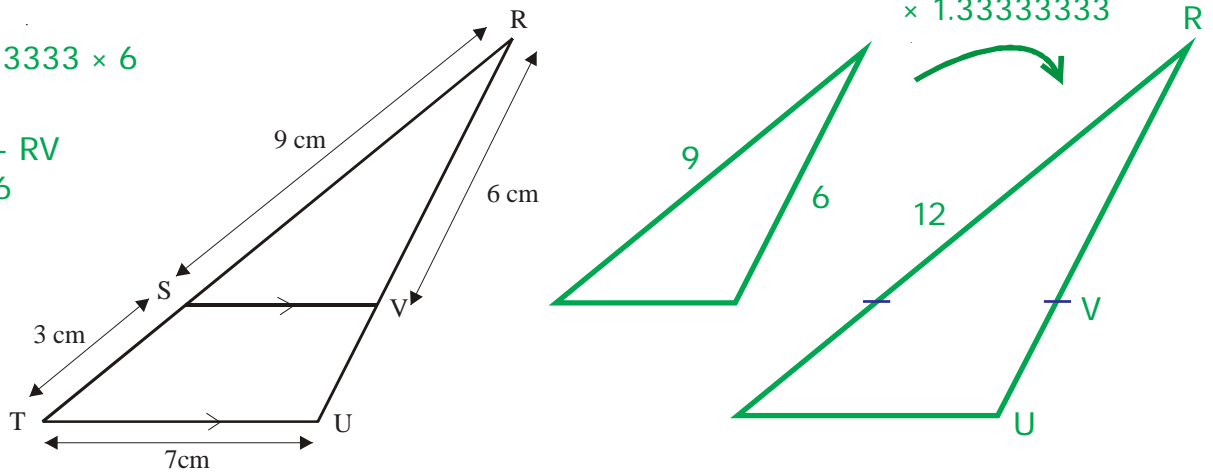
- a) Calculate the length of AB **28 cm** $AB = PQ \times 3.5$
 b) Calculate the length of PS **6 cm** $PS = AD \div 3.5$

2) SV is parallel to TU.
 RST and RVU are straight lines.
 RS = 9 cm, ST = 3 cm, TU = 7 cm, RV = 6 cm

$12 \div 9 = 1.33333333$

Calculate the length of VU. **2 cm**

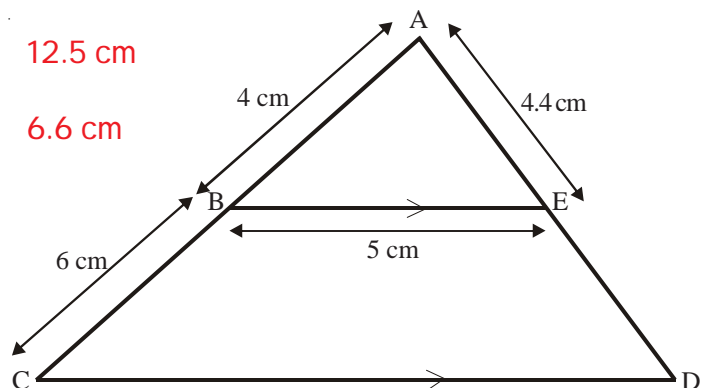
$RU = 1.333333 \times 6$
 $RU = 8$
 $VU = RU - RV$
 $VU = 8 - 6$



3) BE is parallel to CD.
 ABC and AED are straight lines.
 AB = 4 cm, BC = 6 cm, BE = 5 cm, AE = 4.4 cm

Scale factor = 2.5 $(10 \div 4)$

- a) Calculate the length of CD. **12.5 cm**
 b) Calculate the length of ED. **6.6 cm**



- 1) The table shows some expressions.
The letters a , b , c and d represent lengths.
 π and 3 are numbers that have no dimensions.

Underneath each one write

L if it is a length

A if it is an area

V if it is a volume

N if it is none of the above.

$\frac{\pi abc}{3d}$	πa^3	$3a^2$	$\pi a^2 + b$	$\pi(a + b)$	$3(c^2 + d^2)$	$3ad^2$

- 2) The table shows some expressions.
The letters a , b , c and d represent lengths.
 π and 2 are numbers that have no dimensions.

Underneath each one write

L if it is a length

A if it is an area

V if it is a volume

N if it is none of the above.

$2a^2$	$\frac{\pi ab^3}{2d}$	πbc	$ac + bd$	$\pi d(a + b)$	$2(c + d)^3$	$2\pi bc^2$

- 1) The table shows some expressions.
The letters a, b, c and d represent lengths.
 π and 3 are numbers that have no dimensions.

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L if it is a length

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$\frac{\pi abc}{3d}$	πa^3	$3a^2$	$\pi a^2 + b$	$\pi(a + b)$	$3(c^2 + d^2)$	$3ad^2$
A	V	A	N	L	A	V

- 2) The table shows some expressions.
The letters a, b, c and d represent lengths.
 π and 2 are numbers that have no dimensions.

Underneath each one write

L if it is a length

A if it is an area

V if it is a volume

N if it is none of the above.

$2a^2$	$\frac{\pi ab^3}{2d}$	πbc	$ac + bd$	$\pi d(a + b)$	$2(c + d)^3$	$2\pi bc^2$
A	V	A	A	A	V	V

1. A silver necklace has a mass of 123 grams, correct to the nearest gram.
 - a) Write down the least possible mass of the necklace.

 - b) Write down the greatest possible mass of the necklace.

2. Each of these measurements was made correct to one decimal place.
Write the maximum and minimum possible measurement in each case.
 - a) 4.6 cm
 - b) 0.8 kg
 - c) 12.5 litres
 - d) 25.0 km/h

 - e) 10.3 s
 - f) 36.1 m
 - g) 136.7 m/s
 - h) 0.1 g

3. Each side of a regular octagon has a length of 20.6 cm, correct to the nearest millimetre.
 - a) Write down the least possible length of each side.

 - b) Write down the greatest possible length of each side.

 - c) Write down the greatest possible perimeter of the octagon.

4. A girl has a pencil that is of length 12 cm, measured to the nearest centimetre.
Her pencil case has a diagonal of length 12.3 cm, measured to the nearest millimetre.
Explain why it might not be possible for her to fit the pen in the pencil case.

5. A square has sides of length 7 cm, correct to the nearest centimetre.
 - a) Calculate the lower bound for the perimeter of the square.

 - b) Calculate the upper bound for the area of the square.

1. A silver necklace has a mass of 123 grams, correct to the nearest gram.

- a) Write down the least possible mass of the necklace. **122.5 g**
- b) Write down the greatest possible mass of the necklace. **123.5 g**

2. Each of these measurements was made correct to one decimal place.

Write the maximum and minimum possible measurement in each case.

- | | | | |
|--------------|--------------|-----------------|-----------------|
| a) 4.6 cm | b) 0.8 kg | c) 12.5 litres | d) 25.0 km/h |
| max: 4.65 cm | max: 0.85 kg | max: 12.55 L | max: 25.05 km/h |
| min: 4.55 cm | min: 0.75 kg | min: 12.45 L | min: 24.95 km/h |
| e) 10.3 s | f) 36.1 m | g) 136.7 m/s | h) 0.1 g |
| max: 10.35 s | max: 36.15 m | max: 136.75 m/s | max: 0.15 g |
| min: 10.25 s | min: 36.05 m | min: 136.65 m/s | min: 0.05 g |

3. Each side of a regular octagon has a length of 20.6 cm, correct to the nearest millimetre.

- a) Write down the least possible length of each side. **20.55 cm**
- b) Write down the greatest possible length of each side. **20.65 cm**
- c) Write down the greatest possible perimeter of the octagon. **165.2 cm**

4. A girl has a pencil that is of length 12 cm, measured to the nearest centimetre.

Her pencil case has a diagonal of length 12.3 cm, measured to the nearest millimetre.

Explain why it might not be possible for her to fit the pen in the pencil case.

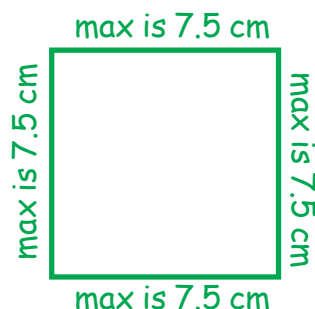
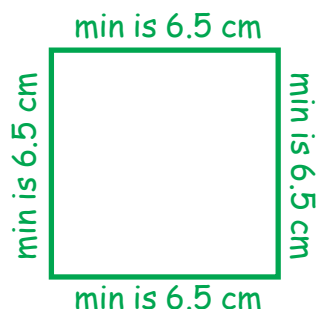
12 cm to the nearest cm has a maximum possible length of 12.5 cm.

12.3 cm to the nearest mm has a minimum possible length of 12.25 cm.

A 12.5 cm pencil won't fit into a pencil case with a diagonal length of 12.25 cm.

5. A square has sides of length 7 cm, correct to the nearest centimetre.

- a) Calculate the lower bound for the perimeter of the square. **26 cm** **$6.5 + 6.5 + 6.5 + 6.5$**
- b) Calculate the upper bound for the area of the square. **56.25 cm^2** **7.5×7.5**



- 1) Jane runs 200 metres in 21.4 seconds.
Work out Jane's average speed in metres per second.
Give your answer correct to 1 decimal place.

 - 2) A car travels at a steady speed and takes five hours to travel 310 miles.
Work out the average speed of the car in miles per hour.

 - 3) A plane flies 1440 miles at a speed of 240 mph.
How long does it take?

 - 4) A marathon runner runs at 7.6 mph for three and a half hours.
How many miles has he run?

 - 5) A car takes 15 minutes to travel 24 miles.
Find its speed in **mph**.

 - 6) A cyclist takes 10 minutes to travel 2.4 miles.
Calculate the average speed in mph.
-
- 7) An ice hockey puck has a volume of 113 cm^3 .
It is made out of rubber with a density of $1.5 \text{ grams per cm}^3$.
Work out the mass of the ice hockey puck.

 - 8) An apple has a mass of 160 g and a volume of 100 cm^3 .
Find its density in g/cm^3 .

 - 9) A steel ball has a volume of 1500 cm^3 .
The density of the ball is 95 g/cm^3 .
Find the mass of the ball in kg.

 - 10) The mass of a bar of chocolate is 1800 g.
The density of the chocolate is 9 g/cm^3 .
What is the volume of the bar of chocolate?

- 1) Jane runs 200 metres in 21.4 seconds.

Work out Jane's average speed in metres per second.
Give your answer correct to 1 decimal place.

$$S = 9.3 \text{ m/s}$$

$$S = \frac{D}{T}$$

$$S = \frac{200}{21.4}$$

- 2) A car travels at a steady speed and takes five hours to travel 310 miles.

Work out the average speed of the car in miles per hour.

$$S = 62 \text{ mph}$$

$$S = \frac{D}{T}$$

$$S = \frac{310}{5}$$

- 3) A plane flies 1440 miles at a speed of 240 mph.

How long does it take?

$$T = 6 \text{ hours}$$

$$T = \frac{D}{S}$$

$$T = \frac{1440}{240}$$

- 4) A marathon runner runs at 7.6 mph for three and a half hours.

How many miles has he run?

$$D = 26.6 \text{ miles}$$

$$D = S \times T$$

$$D = 7.6 \times 3.5$$

- 5) A car takes 15 minutes to travel 24 miles.

Find its speed in **mph**.

$$S = 96 \text{ mph}$$

$$S = \frac{D}{T} \quad \text{15 mins is 0.25 of an hour}$$

$$S = \frac{24}{0.25}$$

- 6) A cyclist takes 10 minutes to travel 2.4 miles.

Calculate the average speed in mph.

$$S = 14.4 \text{ mph}$$

$$S = \frac{D}{T} \quad \text{10 mins is 0.16 of an hour}$$

$$S = \frac{2.4}{0.16}$$

- 7) An ice hockey puck has a volume of 113 cm³.

It is made out of rubber with a density of 1.5 grams per cm³.

Work out the mass of the ice hockey puck.

$$M = 169.5 \text{ g}$$

$$M = D \times V$$

$$M = 1.5 \times 113$$

- 8) An apple has a mass of 160 g and a volume of 100 cm³.

Find its density in g/cm³.

$$D = 1.6 \text{ g/cm}^3$$

$$D = \frac{M}{V}$$

$$D = \frac{160}{100}$$

- 9) A steel ball has a volume of 1500 cm³.

The density of the ball is 95 g/cm³.

Find the mass of the ball in kg.

$$M = 142.5 \text{ kg}$$

$$M = D \times V$$

$$M = 95 \times 1500$$

$$M = 142\,500$$

- 10) The mass of a bar of chocolate is 1800 g.

The density of the chocolate is 9 g/cm³.

What is the volume of the bar of chocolate?

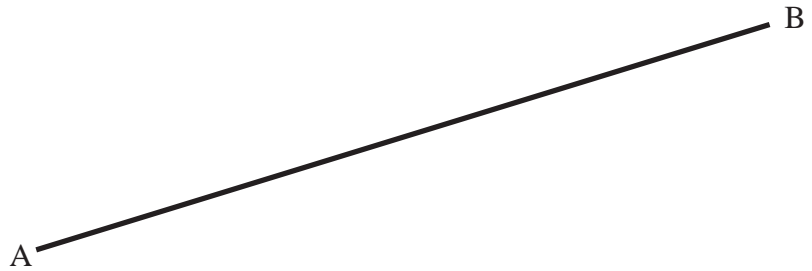
$$V = 200 \text{ cm}^3$$

$$V = \frac{M}{D}$$

$$D = \frac{1800}{9}$$

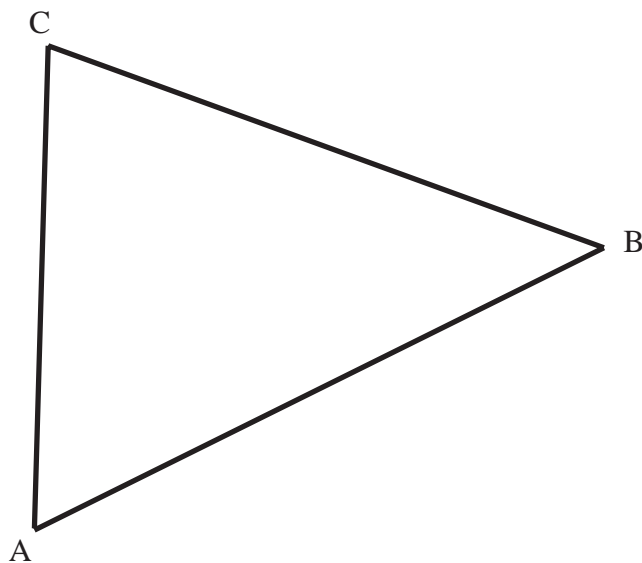
Bisecting a Line

- 1) Using ruler and compasses, bisect line AB.



- 2) Using ruler and compasses
- a) Bisect line AB
 - b) Bisect line BC
 - c) Bisect line AC
 - d) Place your compass point where your three lines cross*

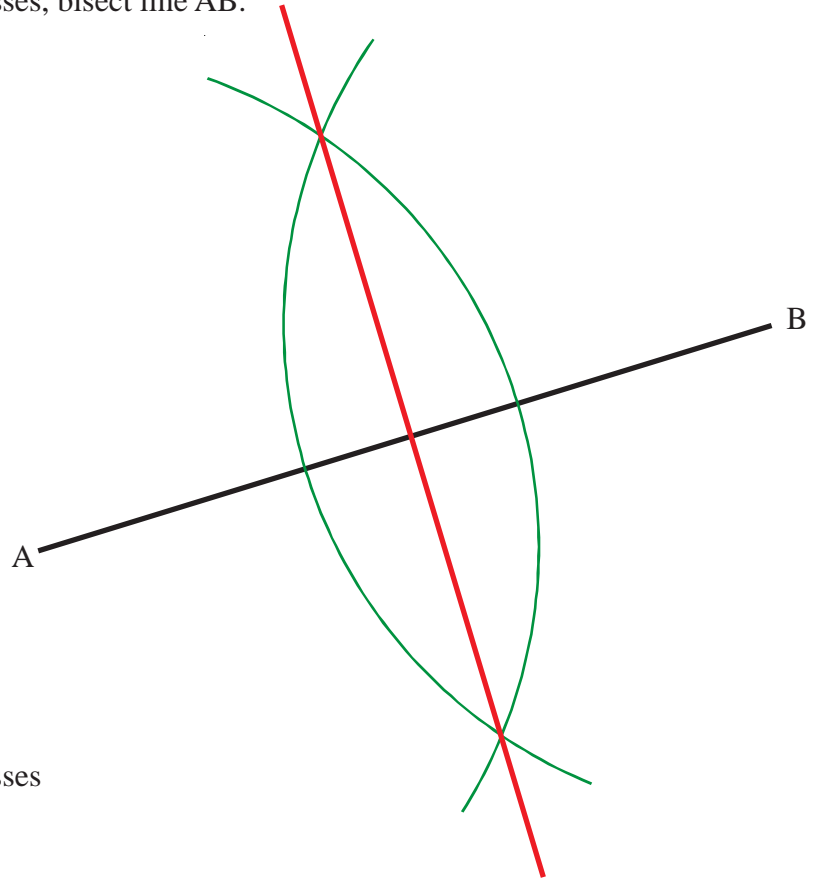
Now open them out until your pencil is touching vertex A.
Draw a circle using this radius.



* If your three lines don't cross at a point then you have a mistake somewhere or just haven't been accurate enough.

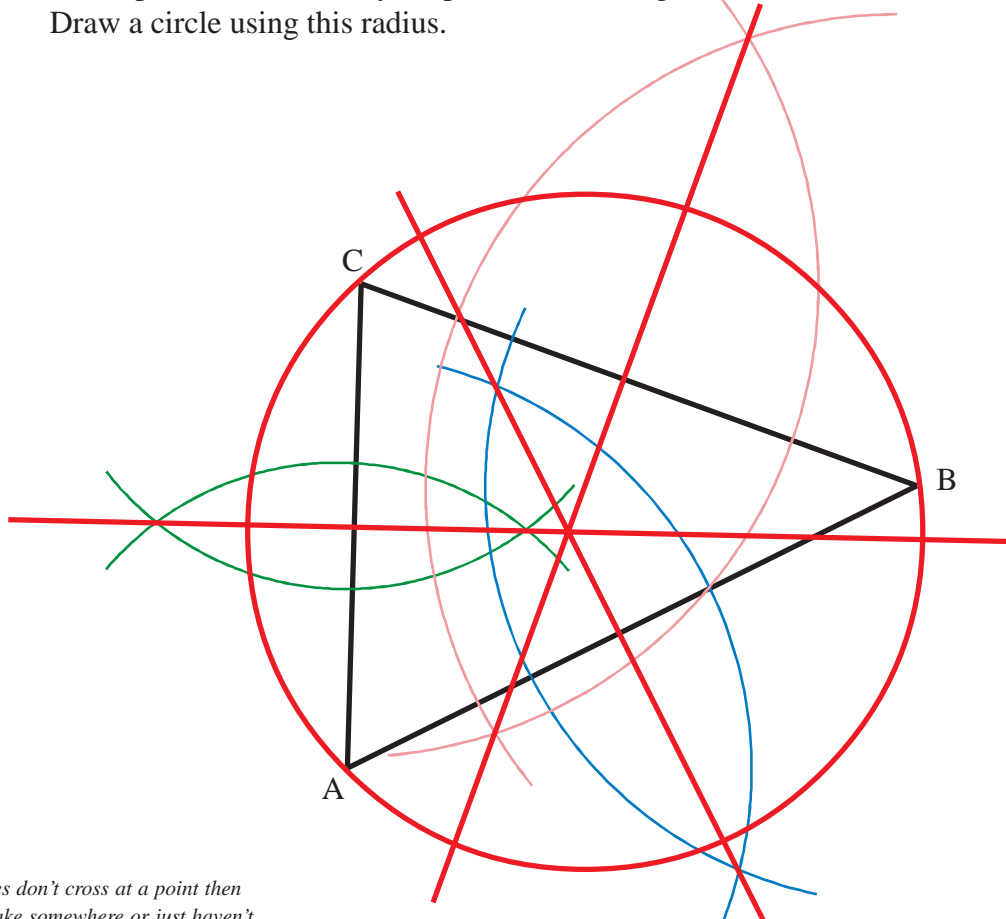
Bisecting a Line

- 1) Using ruler and compasses, bisect line AB.



- 2) Using ruler and compasses

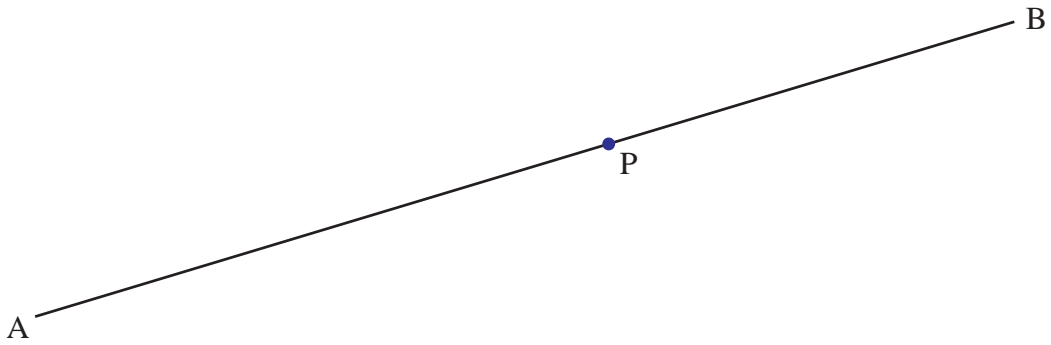
- a) Bisect line AB
- b) Bisect line BC
- c) Bisect line AC
- d) Place your compass point where your three lines cross*
Now open them out until your pencil is touching vertex A.
Draw a circle using this radius.



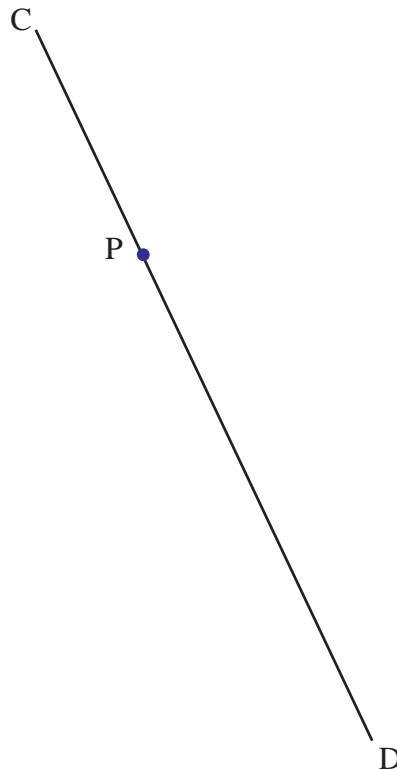
* If your three lines don't cross at a point then you have a mistake somewhere or just haven't been accurate enough.

Drawing a Perpendicular to a Line

- 1) Use ruler and compasses to **construct** the perpendicular to the line segment AB that passes through the point P.
You must show all construction lines.

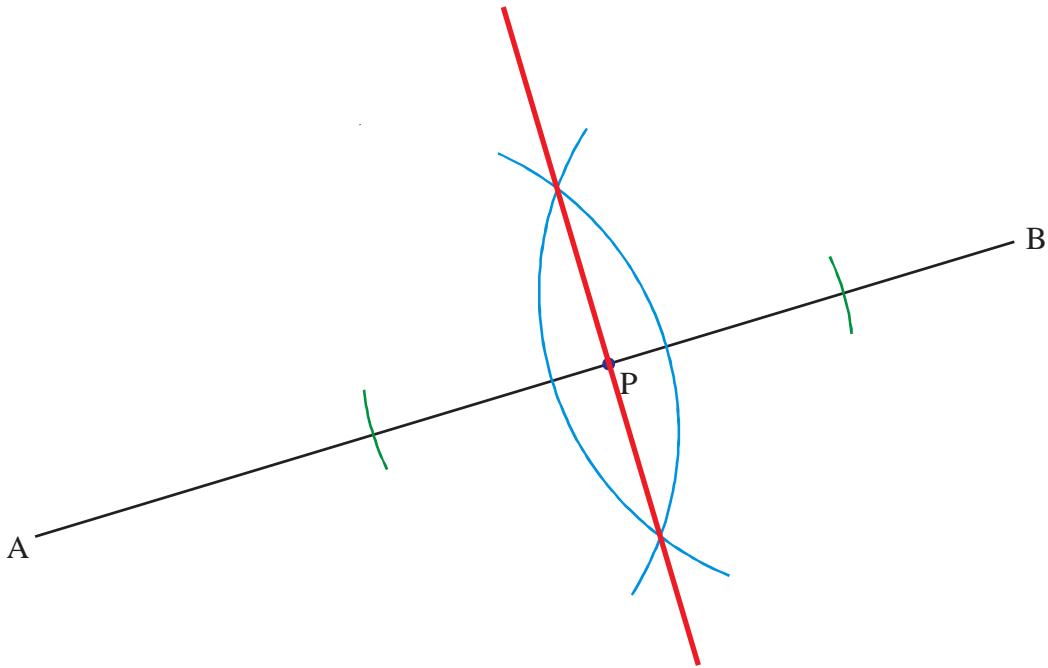


- 2) Use ruler and compasses to **construct** the perpendicular to the line segment CD that passes through the point P.
You must show all construction lines.

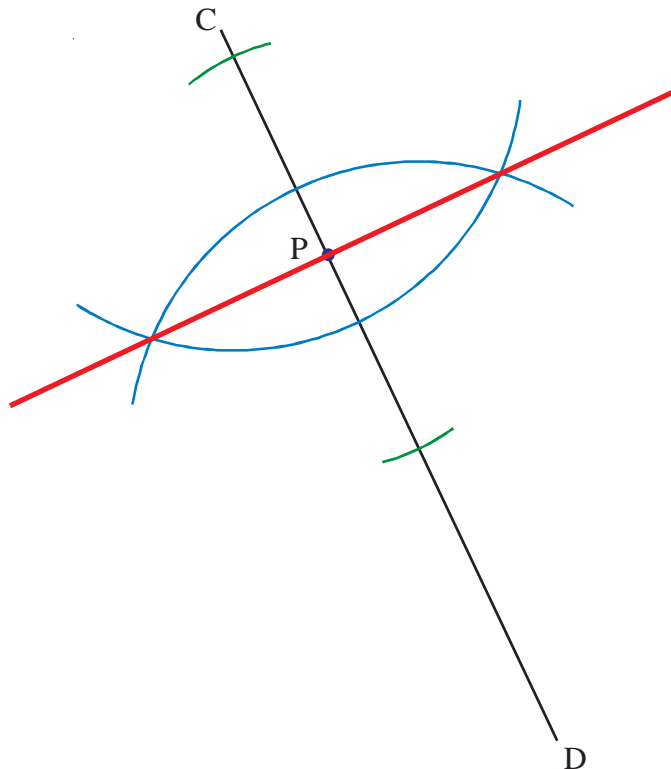


Drawing a Perpendicular to a Line

- 1) Use ruler and compasses to **construct** the perpendicular to the line segment AB that passes through the point P.
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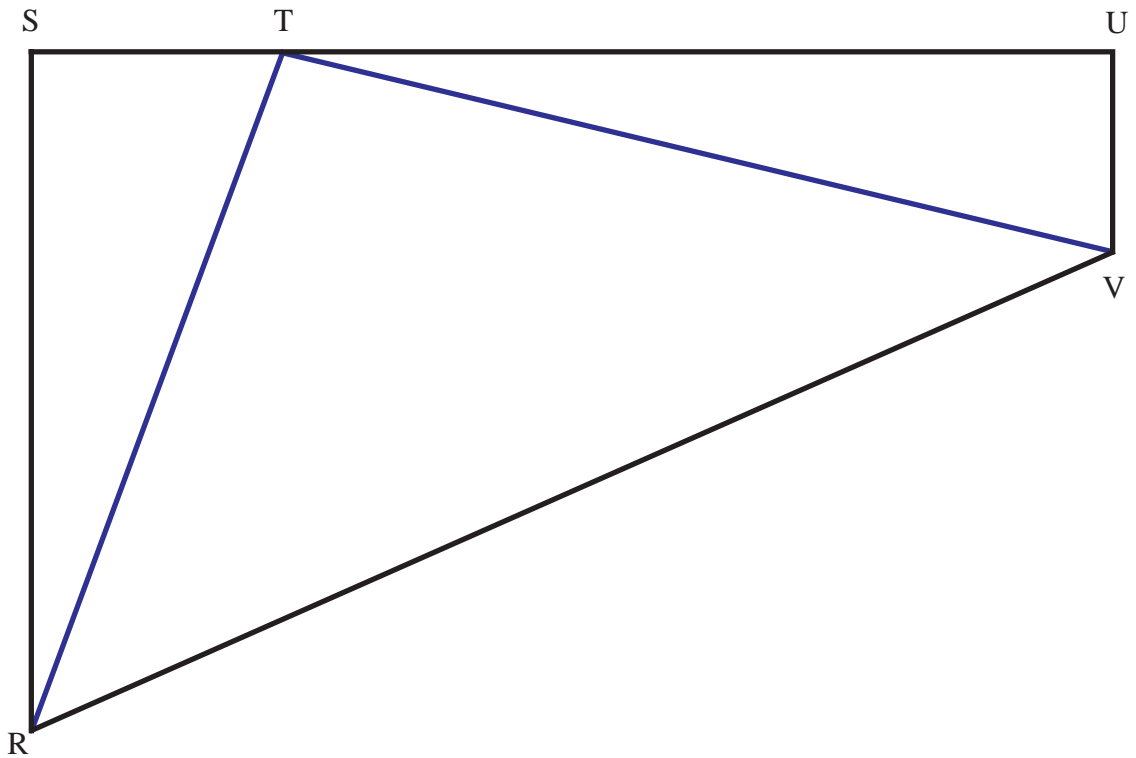


Bisecting an Angle

- 1) Using ruler and compasses, bisect angle ABC.



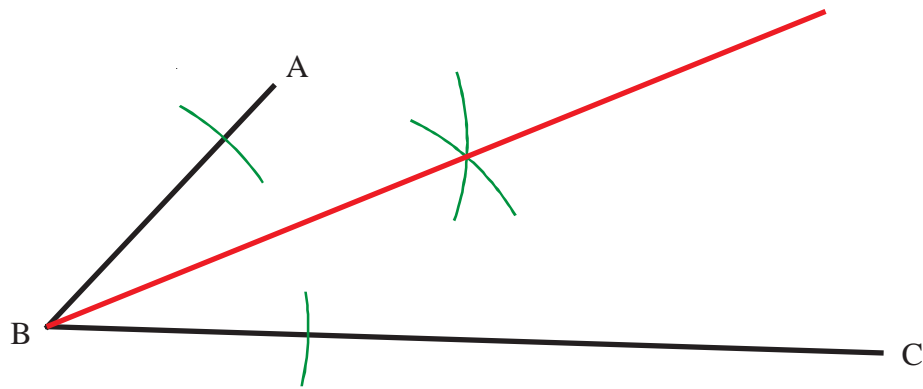
- 2) The diagram below shows the plan of a park.
The border of the park is shown by the quadrilateral RSUV



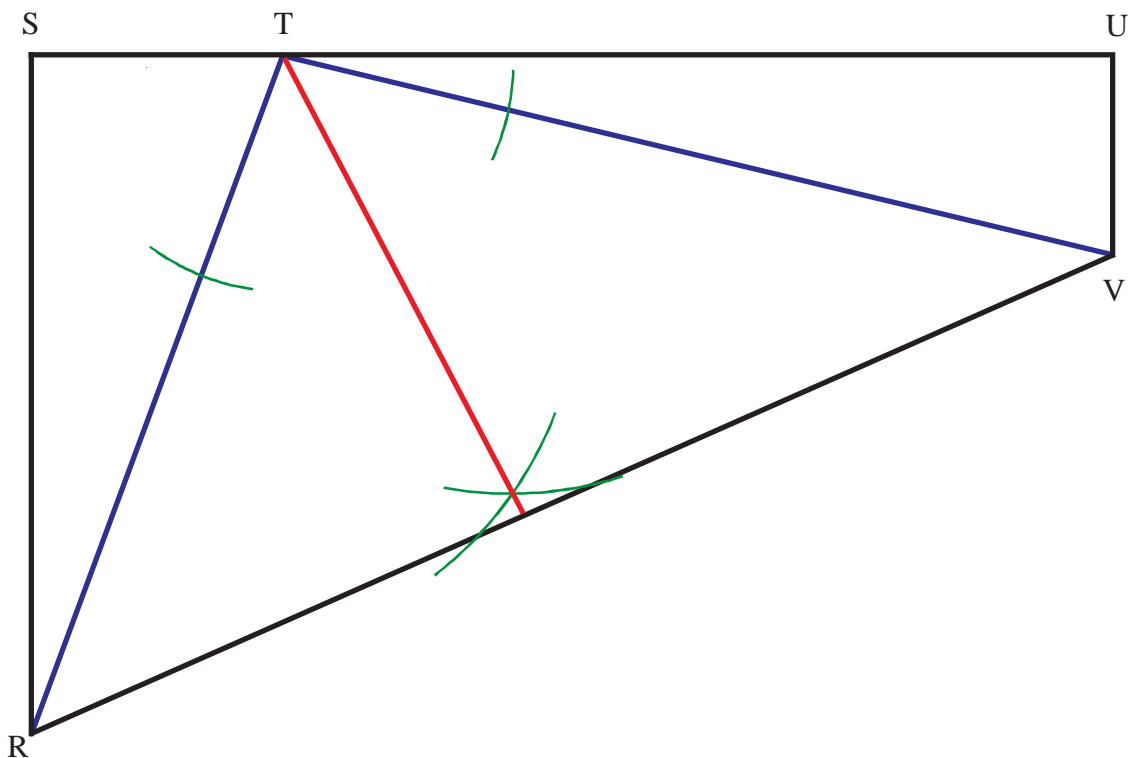
There are two paths in the park. One is labelled TR and the other TV.
A man walks in the park so that he is always the same distance from both paths.
Using ruler and compasses show exactly where the man can walk.

Bisecting an Angle

- 1) Using ruler and compasses, bisect angle ABC.

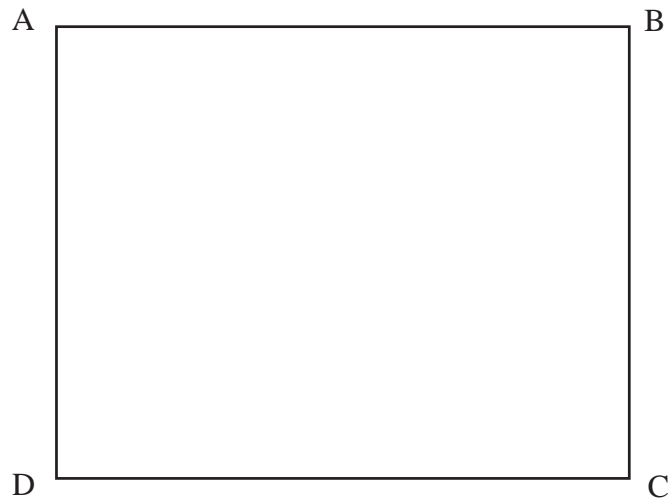


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There are two paths in the park. One is labelled TR and the other TV.
A man walks in the park so that he is always the same distance from both paths.
Using ruler and compasses show exactly where the man can walk.

1)



ABCD is a rectangle.

Shade the set of points inside the rectangle which are **both** more than 4 centimetres from the point D **and** more than 1 centimetre from the line AB.

2) Two radio transmitters, A and B, are situated as below.



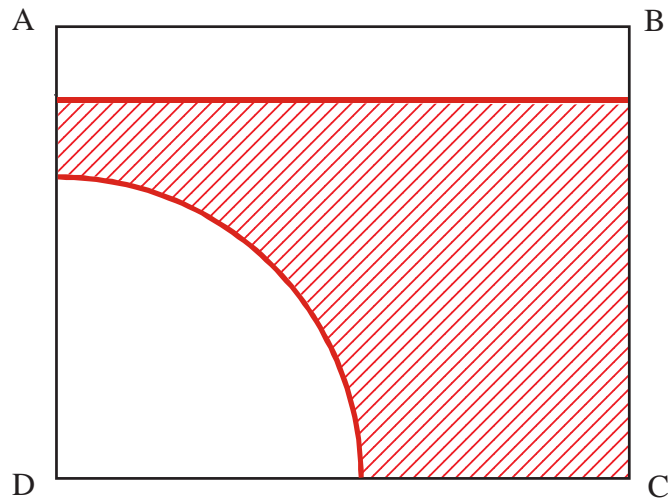
Transmitter A broadcasts signals which can be heard up to 3 km from A.

Transmitter B broadcasts signals which can be heard up to 6 km from B.

Shade in the area in which radio signals can be heard from both transmitters.

Use a scale of 1 cm = 1 km.

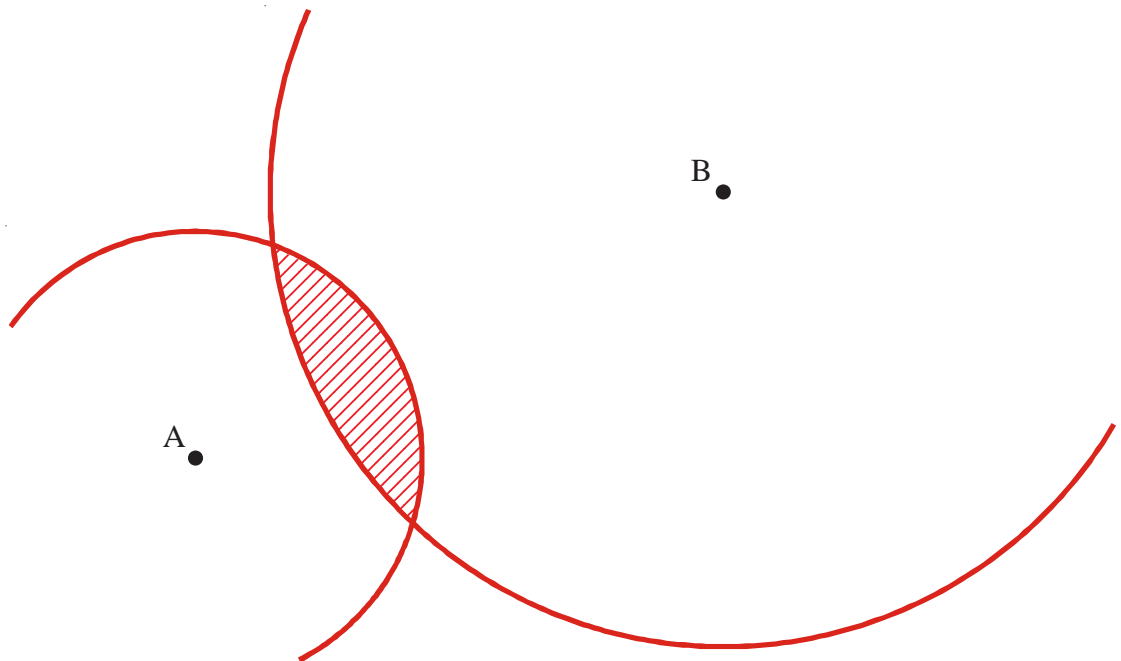
1)



ABCD is a rectangle.

Shade the set of points inside the rectangle which are **both** more than 4 centimetres from the point D **and** more than 1 centimetre from the line AB.

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Transmitter A broadcasts signals which can be heard up to 3 km from A.

Transmitter B broadcasts signals which can be heard up to 6 km from B.

Shade in the area in which radio signals can be heard from both transmitters.

Use a scale of 1 cm = 1 km.

1)

A
×

×

B

×

C

Point C is equidistant from points A and B.

Sarah rolls a ball from point C.

At any point on its path the ball is the same distance from point A and point B.

- a) On the diagram above draw accurately the path that the ball will take.
- b) On the diagram shade the region that contains all the points that are no more than 3cm from point B.

2) The map shows part of a lake.

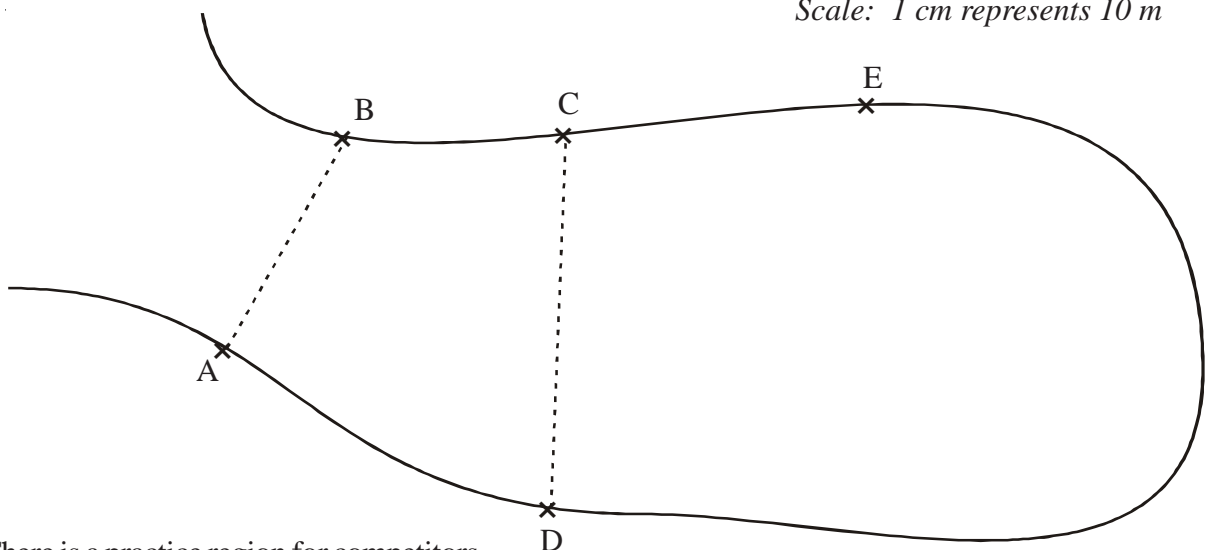
In a competition for radio-controlled ducks, participants have to steer their ducks so that:

its path between AB and CD is a straight line

this path is always the same distance from A as from B

- a) On the map, draw the path the ducks should take.

Scale: 1 cm represents 10 m

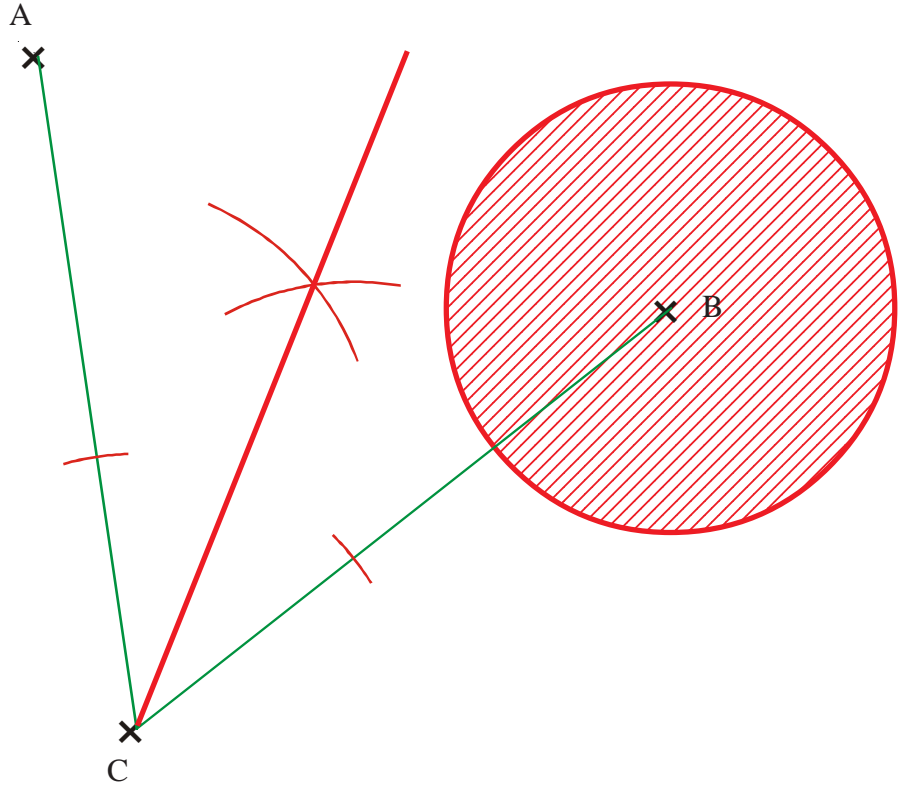


There is a practice region for competitors.

This is the part of the lake which is less than 30 m from point E.

- b) Shade the practice region on the map.

1)



Point C is equidistant from points A and B.

Sarah rolls a ball from point C.

At any point on its path the ball is the same distance from point A and point B.

- a) On the diagram above draw accurately the path that the ball will take.
- b) On the diagram shade the region that contains all the points that are no more than 3cm from point B.

2)

The map shows part of a lake.

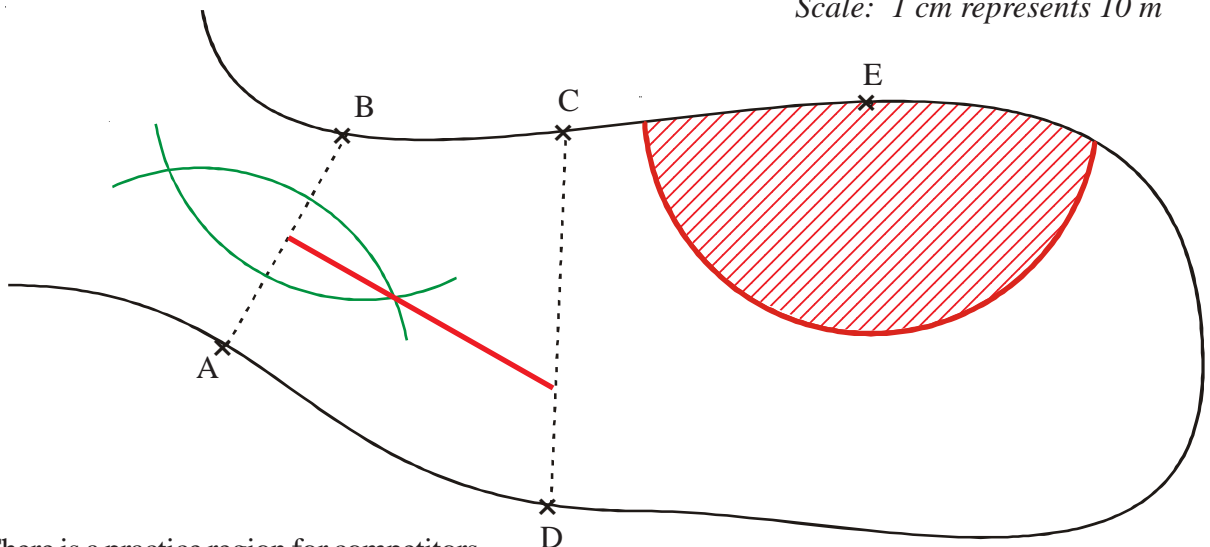
In a competition for radio-controlled ducks, participants have to steer their ducks so that:

its path between AB and CD is a straight line

this path is always the same distance from A as from B

- a) On the map, draw the path the ducks should take.

Scale: 1 cm represents 10 m



There is a practice region for competitors.

This is the part of the lake which is less than 30 m from point E.

- b) Shade the practice region on the map.

Bearings

- 1) School B is due east of school A.
 C is another school.
 The bearing of C from A is 065° .
 The bearing of C from B is 313° .

Complete the scale drawing below.
 Mark with a cross the position of C.



- 2) In the diagram, point A marks the position of Middlewich.
 The position of Middlemarch is to be marked on the diagram as point B
 On the diagram, mark with a cross the position of B given that:
 B is on a bearing of 320° from A and
 B is 5 cm from A



- 3) **Work out** the bearing of
 a) B from P
 b) P from A

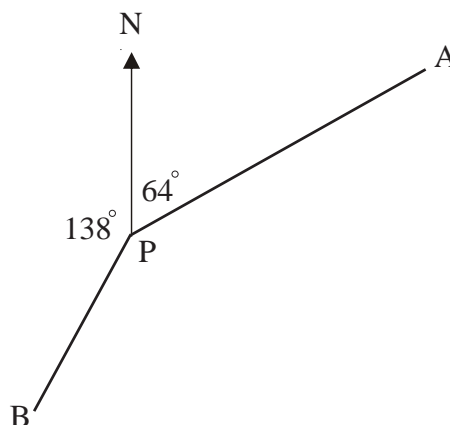
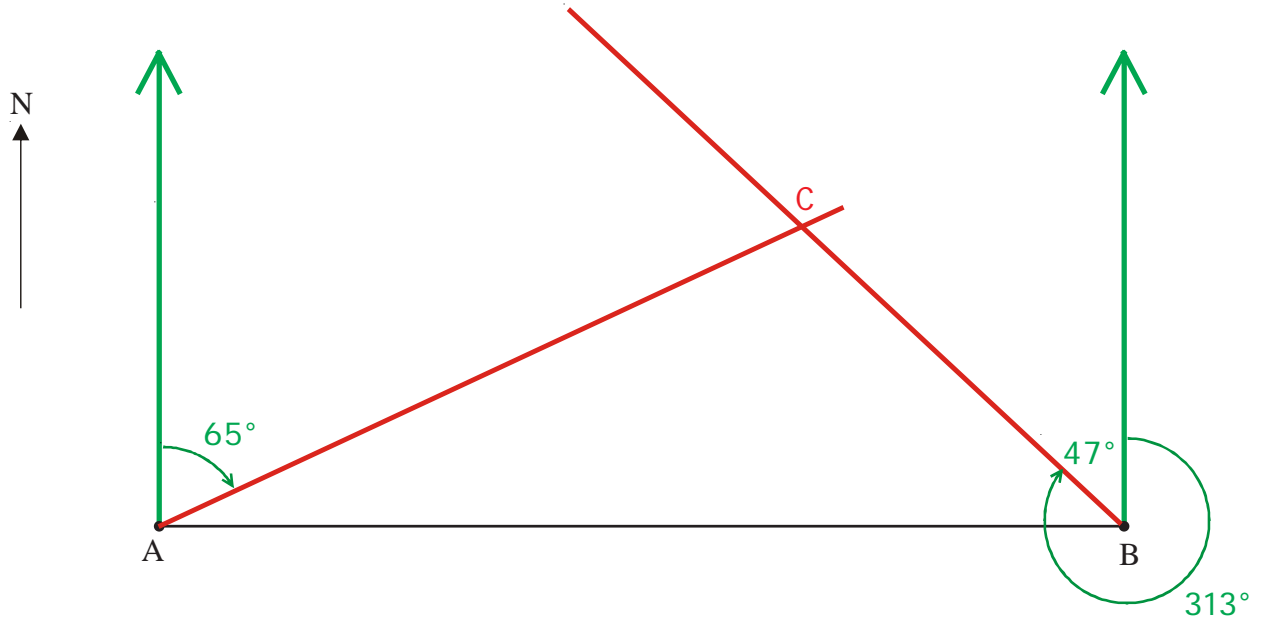


Diagram NOT accurately drawn.

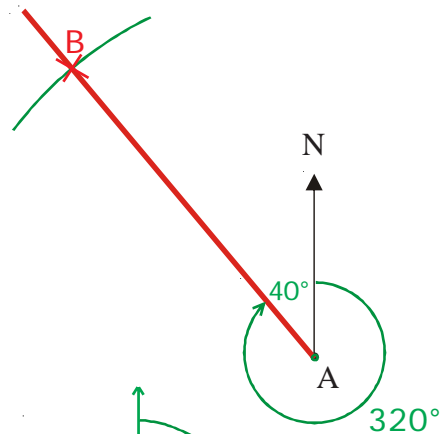
Bearings

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 Mark with a cross the position of C.



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 The position of Middlemarch is to be marked on the diagram as point B
 On the diagram, mark with a cross the position of B given that:
 B is on a bearing of 320° from A and
 B is 5 cm from A



- 3) **Work out** the bearing of
 a) B from P 222°
 b) P from A 244°

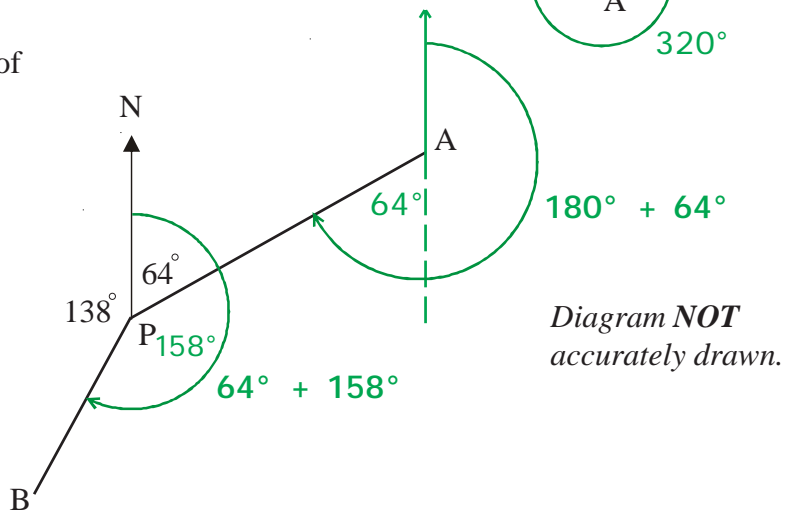


Diagram NOT accurately drawn.

- 1) Ahmad does a statistical experiment.
He throws a dice 600 times.
He scores one, 200 times.
Is the dice fair? Explain your answer

- 2) Chris has a biased coin.
The probability that the biased coin will land on a tail is 0.3
Chris is going to flip the coin 150 times.
Work out an estimate for the number of times the coin will land on a tail.

- 3) On a biased dice, the probability of getting a six is $\frac{2}{3}$.
The dice is rolled 300 times.
Work out an estimate for the number of times the dice will land on a six.

- 4) On a biased dice, the probability of getting a three is 0.5
The dice is rolled 350 times.
Work out an estimate for the number of times the dice will land on a three.

- 5) Jenny throws a biased dice 100 times.
The table shows her results.

Score	Frequency
1	15
2	17
3	10
4	24
5	18
6	16

- a) She throws the dice once more.
Find an estimate for the probability that she will get a four.

- b) If the dice is rolled 250 times, how many times would you expect to get a five?

- 1) Ahmad does a statistical experiment.
He throws a dice 600 times.
He scores one, 200 times.
Is the dice fair? Explain your answer **Two possible answers:**
No, you would expect to score 1 about 100 times.
Yes, although you would expect 1 about 100 times, you could still get it 200 times.
- 2) Chris has a biased coin.
The probability that the biased coin will land on a tail is 0.3
Chris is going to flip the coin 150 times.
Work out an estimate for the number of times the coin will land on a tail. **45 times**
 $0.3 \times 150 = 45$
- 3) On a biased dice, the probability of getting a six is $\frac{2}{3}$.
The dice is rolled 300 times.
Work out an estimate for the number of times the dice will land on a six. **200 times**
 $\frac{2}{3} \times 300 = 200$
- 4) On a biased dice, the probability of getting a three is 0.5
The dice is rolled 350 times.
Work out an estimate for the number of times the dice will land on a three. **175 times**
 $0.5 \times 350 = 175$
- 5) Jenny throws a biased dice 100 times.
The table shows her results.

Score	Frequency
1	15
2	17
3	10
4	24
5	18
6	16

- a) She throws the dice once more.
Find an estimate for the probability that she will get a four. **$\frac{24}{100}$ or 0.24**
- b) If the dice is rolled 250 times, how many times would you expect to get a five? **45 times**
 $\frac{18}{100} \times 250 = 45$

Averages From a Table

- 1) The number of pens in each pupil's pencil case in a classroom has been counted. The results are displayed in a table.

Number of pens	Number of pupils
0	4
1	6
2	7
3	5
4	3
5	1

- a) Work out the total number of pens in the classroom.
- b) Write down the modal number of pens in a pencil case.
- c) Work out the mean number of pens in a pencil case.
- d) Work out the range of the number of pens in a pencil case.

- 2) Thomas is analysing the local football team. He records the number of goals scored in each football match in the past twelve months.

Thomas said that the mode is 7
Thomas is wrong.

- a) Explain why.
- b) Calculate the mean number of goals scored.

Goals scored	Frequency
0	7
1	5
2	3
3	6
4	2
5	1
6	1

- 3) Tina recorded how long, in minutes, she watched TV for each day during a month.

- a) Find the class interval in which the median lies.
- b) Work out an estimate for the mean amount of time Tina watched TV each day of this month. Give your answer to the nearest minute.

Time (t in minutes)	Frequency
$10 < t \leq 20$	5
$20 < t \leq 30$	9
$30 < t \leq 45$	8
$45 < t \leq 60$	6
$60 < t \leq 90$	3

Averages From a Table

- 1) The number of pens in each pupil's pencil case in a classroom has been counted. The results are displayed in a table.

Number of pens	Number of pupils		
0	4	0×4	0
1	6	1×6	6
2	7	2×7	14
3	5	3×5	15
4	3	4×3	12
5	1	5×1	5
	26		52

Total

- a) Work out the total number of pens in the classroom. **52 pens**
- b) Write down the modal number of pens in a pencil case. **2 pens**
- c) Work out the mean number of pens in a pencil case. **2 pens** $52 \div 26$
- d) Work out the range of the number of pens in a pencil case. **5 pens** $5 - 0$

- 2) Thomas is analysing the local football team. He records the number of goals scored in each football match in the past twelve months.

Thomas said that the mode is 7

Thomas is wrong. **Thomas gave the highest frequency instead of giving the number of "goals scored" associated with it.**

- a) Explain why.

1.92 goals $48 \div 25$

Goals scored	Frequency		
0	7	0×7	0
1	5	1×5	5
2	3	2×3	6
3	6	3×6	18
4	2	4×2	8
5	1	5×1	5
6	1	6×1	6
	Total		48

- 3) Tina recorded how long, in minutes, she watched TV for each day during a month.

- a) Find the class interval in which the median lies.

$30 < t < 45$

- b) Work out an estimate for the mean amount of time Tina watched TV each day of this month. Give your answer to the nearest minute.

37 minutes $1140 \div 31$

Time (t in minutes)	Frequency	MP	MP \times F
$10 < t \leq 20$	5	15	75
$20 < t \leq 30$	9	25	225
$30 < t \leq 45$	8	37.5	300
$45 < t \leq 60$	6	52.5	315
$60 < t \leq 90$	3	75	225
	Total	31	1140

Questionnaires

- 1) A survey into how people communicate with each other is carried out. A questionnaire is designed and two of the questions used are shown below. The questions are **not** suitable. For each question, write down a reason why.

a) Do you prefer to communicate with your friend by phone (voice call) or by text message?

Yes No

Reason

.....

b) How many text messages do you send?

1 2 3 4

Reason

.....

- 2) A restaurant owner has made some changes. He wants to find out what customers think of these changes. He uses this question on a questionnaire.

“What do you think of the changes in the restaurant?”

 Excellent Very good Good

a) Write down what is wrong with this question.

This is another question on the questionnaire.

“How often do you come to the restaurant?”

 Very often Not often

b) i) Write down one thing that is wrong with this question.

- ii) Design a better question to use. You should include some response boxes.

Questionnaires

- 1) A survey into how people communicate with each other is carried out. A questionnaire is designed and two of the questions used are shown below. The questions are **not** suitable. For each question, write down a reason why.

a) Do you prefer to communicate with your friend by phone (voice call) or by text message?

Yes No

Reason **This is not a question you can answer 'yes' or 'no' to.**

b) How many text messages do you send?

1 2 3 4

Reason **Response boxes need to include '0' and 'more than 4'.**
Question needs a time frame eg per day, per week.

- 2) A restaurant owner has made some changes. He wants to find out what customers think of these changes. He uses this question on a questionnaire.

“What do you think of the changes in the restaurant?”

 Excellent Very good Good

a) Write down what is wrong with this question.

There is no negative or neutral response box.

This is another question on the questionnaire.

“How often do you come to the restaurant?”

 Very often Not often

b) i) Write down one thing that is wrong with this question.

Question needs a time frame eg per week, per month.
Response boxes need to be more specific eg once a week, twice a week.

ii) Design a better question to use.

You should include some response boxes.

How many times do you visit this restaurant per month?

 None Once Twice More than twice

1) Work out the following, giving your answer in standard form.

a) $(6 \times 10^2) \times (8 \times 10^4)$

c) $\frac{3 \times 10^3}{6 \times 10^{-5}}$

b) $(2 \times 10^5) + (3 \times 10^4)$

d) $(9.2 \times 10^5) \div (2 \times 10^2)$

2) A spaceship travelled for 5×10^3 hours at a speed of 9×10^4 km/h.

a) Work out the distance travelled by the spaceship.

Give your answer in standard form.

Another spaceship travelled a distance of 2×10^7 km, last month.

This month it has travelled 5×10^6 km.

b) Work out the total distance travelled by the spaceship over these past two months.

Give your answer as a normal (or ordinary) number.

3) Work out the following, giving your answer in standard form, correct to 2 significant figures.

a) $2.6 \times 10^3 \times 4.3 \times 10^4$

c) $\frac{9.435 \times 10^5}{3.28 \times 10^3}$

b) $(7.5 \times 10^5) \times (1.9 \times 10^{-2})$

d) $\frac{5.98 \times 10^8}{6.14 \times 10^{-2}}$

4) Work out the following, giving your answer in standard form correct to 3 significant figures.

a) $\frac{5.76 \times 10^7 + 3.89 \times 10^9}{7.18 \times 10^{-2}}$

c) $\frac{3 \times 10^8 \times 2 \times 10^7}{3 \times 10^8 + 2 \times 10^7}$

b) $\frac{7.2 \times 10^{-2} - 5.4 \times 10^{-1}}{9.25 \times 10^{-7}}$

d) $\frac{3 \times 3.2 \times 10^{12} \times 1.5 \times 10^{12}}{3.2 \times 10^{12} - 1.5 \times 10^{12}}$

5) A microsecond is 0.000 001 seconds.

a) Write the number 0.000 001 in standard form.

A computer does a calculation in 3 microseconds.

b) How many of these calculations can the computer do in 1 second?

Give your answer in standard form, correct to 3 significant figures.

6) 340 000 tomato seeds weigh 1 gram.

Each tomato seed weighs the same.

a) Write the number 340 000 in standard form.

b) Calculate the weight, in grams, of one tomato seed.

Give your answer in standard form, correct to 2 significant figures.

1) Work out the following, giving your answer in standard form.

a) $(6 \times 10^2) \times (8 \times 10^4)$ 4.8×10^7

c) $\frac{3 \times 10^3}{6 \times 10^{-5}}$ 5×10^7

b) $(2 \times 10^5) + (3 \times 10^4)$ 2.3×10^5

d) $(9.2 \times 10^5) \div (2 \times 10^2)$ 4.6×10^3

2) A spaceship travelled for 5×10^3 hours at a speed of 9×10^4 km/h.

a) Work out the distance travelled by the spaceship.

$$D = S \times T$$

Give your answer in standard form. 4.5×10^8 km

$$D = 5 \times 10^3 \times 9 \times 10^4$$

Another spaceship travelled a distance of 2×10^7 km, last month.

$$2 \times 10^7 = 20\,000\,000$$

This month it has travelled 5×10^6 km.

$$5 \times 10^6 = 5\,000\,000 +$$

b) Work out the total distance travelled by the spaceship over these past two months.

Give your answer as a normal (or ordinary) number. $25\,000\,000$ km

3) Work out the following, giving your answer in standard form, correct to 2 significant figures.

a) $2.6 \times 10^3 \times 4.3 \times 10^4$ 1.1×10^8

c) $\frac{9.435 \times 10^5}{3.28 \times 10^3}$ 2.9×10^2

b) $(7.5 \times 10^5) \times (1.9 \times 10^{-2})$ 1.4×10^4

d) $\frac{5.98 \times 10^8}{6.14 \times 10^{-2}}$ 9.7×10^9

4) Work out the following, giving your answer in standard form correct to 3 significant figures.

a) $\frac{5.76 \times 10^7 + 3.89 \times 10^9}{7.18 \times 10^{-2}}$ 5.50×10^{10}

c) $\frac{3 \times 10^8 \times 2 \times 10^7}{3 \times 10^8 + 2 \times 10^7}$ 1.88×10^7

b) $\frac{7.2 \times 10^{-2} - 5.4 \times 10^{-1}}{9.25 \times 10^{-7}}$ -5.06×10^5

d) $\frac{3 \times 3.2 \times 10^{12} \times 1.5 \times 10^{12}}{3.2 \times 10^{12} - 1.5 \times 10^{12}}$ 8.47×10^{12}

5) A microsecond is 0.000 001 seconds.

a) Write the number 0.000 001 in standard form. 1×10^{-6}

A computer does a calculation in 3 microseconds.

b) How many of these calculations can the computer do in 1 second?

$$1 \div (3 \times 10^{-6})$$

Give your answer in standard form, correct to 3 significant figures.

$$3.33 \times 10^5$$

6) 340 000 tomato seeds weigh 1 gram.

Each tomato seed weighs the same.

a) Write the number 340 000 in standard form. 3.4×10^5

b) Calculate the weight, in grams, of one tomato seed.

Give your answer in standard form, correct to 2 significant figures.

$$2.9 \times 10^{-6}$$

$$1 \div (3.4 \times 10^5)$$

- 1) A car dealer is comparing his sales over the past two years.
In 2006, he sold 175 cars.
In 2007, he sold 196 cars.

Work out the percentage increase in the number of cars sold.

- 2) In September 2005, the number of pupils attending MathsWatch College was 1352.
In September 2006, the number of pupils attending MathsWatch College was 1014.

Work out the percentage decrease in the number of pupils attending MathsWatch College.

- 3) The usual price of a shirt is £32.50
In a sale, the shirt is reduced to £29.25

What is the percentage reduction?

- 4) Olivia opened an account with £750 at the MathsWatch Bank.
After one year, the bank paid her interest.
She then had £795 in her account.

Work out, as a percentage, MathsWatch Bank's interest rate.

- 5) Ken buys a house for £270 000 and sells it two years later for £300 000.

What is his percentage profit?
Give your answer to 2 significant figures.

- 6) Shelley bought some items at a car boot sale and then sold them on ebay.
Work out the percentage profit or loss she made on each of these items.
 - a) Trainers bought for £15, sold for £20
 - b) DVD recorder bought for £42, sold for £60.90
 - c) Gold necklace bought for £90, sold for £78.30
 - d) A DVD collection bought for £120, sold for £81.60

- 1) A car dealer is comparing his sales over the past two years.

In 2006, he sold 175 cars.

In 2007, he sold 196 cars.

Work out the percentage increase in the number of cars sold. **12%**

$$196 - 175 = 21 \quad \frac{21}{175} \times 100 = 12$$

- 2) In September 2005, the number of pupils attending MathsWatch College was 1352.

In September 2006, the number of pupils attending MathsWatch College was 1014.

Work out the percentage decrease in the number of pupils attending MathsWatch College. **25%**

$$1352 - 1014 = 338 \quad \frac{338}{1352} \times 100 = 25$$

- 3) The usual price of a shirt is £32.50

In a sale, the shirt is reduced to £29.25

What is the percentage reduction? **10%**

$$32.50 - 29.25 = 3.25 \quad \frac{3.25}{32.50} \times 100 = 10$$

- 4) Olivia opened an account with £750 at the MathsWatch Bank.

After one year, the bank paid her interest.

She then had £795 in her account.

Work out, as a percentage, MathsWatch Bank's interest rate. **6%**

$$795 - 750 = 45 \quad \frac{45}{750} \times 100 = 6$$

- 5) Ken buys a house for £270 000 and sells it two years later for £300 000.

What is his percentage profit?

Give your answer to 2 significant figures. **11%**

$$300\,000 - 270\,000 = 30\,000 \quad \frac{30\,000}{270\,000} \times 100 = 11$$

- 6) Shelley bought some items at a car boot sale and then sold them on ebay.

Work out the percentage profit or loss she made on each of these items.

a) Trainers bought for £15, sold for £20 **33% profit**

b) DVD recorder bought for £42, sold for £60.90 **45% profit**

c) Gold necklace bought for £90, sold for £78.30 **13% loss**

d) A DVD collection bought for £120, sold for £81.60 **32% loss**

- 1) Henry places £6000 in an account which pays 4.6% compound interest each year.
Calculate the amount in his account after 2 years.

 - 2) Sarah puts £8600 in a bank. The bank pays compound interest of 3.8% per year.
Calculate the amount Sarah has in her account after 4 years.

 - 3) Mary deposits £10000 in an account which pays 5.6% compound interest per year.
How much will Mary have in her account after 5 years?

 - 4) Susan places £7900 in an account which pays 2.4% compound interest per year.
How much interest does she earn in 3 years?

 - 5) Harry puts money into an account which pays 6% compound interest per year.
If he puts £23000 in the account for 5 years how much interest will he earn altogether?
-
- 6) Laura buys a new car for £14600.
The annual rate of depreciation is 23%.
How much is the car worth after 3 years?

 - 7) The rate of depreciation of a particular brand of computer is 65% per year. If the cost of the computer when new is £650 how much is it worth after 2 years?

 - 8) Sharon pays £3500 for a secondhand car.
The annual rate of depreciation of the car is 24%
How much will it be worth four years after she has bought it?
-
- 9) Dave places £17000 in an account which pays 4% compound interest per year.
How many years will it take before he has £19122.68 in the bank?

 - 10) A new motorbike costs £8900.
The annual rate of depreciation is 18% per year.
After how many years will it be worth £2705.66?

- 1) Henry places £6000 in an account which pays 4.6% compound interest each year.
Calculate the amount in his account after 2 years. **£6564.70**
 $6000 \times 1.046^2 = 6564.70$
- 2) Sarah puts £8600 in a bank. The bank pays compound interest of 3.8% per year.
Calculate the amount Sarah has in her account after 4 years. **£9983.62**
 $8600 \times 1.038^4 = 9983.62$
- 3) Mary deposits £10000 in an account which pays 5.6% compound interest per year.
How much will Mary have in her account after 5 years? **£13131.66**
 $10000 \times 1.056^5 = 13131.66$
- 4) Susan places £7900 in an account which pays 2.4% compound interest per year.
How much interest does she earn in 3 years? **£582.56**
 $7900 \times 1.024^3 = 8482.56$ $£8482.56 - £7900 = £582.56$
- 5) Harry puts money into an account which pays 6% compound interest per year.
If he puts £23000 in the account for 5 years how much interest will he earn altogether? **£7779.19**
 $23000 \times 1.06^5 = 30779.19$ $£30779.19 - £23000 = £7779.19$
-
- 6) Laura buys a new car for £14600.
The annual rate of depreciation is 23%.
How much is the car worth after 3 years? **£6665.38**
 $14600 \times 0.77^3 = 6665.38$
- 7) The rate of depreciation of a particular brand of computer is 65% per year. If the cost of the computer when new is £650 how much is it worth after 2 years? **£79.63**
 $650 \times 0.35^2 = 79.63$
- 8) Sharon pays £3500 for a secondhand car.
The annual rate of depreciation of the car is 24%
How much will it be worth four years after she has bought it? **£1167.68**
 $3500 \times 0.76^4 = 1167.68$
-
- 9) Dave places £17000 in an account which pays 4% compound interest per year.
How many years will it take before he has £19122.68 in the bank? **3 years**
 $17000 \times 1.04^3 = 19122.68$
- 10) A new motorbike costs £8900.
The annual rate of depreciation is 18% per year.
After how many years will it be worth £2705.66? **6 years**
 $8900 \times 0.82^6 = 2705.66$

- 1) In a sale, normal prices are reduced by 20%.
The sale price of a shirt is £26
Calculate the normal price of the shirt.

- 2) A car dealer offers a discount of 15% off the normal price of a car for cash.
Emma pays £6120 cash for a car.
Calculate the normal price of the car.

- 3) In a sale, normal prices are reduced by 13%.
The sale price of a DVD recorder is £108.75
Calculate the normal price of the DVD recorder.

- 4) A salesman gets a basic wage of £160 per week plus a commission of 30% of the sales he makes that week.
In one week his total wage was £640
Work out the value of the sales he made that week.

- 5) Jason opened an account at MathsWatch Bank.
MathsWatch Bank's interest rate was 4%.
After one year, the bank paid him interest.
The total amount in his account was then £1976
Work out the amount with which Jason opened his account

- 6) Jonathan's weekly pay this year is £960.
This is 20% more than his weekly pay last year.
Tess says "This means Jonathan's weekly pay last year was £768".
Tess is wrong.
 - a) Explain why
 - b) Work out Jonathan's weekly pay last year.

- 7) The price of all rail season tickets to London increased by 4%.
 - a) The price of a rail season ticket from Oxford to London increased by £122.40
Work out the price before this increase.
 - b) After the increase, the price of a rail season ticket from Newport to London was £2932.80
Work out the price before this increase.

- 1) In a sale, normal prices are reduced by 20%.
The sale price of a shirt is £26
Calculate the normal price of the shirt. **£32.50**
 $(26 \div 80) \times 100 = 32.5$
- 2) A car dealer offers a discount of 15% off the normal price of a car for cash.
Emma pays £6120 cash for a car.
Calculate the normal price of the car. **£7200**
 $(6120 \div 85) \times 100 = 7200$
- 3) In a sale, normal prices are reduced by 13%.
The sale price of a DVD recorder is £108.75
Calculate the normal price of the DVD recorder. **£125**
 $(108.75 \div 87) \times 100 = 125$
- 4) A salesman gets a basic wage of £160 per week plus a commission of 30% of the sales he makes that week.
In one week his total wage was £640
Work out the value of the sales he made that week. **£1600**
 $640 - 160 = 480$
 $(480 \div 30) \times 100 = 1600$
- 5) Jason opened an account at MathsWatch Bank.
MathsWatch Bank's interest rate was 4%.
After one year, the bank paid him interest.
The total amount in his account was then £1976
Work out the amount with which Jason opened his account **£1900**
 $(1976 \div 104) \times 100 = 1900$
- 6) Jonathan's weekly pay this year is £960.
This is 20% more than his weekly pay last year.
Tess says "This means Jonathan's weekly pay last year was £768".
Tess is wrong.
a) Explain why **Tess has calculated 20% of £960, and subtracted it.**
b) Work out Jonathan's weekly pay last year. **£800**
 $(960 \div 120) \times 100 = 800$
- 7) The price of all rail season tickets to London increased by 4%.
a) The price of a rail season ticket from Oxford to London increased by £122.40
Work out the price before this increase. **£3060** $(122.40 \div 4) \times 100 = 3060$
b) After the increase, the price of a rail season ticket from Newport to London was £2932.80
Work out the price before this increase. **£2820**
 $(2932.80 \div 104) \times 100 = 2820$

Work out

1) $\frac{2}{3} + \frac{1}{5}$

11) $\frac{2}{3} \times \frac{3}{4}$

21) $\frac{2}{5} \times \frac{3}{7}$

2) $1\frac{2}{3} + 2\frac{3}{4}$

12) $\frac{11}{12} - \frac{5}{6}$

22) $5\frac{2}{3} - 2\frac{3}{4}$

3) $\frac{2}{5} + \frac{3}{8}$

13) $2\frac{1}{4} \div \frac{3}{5}$

23) $2\frac{1}{2} + 1\frac{2}{3}$

4) $\frac{3}{4} + \frac{1}{6}$

14) $2\frac{2}{3} \times 1\frac{1}{4}$

24) $1\frac{2}{5} + 2\frac{3}{7}$

5) $3\frac{2}{5} - 1\frac{3}{4}$

15) $\frac{1}{3} + \frac{3}{5}$

25) $3\frac{3}{4} + 11\frac{1}{2}$

6) $\frac{4}{5} \times \frac{2}{9}$

16) $1 - (\frac{1}{2} + \frac{1}{6})$

26) $12\frac{1}{2} \div \frac{5}{8}$

7) $14\frac{3}{4} - 11\frac{1}{2}$

17) $1 - (\frac{1}{5} + \frac{3}{8})$

27) $1 - (\frac{3}{10} + \frac{3}{5})$

8) $\frac{9}{10} - \frac{3}{7}$

18) $2\frac{1}{3} \times 3\frac{1}{2}$

28) $6\frac{1}{4} \div \frac{5}{12}$

9) $\frac{4}{9} \div \frac{12}{18}$

19) $\frac{4}{7} + \frac{1}{3}$

29) $2\frac{1}{3} \times \frac{2}{5}$

10) $\frac{7}{10} \times \frac{5}{8}$

20) $3\frac{1}{3} + 2\frac{3}{4}$

30) $1 - (\frac{2}{3} + \frac{1}{5})$

Work out

1) $\frac{2}{3} + \frac{1}{5} = \frac{13}{15}$

11) $\frac{2}{3} \times \frac{3}{4} = \frac{1}{2}$

21) $\frac{2}{5} \times \frac{3}{7} = \frac{6}{35}$

2) $1\frac{2}{3} + 2\frac{3}{4} = 4\frac{5}{12}$

12) $\frac{11}{12} - \frac{5}{6} = \frac{1}{12}$

22) $5\frac{2}{3} - 2\frac{3}{4} = 2\frac{11}{12}$

3) $\frac{2}{5} + \frac{3}{8} = \frac{31}{40}$

13) $2\frac{1}{4} \div \frac{3}{5} = 3\frac{3}{4}$

23) $2\frac{1}{2} + 1\frac{2}{3} = 4\frac{1}{6}$

4) $\frac{3}{4} + \frac{1}{6} = \frac{11}{12}$

14) $2\frac{2}{3} \times 1\frac{1}{4} = 3\frac{1}{3}$

24) $1\frac{2}{5} + 2\frac{3}{7} = 3\frac{29}{35}$

5) $3\frac{2}{5} - 1\frac{3}{20} = 1\frac{13}{20}$

15) $\frac{1}{3} + \frac{3}{5} = \frac{14}{15}$

25) $3\frac{3}{4} + 11\frac{1}{2} = 15\frac{1}{4}$

6) $\frac{4}{5} \times \frac{2}{9} = \frac{8}{45}$

16) $1 - (\frac{1}{2} + \frac{1}{6}) = \frac{1}{3}$

26) $12\frac{1}{2} \div \frac{5}{8} = 20$

7) $14\frac{3}{4} - 11\frac{1}{2} = 3\frac{1}{4}$

17) $1 - (\frac{1}{5} + \frac{3}{8}) = \frac{17}{40}$

27) $1 - (\frac{3}{10} + \frac{3}{5}) = \frac{1}{10}$

8) $\frac{9}{10} - \frac{3}{7} = \frac{33}{70}$

18) $2\frac{1}{3} \times 3\frac{1}{2} = 8\frac{1}{6}$

28) $6\frac{1}{4} \div \frac{5}{12} = 15$

9) $\frac{4}{9} \div \frac{12}{18} = \frac{2}{3}$

19) $\frac{4}{7} + \frac{1}{3} = \frac{19}{21}$

29) $2\frac{1}{3} \times \frac{2}{5} = \frac{14}{15}$

10) $\frac{7}{10} \times \frac{5}{8} = \frac{7}{16}$

20) $3\frac{1}{3} + 2\frac{3}{4} = 6\frac{1}{12}$

30) $1 - (\frac{2}{3} + \frac{1}{5}) = \frac{2}{15}$

1) Factorise and solve the following equations:

a) $x^2 + 5x + 6 = 0$

b) $x^2 + 9x + 20 = 0$

c) $x^2 + x - 6 = 0$

d) $x^2 + 5x - 24 = 0$

e) $x^2 - 6x + 8 = 0$

f) $x^2 - 3x - 28 = 0$

g) $2x^2 + 7x + 3 = 0$

h) $6x^2 + 11x + 3 = 0$

i) $3x^2 + 13x - 10 = 0$

j) $3x^2 - 34x + 63 = 0$

2) Lucy said that -1 is the only solution of x that satisfies the equation

$$x^2 + 2x + 1 = 0$$

Was Lucy correct?

Show working to justify your answer

3) Ben said that -5 is the only solution of x that satisfies the equation

$$x^2 + 10x + 25 = 0$$

Was Ben correct?

Show working to justify your answer

1) Factorise and solve the following equations:

a) $x^2 + 5x + 6 = 0$ $(x + 2)(x + 3) = 0$ $x = -2$ or -3

b) $x^2 + 9x + 20 = 0$ $(x + 4)(x + 5) = 0$ $x = -4$ or -5

c) $x^2 + x - 6 = 0$ $(x + 3)(x - 2) = 0$ $x = -3$ or 2

d) $x^2 + 5x - 24 = 0$ $(x + 8)(x - 3) = 0$ $x = -8$ or 3

e) $x^2 - 6x + 8 = 0$ $(x - 2)(x - 4) = 0$ $x = 2$ or 4

f) $x^2 - 3x - 28 = 0$ $(x - 7)(x + 4) = 0$ $x = 7$ or -4

g) $2x^2 + 7x + 3 = 0$ $(x + 3)(2x + 1) = 0$ $x = -3$ or $-\frac{1}{2}$

h) $6x^2 + 11x + 3 = 0$ $(2x + 3)(3x + 1) = 0$ $x = -\frac{3}{2}$ or $-\frac{1}{3}$

i) $3x^2 + 13x - 10 = 0$ $(x + 5)(3x - 2) = 0$ $x = -5$ or $\frac{2}{3}$

j) $3x^2 - 34x + 63 = 0$ $(3x - 7)(x - 9) = 0$ $x = \frac{7}{3}$ or 9

2) Lucy said that -1 is the only solution of x that satisfies the equation
 $x^2 + 2x + 1 = 0$

Was Lucy correct? **Yes**

Show working to justify your answer

$$\begin{aligned} x^2 + 2x + 1 &= 0 \\ (x + 1)(x + 1) &= 0 \\ \text{so } x &= -1 \end{aligned}$$

3) Ben said that -5 is the only solution of x that satisfies the equation
 $x^2 + 10x + 25 = 0$

Was Ben correct? **Yes**

Show working to justify your answer

$$\begin{aligned} x^2 + 10x + 25 &= 0 \\ (x + 5)(x + 5) &= 0 \\ \text{so } x &= -5 \end{aligned}$$

Difference of Two Squares

$$x^2 - y^2 = (x - y)(x + y)$$

1) Factorise

a) $x^2 - 16$

c) $y^2 - 9$

e) $x^2 - \frac{1}{4}$

b) $a^2 - b^2$

d) $x^2 - 1$

f) $x^2 - \frac{1}{9}$

2) Factorise

a) $x^2 - 4y^2$

c) $9x^2 - 16y^2$

e) $4x^2 - 25y^2$

b) $9a^2 - b^2$

d) $\frac{1}{4}x^2 - y^2$

f) $x^2 - \frac{1}{9}y^2$

3) Simplify

a) $\frac{y^2 - 4}{y + 2} \times \frac{5}{y + 5}$

b) $\frac{3}{2x + 1} \times \frac{4x^2 - 1}{x - 2}$

c) $\frac{12x^2 + 8x}{9x^2 - 4}$

d) $\frac{25a^2 - 16b^2}{10ab - 8b^2}$

4) Solve

a) $4x^2 - 16 = 0$

c) $49x^2 = 121$

b) $25x^2 = 1$

d) $9x^2 - 9 = 7$

Difference of Two Squares

$$x^2 - y^2 = (x - y)(x + y)$$

1) Factorise

a) $x^2 - 16$ $(x - 4)(x + 4)$ c) $y^2 - 9$ $(y - 3)(y + 3)$ e) $x^2 - \frac{1}{4}$ $(x - \frac{1}{2})(x + \frac{1}{2})$

b) $a^2 - b^2$ $(a - b)(a + b)$ d) $x^2 - 1$ $(x - 1)(x + 1)$ f) $x^2 - \frac{1}{9}$ $(x - \frac{1}{3})(x + \frac{1}{3})$

2) Factorise

a) $x^2 - 4y^2$
 $(x - 2y)(x + 2y)$ c) $9x^2 - 16y^2$
 $(3x - 4y)(3x + 4y)$ e) $4x^2 - 25y^2$
 $(2x - 5y)(2x + 5y)$

b) $9a^2 - b^2$
 $(3a - b)(3a + b)$ d) $\frac{1}{4}x^2 - y^2$
 $(\frac{1}{2}x - y)(\frac{1}{2}x + y)$ f) $x^2 - \frac{1}{9}y^2$
 $(x - \frac{1}{3}y)(x + \frac{1}{3}y)$

3) Simplify

a) $\frac{y^2 - 4}{y + 2} \times \frac{5}{y + 5}$ $\frac{5(y - 2)}{y + 5}$ $\frac{(y - 2)(y + 2)}{y + 2} \times \frac{5}{y + 5}$

b) $\frac{3}{2x + 1} \times \frac{4x^2 - 1}{x - 2}$ $\frac{3(2x - 1)}{x - 2}$ $\frac{3}{2x + 1} \times \frac{(2x - 1)(2x + 1)}{x - 2}$

c) $\frac{12x^2 + 8x}{9x^2 - 4}$ $\frac{4x}{3x - 2}$ $\frac{4x(3x + 2)}{(3x - 2)(3x + 2)}$

d) $\frac{25a^2 - 16b^2}{10ab - 8b^2}$ $\frac{5a + 4b}{2b}$ $\frac{(5a - 4b)(5a + 4b)}{2b(5a - 4b)}$

4) Solve

a) $4x^2 - 16 = 0$ $(2x - 4)(2x + 4) = 0$ c) $49x^2 = 121$ $(7x - 11)(7x + 11) = 0$
 $x = 2$, $x = -2$ $x = 1\frac{4}{7}$, $x = -1\frac{4}{7}$

b) $25x^2 = 1$ $(5x - 1)(5x + 1) = 0$ d) $9x^2 - 9 = 7$ $(3x - 4)(3x + 4) = 0$
 $x = \frac{1}{5}$, $x = -\frac{1}{5}$ $x = 1\frac{1}{3}$, $x = -1\frac{1}{3}$

Simultaneous Linear Equations

1) Solve

$$\begin{aligned}4x + 3y &= 6 \\5x - 3y &= 21\end{aligned}$$

2) Solve

$$\begin{aligned}4x + 3y &= 19 \\3x - 5y &= 7\end{aligned}$$

3) Solve

$$\begin{aligned}3x + 5y &= 13 \\2x + 3y &= 8\end{aligned}$$

4) Solve

$$\begin{aligned}x + 4y &= 5 \\4x - 2y &= 11\end{aligned}$$

5) Solve

$$\begin{aligned}2a + b &= 3 \\4a - 5b &= 20\end{aligned}$$

6) Solve

$$\begin{aligned}5x + 3y &= 4 \\3x + 4y &= 9\end{aligned}$$

7) Solve

$$\begin{aligned}6x - 2y &= 13 \\2x + 3y &= -3\end{aligned}$$

8) Solve

$$\begin{aligned}3a - 2b &= 14 \\4a + 3b &= 13\end{aligned}$$

9) Solve

$$\begin{aligned}5x + 4y &= 5 \\2x + 7y &= 29\end{aligned}$$

10) Solve

$$\begin{aligned}6x - 4y &= 39 \\2x + y &= 6\end{aligned}$$

Simultaneous Linear Equations

1) Solve

$$\begin{aligned}4x + 3y &= 6 & x = 3 \text{ and } y = -2 \\5x - 3y &= 21\end{aligned}$$

2) Solve

$$\begin{aligned}4x + 3y &= 19 & x = 4 \text{ and } y = 1 \\3x - 5y &= 7\end{aligned}$$

3) Solve

$$\begin{aligned}3x + 5y &= 13 & x = 1 \text{ and } y = 2 \\2x + 3y &= 8\end{aligned}$$

4) Solve

$$\begin{aligned}x + 4y &= 5 & x = 3 \text{ and } y = 0.5 \\4x - 2y &= 11\end{aligned}$$

5) Solve

$$\begin{aligned}2a + b &= 3 & a = 2.5 \text{ and } b = -2 \\4a - 5b &= 20\end{aligned}$$

6) Solve

$$\begin{aligned}5x + 3y &= 4 & x = -1 \text{ and } y = 3 \\3x + 4y &= 9\end{aligned}$$

7) Solve

$$\begin{aligned}6x - 2y &= 13 & x = 1.5 \text{ and } y = -2 \\2x + 3y &= -3\end{aligned}$$

8) Solve

$$\begin{aligned}3a - 2b &= 14 & a = 4 \text{ and } b = -1 \\4a + 3b &= 13\end{aligned}$$

9) Solve

$$\begin{aligned}5x + 4y &= 5 & x = -3 \text{ and } y = 5 \\2x + 7y &= 29\end{aligned}$$

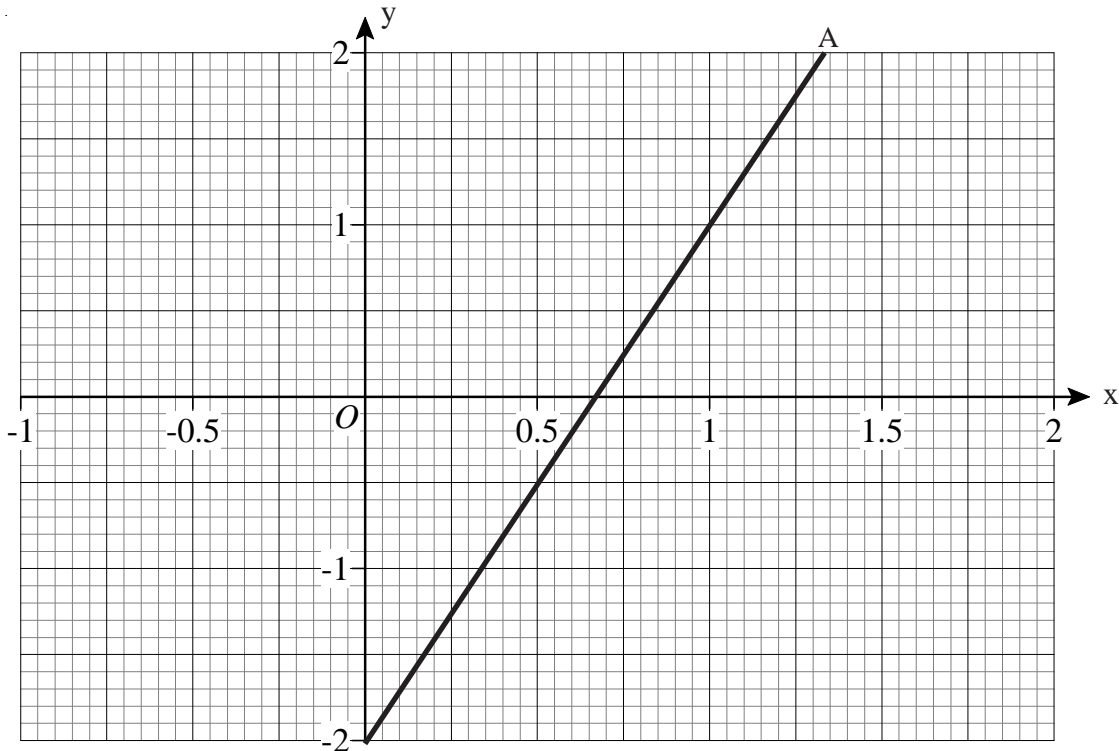
10) Solve

$$\begin{aligned}6x - 4y &= 39 & x = 4.5 \text{ and } y = -3 \\2x + y &= 6\end{aligned}$$

Understand $y = mx + c$

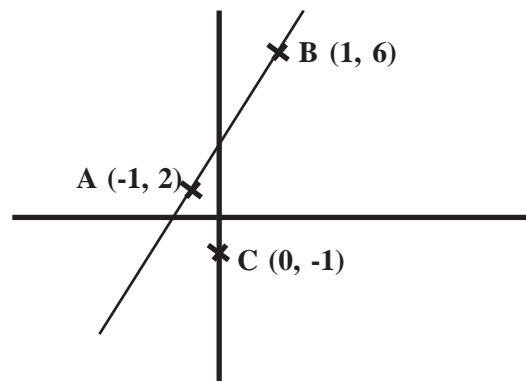
gradient \nearrow \nwarrow cuts the y-axis

- 1) a) Find the equation of line A.
- b) Draw the line B, with equation $y = x - 1$.
- c) Draw the line C, with equation $y = 1 - 2x$.



- 2) A straight line passes through points (0, 4) and (3, 13).
What is its equation?
- 3) A straight line passes through points (0, 7) and (2, -1).
What is its equation?
- 4) A straight line is parallel to $y = 3x - 2$ and goes through (1, 8).
What is its equation?
- 5) A straight line is parallel to $y = 2x + 5$ and goes through (5, 6).
What is its equation?

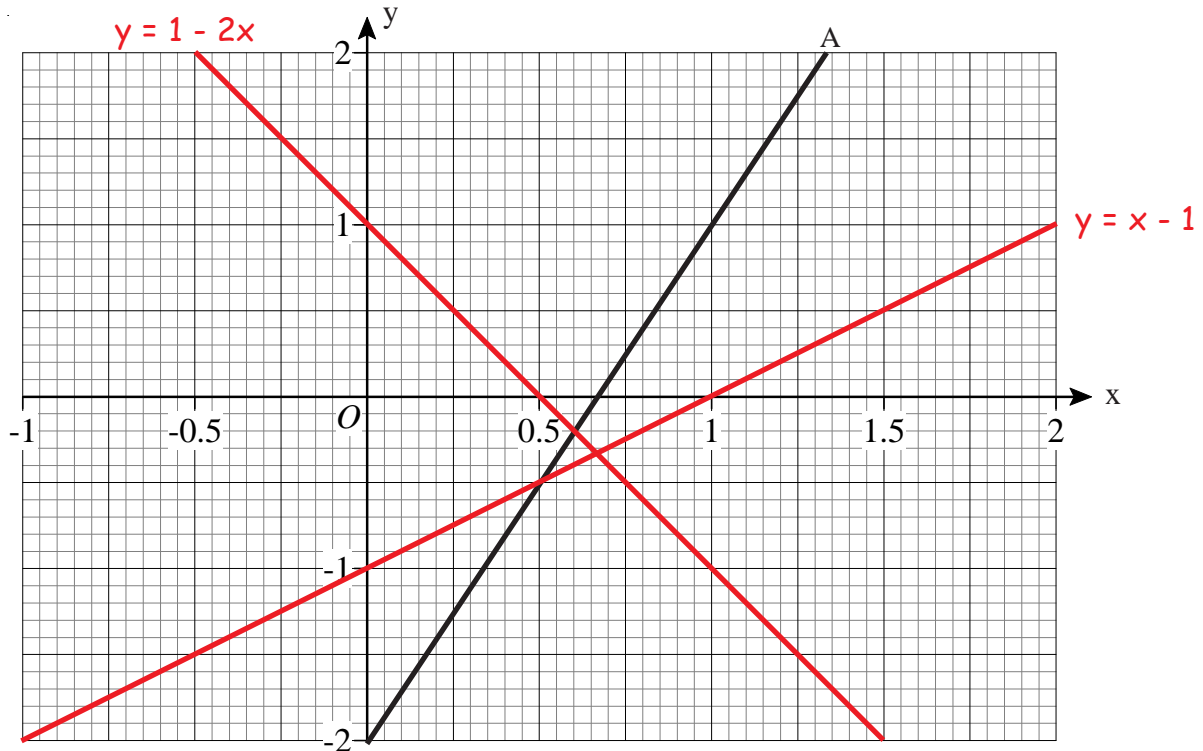
- 6) A is the point (-1, 2).
B is the point (1, 6).
C is the point (0, -1).
Find the equation of the line which passes through C and is parallel to AB.



Understand $y = mx + c$

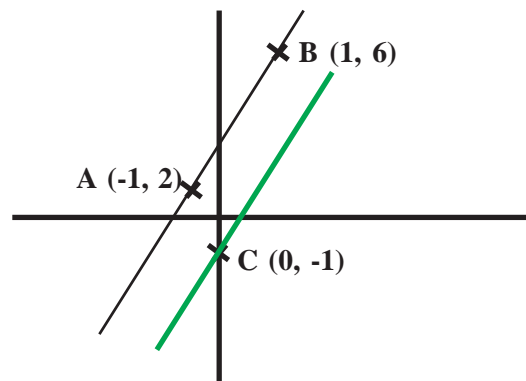
gradient \nearrow \nwarrow cuts the y-axis

- 1) a) Find the equation of line A. $y = 3x - 2$
 b) Draw the line B, with equation $y = x - 1$.
 c) Draw the line C, with equation $y = 1 - 2x$.



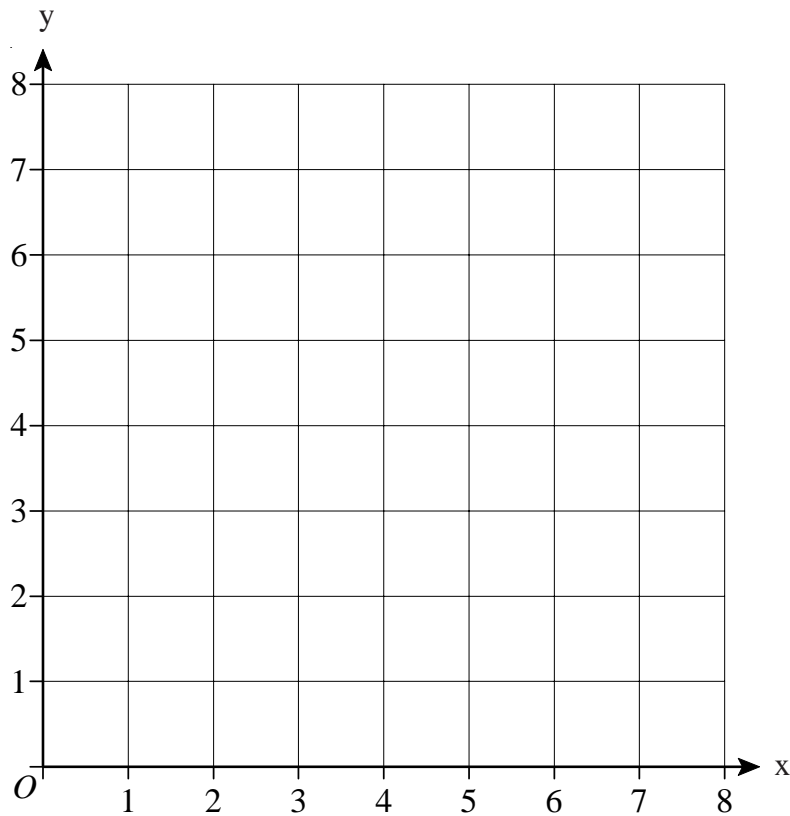
- 2) A straight line passes through points (0, 4) and (3, 13).
 What is its equation? $y = 3x + 4$
- 3) A straight line passes through points (0, 7) and (2, -1).
 What is its equation? $y = -4x + 7$
- 4) A straight line is parallel to $y = 3x - 2$ and goes through (1, 8).
 What is its equation? $y = 3x + 5$
- 5) A straight line is parallel to $y = 2x + 5$ and goes through (5, 6).
 What is its equation? $y = 2x - 4$

- 6) A is the point (-1, 2).
 B is the point (1, 6).
 C is the point (0, -1).
 Find the equation of the line which passes through C and is parallel to AB. $y = 2x - 1$

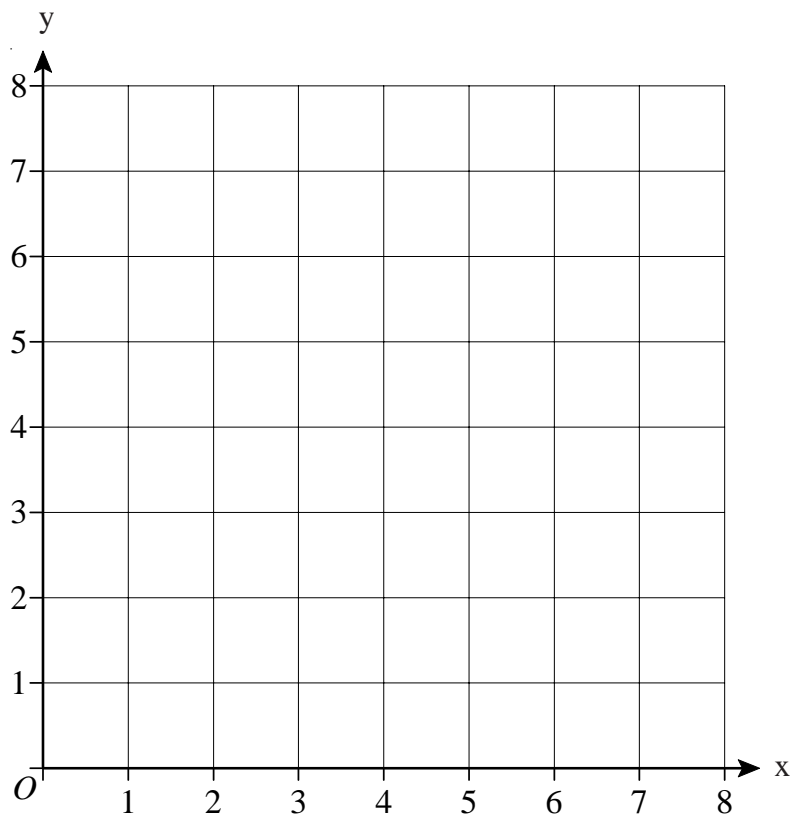


Regions

- 1) On the grid below, draw straight lines and use shading to show the region **R** that satisfies the inequalities $x > 1$ $y > x$ $x + y < 7$

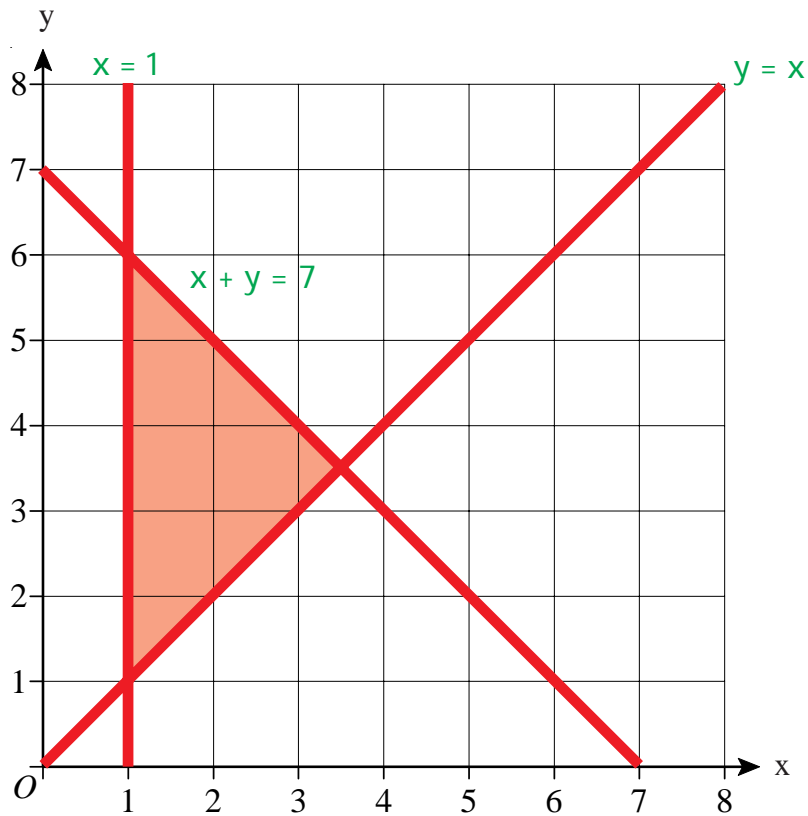


- 2) On the grid below, draw straight lines and use shading to show the region **R** that satisfies the inequalities $y > x + 1$ $y < 5$ $x > 1$

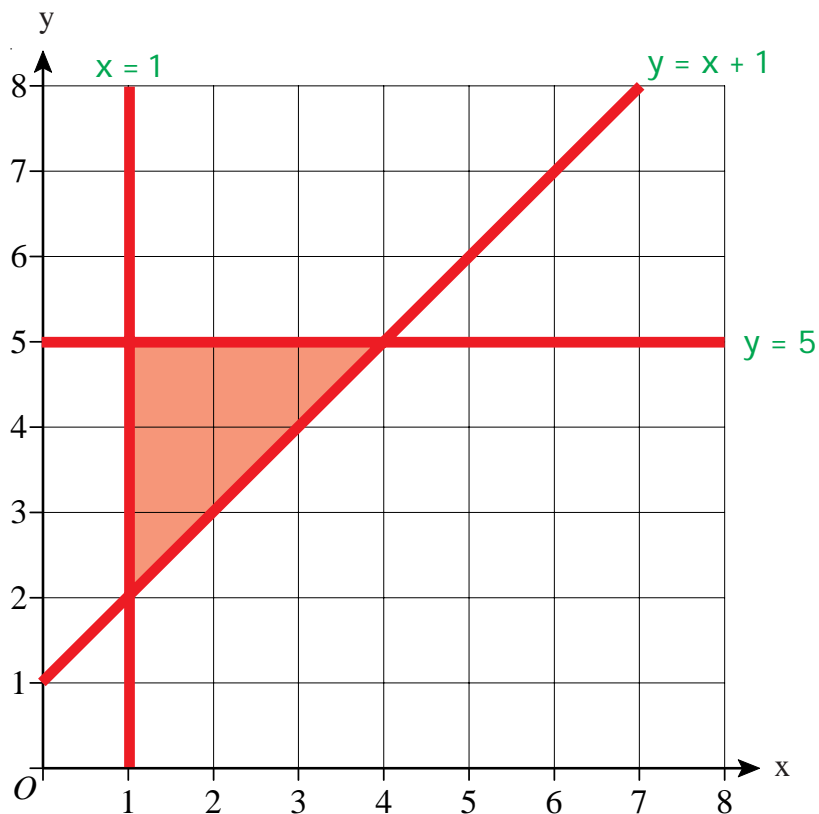


Regions

- 1) On the grid below, draw straight lines and use shading to show the region **R** that satisfies the inequalities $x > 1$ $y > x$ $x + y < 7$



- 2) On the grid below, draw straight lines and use shading to show the region **R** that satisfies the inequalities $y > x + 1$ $y < 5$ $x > 1$

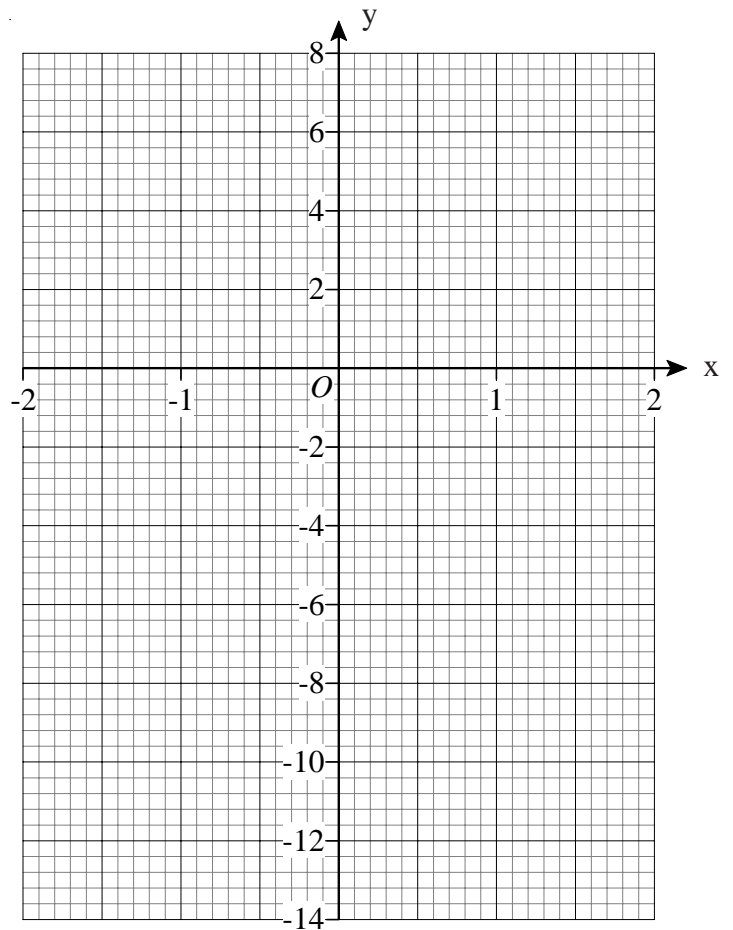


Cubic and Reciprocal Functions

- 1) a) Complete this table of values for
 $y = x^3 + x - 4$

x	-2	-1	0	1	2
y	-14			-2	

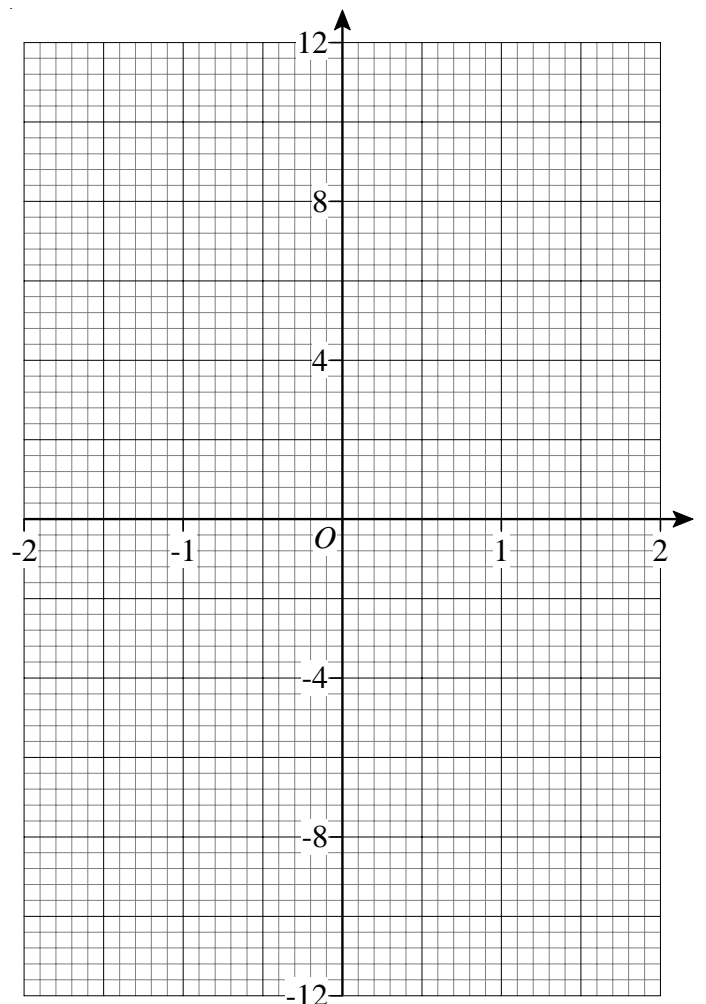
- b) On the grid, draw the graph of
 $y = x^3 + x - 4$
- c) Use the graph to find the value of x when y = 2



- 2) a) Complete this table of values for
 $y = x^3 + 2x$

x	-2	-1	0	1	2
y	-12		0		

- b) On the grid, draw the graph of
 $y = x^3 + 2x$
- c) Use the graph to find the value of x when y = -6



- 3) Sketch the graph of $y = 1 + \frac{1}{x}$ in your book.

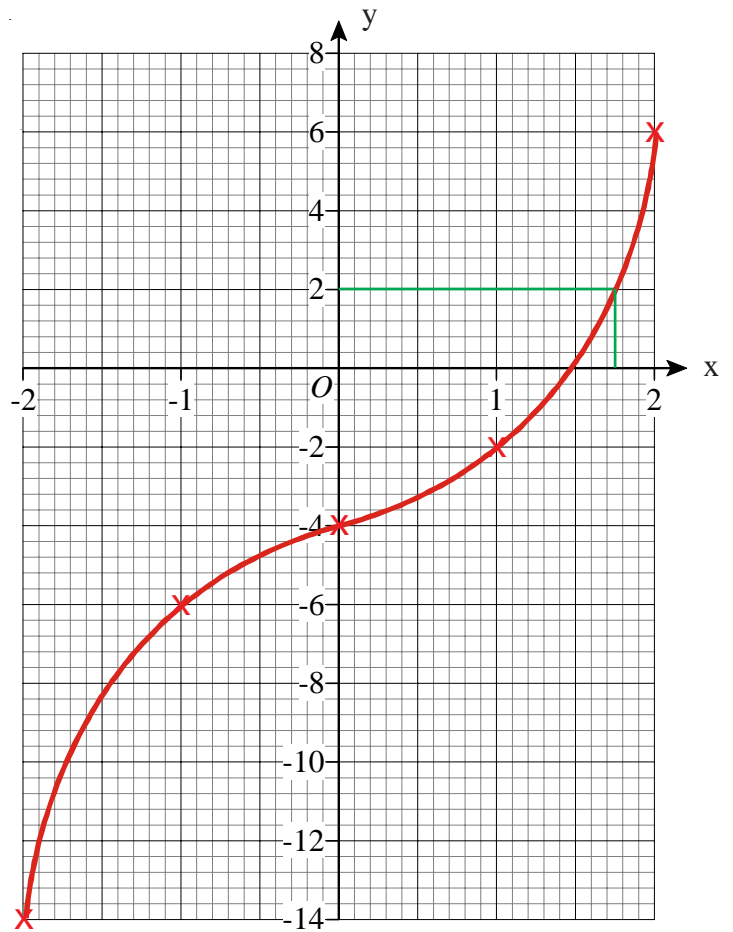
Cubic and Reciprocal Functions

- 1) a) Complete this table of values for
 $y = x^3 + x - 4$

x	-2	-1	0	1	2
y	-14	-6	-4	-2	6

- b) On the grid, draw the graph of
 $y = x^3 + x - 4$

- c) Use the graph to find the value of x when y = 2
 $x = 1.75$

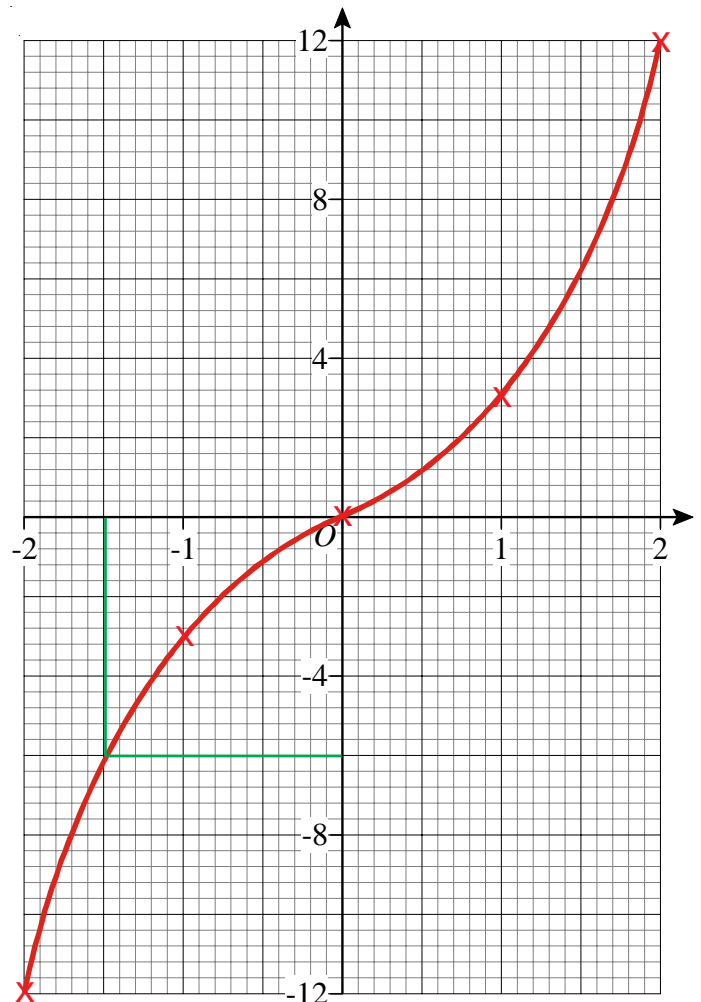


- 2) a) Complete this table of values for
 $y = x^3 + 2x$

x	-2	-1	0	1	2
y	-12	-3	0	3	12

- b) On the grid, draw the graph of
 $y = x^3 + 2x$

- c) Use the graph to find the value of x when y = -6
 $x = -1.5$



- 3) Sketch the graph of $y = 1 + \frac{1}{x}$ in your book.



Recognise the Shapes of Functions

Match each of the functions below, with the correct sketch of its graph.

$$y = 3x^3$$

$$y = \frac{-2}{x}$$

$$y = 3x - 1$$

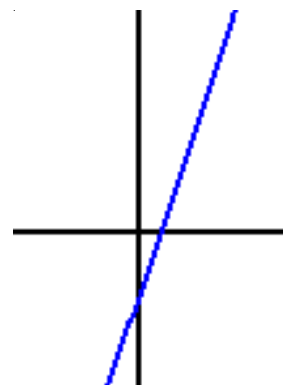
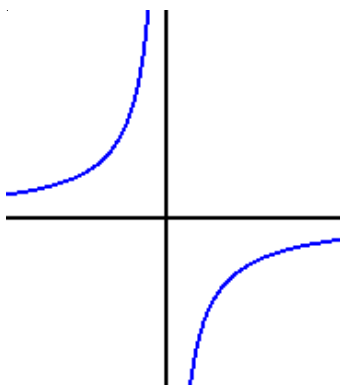
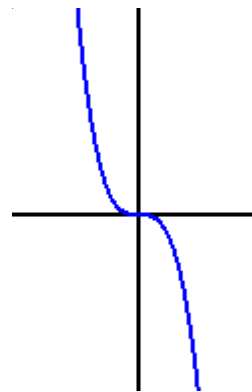
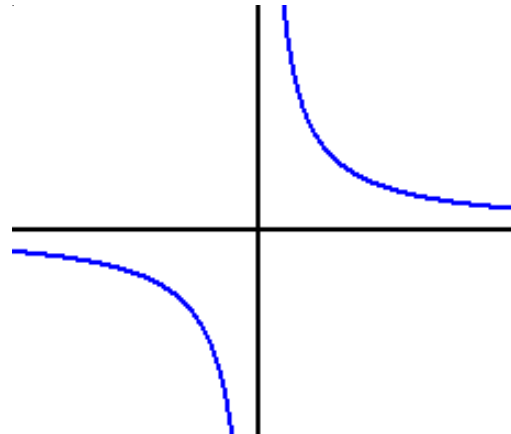
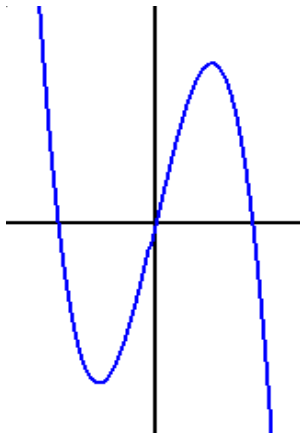
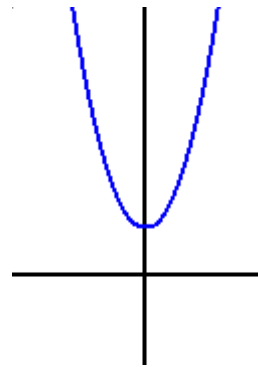
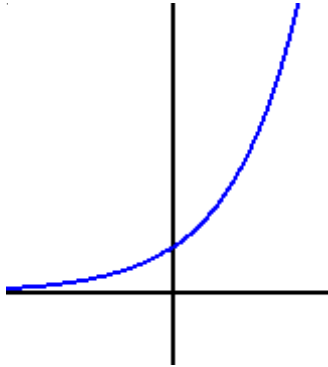
$$y = 2^x$$

$$y = 2x^2 + 1$$

$$y = \frac{2}{x}$$

$$y = 5x - x^3$$

$$y = -2x^3$$



Recognise the Shapes of Functions

Match each of the functions below, with the correct sketch of its graph.

$$y = 3x^3$$

$$y = \frac{-2}{x}$$

$$y = 3x - 1$$

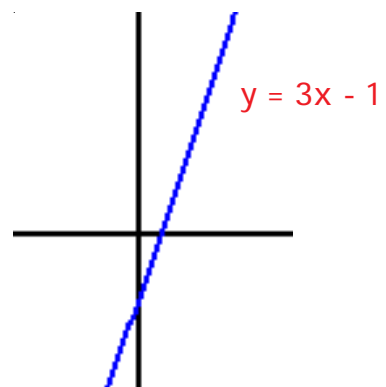
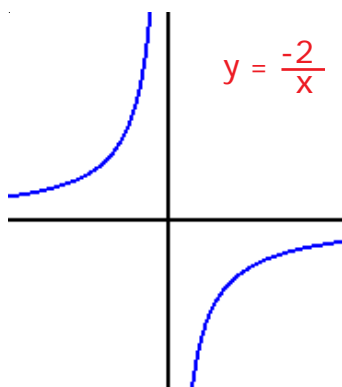
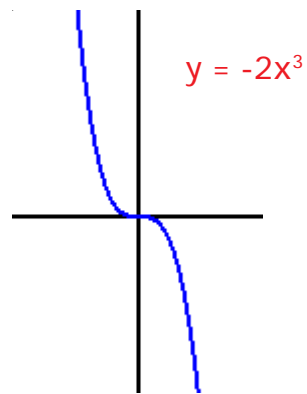
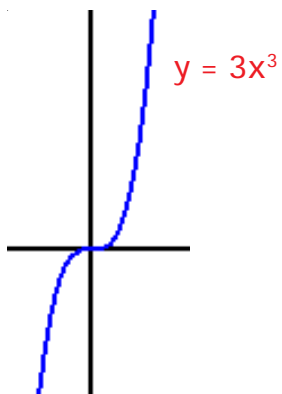
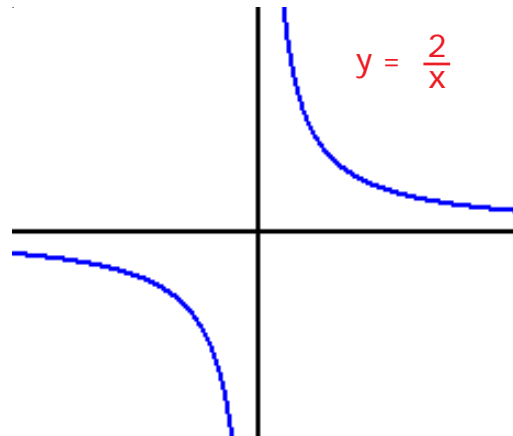
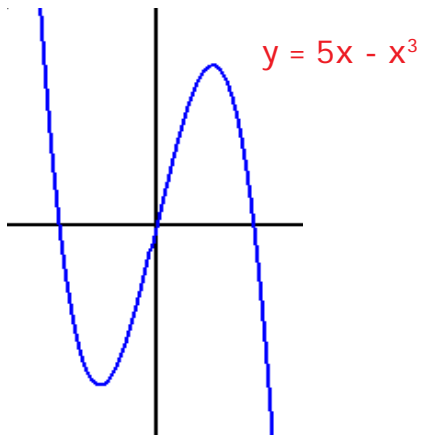
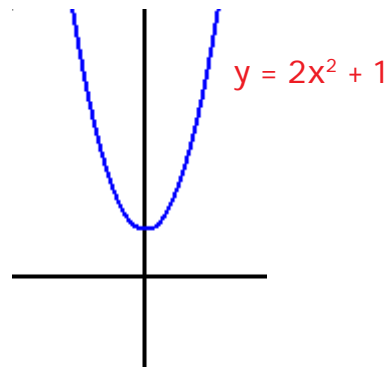
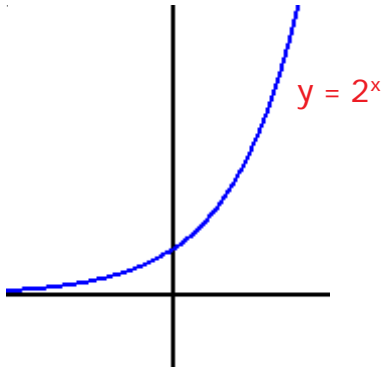
$$y = 2^x$$

$$y = 2x^2 + 1$$

$$y = \frac{2}{x}$$

$$y = 5x - x^3$$

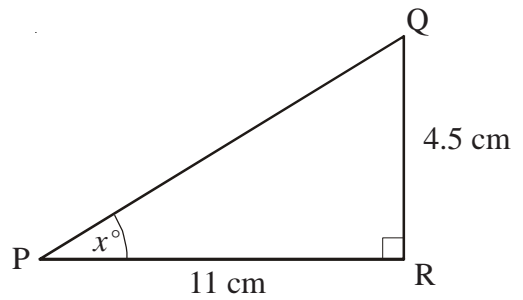
$$y = -2x^3$$



Trigonometry

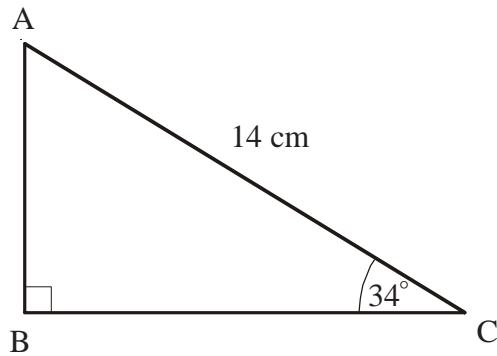
- 1) PQR is a right-angled triangle.
 PR = 11 cm.
 QR = 4.5 cm
 Angle PRQ = 90°

Work out the value of x .
 Give your answer correct to 1 decimal place.



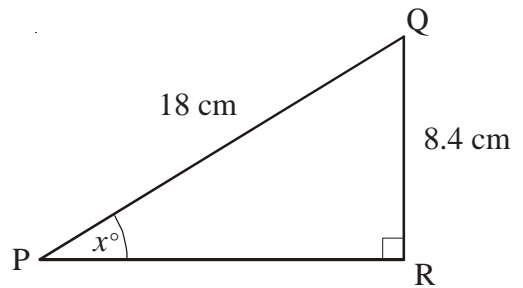
- 2) AC = 14 cm.
 Angle ABC = 90°
 Angle ACB = 34°

Calculate the length of BC.
 Give your answer correct to 3 significant figures.



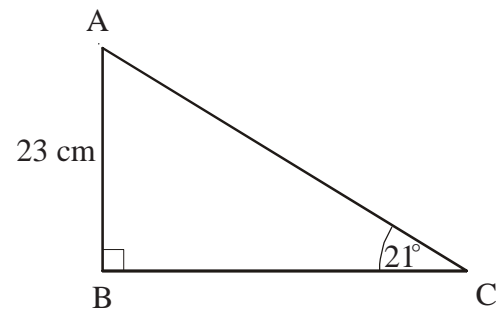
- 3) PQR is a right-angled triangle.
 PQ = 18 cm.
 QR = 8.4 cm
 Angle PRQ = 90°

Work out the value of x .
 Give your answer correct to 1 decimal place.

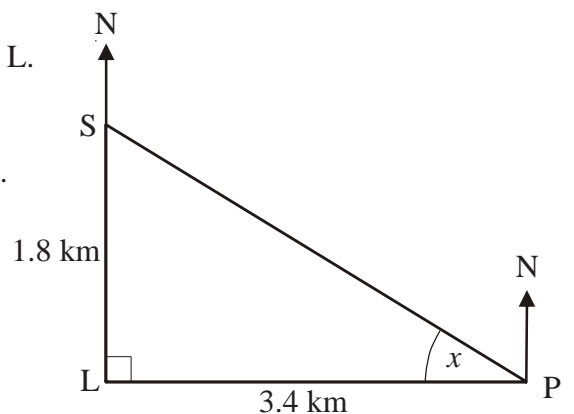


- 4) AB = 23 cm.
 Angle ABC = 90°
 Angle ACB = 21°

Calculate the length of AC.
 Give your answer correct to 3 significant figures.



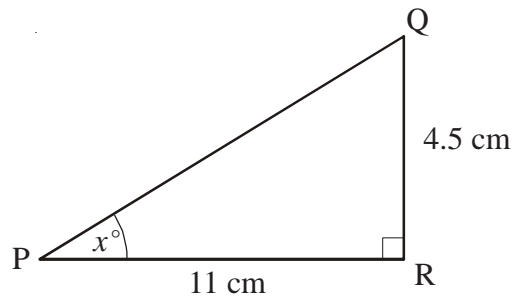
- 5) A lighthouse, L, is 3.4 km due West of a port, P.
 A ship, S, is 1.8 km due North of the lighthouse, L.
 Calculate the size of the angle marked x .
 Give your answer correct to 3 significant figures.



Trigonometry

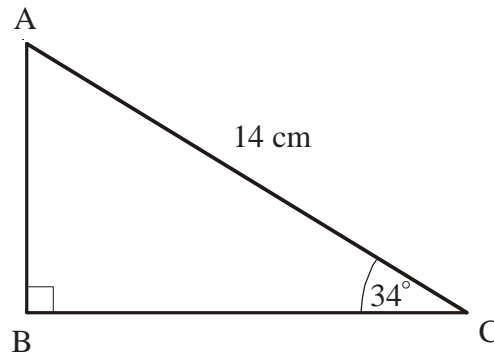
- 1) PQR is a right-angled triangle.
 PR = 11 cm.
 QR = 4.5 cm
 Angle PRQ = 90°

Work out the value of x . **22.2°**
 Give your answer correct to 1 decimal place.



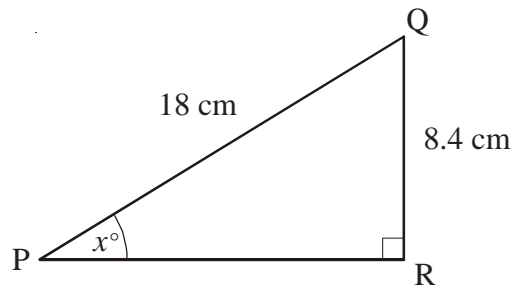
- 2) AC = 14 cm.
 Angle ABC = 90°
 Angle ACB = 34°

Calculate the length of BC. **11.6 cm**
 Give your answer correct to 3 significant figures.



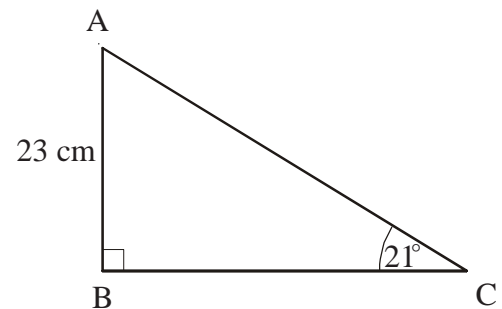
- 3) PQR is a right-angled triangle.
 PQ = 18 cm.
 QR = 8.4 cm
 Angle PRQ = 90°

Work out the value of x . **27.8°**
 Give your answer correct to 1 decimal place.



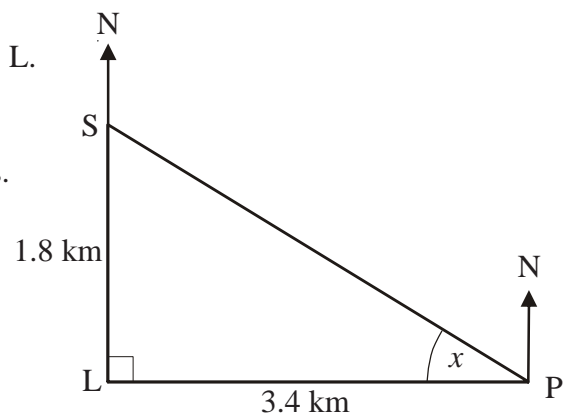
- 4) AB = 23 cm.
 Angle ABC = 90°
 Angle ACB = 21°

Calculate the length of AC. **64.2 cm**
 Give your answer correct to 3 significant figures.



- 5) A lighthouse, L, is 3.4 km due West of a port, P.
 A ship, S, is 1.8 km due North of the lighthouse, L.

Calculate the size of the angle marked x . **27.9°**
 Give your answer correct to 3 significant figures.



Bearings by Trigonometry

1)

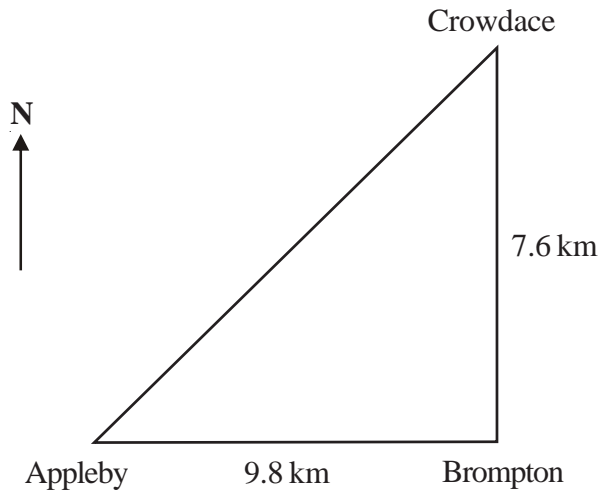


Diagram **NOT**
accurately drawn.

Appleby, Brompton and Crowdace are three towns.

Appleby is 9.8 km due west of Brompton.

Brompton is 7.6 km due south of Crowdace.

- Calculate the bearing of Crowdace from Appleby.
Give your answer correct to 1 decimal place.
- Calculate the bearing of Appleby from Crowdace.
Give your answer correct to 1 decimal place.

2)

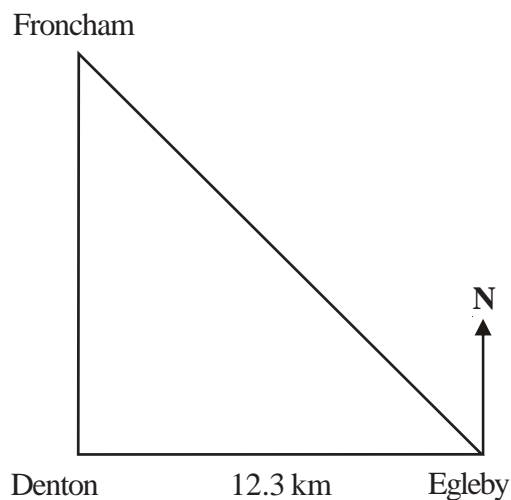


Diagram **NOT**
accurately drawn.

Denton, Egleby and Froncham are three towns.

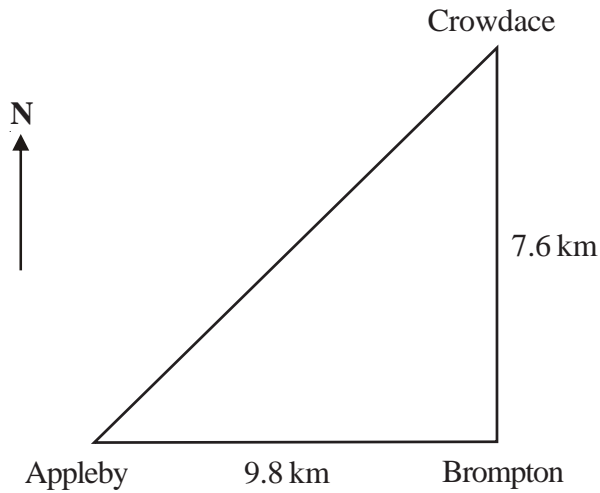
Egleby is 12.3 km due East of Denton.

Froncham is due north of Denton and on a bearing of 320° from Egleby.

Calculate the distance between Froncham and Egleby.

Give your answer correct to 1 decimal place.

1)

Diagram **NOT**
accurately drawn.

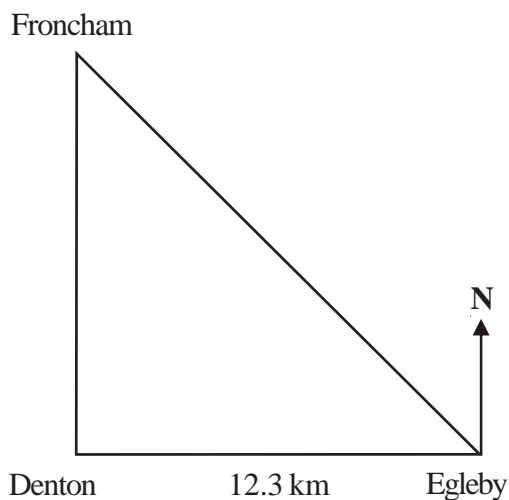
Appleby, Brompton and Crowdace are three towns.

Appleby is 9.8 km due west of Brompton.

Brompton is 7.6 km due south of Crowdace.

- Calculate the bearing of Crowdace from Appleby.
Give your answer correct to 1 decimal place. **052.2°**
- Calculate the bearing of Appleby from Crowdace.
Give your answer correct to 1 decimal place. **232.2°**

2)

Diagram **NOT**
accurately drawn.

Denton, Egleby and Froncham are three towns.

Egleby is 12.3 km due East of Denton.

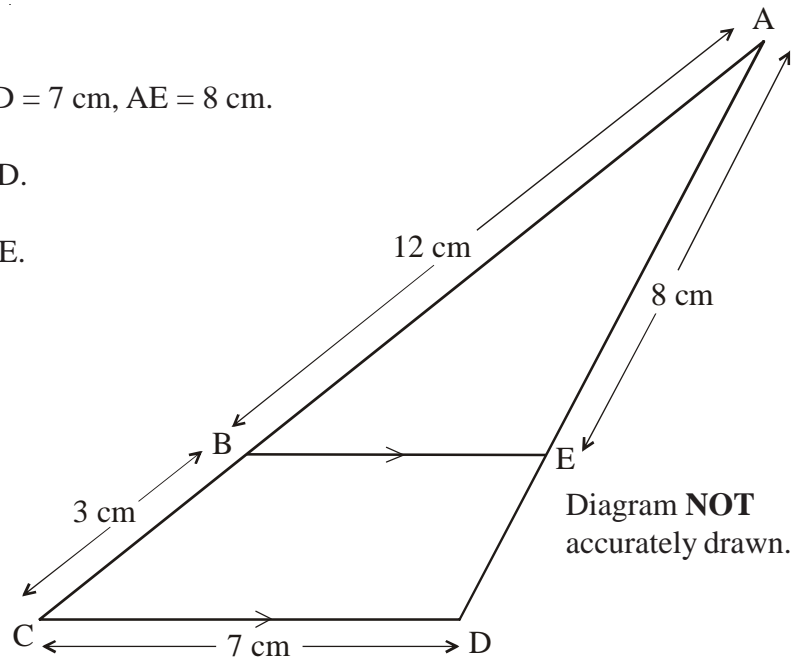
Froncham is due north of Denton and on a bearing of 320° from Egleby.

Calculate the distance between Froncham and Egleby.

Give your answer correct to 1 decimal place. **19.1 km**

Similar Shapes

- 1) BE is parallel to CD.
 AB = 12 cm, BC = 3 cm, CD = 7 cm, AE = 8 cm.
- a) Calculate the length of ED.
- b) Calculate the length of BE.



2)

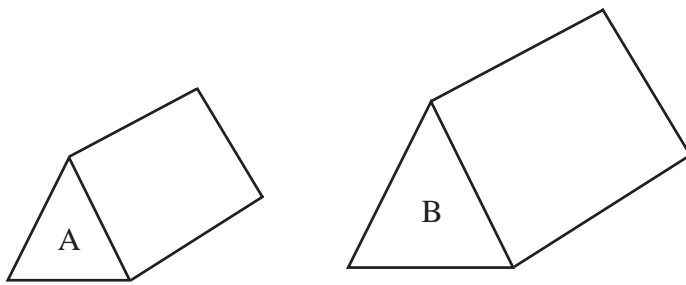


Diagram **NOT** accurately drawn.

Two prisms, A and B, are mathematically similar.
 The volume of prism A is 36000 cm^3 .
 The volume of prism B is 383328 cm^3 .
 The total surface area of prism B is 40656 cm^2 .

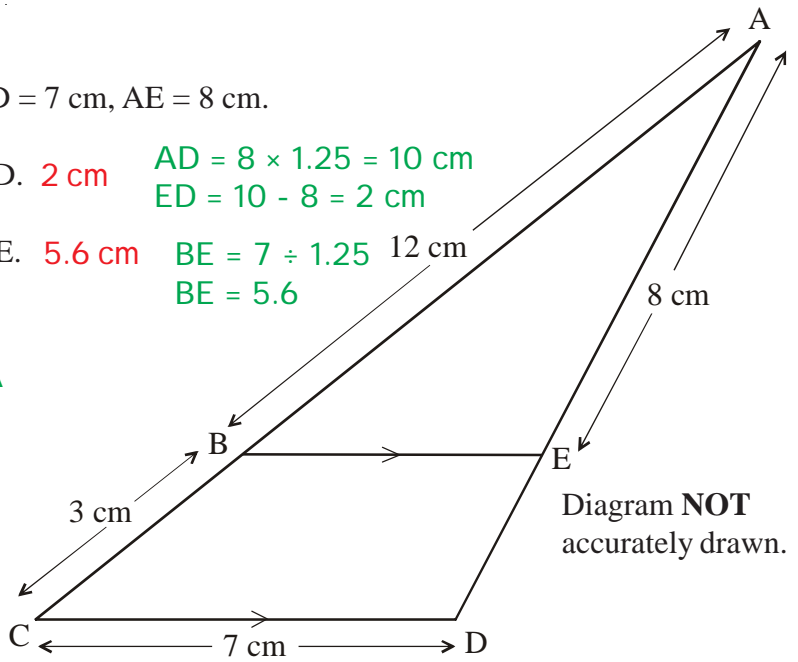
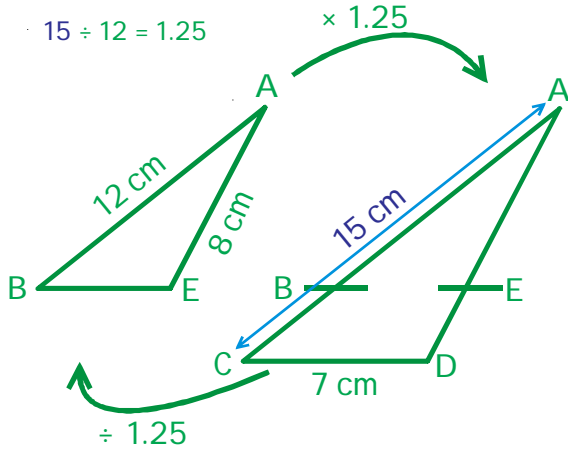
Calculate the total surface area of prism A.

- 3) P and Q are two geometrically similar solid shapes.
- The total surface area of shape P is 540 cm^2 .
 The total surface area of shape Q is 960 cm^2 .
 The volume of shape P is 2700 cm^3 .
- Calculate the volume of shape Q.

Similar Shapes

- 1) BE is parallel to CD.
 AB = 12 cm, BC = 3 cm, CD = 7 cm, AE = 8 cm.

- a) Calculate the length of ED. **2 cm** $AD = 8 \times 1.25 = 10 \text{ cm}$
 $ED = 10 - 8 = 2 \text{ cm}$
- b) Calculate the length of BE. **5.6 cm** $BE = 7 \div 1.25 = 5.6$



- 2)

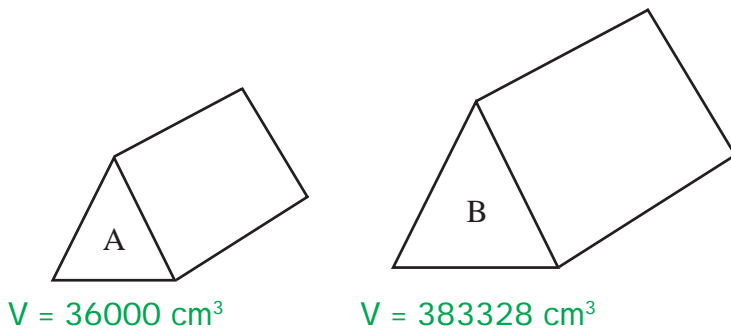


Diagram NOT accurately drawn.

Volume scale factor
 $383328 \div 36000 = 10.648$

Linear scale factor
 $\sqrt[3]{10.648} = 2.2$

Area scale factor
 $2.2^2 = 4.84$

$40656 \div 4.84 = 8400 \text{ cm}^2$

Two prisms, A and B, are mathematically similar.
 The volume of prism A is 36000 cm^3 .
 The volume of prism B is 383328 cm^3 .
 The total surface area of prism B is 40656 cm^2 .

Calculate the total surface area of prism A. **8400 cm^2**

- 3) P and Q are two geometrically similar solid shapes.
 The total surface area of shape P is 540 cm^2 .
 The total surface area of shape Q is 960 cm^2 .
 The volume of shape P is 2700 cm^3 .
 Calculate the volume of shape Q. **6400 cm^3**

Area scale factor
 $960 \div 540 = 1.7$

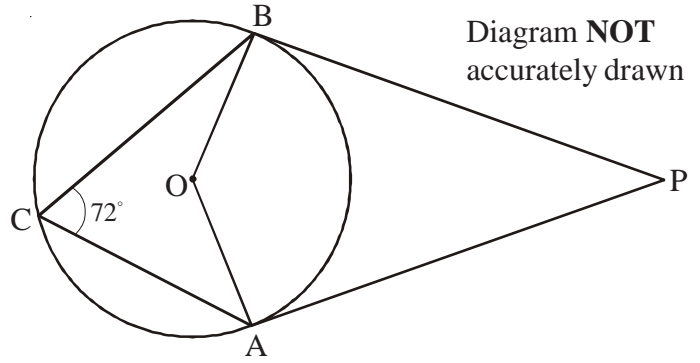
Linear scale factor
 $\sqrt{1.7} = 1.3$

Volume scale factor
 $1.3^3 = 2.197$

$2700 \times 2.197 = 5931.9$

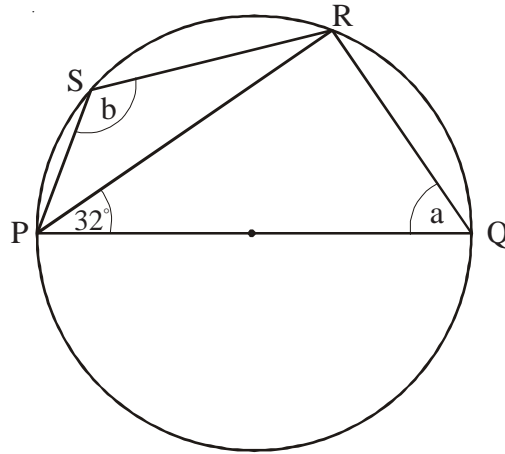
Circle Theorems

- 1) In the diagram, A, B and C are points on the circumference of a circle, centre O. PA and PB are tangents to the circle. Angle $ACB = 72^\circ$.



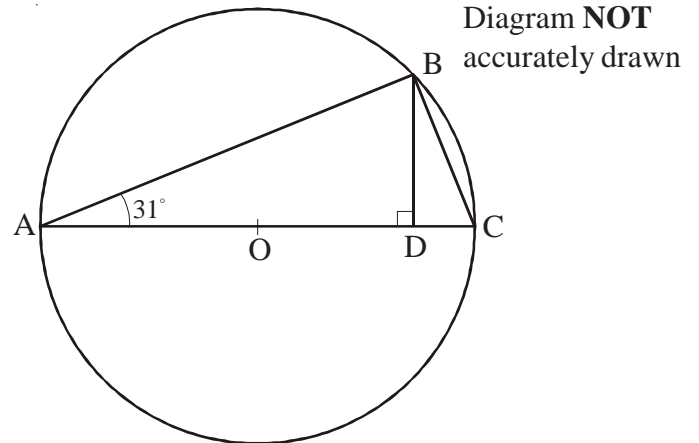
- a) (i) Work out the size of angle AOB.
 (ii) Give a reason for your answer.
- b) Work out the size of angle APB.

- 2) P, Q, R and S are points on the circle. PQ is a diameter of the circle. Angle $RPQ = 32^\circ$.



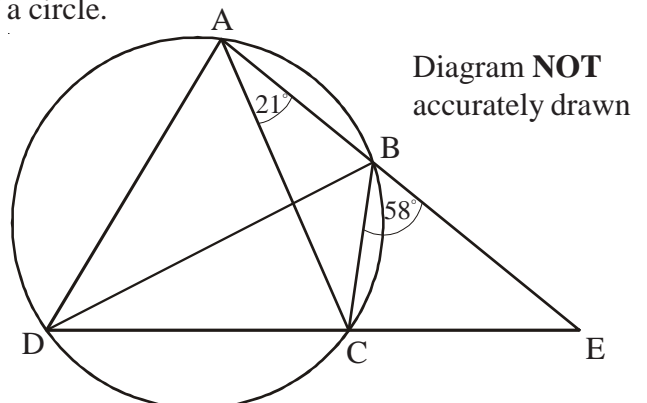
- a) (i) Work out the size of angle PQR.
 (ii) Give reasons for your answer.
- b) (i) Work out the size of angle PSR.
 (ii) Give a reason for your answer.

- 3) The diagram shows a circle, centre O. AC is a diameter. Angle $BAC = 31^\circ$. D is a point on AC such that angle BDA is a right angle.



- a) Work out the size of angle BCA.
 Give reasons for your answer.
- b) Calculate the size of angle DBC.
- c) Calculate the size of angle BOA.

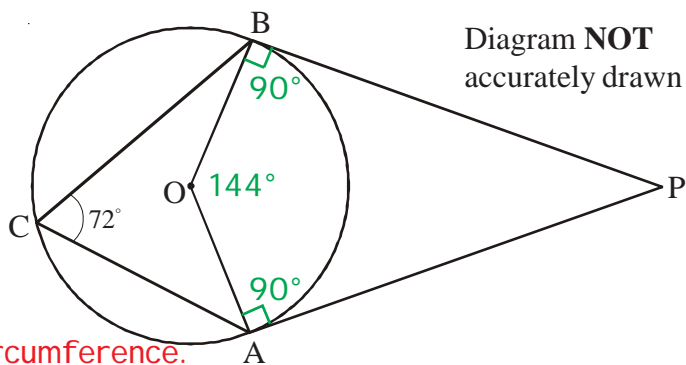
- 4) A, B, C and D are four points on the circumference of a circle. ABE and DCE are straight lines. Angle $BAC = 21^\circ$. Angle $EBC = 58^\circ$.



- a) Find the size of angle ADC.
- b) Find the size of angle ADB.
- Angle $CAD = 69^\circ$.
- c) Is BD a diameter of the circle?
 You must explain your answer.

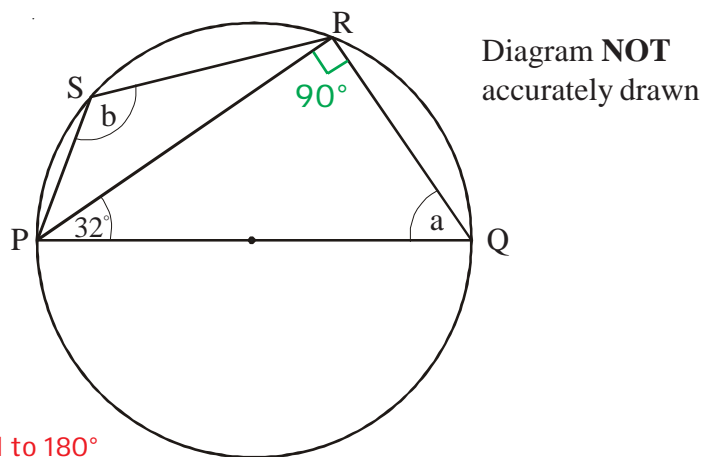
Circle Theorems

- 1) In the diagram, A, B and C are points on the circumference of a circle, centre O. PA and PB are tangents to the circle. Angle ACB = 72° .



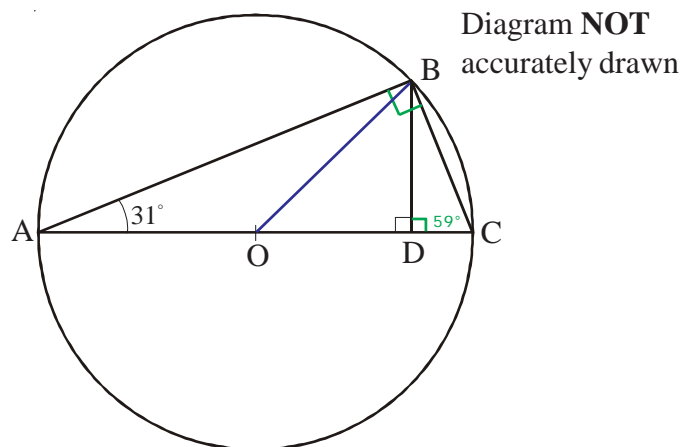
- a) (i) Work out the size of angle AOB. 144°
 (ii) Give a reason for your answer.
Angle at centre is twice angle on circumference.
- b) Work out the size of angle APB. 36°

- 2) P, Q, R and S are points on the circle. PQ is a diameter of the circle. Angle RPQ = 32° .



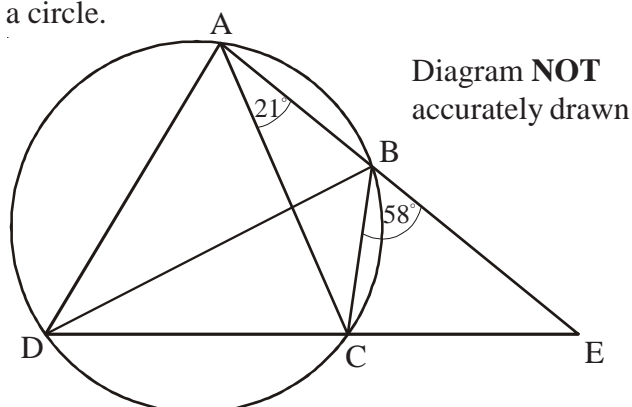
- a) (i) Work out the size of angle PQR. 58°
 (ii) Give reasons for your answer.
Angle in semi-circle is 90°
Angles in triangle add to 180°
- b) (i) Work out the size of angle PSR. 122°
 (ii) Give a reason for your answer.
Opposite angles of a cyclic quadrilateral add to 180°

- 3) The diagram shows a circle, centre O. AC is a diameter. Angle BAC = 31° . D is a point on AC such that angle BDA is a right angle.



- a) Work out the size of angle BCA. 59°
 Give reasons for your answer.
Angle in semi-circle is 90°
Angles in triangle add to 180°
- b) Calculate the size of angle DBC. 31°
- c) Calculate the size of angle BOA. 118°

- 4) A, B, C and D are four points on the circumference of a circle. ABE and DCE are straight lines. Angle BAC = 21° . Angle EBC = 58° .



- a) Find the size of angle ADC. 58°
- b) Find the size of angle ADB. 37°
- Angle CAD = 69° .
- c) Is BD a diameter of the circle? **Yes**
 You must explain your answer.
Angle DAB = $69^\circ + 21^\circ = 90^\circ$
BD subtends 90° on the circumference. Therefore BD is a diameter.

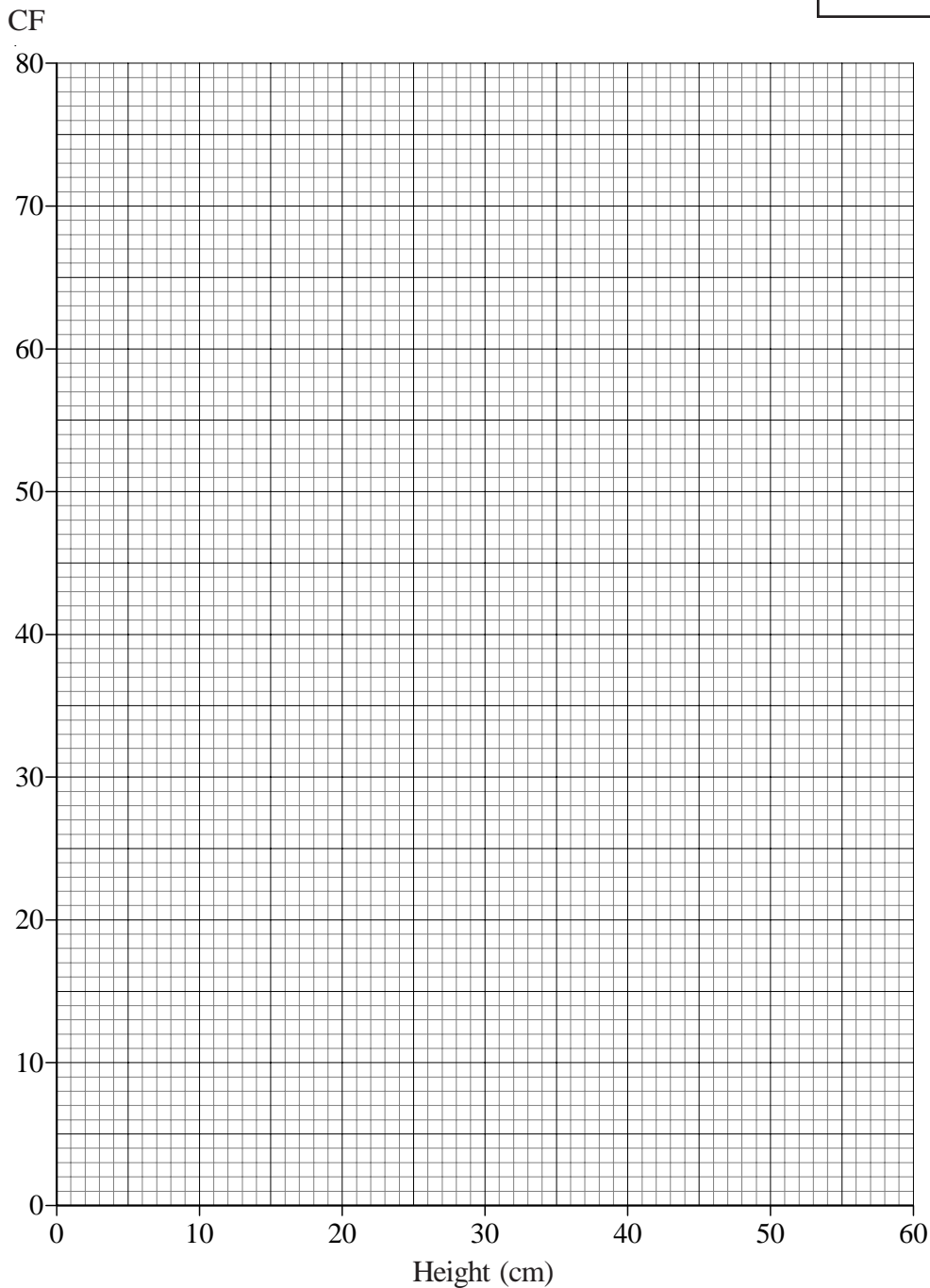
Cumulative Frequency

The heights of 80 plants were measured and can be seen in the table, below.

Height (cm)	Frequency
$0 < h < 10$	2
$10 < h < 20$	5
$20 < h < 30$	19
$30 < h \leq 40$	38
$40 < h < 50$	13
$50 < h < 60$	3

a) Complete the cumulative frequency table for the plants.

Height (cm)	Cumulative Frequency
$0 < h \leq 10$	2
$0 < h < 20$	
$0 < h < 30$	
$0 < h \leq 40$	
$0 < h \leq 50$	
$0 < h \leq 60$	



b) Draw a cumulative frequency graph for your table.

c) Use your graph to find an estimate for

- (i) the median height of a plant.
- (ii) the interquartile range of the heights of the plants.

d) Use your graph to estimate how many plants had a height that was greater than 45cm.

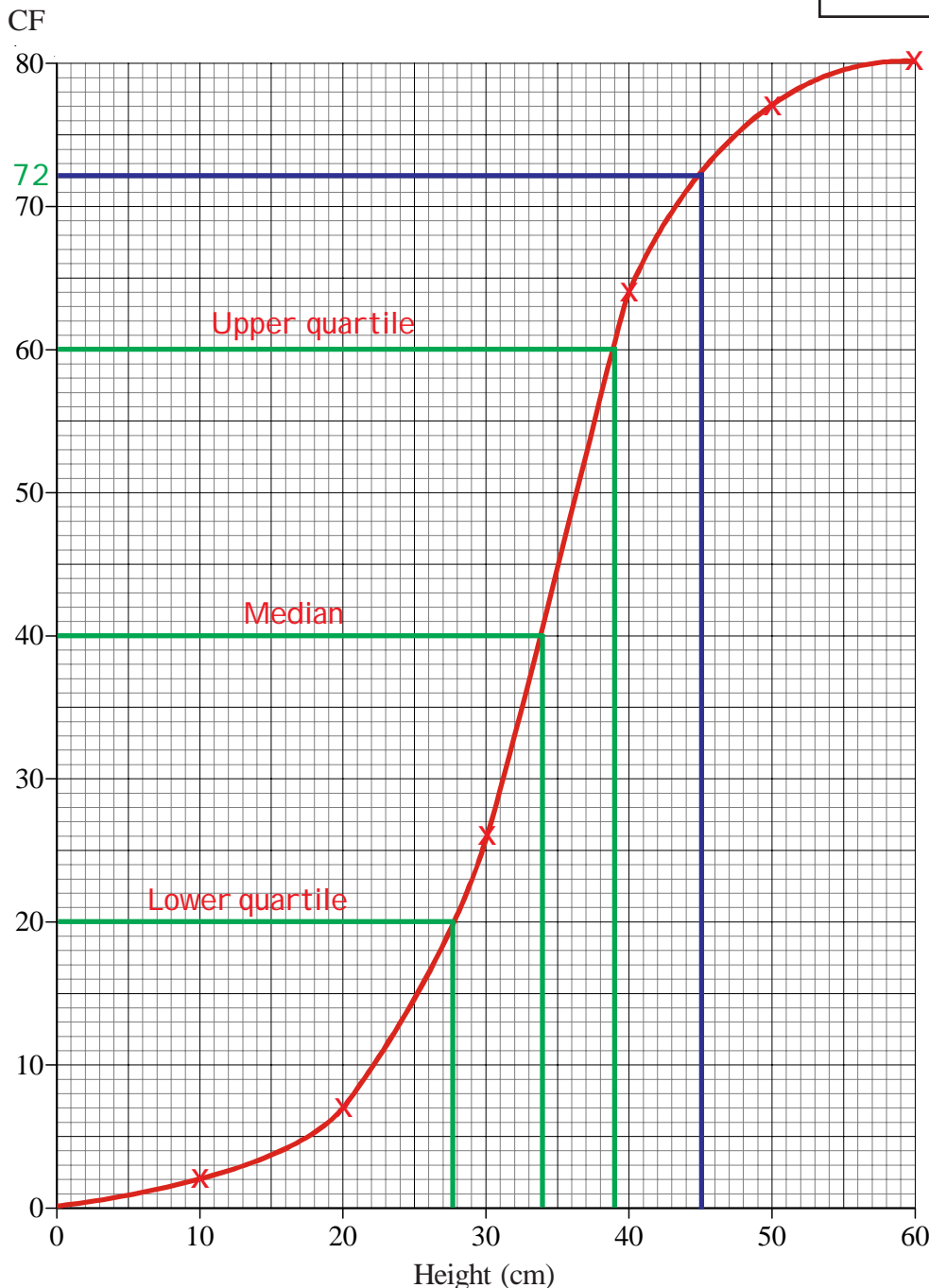
Cumulative Frequency

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$50 < h < 60$	3

a) Complete the cumulative frequency table for the plants.

Height (cm)	Cumulative Frequency
$0 < h \leq 10$	2
$0 < h < 20$	7
$0 < h < 30$	26
$0 < h \leq 40$	64
$0 < h \leq 50$	77
$0 < h \leq 60$	80



b) Draw a cumulative frequency graph for your table.

c) Use your graph to find an estimate for

(i) the median height of a plant.

34 cm

(ii) the interquartile range of the heights of the plants.

$$39 - 27.7 = 11.3 \text{ cm}$$

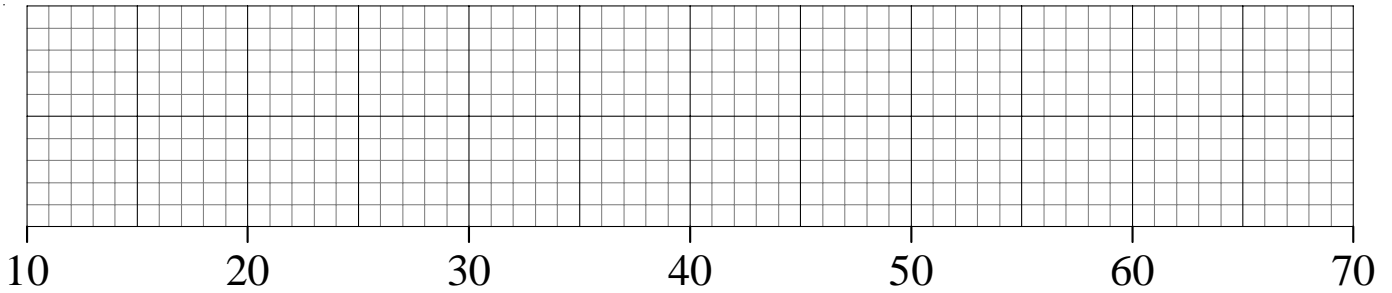
d) Use your graph to estimate how many plants had a height that was greater than 45cm.

$$80 - 72 = 8 \text{ plants}$$

1) The ages of 20 teachers are listed below.

22, 22, 24, 25, 27, 27, 28, 29, 29, 29, 34, 35, 41, 43, 44, 49, 55, 57, 58, 58

a) On the grid below, draw a boxplot to show the information about the teachers.



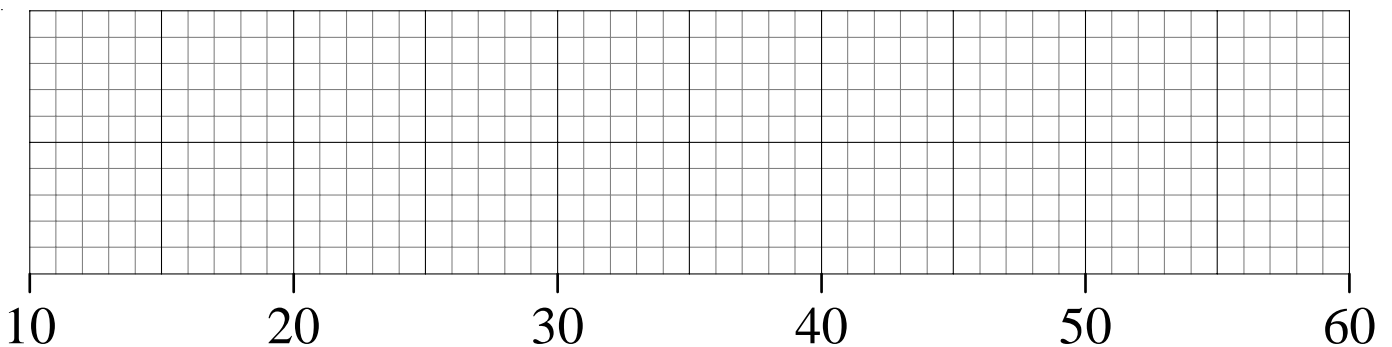
b) What is the interquartile range of the ages of the teachers?

2) A warehouse has 60 employees working in it.

The age of the youngest employee is 16 years.
The age of the oldest employee is 55 years.

The median age is 37 years.
The lower quartile age is 29 years.
The upper quartile age is 43 years.

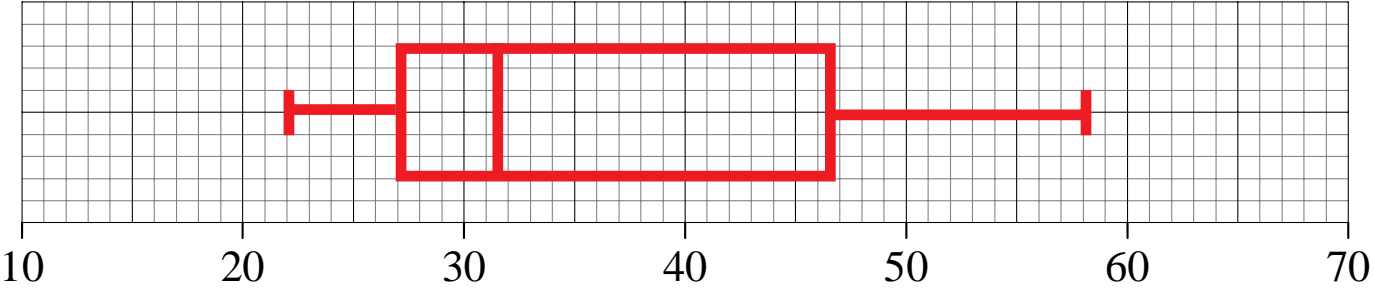
On the grid below, draw a boxplot to show information about the ages of the employees.



1) The ages of 20 teachers are listed below.



a) On the grid below, draw a boxplot to show the information about the teachers.



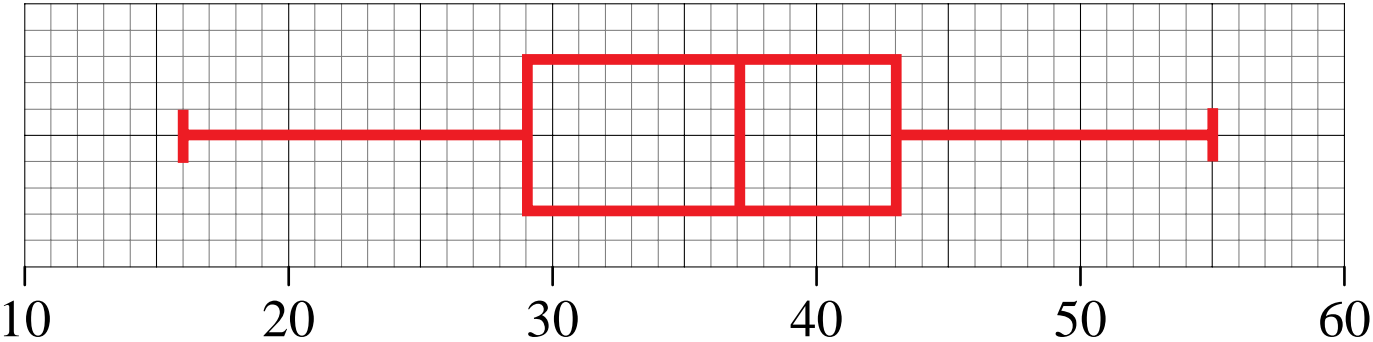
b) What is the interquartile range of the ages of the teachers? 19.5 years

2) A warehouse has 60 employees working in it.

The age of the youngest employee is 16 years.
 The age of the oldest employee is 55 years.

The median age is 37 years.
 The lower quartile age is 29 years.
 The upper quartile age is 43 years.

On the grid below, draw a boxplot to show information about the ages of the employees.



Moving Averages

- 1) The table shows the number of board games sold in a supermarket each month from January to June.

Jan	Feb	Mar	Apr	May	Jun
146	163	237	134	169	259

Work out the 3-month moving averages for this information.

_____, _____, _____, _____

- 2) The table shows the number of computers sold in a shop in the first five months of 2007.

Jan	Feb	Mar	Apr	May	June
74	83	112	78	91	x

- a) Work out the first two 3-month moving averages for this information.

_____, _____

- b) Work out the first 4-month moving average for this information.

The third 4-month moving average of the number of computers sold in 2007 is 96.
The number of computers sold in the shop in June was x.

- c) Work out the value of x.

Moving Averages

- 1) The table shows the number of board games sold in a supermarket each month from January to June.

Jan	Feb	Mar	Apr	May	Jun
146	163	237	134	169	259

Work out the 3-month moving averages for this information.

$$\frac{182}{(146+163+237) \div 3}, \quad \frac{178}{(163+237+134) \div 3}, \quad \frac{180}{(237+134+169) \div 3}, \quad \frac{187.\dot{3}}{(134+169+259) \div 3}$$

- 2) The table shows the number of computers sold in a shop in the first five months of 2007.

Jan	Feb	Mar	Apr	May	June
74	83	112	78	91	x

- a) Work out the first two 3-month moving averages for this information.

$$\frac{89.\dot{6}}{(74 + 83 + 112) \div 3}, \quad \frac{91}{(83 + 112 + 78) \div 3}$$

- b) Work out the first 4-month moving average for this information.

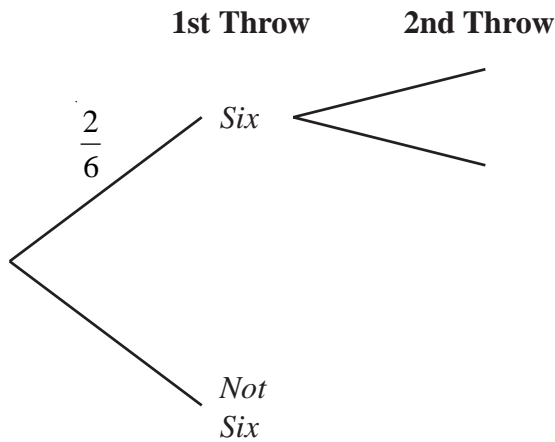
$$\frac{86.75}{(74 + 83 + 112 + 78) \div 4}$$

The third 4-month moving average of the number of computers sold in 2007 is 96. The number of computers sold in the shop in June was x.

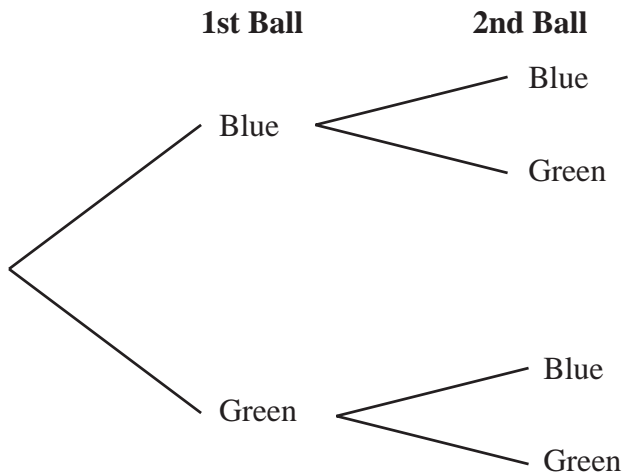
- c) Work out the value of x. $x = 103$

$$\begin{aligned} 4 \times 96 &= 384 \\ 112 + 78 + 91 &= 281 \\ 384 - 281 &= 103 \end{aligned}$$

- 1) Lucy throws a biased dice twice.
 Complete the probability tree diagram to show the outcomes.
 Label clearly the branches of the tree diagram.



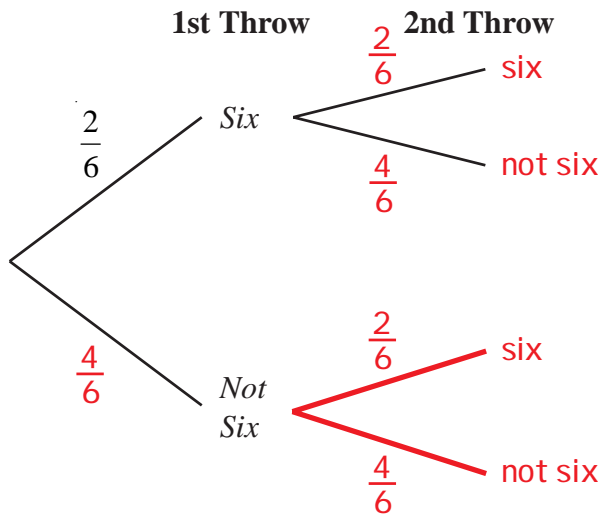
- 2) A bag contains 10 coloured balls.
 7 of the balls are blue and 3 of the balls are green.
 Nathan is going to take a ball, replace it, and then take a second ball.
 a) Complete the tree diagram.



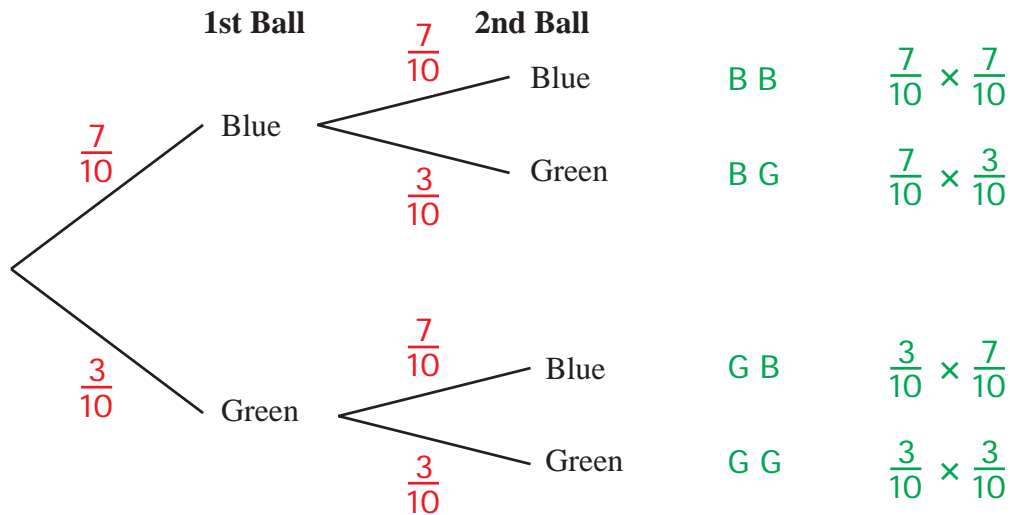
- b) Work out the probability that Nathan will take two blue balls.
- c) Work out the probability that Nathan will take one of each coloured balls.
- d) Work out the probability that Nathan will take two balls of the same colour.

Tree Diagrams

- 1) Lucy throws a biased dice twice.
 Complete the probability tree diagram to show the outcomes.
 Label clearly the branches of the tree diagram.



- 2) A bag contains 10 coloured balls.
 7 of the balls are blue and 3 of the balls are green.
 Nathan is going to take a ball, replace it, and then take a second ball.
 a) Complete the tree diagram.



b) Work out the probability that Nathan will take two blue balls. $\frac{49}{100}$ $\frac{7}{10} \times \frac{7}{10}$

c) Work out the probability that Nathan will take one of each coloured balls. $\frac{42}{100}$ $\frac{21}{100} + \frac{21}{100}$

d) Work out the probability that Nathan will take two balls of the same colour. $\frac{58}{100}$ $\frac{49}{100} + \frac{9}{100}$

- 1) a) Convert the recurring decimal $0.\dot{3}\dot{6}$ to a fraction in its simplest form.
- b) Prove that the recurring decimal $0.\dot{7}\dot{2} = \frac{8}{11}$
- 2) a) Change $\frac{4}{9}$ to a decimal.
- b) Prove that the recurring decimal $0.\dot{5}\dot{7} = \frac{19}{33}$
- 3) a) Change $\frac{3}{11}$ to a decimal.
- b) Prove that the recurring decimal $0.\dot{4}\dot{5} = \frac{15}{33}$
- 4) a) Change $\frac{1}{6}$ to a decimal.
- b) Prove that the recurring decimal $0.\dot{1}\dot{3}\dot{5} = \frac{5}{37}$
- 5) a) Convert the recurring decimal $0.\dot{2}\dot{6}\dot{1}$ to a fraction in its simplest form.
- b) Prove that the recurring decimal $0.2\dot{7} = \frac{5}{18}$
- 6) a) Convert the recurring decimal $5.\dot{2}$ to a fraction in its simplest form.
- b) Prove that the recurring decimal $0.1\dot{3}\dot{6} = \frac{3}{22}$

- 1) a) Convert the recurring decimal $0.\dot{3}\dot{6}$ to a fraction in its simplest form. $\frac{4}{11}$
- $x = 0.3636\dots$
 $100x = 36.3636\dots$
 $99x = 36$
 $x = \frac{36}{99} = \frac{4}{11}$
- b) Prove that the recurring decimal $0.\dot{7}\dot{2} = \frac{8}{11}$
- $0.\dot{7}\dot{2} = 2 \times 0.\dot{3}\dot{6}$
 $0.\dot{7}\dot{2} = 2 \times \frac{4}{11}$
 $0.\dot{7}\dot{2} = \frac{8}{11}$
- 2) a) Change $\frac{4}{9}$ to a decimal. $0.\dot{4}$ $\begin{array}{r} 0.44 \\ 9 \overline{) 4.00} \end{array}$
- b) Prove that the recurring decimal $0.\dot{5}\dot{7} = \frac{19}{33}$
- $x = 0.5757\dots$
 $100x = 57.5757\dots$
 $99x = 57$
 $x = \frac{57}{99} = \frac{19}{33}$
- 3) a) Change $\frac{3}{11}$ to a decimal. $0.\dot{2}\dot{7}$
- b) Prove that the recurring decimal $0.\dot{4}\dot{5} = \frac{15}{33}$
- $x = 0.4545\dots$
 $100x = 45.4545\dots$
 $99x = 45$
 $x = \frac{45}{99} = \frac{15}{33}$
- 4) a) Change $\frac{1}{6}$ to a decimal. $0.\dot{1}\dot{6}$ $\begin{array}{r} 0.166 \\ 6 \overline{) 1.000} \end{array}$
- b) Prove that the recurring decimal $0.\dot{1}\dot{3}\dot{5} = \frac{5}{37}$
- $x = 0.135135\dots$
 $1000x = 135.135135\dots$
 $999x = 135$
 $x = \frac{135}{999} = \frac{5}{37}$
- 5) a) Convert the recurring decimal $0.\dot{2}\dot{6}\dot{1}$ to a fraction in its simplest form. $\frac{29}{111}$ $0.\dot{2}\dot{6}\dot{1} = \frac{261}{999}$
- $x = 0.2777\dots$
 $100x = 27.777\dots$
 $99x = 27.5$
 $x = \frac{27.5}{99} = \frac{55}{198} = \frac{5}{18}$
- b) Prove that the recurring decimal $0.2\dot{7} = \frac{5}{18}$
- 6) a) Convert the recurring decimal $5.\dot{2}$ to a fraction in its simplest form. $x = 5.222\dots$
- $10x = 52.222\dots$
 $9x = 47$
 $x = \frac{47}{9} = 5\frac{2}{9}$
- b) Prove that the recurring decimal $0.1\dot{3}\dot{6} = \frac{3}{22}$
- $x = 0.13636\dots$
 $100x = 13.63636\dots$
 $99x = 13.5$
 $x = \frac{13.5}{99} = \frac{27}{198} = \frac{3}{22}$

$$a^x \times a^y = a^{x+y}$$

$$\frac{a^x}{a^y} = a^{x-y}$$

$$(a^x)^y = a^{xy}$$

$$a^0 = 1$$

$$a^{-x} = \frac{1}{a^x}$$

$$a^{\frac{x}{y}} = (\sqrt[y]{a})^x$$

$$a^{-\frac{x}{y}} = \frac{1}{(\sqrt[y]{a})^x}$$

1) Simplify

a) $(p^5)^5$

c) $x^5 \div x^2$

e) $(m^{-5})^{-2}$

b) $k^3 \times k^2$

d) $(p^2)^{-3}$

f) $(3xy^2)^3$

2) Without using a calculator, find the exact value of the following.

a) $4^0 \times 4^2$

c) $7^5 \div 7^3$

e) $(8^5)^0$

b) $5^4 \times 5^{-2}$

d) $\frac{6^7}{6^6}$

f) $(2^3)^2$

3) Work out each of these, leaving your answers as exact fractions when needed.

a) 4^0

e) 4^{-2}

i) $49^{\frac{1}{2}}$

m) $49^{-\frac{1}{2}}$

b) 7^0

f) 8^{-1}

j) $32^{\frac{2}{5}}$

n) $32^{-\frac{2}{5}}$

c) 25^0

g) 5^{-3}

k) $27^{\frac{1}{3}}$

o) $27^{-\frac{1}{3}}$

d) 139^0

h) 10^{-5}

l) $16^{\frac{3}{2}}$

p) $16^{-\frac{3}{2}}$

4) $5\sqrt{5}$ can be written in the form 5^n .Find the value of n .

5) $2 \times \sqrt{8} = 2^m$

Find the value of m .6) Find the value of x when

$$\sqrt{125} = 5^x$$

7) Find the value of y when

$$\sqrt{128} = 2^y$$

8) $a = 2^x$, $b = 2^y$

a) Express in terms of a and b

i) 2^{x+y} ii) 2^{2x} iii) 2^{x+2y}

$$ab = 16 \quad \text{and} \quad 2ab^2 = 16$$

b) Find the value of x and the value of y .

$a^x \times a^y = a^{x+y}$	$\frac{a^x}{a^y} = a^{x-y}$	$(a^x)^y = a^{xy}$	
$a^0 = 1$	$a^{-x} = \frac{1}{a^x}$	$a^{\frac{x}{y}} = (\sqrt[y]{a})^x$	$a^{-\frac{x}{y}} = \frac{1}{(\sqrt[y]{a})^x}$

1) Simplify

a) $(p^5)^5$ p^{25}

c) $x^5 \div x^2$ x^3

e) $(m^{-5})^{-2}$ m^{10}

b) $k^3 \times k^2$ k^5

d) $(p^2)^{-3}$ p^{-6}

f) $(3xy^2)^3$ $27x^3y^6$

2) Without using a calculator, find the exact value of the following.

a) $4^0 \times 4^2$ 16
 $1 \times 16 = 16$

c) $7^5 \div 7^3$ 49
 $7^2 = 49$

e) $(8^5)^0$ 1
 $8^0 = 1$

b) $5^4 \times 5^{-2}$ 25
 $5^2 = 25$

d) $\frac{6^7}{6^6}$ 6
 $6^1 = 6$

f) $(2^3)^2$ 64
 $2^6 = 64$

3) Work out each of these, leaving your answers as exact fractions when needed.

a) 4^0 1

e) 4^{-2} $\frac{1}{16}$

i) $49^{\frac{1}{2}}$ 7

m) $49^{-\frac{1}{2}}$ $\frac{1}{7}$

b) 7^0 1

f) 8^{-1} $\frac{1}{8}$

j) $32^{\frac{2}{5}}$ 4

n) $32^{-\frac{2}{5}}$ $\frac{1}{4}$

c) 25^0 1

g) 5^{-3} $\frac{1}{125}$

k) $27^{\frac{1}{3}}$ 3

o) $27^{-\frac{1}{3}}$ $\frac{1}{3}$

d) 139^0 1

h) 10^{-5} $\frac{1}{100000}$

l) $16^{\frac{3}{2}}$ 64

p) $16^{-\frac{3}{2}}$ $\frac{1}{64}$

4) $5\sqrt{5}$ can be written in the form 5^n .

Find the value of n . 1.5 $5^1 \times 5^{\frac{1}{2}}$

5) $2 \times \sqrt{8} = 2^m$

Find the value of m . 2.5 $2^1 \times (2^3)^{\frac{1}{2}}$

6) Find the value of x when

$\sqrt{125} = 5^x$ 1.5 $(5^3)^{\frac{1}{2}}$

7) Find the value of y when

$\sqrt{128} = 2^y$ 3.5 $(2^7)^{\frac{1}{2}}$

8) $a = 2^x$, $b = 2^y$ a) Express in terms of a and b

i) 2^{x+y} ab ii) 2^{2x} a^2 iii) 2^{x+2y} ab^2

$ab = 16$ and $2ab^2 = 16$

b) Find the value of x and the value of y . $x = 5$, $y = -1$

$16 = 2^x \times 2^y$ $16 = 2(2^x \times 2^y \times 2^y)$

$= 2^{x+y}$ $8 = 2^x \times 2^y \times 2^y$

$x + y = 4$ $x + 2y = 3$

$\sqrt{25}$ is not a surd because it is equal to exactly 5.

$\sqrt{3}$ is a surd because you can only ever approximate the answer.

We don't like surds as denominators.
When we **rationalise** the denominator it means that we transfer the surd expression to the numerator.

1) Simplify the following:

a) $\sqrt{7} \times \sqrt{7}$

b) $\sqrt{3} \times \sqrt{3}$

c) $\sqrt{20}$

d) $\sqrt{24}$

e) $\sqrt{72}$

f) $\sqrt{200}$

g) $\sqrt{\frac{2}{25}}$

2) Simplify the following:

a) $\sqrt{2} \times \sqrt{18}$

b) $\sqrt{8} \times \sqrt{32}$

c) $\sqrt{99} \times \sqrt{22}$

d) $\sqrt{45} \times \sqrt{20}$

e) $\sqrt{18} \times \sqrt{128}$

f) $\sqrt{28} \times \sqrt{175}$

3) Expand and simplify where possible:

a) $\sqrt{3}(3 - \sqrt{3})$

b) $\sqrt{2}(6 + 2\sqrt{2})$

c) $\sqrt{7}(2 + 3\sqrt{7})$

d) $\sqrt{2}(\sqrt{32} - \sqrt{8})$

4) Expand and simplify where possible:

a) $(1 + \sqrt{2})(1 - \sqrt{2})$

b) $(3 + \sqrt{5})(2 - \sqrt{5})$

c) $(\sqrt{3} + 2)(\sqrt{3} + 4)$

d) $(\sqrt{5} - 3)(\sqrt{5} + 1)$

e) $(2 + \sqrt{7})(2 - \sqrt{7})$

f) $(\sqrt{6} - 3)^2$

5) Rationalise the denominator, simplifying where possible:

a) $\frac{3}{\sqrt{2}}$

b) $\frac{2}{\sqrt{2}}$

c) $\frac{3\sqrt{2}}{\sqrt{7}}$

d) $\frac{\sqrt{5}}{\sqrt{10}}$

e) $\frac{1}{4\sqrt{8}}$

f) $\frac{\sqrt{15}}{\sqrt{3}}$

g) $\frac{1}{\sqrt{27}}$

6) $3 \times \sqrt{27} = 3^n$

Find the value of n

7) Express $8\sqrt{8}$ in

the form $m\sqrt{2}$ where m is an integer.

8) Rationalise the denominator

of $\frac{1}{8\sqrt{8}}$ giving the answer in

the form $\frac{\sqrt{2}}{p}$

9) Work out the following, giving your answer in its simplest form:

a) $\frac{(5 + \sqrt{3})(5 - \sqrt{3})}{\sqrt{22}}$

b) $\frac{(4 - \sqrt{5})(4 + \sqrt{5})}{\sqrt{11}}$

c) $\frac{(3 - \sqrt{2})(3 + \sqrt{2})}{\sqrt{14}}$

d) $\frac{(\sqrt{3} + 1)^2}{\sqrt{3}}$

e) $\frac{(\sqrt{5} + 3)^2}{\sqrt{20}}$

f) $\frac{(5 - \sqrt{5})(2 + 2\sqrt{5})}{\sqrt{20}}$

$\sqrt{25}$ is not a surd because it is equal to exactly 5.

$\sqrt{3}$ is a surd because you can only ever approximate the answer.

We don't like surds as denominators.
When we **rationalise** the denominator it means that we transfer the surd expression to the numerator.

1) Simplify the following:

a) $\sqrt{7} \times \sqrt{7}$ **7**

b) $\sqrt{3} \times \sqrt{3}$ **3**

c) $\sqrt{20}$ **$2\sqrt{5}$**

d) $\sqrt{24}$ **$2\sqrt{6}$**

e) $\sqrt{72}$ **$6\sqrt{2}$**

f) $\sqrt{200}$ **$10\sqrt{2}$**

g) $\sqrt{\frac{2}{25}}$ **$\frac{\sqrt{2}}{5}$**

2) Simplify the following:

a) $\sqrt{2} \times \sqrt{18}$ **6**

b) $\sqrt{8} \times \sqrt{32}$ **16**

c) $\sqrt{99} \times \sqrt{22}$ **$33\sqrt{2}$**

d) $\sqrt{45} \times \sqrt{20}$ **30**

e) $\sqrt{18} \times \sqrt{128}$ **48**

f) $\sqrt{28} \times \sqrt{175}$ **70**

3) Expand and simplify where possible:

a) $\sqrt{3}(3 - \sqrt{3})$ **$3\sqrt{3} - 3$**

b) $\sqrt{2}(6 + 2\sqrt{2})$ **$6\sqrt{2} + 4$**

c) $\sqrt{7}(2 + 3\sqrt{7})$ **$2\sqrt{7} + 21$**

d) $\sqrt{2}(\sqrt{32} - \sqrt{8})$ **4**

4) Expand and simplify where possible:

a) $(1 + \sqrt{2})(1 - \sqrt{2})$ **-1**

b) $(3 + \sqrt{5})(2 - \sqrt{5})$ **$1 - \sqrt{5}$**

c) $(\sqrt{3} + 2)(\sqrt{3} + 4)$ **$11 + 6\sqrt{3}$**

d) $(\sqrt{5} - 3)(\sqrt{5} + 1)$ **$2 - 2\sqrt{5}$**

e) $(2 + \sqrt{7})(2 - \sqrt{7})$ **-3**

f) $(\sqrt{6} - 3)^2$ **$15 - 6\sqrt{6}$**

5) Rationalise the denominator, simplifying where possible:

a) $\frac{3}{\sqrt{2}}$ **$\frac{3\sqrt{2}}{2}$**

b) $\frac{2}{\sqrt{2}}$ **$\sqrt{2}$**

c) $\frac{3\sqrt{2}}{\sqrt{7}}$ **$\frac{3\sqrt{14}}{7}$**

d) $\frac{\sqrt{5}}{\sqrt{10}}$ **$\frac{\sqrt{2}}{2}$**

e) $\frac{1}{4\sqrt{8}}$ **$\frac{\sqrt{2}}{16}$**

f) $\frac{\sqrt{15}}{\sqrt{3}}$ **$\sqrt{5}$**

g) $\frac{1}{\sqrt{27}}$ **$\frac{\sqrt{3}}{9}$**

6) $3 \times \sqrt{27} = 3^n$ **$2\frac{1}{2}$**

Find the value of n

7) Express $8\sqrt{8}$ in **$16\sqrt{2}$**

the form $m\sqrt{2}$ where m is an integer.

8) Rationalise the denominator

of $\frac{1}{8\sqrt{8}}$ giving the answer in

the form $\frac{\sqrt{2}}{p}$ **$\frac{\sqrt{2}}{32}$**

9) Work out the following, giving your answer in its simplest form:

a) $\frac{(5 + \sqrt{3})(5 - \sqrt{3})}{\sqrt{22}}$ **$\sqrt{22}$**

b) $\frac{(4 - \sqrt{5})(4 + \sqrt{5})}{\sqrt{11}}$ **$\sqrt{11}$**

c) $\frac{(3 - \sqrt{2})(3 + \sqrt{2})}{\sqrt{14}}$ **$\frac{\sqrt{14}}{2}$**

d) $\frac{(\sqrt{3} + 1)^2}{\sqrt{3}}$ **$\frac{4\sqrt{3} + 6}{3}$**

e) $\frac{(\sqrt{5} + 3)^2}{\sqrt{20}}$ **$\frac{7\sqrt{5} + 15}{5}$**

f) $\frac{(5 - \sqrt{5})(2 + 2\sqrt{5})}{\sqrt{20}}$ **4**

- 1) x is directly proportional to y .
When $x = 21$, then $y = 3$.
- Express x in terms of y .
 - Find the value of x when y is equal to:
(i) 1 (ii) 2 (iii) 10
- 2) a is inversely proportional to b .
When $a = 12$, then $b = 4$.
- Find a formula for a in terms of b .
 - Find the value of a when b is equal to:
(i) 1 (ii) 8 (iii) 10
 - Find the value of b when a is equal to:
(i) 4 (ii) 24 (iii) 3.2
- 3) The variables u and v are in inverse proportion to one another.
When $u = 3$, then $v = 8$.
Find the value of u when $v = 12$.
- 4) p is directly proportional to the square of q .
 $p = 75$ when $q = 5$
- Express p in terms q .
 - Work out the value of p when $q = 7$.
 - Work out the positive value of q when $p = 27$.
- 5) y is directly proportional to x^2 .
When $x = 3$, then $y = 36$.
- Express y in terms of x .
- z is inversely proportional to x .
When $x = 4$, $z = 2$.
- Show that $z = c y^n$, where c and n are numbers and $c > 0$.
You must find the values of c and n .

- 1)
- x
- is directly proportional to
- y
- .

When $x = 21$, then $y = 3$.

$$\begin{aligned}x &= k y \\21 &= k \times 3 \\k &= 7\end{aligned}$$

- a) Express x in terms of y . $x = 7y$
- b) Find the value of x when y is equal to:
 (i) 1 **7** (ii) 2 **14** (iii) 10 **70**

- 2)
- a
- is inversely proportional to
- b
- .

When $a = 12$, then $b = 4$.

$$\begin{aligned}a &= \frac{k}{b} \\12 &= \frac{k}{4} \\k &= 48\end{aligned}$$

- a) Find a formula for a in terms of b . $a = \frac{48}{b}$
- b) Find the value of a when b is equal to:
 (i) 1 **48** (ii) 8 **6** (iii) 10 **4.8**
- c) Find the value of b when a is equal to:
 (i) 4 **12** (ii) 24 **2** (iii) 3.2 **15**

$$b = \frac{48}{a}$$

- 3) The variables
- u
- and
- v
- are in inverse proportion to one another.

When $u = 3$, then $v = 8$.Find the value of u when $v = 12$. $u = 2$

$$\begin{aligned}u &= \frac{k}{v} \\3 &= \frac{k}{8} \\k &= 24 \\u &= \frac{24}{v}\end{aligned}$$

- 4)
- p
- is directly proportional to the square of
- q
- .

 $p = 75$ when $q = 5$

$$\begin{aligned}p &= k q^2 \\75 &= k \times 5^2 \\75 &= k \times 25 \\k &= 3\end{aligned}$$

- a) Express p in terms of q . $p = 3q^2$
- b) Work out the value of p when $q = 7$. $p = 147$
- c) Work out the positive value of q when $p = 27$. $q = 3$

$$\begin{aligned}p &= 3 \times 7^2 \\p &= 3 \times 49\end{aligned}$$

- 5)
- y
- is directly proportional to
- x^2
- .

When $x = 3$, then $y = 36$.

- a) Express
- y
- in terms of
- x
- .
- $y = 4x^2$

 z is inversely proportional to x .When $x = 4$, $z = 2$.

- b) Show that
- $z = c y^n$
- , where
- c
- and
- n
- are numbers and
- $c > 0$
- .

You must find the values of c and n . $z = 16y^{-0.5}$

$$\begin{aligned}c &= 16 \\n &= -0.5\end{aligned}$$

Upper and Lower Bounds

- 1) $A = 11.3$ correct to 1 decimal place
 $B = 300$ correct to 1 significant figure
 $C = 9$ correct to the nearest integer
- Calculate the upper bound for $A + B$.
 - Calculate the lower bound for $B \div C$.
 - Calculate the least possible value of AC .
 - Calculate the greatest possible value of $\frac{A+B}{B+C}$
-

2) An estimate of the acceleration due to gravity can be found using the formula:

$$g = \frac{2L}{T^2 \sin x}$$

Using

- $T = 1.2$ correct to 1 decimal place
 $L = 4.50$ correct to 2 decimal places
 $x = 40$ correct to the nearest integer

- Calculate the lower bound for the value of g .
Give your answer correct to 3 decimal places.
 - Calculate the upper bound for the value of g .
Give your answer correct to 3 decimal places.
-

3) The diagram shows a triangle ABC .

$AB = 73\text{mm}$ correct to 2 significant figures.
 $BC = 80\text{mm}$ correct to 1 significant figure.

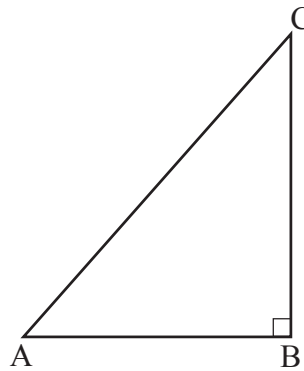


Diagram **NOT** accurately drawn

(a) Write the upper and lower bounds of both AB and BC .

$$\begin{aligned} AB_{\text{upper}} &= \dots\dots\dots \\ AB_{\text{lower}} &= \dots\dots\dots \end{aligned}$$

$$\begin{aligned} BC_{\text{upper}} &= \dots\dots\dots \\ BC_{\text{lower}} &= \dots\dots\dots \end{aligned}$$

(b) Calculate the upper bound for the area of the triangle ABC .

..... mm^2

Angle $CAB = x^\circ$

(c) Calculate the lower bound for the value of $\tan x^\circ$.

Upper and Lower Bounds

- 1) A = 11.3 correct to 1 decimal place
 B = 300 correct to 1 significant figure
 C = 9 correct to the nearest integer



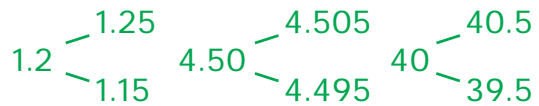
- a) Calculate the upper bound for A + B. **361.35**
 $11.35 + 350 = 361.35$
- b) Calculate the lower bound for B ÷ C. **26.3 (1 dp)**
 $250 \div 9.5 = 26.3 (1 \text{ dp})$
- c) Calculate the least possible value of AC. **95.625**
 $11.25 \times 8.5 = 95.625$
- d) Calculate the greatest possible value of $\frac{A+B}{B+C}$ **1.4 (1 dp)** $\frac{11.35 + 350}{250 + 8.5} = 1.4 (1 \text{ dp})$

- 2) An estimate of the acceleration due to gravity can be found using the formula:

$$g = \frac{2L}{T^2 \sin x}$$

Using

- T = 1.2 correct to 1 decimal place
 L = 4.50 correct to 2 decimal places
 x = 40 correct to the nearest integer



- a) Calculate the lower bound for the value of g.
 Give your answer correct to 3 decimal places. **8.859** $\frac{2 \times 4.495}{1.25^2 \times \sin 40.5} = 8.859$
- b) Calculate the upper bound for the value of g.
 Give your answer correct to 3 decimal places. **10.711** $\frac{2 \times 4.505}{1.15^2 \times \sin 39.5} = 10.711$

- 3) The diagram shows a triangle ABC.

AB = 73mm correct to 2 significant figures.
 BC = 80mm correct to 1 significant figure.

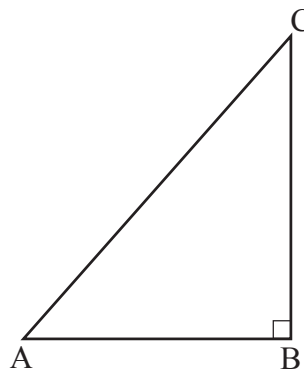


Diagram **NOT** accurately drawn

- (a) Write the upper and lower bounds of both AB and BC.

$$AB_{\text{upper}} = \underline{\underline{73.5}}$$

$$AB_{\text{lower}} = \underline{\underline{72.5}}$$

$$BC_{\text{upper}} = \underline{\underline{85}}$$

$$BC_{\text{lower}} = \underline{\underline{75}}$$

- (b) Calculate the upper bound for the area of the triangle ABC.

$$\underline{\underline{3123.75}} \text{ mm}^2 \quad \frac{73.5 \times 85}{2} = 3123.75$$

Angle CAB = x°

- (c) Calculate the lower bound for the value of $\tan x^\circ$. **1.02 (2 dp)**

$$\tan x = \frac{O}{A} = \frac{BC}{AB} = \frac{75}{73.5} = 1.02 (2 \text{ dp})$$

$$ax^2 + bx + c = 0$$

$$x_{1,2} = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

- 1) Solve the equation $x^2 + 4x + 1 = 0$
Give your answers correct to 3 decimal places.
- 2) Solve the equation $x^2 + 8x + 6 = 0$
Give your answers correct to 3 significant figures.
- 3) Solve the equation $x^2 - 3x - 2 = 0$
Give your answers correct to 3 significant figures.
- 4) Solve the equation $x^2 - 7x + 2 = 0$
Give your answers correct to 3 significant figures.
- 5) Solve the equation $2x^2 + 6x - 1 = 0$
Give your answers correct to 3 significant figures.
- 6) Solve the equation $3x^2 - 2x - 20 = 0$
Give your answers correct to 3 significant figures.
- 7) Solve the equation $x^2 - 14x - 161.25 = 0$
- 8) Solve the equation $17x^2 - 92x - 206 = 0$
Give your answers correct to 3 significant figures.
- 9) $x^2 + 10x = 300$
Find the positive value of x .
Give your answer correct to 3 significant figures.
- 10) $(x + 2)(x - 3) = 1$
 - a) Show that $x^2 - x - 7 = 0$
 - b) Solve the equation $x^2 - x - 7 = 0$
Give your answers correct to 3 significant figures.

$$ax^2 + bx + c = 0$$

$$x_{1,2} = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

- 1) Solve the equation $x^2 + 4x + 1 = 0$ $a = 1$ $b = 4$ $c = 1$
 Give your answers correct to 3 decimal places.
 $x = -0.268$ or $x = -3.732$
- 2) Solve the equation $x^2 + 8x + 6 = 0$ $a = 1$ $b = 8$ $c = 6$
 Give your answers correct to 3 significant figures.
 $x = -0.838$ or $x = -7.16$
- 3) Solve the equation $x^2 - 3x - 2 = 0$ $a = 1$ $b = -3$ $c = -1$
 Give your answers correct to 3 significant figures.
 $x = -0.562$ or $x = 3.56$
- 4) Solve the equation $x^2 - 7x + 2 = 0$ $a = 1$ $b = -7$ $c = 2$
 Give your answers correct to 3 significant figures.
 $x = 0.298$ or $x = 6.70$
- 5) Solve the equation $2x^2 + 6x - 1 = 0$ $a = 2$ $b = 6$ $c = -1$
 Give your answers correct to 3 significant figures.
 $x = -3.16$ or $x = 0.158$
- 6) Solve the equation $3x^2 - 2x - 20 = 0$ $a = 3$ $b = -2$ $c = -20$
 Give your answers correct to 3 significant figures.
 $x = -2.27$ or $x = 2.94$
- 7) Solve the equation $x^2 - 14x - 161.25 = 0$ $a = 1$ $b = -14$ $c = -161.25$
 $x = -7.5$ or $x = 21.5$
- 8) Solve the equation $17x^2 - 92x - 206 = 0$ $a = 17$ $b = -92$ $c = -206$
 Give your answers correct to 3 significant figures.
 $x = -1.70$ or $x = 7.11$
- 9) $x^2 + 10x = 300$ $x^2 + 10x - 300 = 0$ $a = 1$ $b = 10$ $c = -300$
 Find the positive value of x .
 Give your answer correct to 3 significant figures.
 $x = 13.0$
- 10) $(x + 2)(x - 3) = 1$
- a) Show that $x^2 - x - 7 = 0$ $x^2 - 3x + 2x - 6 = 1$
 $x^2 - x - 6 = 1$
 $x^2 - x - 7 = 0$
- b) Solve the equation $x^2 - x - 7 = 0$
 Give your answers correct to 3 significant figures.
 $x = -2.19$ or $x = 3.19$

Completing the Square

- 1) Show that if $y = x^2 + 8x - 3$
then $y \geq -19$ for all values of x .
- 2) Show that if $y = x^2 - 10x + 30$
then $y \geq 5$ for all values of x .
- 3) The expression $x^2 + 4x + 10$ can be written in the form $(x + p)^2 + q$ for all values of x .
Find the values of p and q .
- 4) Given that $x^2 - 6x + 17 = (x - p)^2 + q$ for all values of x ,
find the value of p and the value of q .

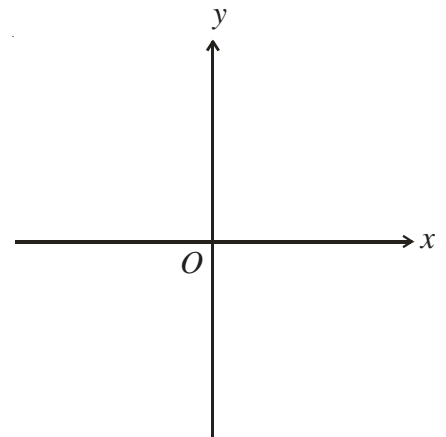
- 5) For all values of x ,

$$x^2 + 6x = (x + p)^2 + q$$

- a) Find the values of p and q .
- b) Find the minimum value of $x^2 + 6x$.
- 6) For all values of x ,

$$x^2 - 8x - 5 = (x - p)^2 + q$$

- a) Find the value of p and the value of q .
- b) On the axes, sketch the graph of $y = x^2 - 8x - 5$.



- c) Find the coordinate of the minimum point on the graph of $y = x^2 - 8x - 5$.
- 7) The expression $10x - x^2$ can be written in the form $p - (x - q)^2$ for all values of x .
- a) Find the values of p and q .
- b) The expression $10x - x^2$ has a maximum value.
- (i) Find the maximum value of $10x - x^2$.
- (ii) State the value of x for which this maximum value occurs.

Completing the Square

- 1) Show that if $y = x^2 + 8x - 3$
then $y \geq -19$ for all values of x .

$$y = (x + 4)^2 - 16 - 3$$

$$y = (x + 4)^2 - 19$$

$$(x + 4)^2 \geq 0$$

$$y \geq -19$$

- 2) Show that if $y = x^2 - 10x + 30$
then $y \geq 5$ for all values of x .

$$y = (x - 5)^2 - 25 + 30$$

$$y = (x - 5)^2 + 5$$

$$(x - 5)^2 \geq 0$$

$$y \geq 5$$

- 3) The expression $x^2 + 4x + 10$ can be written in the form
 $(x + p)^2 + q$ for all values of x .

$$(x + 2)^2 - 4 + 10$$

$$(x + 2)^2 + 6$$

Find the values of p and q .

$$p = 2 \text{ and } q = 6$$

- 4) Given that $x^2 - 6x + 17 = (x - p)^2 + q$ for all values of x ,
find the value of p and the value of q .

$$(x - 3)^2 - 9 + 17$$

$$(x - 3)^2 + 8$$

$$p = 3 \text{ and } q = 8$$

- 5) For all values of x ,

$$x^2 + 6x = (x + p)^2 + q \quad (x + 3)^2 - 9$$

- a) Find the values of p and q . $p = 3$ and $q = -9$

- b) Find the minimum value of $x^2 + 6x$. -9

- 6) For all values of x ,

$$x^2 - 8x - 5 = (x - p)^2 + q$$

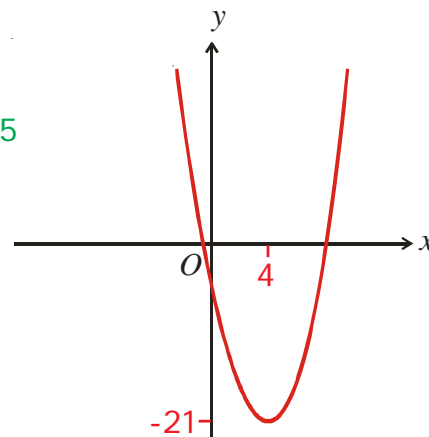
- a) Find the value of p and the value of q .

$$p = 4 \text{ and } q = -21$$

$$(x - 4)^2 - 16 - 5$$

$$(x - 4)^2 - 21$$

- b) On the axes, sketch the graph of $y = x^2 - 8x - 5$.



- c) Find the coordinate of the minimum point on the graph of $y = x^2 - 8x - 5$.

$$(4, -21)$$

- 7) The expression $10x - x^2$ can be written in the form $p - (x - q)^2$ for all values of x .

- a) Find the values of p and q .

$$p = 25 \text{ and } q = 5$$

- b) The expression $10x - x^2$ has a maximum value.

- (i) Find the maximum value of $10x - x^2$.

$$25$$

- (ii) State the value of x for which this maximum value occurs.

$$x = 5$$

$$10x - x^2 \text{ can be rearranged as}$$

$$-x^2 + 10x$$

$$-(x^2 - 10x)$$

$$-[(x - 5)^2 - 25]$$

$$-(x - 5)^2 + 25 \text{ rearranged as}$$

$$25 - (x - 5)^2$$

1) Simplify fully

a) $\frac{9x^2}{21x^3}$

c) $\frac{18a^3b^2}{2ab^2}$

e) $\frac{2a^2b-14a^2b^3}{6a^3b^3}$

b) $\frac{10xy^3}{5y^2}$

d) $\frac{4x^2+12x}{10x}$

f) $\frac{5x^2y+5xy^2}{10x^2y^2}$

2) Simplify fully

a) $\frac{x^2+x}{x^2+6x+5}$

c) $\frac{x^2-3x}{x^2+x-12}$

b) $\frac{x^2-6x+8}{2x^2-8x}$

d) $\frac{x^2+7x+10}{x^2+5x}$

3) a) Factorise $4x^2-12x+9$

b) Simplify $\frac{6x^2-7x-3}{4x^2-12x+9}$

4) Write as single fractions in their simplest form

a) $\frac{3}{x} + \frac{3}{2x}$

c) $\frac{x+2}{5} + \frac{x-1}{2}$

b) $\frac{5}{3x} - \frac{3}{4x}$

d) $\frac{3}{x+2} - \frac{5}{2x+1}$

5) a) Factorise $2x^2+7x+6$

b) Write as a single fraction in its simplest form $\frac{3}{x+2} + \frac{4x}{2x^2+7x+6}$

6) Solve

a) $\frac{1}{x} + \frac{1}{3x} = 2$

c) $\frac{1}{x-5} + \frac{6}{x} = 2$

e) $\frac{3}{x+2} + \frac{1}{x-2} = \frac{7}{x^2-4}$

b) $\frac{1}{x-2} + \frac{3}{x+6} = \frac{1}{2}$

d) $\frac{7}{x+2} + \frac{1}{x-1} = 4$

f) $\frac{x}{2x-1} + \frac{2}{x+2} = 1$

1) Simplify fully

a) $\frac{9x^2}{21x^3} = \frac{3}{7x}$

c) $\frac{18a^3b^2}{2ab^2} = 9a^2$

e) $\frac{2a^2b - 14a^2b^3}{6a^3b^3} = \frac{1 - 7b^2}{3ab^2}$

b) $\frac{10xy^3}{5y^2} = 2xy$

d) $\frac{4x^2 + 12x}{10x} = \frac{2(x + 3)}{5}$

f) $\frac{5x^2y + 5xy^2}{10x^2y^2} = \frac{x + y}{2xy}$

2) Simplify fully

a) $\frac{x^2 + x}{x^2 + 6x + 5} = \frac{x}{x + 5}$

c) $\frac{x^2 - 3x}{x^2 + x - 12} = \frac{x}{x + 4}$

b) $\frac{x^2 - 6x + 8}{2x^2 - 8x} = \frac{x - 2}{2x}$

d) $\frac{x^2 + 7x + 10}{x^2 + 5x} = \frac{x + 2}{x}$

3) a) Factorise $4x^2 - 12x + 9 = (2x - 3)^2$

b) Simplify $\frac{6x^2 - 7x - 3}{4x^2 - 12x + 9} = \frac{3x + 1}{2x - 3}$

4) Write as single fractions in their simplest form

a) $\frac{3}{x} + \frac{3}{2x} = \frac{9}{2x}$

c) $\frac{x+2}{5} + \frac{x-1}{2} = \frac{7x-1}{10}$

b) $\frac{5}{3x} - \frac{3}{4x} = \frac{11}{12x}$

d) $\frac{3}{x+2} - \frac{5}{2x+1} = \frac{x-7}{(x+2)(2x+1)}$

5) a) Factorise $2x^2 + 7x + 6 = (x + 2)(2x + 3)$

b) Write as a single fraction in its simplest form $\frac{3}{x+2} + \frac{4x}{2x^2 + 7x + 6} = \frac{10x + 9}{(x + 2)(2x + 3)}$

6) Solve

a) $\frac{1}{x} + \frac{1}{3x} = 2 \quad x = \frac{2}{3}$

c) $\frac{1}{x-5} + \frac{6}{x} = 2$
 $x = 2.5 \text{ or } 6$

e) $\frac{3}{x+2} + \frac{1}{x-2} = \frac{7}{x^2 - 4}$
 $x = 2.75$

b) $\frac{1}{x-2} + \frac{3}{x+6} = \frac{1}{2}$
 $x = -2 \text{ or } 6$

d) $\frac{7}{x+2} + \frac{1}{x-1} = 4$
 $x = -0.5 \text{ or } 1.5$

f) $\frac{x}{2x-1} + \frac{2}{x+2} = 1$
 $x = 0 \text{ or } 3$

- 1) Make c the subject of the formula.

$$v = 2a + 3b + c$$

- 2) Make t the subject of the formula.

$$A = \pi t + 5t$$

- 3) Make s the subject of the formula.

$$R = 3s + \pi s + 2t$$

4) $k = \frac{l}{m-l}$

- a) Make l the subject of the formula.

- b) Make m the subject of the formula.

5) $A = \frac{k(x+5)}{3}$

Make x the subject of the formula.

6) $R = \frac{u+v^2}{u+v}$

Make u the subject of the formula.

7) $\frac{3x+2}{5} = \frac{y}{10+y}$

Make y the subject of the formula.

8) $\sqrt{\frac{a-3}{5}} = 4b$

Rearrange this formula to give a in terms of b .

9) $S = 2\pi d\sqrt{h^2 + d^2}$

Rearrange this formula to make h the subject.

Rearranging Difficult Formulae

- 1) Make
- c
- the subject of the formula.

$$v = 2a + 3b + c \quad c = v - 2a - 3b$$

- 2) Make
- t
- the subject of the formula.

$$A = \pi t + 5t \quad t = \frac{A}{\pi + 5} \quad A = t(\pi + 5)$$

- 3) Make
- s
- the subject of the formula.

$$R = 3s + \pi s + 2t \quad s = \frac{R - 2t}{3 + \pi} \quad R - 2t = 3s + \pi s$$

$$R - 2t = s(3 + \pi)$$

4) $k = \frac{l}{m-l}$

- a) Make
- l
- the subject of the formula.
- $l = \frac{km}{1+k}$

- b) Make
- m
- the subject of the formula.
- $m = \frac{l+kl}{k}$

$k(m-l) = l$

$km - kl = l$

$km = l + kl$

$km = l(1+k)$

5) $A = \frac{k(x+5)}{3}$

- Make
- x
- the subject of the formula.
- $x = \frac{3A - 5k}{k}$

$3A = k(x+5)$

$3A = kx + 5k$

$3A - 5k = kx$

6) $R = \frac{u+v^2}{u+v}$

- Make
- u
- the subject of the formula.
- $u = \frac{v^2 - Rv}{R-1}$

$R(u+v) = u + v^2$

$Ru + Rv = u + v^2$

$Ru - u = v^2 - Rv$

$u(R-1) = v^2 - Rv$

7) $\frac{3x+2}{5} = \frac{y}{10+y}$

- Make
- y
- the subject of the formula.
- $y = \frac{30x+20}{3-3x}$

$(3x+2)(10+y) = 5y$

$30x + 3xy + 20 + 2y = 5y$

$30x + 20 = 5y - 3xy - 2y$

$30x + 20 = 3y - 3xy$

$30x + 20 = y(3 - 3x)$

8) $\sqrt{\frac{a-3}{5}} = 4b$

- Rearrange this formula to give
- a
- in terms of
- b
- .
- $a = 80b^2 + 3$

$\frac{a-3}{5} = 16b^2$

$a - 3 = 80b^2$

9) $S = 2\pi d\sqrt{h^2 + d^2}$

- Rearrange this formula to make
- h
- the subject.
- $h = \sqrt{\frac{S^2}{4\pi^2 d^2} - d^2}$

$\frac{S}{2\pi d} = \sqrt{h^2 + d^2}$

$\frac{S^2}{4\pi^2 d^2} = h^2 + d^2$

$\frac{S^2}{4\pi^2 d^2} - d^2 = h^2$

- 1) Solve these simultaneous equations.

$$y = x$$

$$y = x^2 - 6$$

- 2) Solve these simultaneous equations.

$$y = x^2 - 4$$

$$y = 3x$$

- 3) Solve these simultaneous equations.

$$y = x^2 - x - 13$$

$$y = x + 2$$

- 4) Solve these simultaneous equations.

$$y = x^2 - 35$$

$$x - y = 5$$

- 5) Solve these simultaneous equations.

$$x^2 + y^2 = 26$$

$$y + 6 = x$$

- 6) Sarah said that the line $y = 7$ cuts the curve $x^2 + y^2 = 25$ at two points.

a) By eliminating y show that Sarah is **not** correct.

b) By eliminating y , find the solutions to the simultaneous equations

$$x^2 + y^2 = 25$$

$$y = 3x - 9$$

- 1) Solve these simultaneous equations.

$$y = x$$

$$y = x^2 - 6$$

$$x = 3 \text{ and } y = 3$$

$$x = -2 \text{ and } y = -2$$

$$x = x^2 - 6$$

$$x^2 - x - 6 = 0$$

$$(x - 3)(x + 2) = 0$$

$$x = 3 \text{ or } x = -2$$

- 2) Solve these simultaneous equations.

$$y = x^2 - 4$$

$$y = 3x$$

$$x = 4 \text{ and } y = 12$$

$$x = -1 \text{ and } y = -3$$

$$3x = x^2 - 4$$

$$x^2 - 3x - 4 = 0$$

$$(x - 4)(x + 1) = 0$$

$$x = 4 \text{ or } x = -1$$

- 3) Solve these simultaneous equations.

$$y = x^2 - x - 13$$

$$y = x + 2$$

$$x = 5 \text{ and } y = 7$$

$$x = -3 \text{ and } y = -1$$

$$x + 2 = x^2 - x - 13$$

$$x^2 - 2x - 15 = 0$$

$$(x - 5)(x + 3) = 0$$

$$x = 5 \text{ or } x = -3$$

- 4) Solve these simultaneous equations.

$$y = x^2 - 35$$

$$x - y = 5$$

$$x = 6 \text{ and } y = 1$$

$$x = -5 \text{ and } y = -10$$

$$y = x - 5$$

$$x - 5 = x^2 - 35$$

$$x^2 - x - 30 = 0$$

$$(x - 6)(x + 5) = 0$$

$$x = 6 \text{ or } x = -5$$

- 5) Solve these simultaneous equations.

$$x^2 + y^2 = 26$$

$$y + 6 = x$$

$$x = 5 \text{ and } y = -1$$

$$x = 1 \text{ and } y = -5$$

$$y = x - 6$$

$$x^2 + (x - 6)^2 = 26$$

$$x^2 + x^2 - 12x + 10 = 0$$

$$2x^2 - 12x + 10 = 0$$

$$x^2 - 6x + 5 = 0$$

$$(x - 5)(x - 1) = 0$$

$$x = 5 \text{ or } x = 1$$

- 6) Sarah said that the line
- $y = 7$
- cuts the curve
- $x^2 + y^2 = 25$
- at two points.
- $x^2 + 49 = 25$

- a) By eliminating
- y
- show that Sarah is
- not**
- correct.
- $x^2 = -24$

There is no solution to $x^2 = -24$ hence $y = 7$ does not cut the curve.

- b) By eliminating
- y
- , find the solutions to the simultaneous equations

$$x^2 + y^2 = 25$$

$$y = 3x - 9$$

$$x = 1.4 \text{ and } y = -4.8$$

$$x = 4 \text{ and } y = 3$$

$$x^2 + (3x - 9)^2 = 25$$

$$x^2 + 9x^2 - 54x + 81 = 25$$

$$10x^2 - 54x + 56 = 0$$

$$5x^2 - 27x + 28 = 0$$

$$(5x - 7)(x - 4) = 0$$

$$x = 1.4 \text{ or } x = 4$$

1)

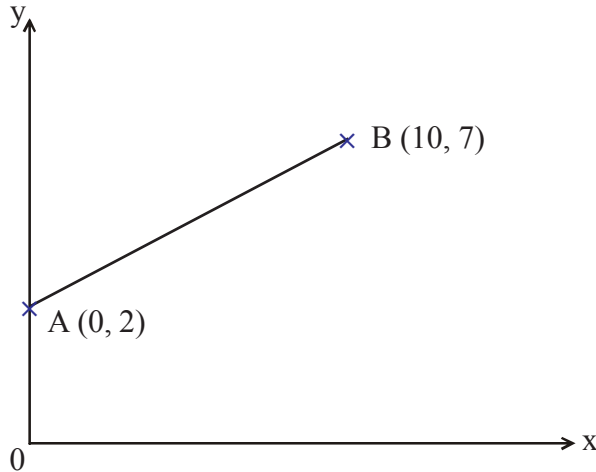


Diagram **NOT** accurately drawn

A is the point (0, 2)
 B is the point (10, 7)

The equation of the straight line through A and B is $y = \frac{1}{2}x + 2$

- Write down the equation of another straight line that is parallel to $y = \frac{1}{2}x + 2$
 - Write down the equation of another straight line that passes through the point (0, 2).
 - Find the equation of the line perpendicular to AB passing through B.
-

- 2) A straight line has equation $y = 2x - 5$
 The point P lies on the straight line.
 The y coordinate of P is -6

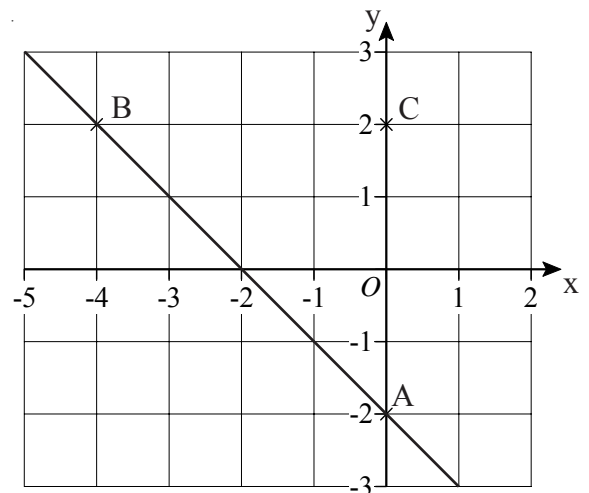
a) Find the x coordinate of P.

A straight line **L** is parallel to $y = 2x - 5$ and passes through the point (3, 2).

- Find the equation of line **L**.
 - Find the equation of the line that is perpendicular to line **L** and passes through point (3, 2).
-

- 3) In the diagram A is the point (0, -2)
 B is the point (-4, 2)
 C is the point (0, 2)

- Find the equation of the line that passes through C and is parallel to AB.
- Find the equation of the line that passes through C and is perpendicular to AB.



1)

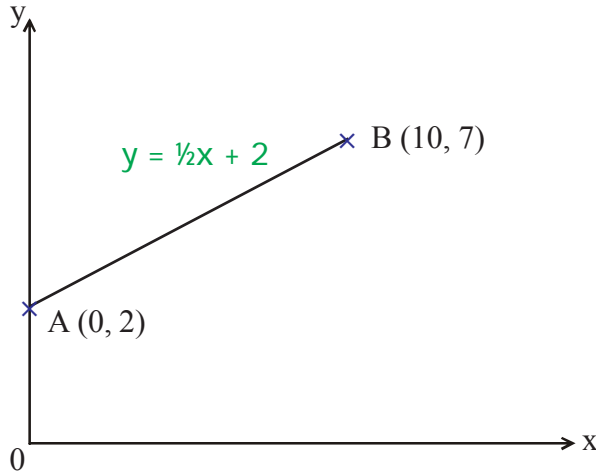


Diagram **NOT** accurately drawn

A is the point (0, 2)
B is the point (10, 7)

In qu a) and b)
c and m can be any numbers
you choose.

The equation of the straight line through A and B is $y = \frac{1}{2}x + 2$

- a) Write down the equation of another straight line that is parallel to $y = \frac{1}{2}x + 2$ $y = \frac{1}{2}x + c$
- b) Write down the equation of another straight line that passes through the point (0, 2). $y = mx + 2$
- c) Find the equation of the line perpendicular to AB passing through B. $y = -2x + 27$

$$y = mx + c$$

$$m = -2, x = 10, y = 7$$

$$7 = -20 + c$$

$$c = 27$$

- 2) A straight line has equation $y = 2x - 5$
The point P lies on the straight line.
The y coordinate of P is -6

a) Find the x coordinate of P. $x = -0.5$

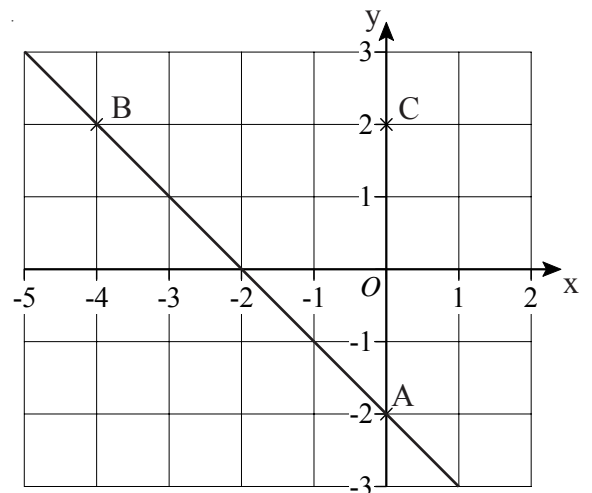
A straight line **L** is parallel to $y = 2x - 5$ and passes through the point (3, 2).

b) Find the equation of line **L**. $y = 2x - 4$

c) Find the equation of the line that is perpendicular to line **L** and passes through point (3, 2).
 $y = -\frac{1}{2}x + 3\frac{1}{2}$

- 3) In the diagram A is the point (0, -2)
B is the point (-4, 2)
C is the point (0, 2)

- a) Find the equation of the line that passes through C and is parallel to AB. $y = -x + 2$
- b) Find the equation of the line that passes through C and is perpendicular to AB. $y = x + 2$

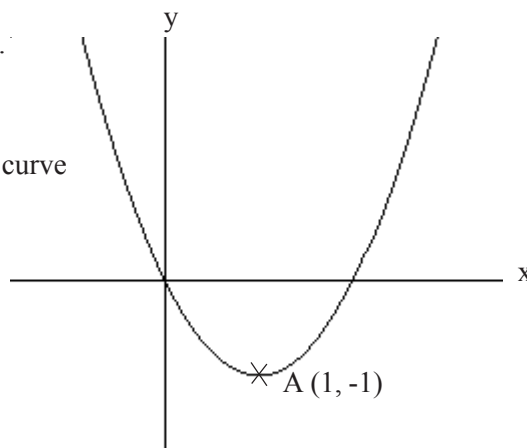


- 1) This is a sketch of the curve with equation $y = f(x)$.
It passes through the origin O.

The only vertex of the curve is at A (1, -1)

- a) Write down the coordinates of the vertex of the curve with equation

- (i) $y = f(x - 3)$
- (ii) $y = f(x) - 5$
- (iii) $y = -f(x)$
- (iv) $y = f(2x)$

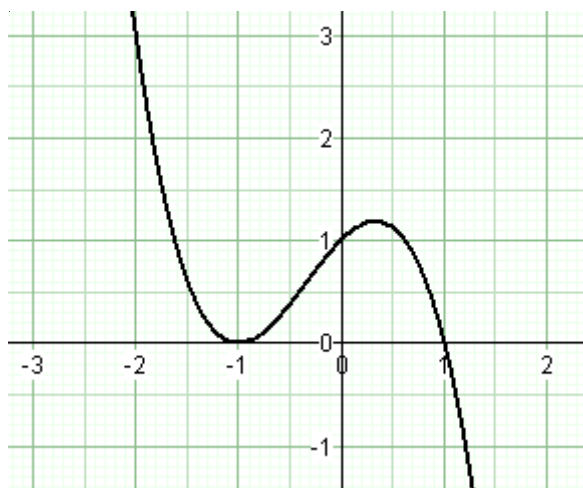


- b) The curve $y = x^2$ has been translated to give the curve $y = f(x)$.

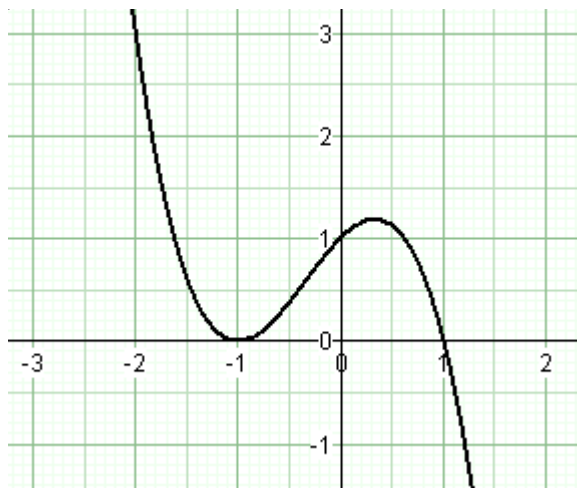
Find $f(x)$ in terms of x .

- 2) The graph of $y = f(x)$ is shown on the grids.

- a) On this grid, sketch the graph of $y = f(x - 1)$

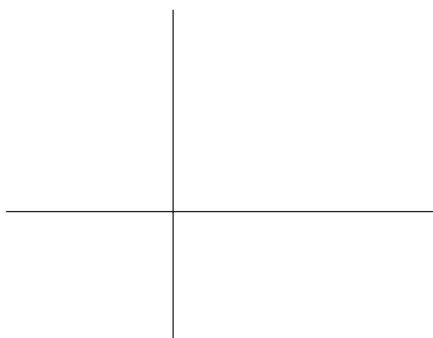


- b) On this grid, sketch the graph of $y = 2f(x)$



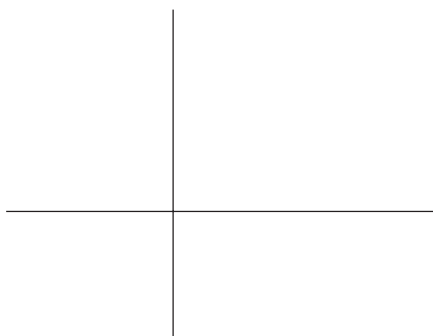
- 3) Sketch the graph of $y = (x - 2)^2 + 3$

State the coordinates of the vertex.



- 4) Sketch the graph of $y = x^2 + 4x - 1$

State the coordinates of the vertex and the points at which the curve crosses the x - axis.



- 1) This is a sketch of the curve with equation $y = f(x)$.
It passes through the origin O.

The only vertex of the curve is at A (1, -1)

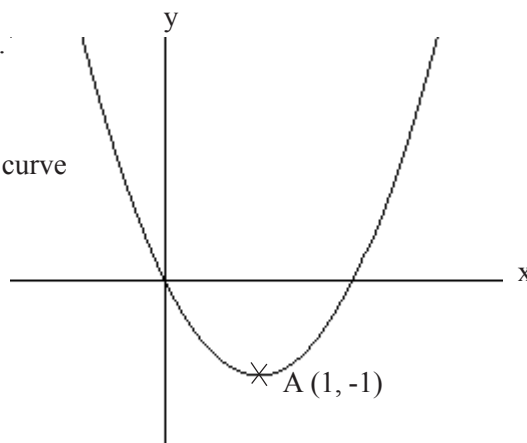
- a) Write down the coordinates of the vertex of the curve with equation

(i) $y = f(x - 3)$ (4, -1)

(ii) $y = f(x) - 5$ (1, -6)

(iii) $y = -f(x)$ (1, 1)

(iv) $y = f(2x)$ (½, -1)



$y = (x - 1)^2 - 1$

$y = x^2 - 2x + 1 - 1$

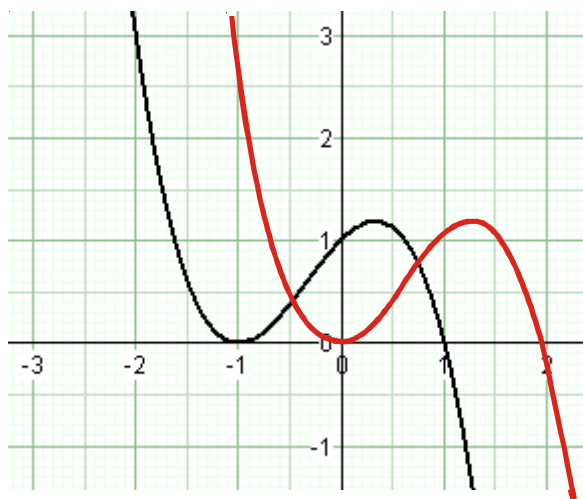
$y = x^2 - 2x$

- b) The curve $y = x^2$ has been translated to give the curve $y = f(x)$.

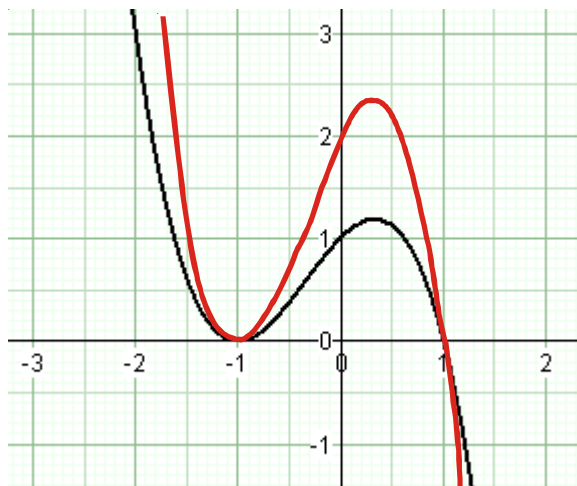
Find $f(x)$ in terms of x . $y = x^2 - 2x$

- 2) The graph of $y = f(x)$ is shown on the grids.

- a) On this grid, sketch the graph of $y = f(x - 1)$



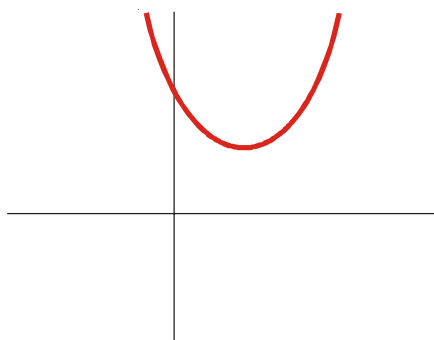
- b) On this grid, sketch the graph of $y = 2f(x)$



- 3) Sketch the graph of $y = (x - 2)^2 + 3$

State the coordinates of the vertex.

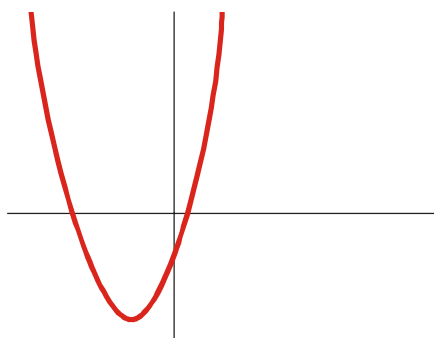
vertex is at (2, 3)



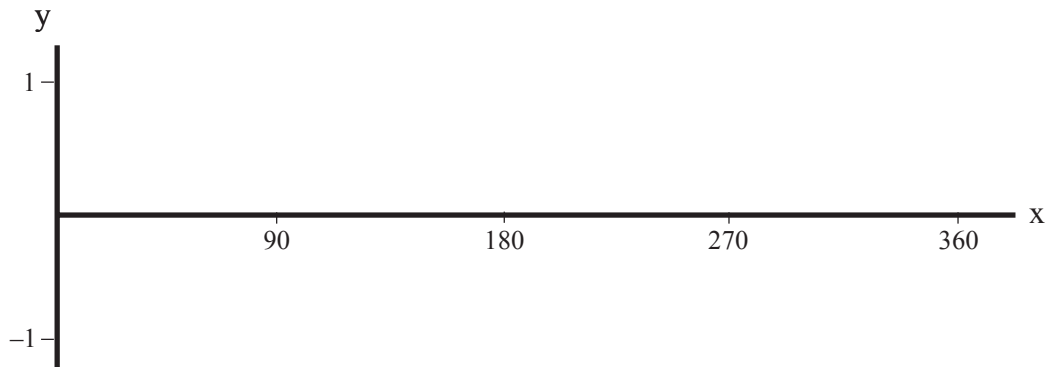
- 4) Sketch the graph of $y = x^2 + 4x - 1$

State the coordinates of the vertex and the points at which the curve crosses the x - axis.

vertex is at (-2, -5)
crosses x axis at $(\sqrt{5} - 2, 0)$
and $(-\sqrt{5} - 2, 0)$



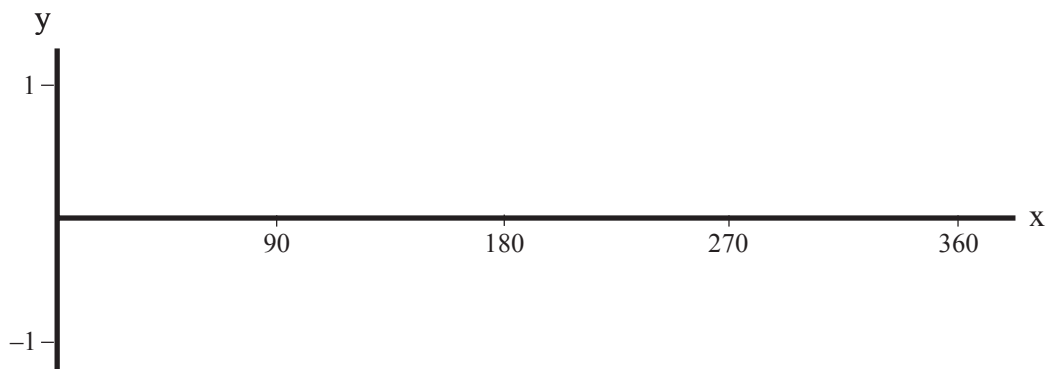
- 1) On the axes below, draw a sketch-graph to show $y = \sin x$



Given that $\sin 30^\circ = 0.5$, write down the value of:

- (i) $\sin 150^\circ$
- (ii) $\sin 330^\circ$

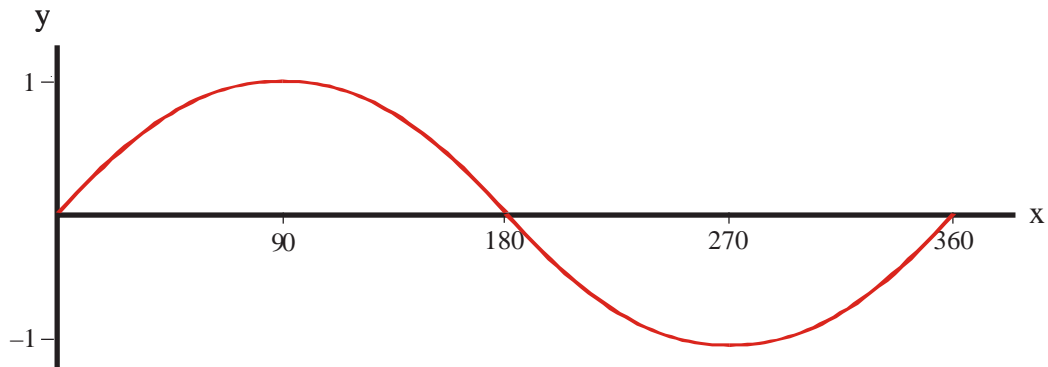
- 2) On the axes below, draw a sketch-graph to show $y = \cos x$



Given that $\cos 60^\circ = 0.5$, write down the value of:

- (i) $\cos 120^\circ$
- (ii) $\cos 240^\circ$

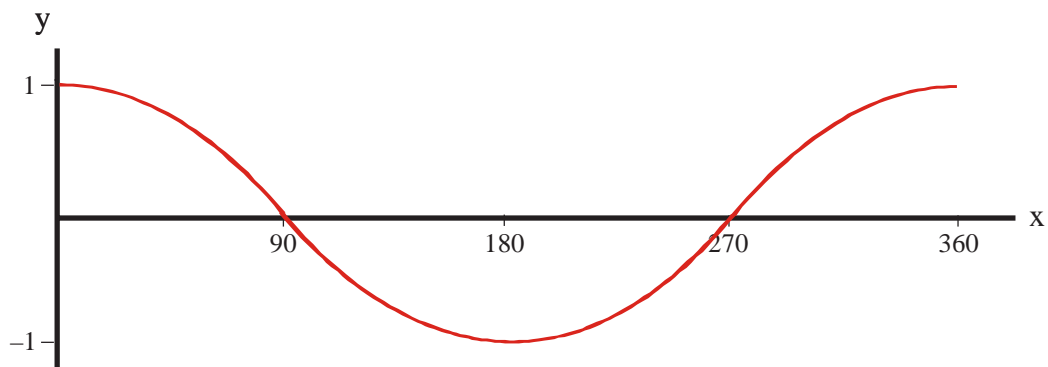
- 1) On the axes below, draw a sketch-graph to show $y = \sin x$



Given that $\sin 30^\circ = 0.5$, write down the value of:

- (i) $\sin 150^\circ$ **0.5**
(ii) $\sin 330^\circ$ **-0.5**

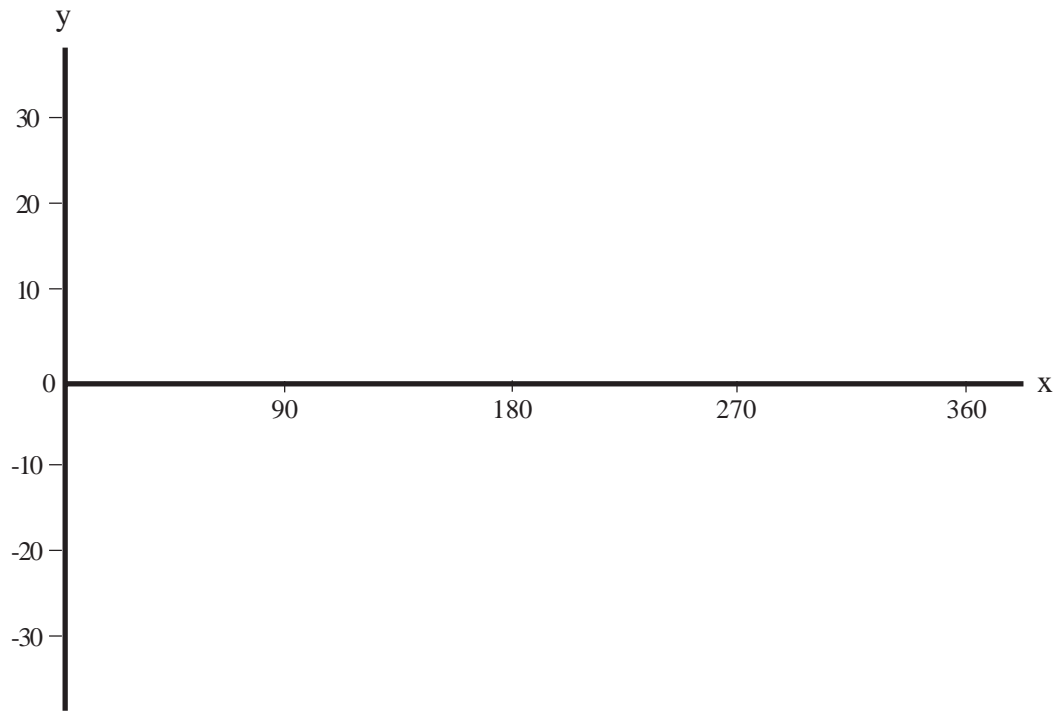
- 2) On the axes below, draw a sketch-graph to show $y = \cos x$



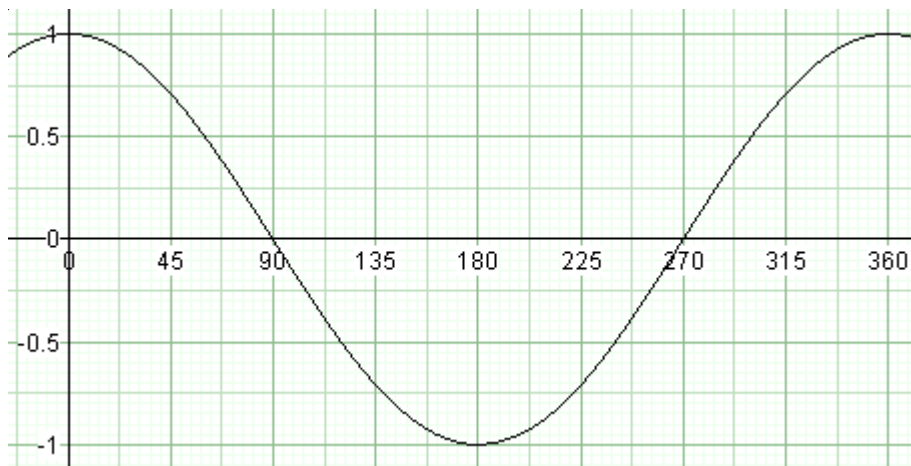
Given that $\cos 60^\circ = 0.5$, write down the value of:

- (i) $\cos 120^\circ$ **-0.5**
(ii) $\cos 240^\circ$ **-0.5**

- 1) On the axes below, draw a sketch-graph to show $y = \tan x$

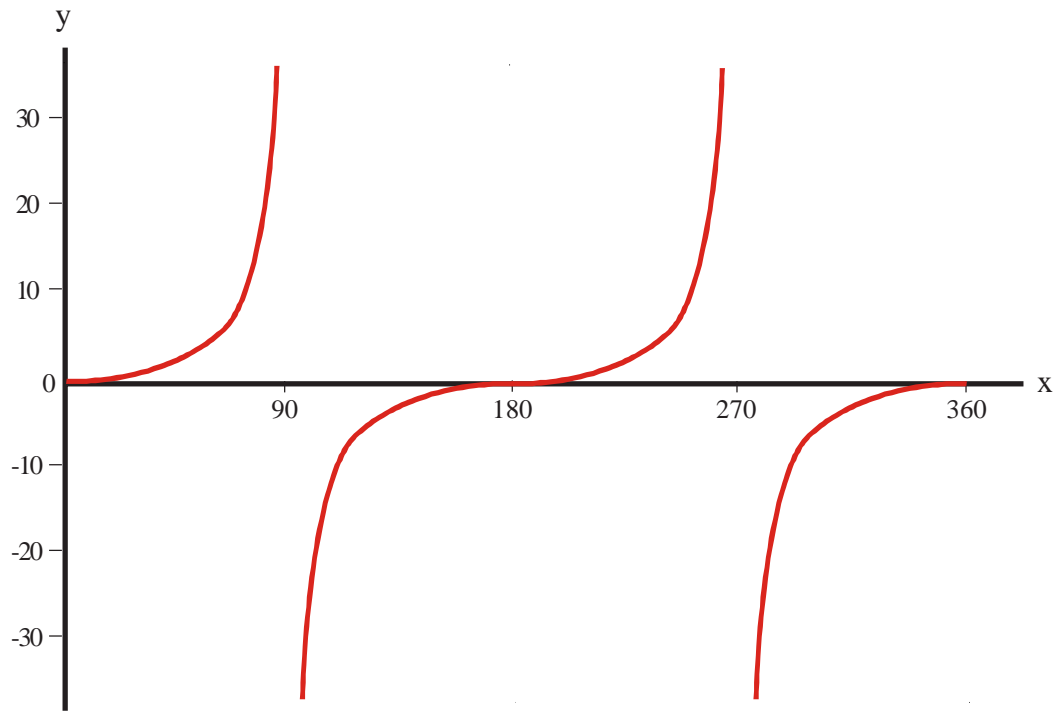


- 2) Here is the graph of the curve $y = \cos x$ for $0 < x < 360^\circ$.

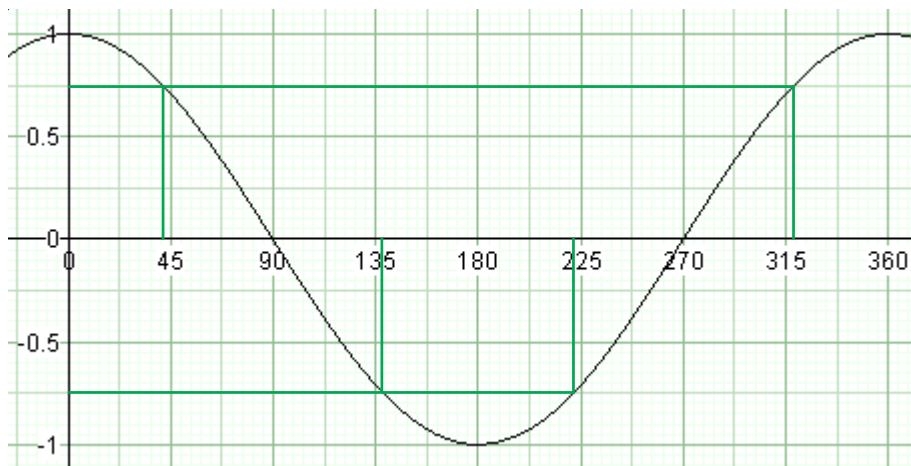


- a) Use the graph to solve $\cos x = 0.75$ for $0 < x < 360^\circ$
 b) Use the graph to solve $\cos x = -0.75$ for $0 < x < 360^\circ$

1) On the axes below, draw a sketch-graph to show $y = \tan x$



2) Here is the graph of the curve $y = \cos x$ for $0 < x < 360^\circ$.

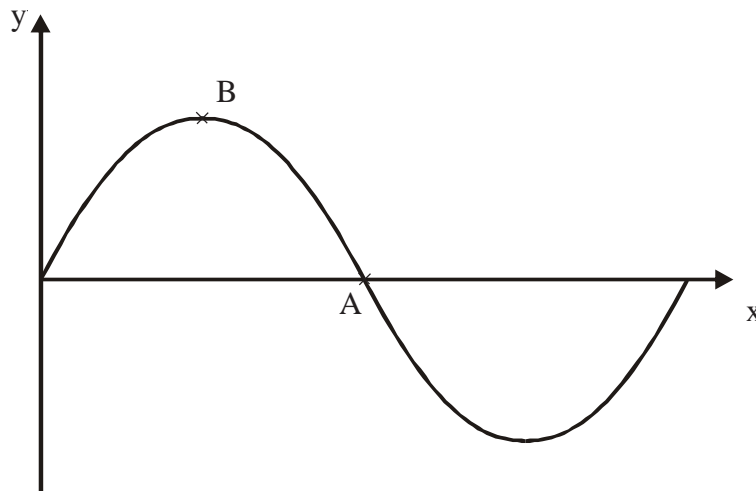


a) Use the graph to solve $\cos x = 0.75$ for $0 < x < 360^\circ$ $x = 41^\circ$ and 319°

b) Use the graph to solve $\cos x = -0.75$ for $0 < x < 360^\circ$ $x = 138^\circ$ and 221°

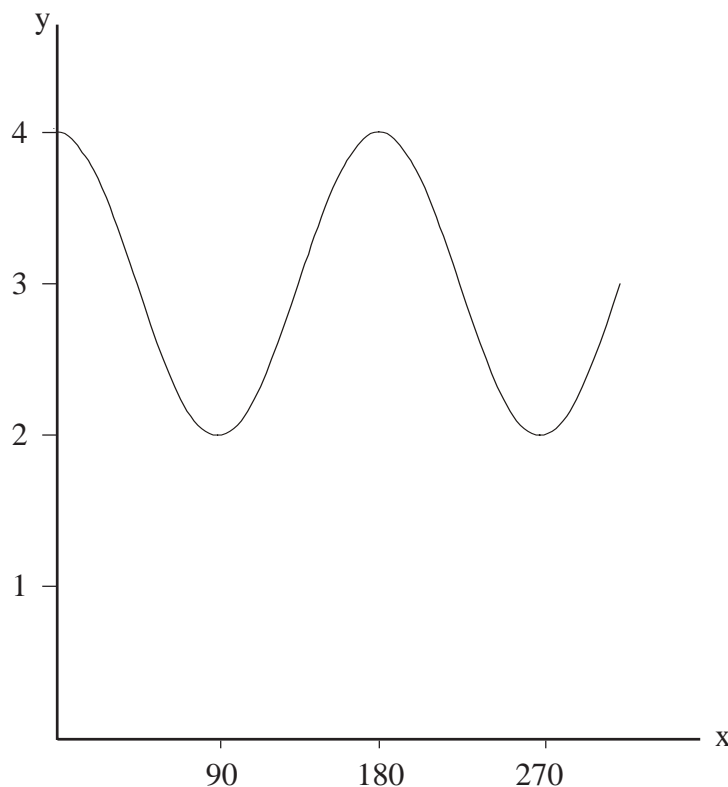
Transformation of Trig. Functions

- 1) The diagram below shows the graph of $y = 2 \sin x$, for values of x between 0 and 360° .



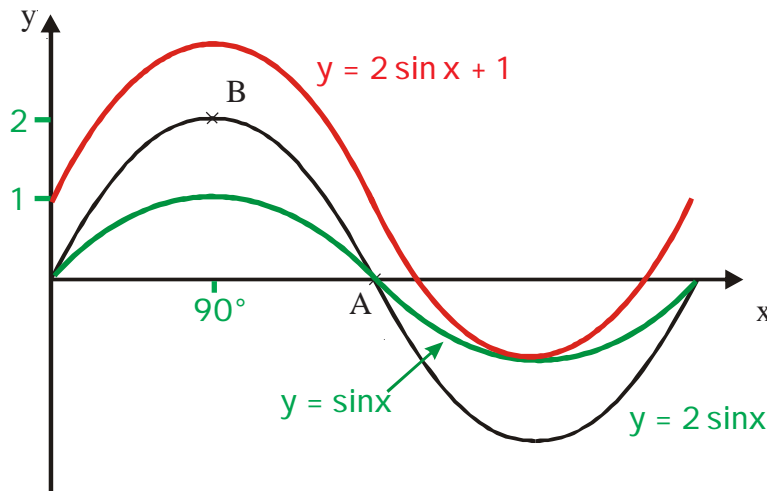
The curve cuts the x axis at the point A.
The graph has a maximum at the point B.

- a) (i) Write down the coordinates of A.
(ii) Write down the coordinates of B.
- b) On the same diagram, sketch the graph of $y = 2 \sin x + 1$ for values of x between 0 and 360° .
- 2) The diagram below shows the graph of $y = \cos ax + b$, for values of x between 0 and 300° .
Work out the values of **a** and **b**.



Transformation of Trig. Functions

- 1) The diagram below shows the graph of $y = 2 \sin x$, for values of x between 0 and 360° .

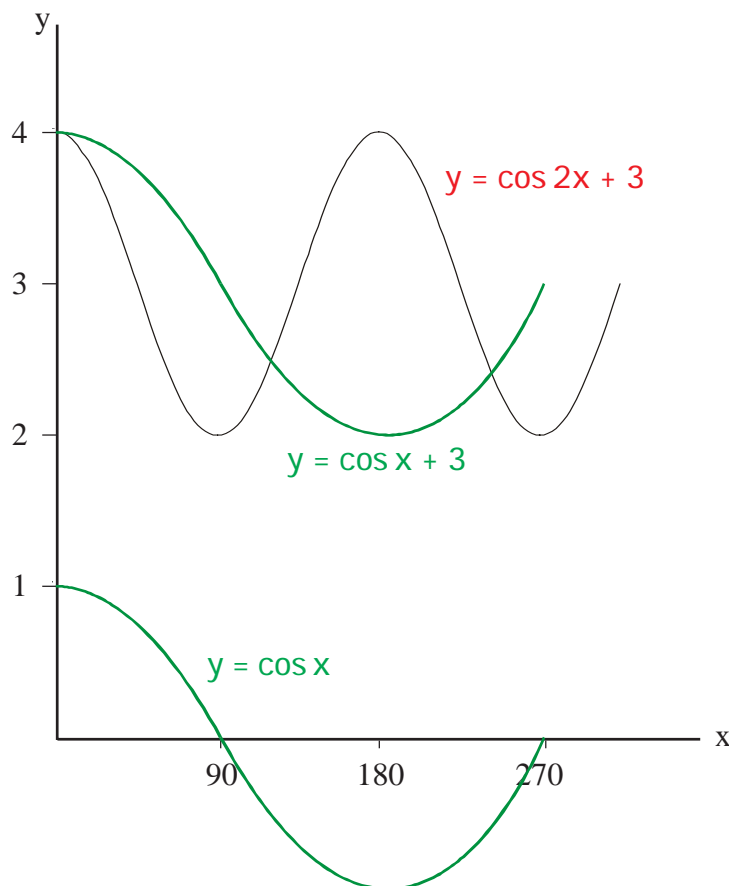


The curve cuts the x axis at the point A.
The graph has a maximum at the point B.

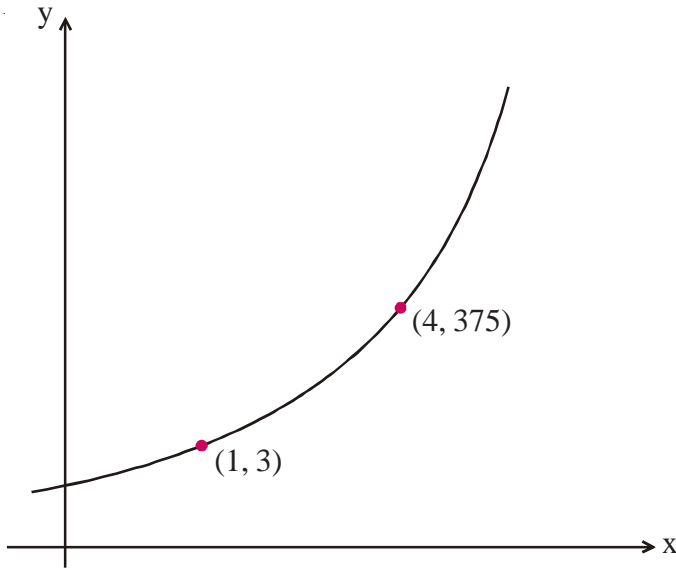
- Write down the coordinates of A. $(180^\circ, 0)$
 - Write down the coordinates of B. $(90^\circ, 2)$
- On the same diagram, sketch the graph of $y = 2 \sin x + 1$ for values of x between 0 and 360° .

- 2) The diagram below shows the graph of $y = \cos ax + b$, for values of x between 0 and 300° .

Work out the values of **a** and **b**. $a = 2$ $b = 3$



1)



The sketch-graph shows a curve with equation $y = pq^x$.

The curve passes through the points $(1, 3)$ and $(4, 375)$.

Calculate the value of p and the value of q .

2) The graph shows the number of bacteria living in a petri dish.

The number N of bacteria at time t is given by the relation:

$$N = a \times b^t$$

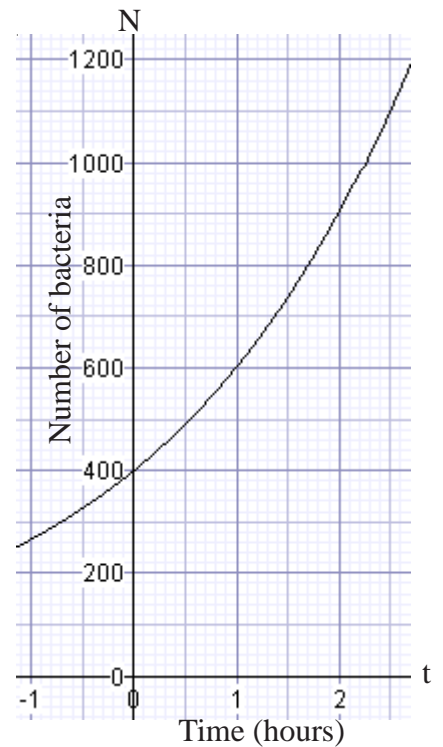
The curve passes through the point $(0, 400)$.

a) Use this information to show that $a = 400$.

The curve also passes through $(2, 900)$.

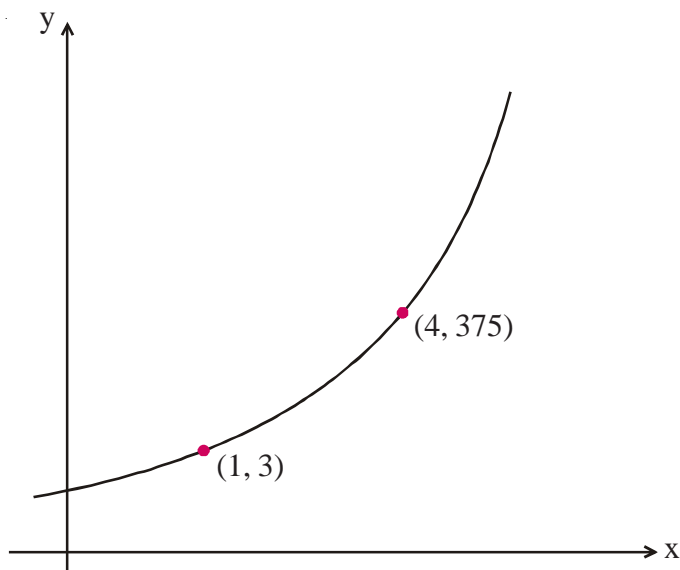
b) Use this information to find the value of b .

c) Work out the number of bacteria in the dish at time $t = 3$.



Graphs of Exponential Functions

1)



Using (1, 3)

$$y = pq^x$$

$$3 = pq^1$$

$$3 = pq$$

$$p = \frac{3}{q}$$

Using (4, 375)

$$y = pq^x$$

$$375 = pq^4$$

Replacing p with $\frac{3}{q}$

$$375 = pq^4$$

$$375 = \frac{3}{q} \times q^4$$

$$375 = 3q^3$$

$$q^3 = 125$$

$$q = 5$$

$$p = \frac{3}{q}$$

$$p = \frac{3}{5}$$

The sketch-graph shows a curve with equation $y = pq^x$.

The curve passes through the points (1, 3) and (4, 375).

Calculate the value of p and the value of q . $p = 0.6$ and $q = 5$

2) The graph shows the number of bacteria living in a petri dish.

The number N of bacteria at time t is given by the relation:

$$N = a \times b^t$$

The curve passes through the point (0, 400).

$$N = a \times b^t$$

a) Use this information to show that $a = 400$.

$$400 = a \times b^0$$

$$400 = a \times 1$$

$$a = 400$$

The curve also passes through (2, 900).

$$N = 400 \times b^t$$

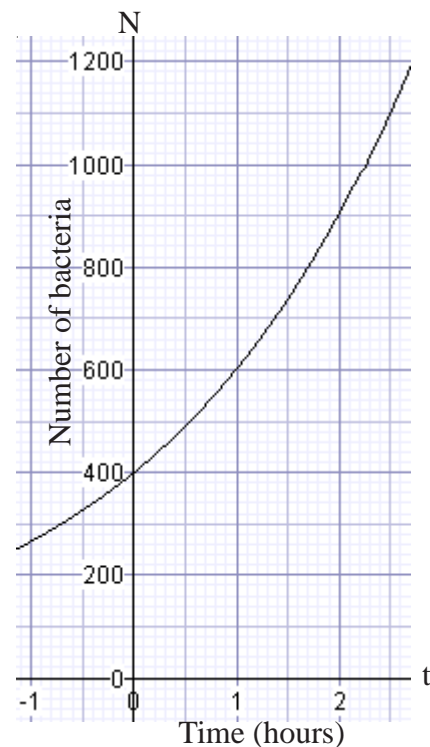
b) Use this information to find the value of b .

$$900 = 400 \times b^2$$

$$b^2 = \frac{900}{400}$$

$$b = \frac{30}{20}$$

$$b = 1.5$$



c) Work out the number of bacteria in the dish at time $t = 3$. $N = 1350$

$$N = 400 \times 1.5^t$$

$$N = 400 \times \left(\frac{3}{2}\right)^3$$

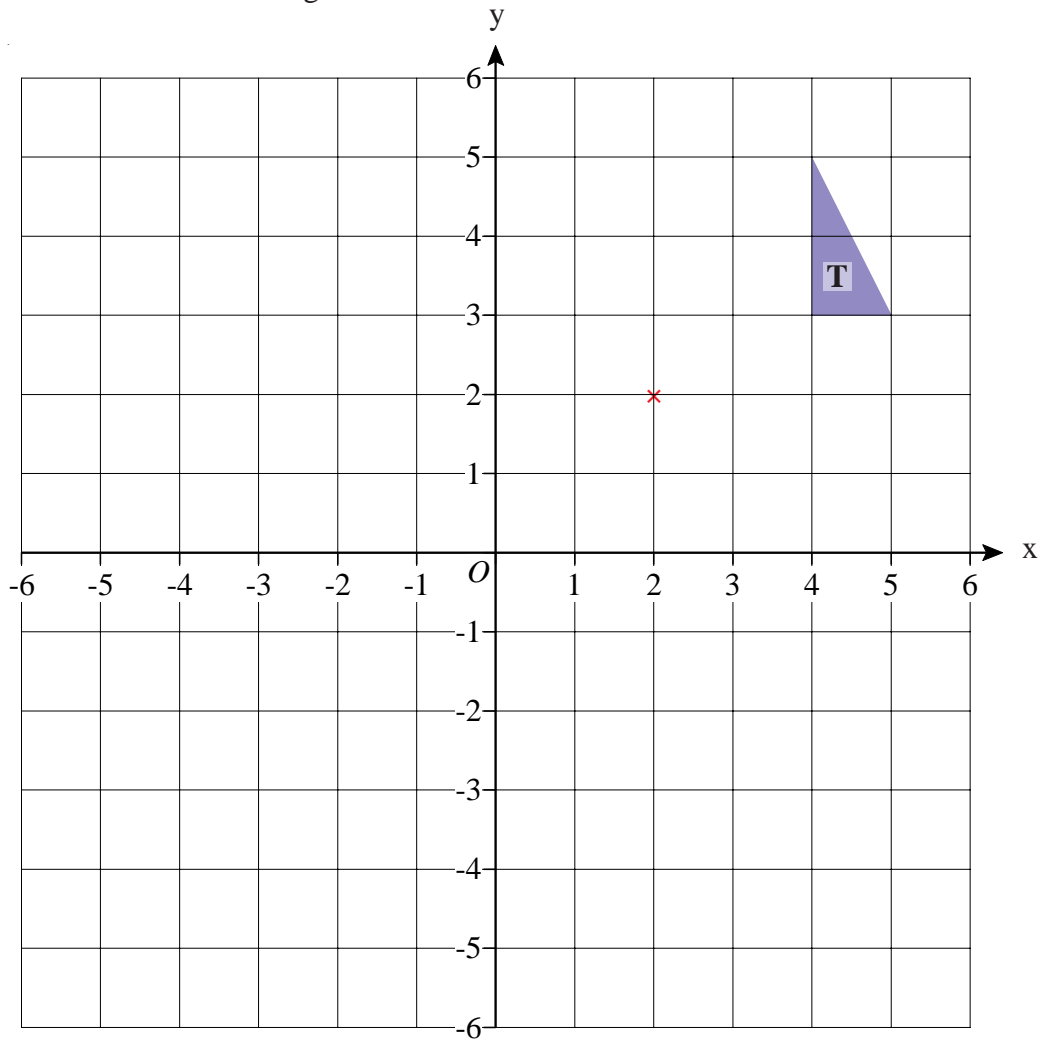
$$N = 400 \times \left(\frac{27}{8}\right)$$

$$N = 50 \times 27$$

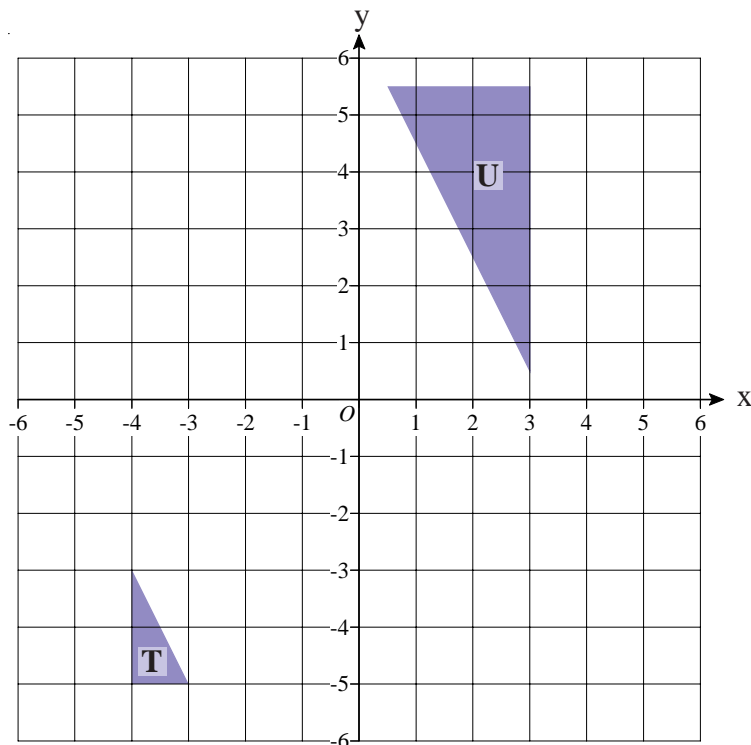
$$N = 1350$$

Enlargement by Negative Scale Factor

- 1) Enlarge triangle T by scale factor -2 using coordinates $(2, 2)$ as the centre of enlargement.

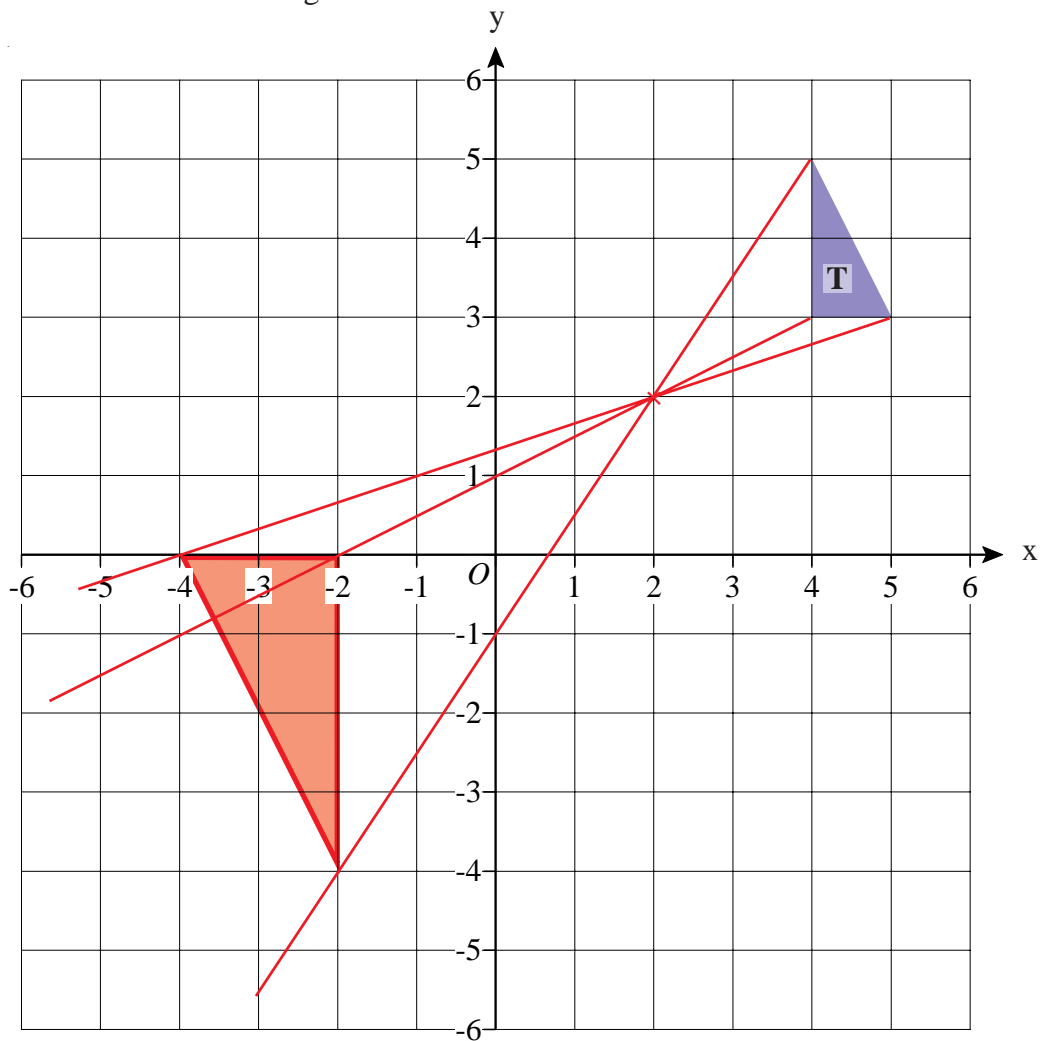


- 2) Describe fully the single transformation which maps triangle T to triangle U.

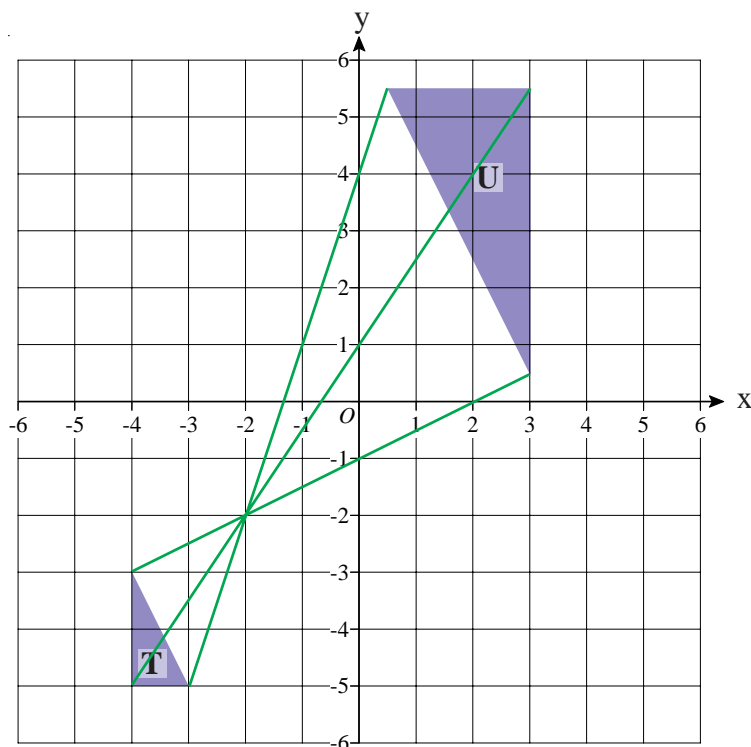


Enlargement by Negative Scale Factor

- 1) Enlarge triangle T by scale factor -2 using coordinates $(2, 2)$ as the centre of enlargement.

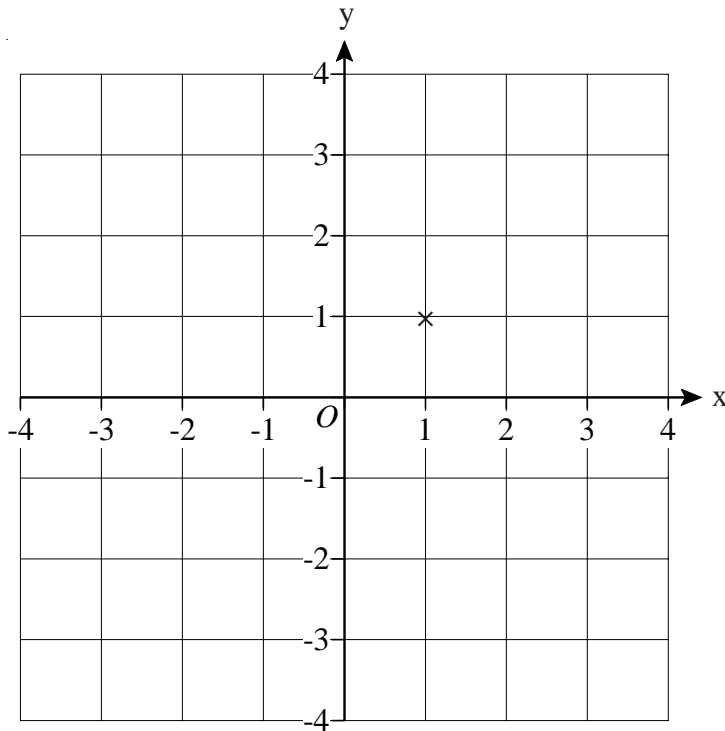


- 2) Describe fully the single transformation which maps triangle T to triangle U.

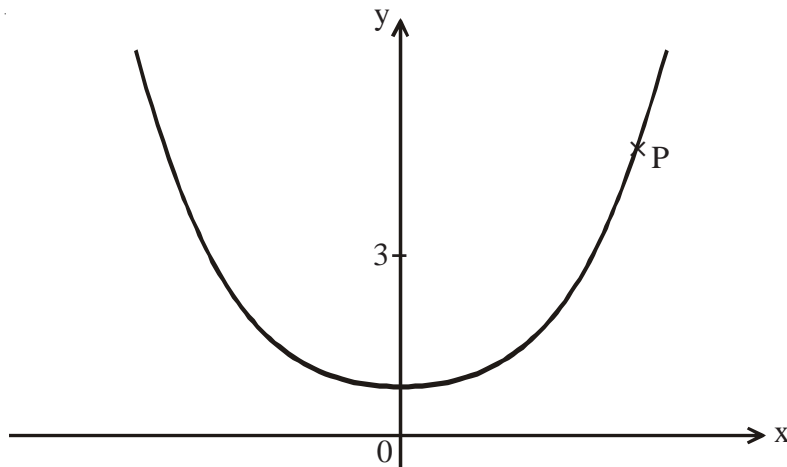


Enlargement with scale factor -2.5
Centre of enlargement at $(-2, -2)$

- 1) Show that any straight line which passes through the point (1, 1) must intersect the curve with equation $x^2 + y^2 = 9$ at two points.



- 2)



The diagram shows a sketch of a curve.

The point $P(x, y)$ lies on the curve.

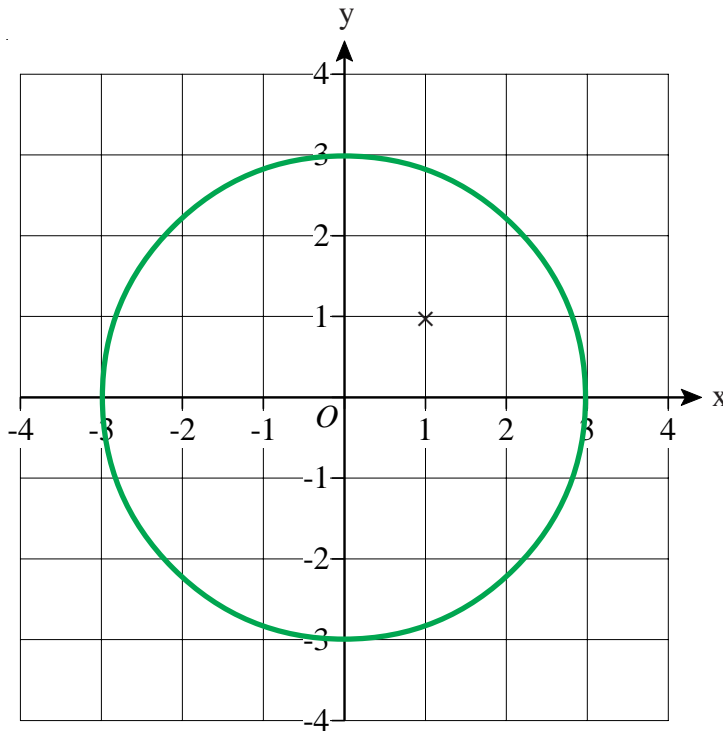
The locus of P has the following property:

The distance of the point P from the point $(0, 3)$ is the same as the distance of the point P from the x -axis.

Show that $y = \frac{x^2 + 9}{6}$

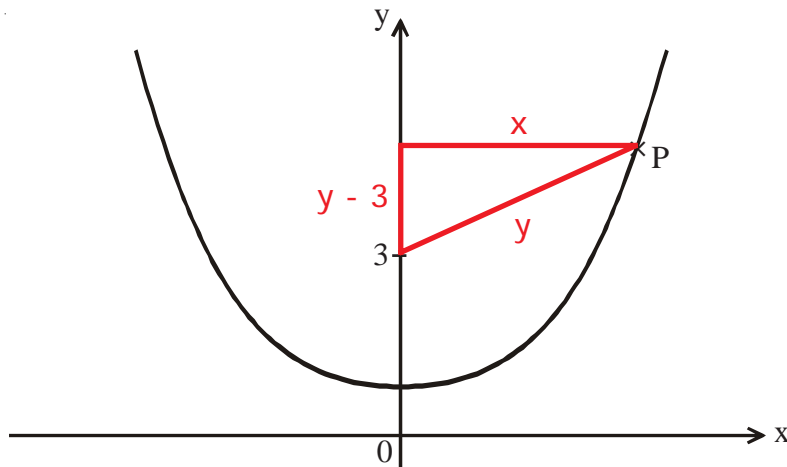
Equations of Circles and Loci

- 1) Show that any straight line which passes through the point (1, 1) must intersect the curve with equation $x^2 + y^2 = 9$ at two points.



$x^2 + y^2 = 9$ is a circle with centre (0, 0).
 Point (1, 1) lies inside the circle.
 Therefore any point which passes through (1, 1) must intersect the curve at two points.

- 2)



The diagram shows a sketch of a curve.

The point $P(x, y)$ lies on the curve.

The locus of P has the following property:

The distance of the point P from the point (0, 3) is the same as the distance of the point P from the x -axis.

Show that $y = \frac{x^2 + 9}{6}$

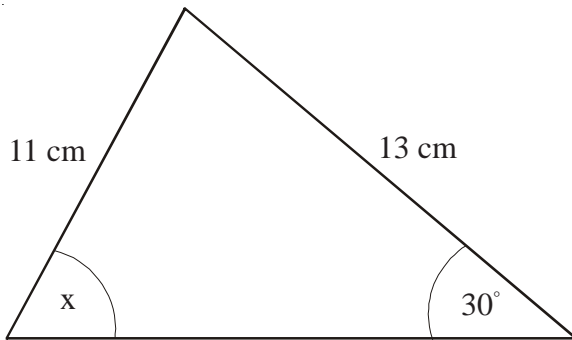
$$y^2 = x^2 + (y - 3)^2$$

$$y^2 = x^2 + y^2 - 6y + 9$$

$$6y = x^2 + 9$$

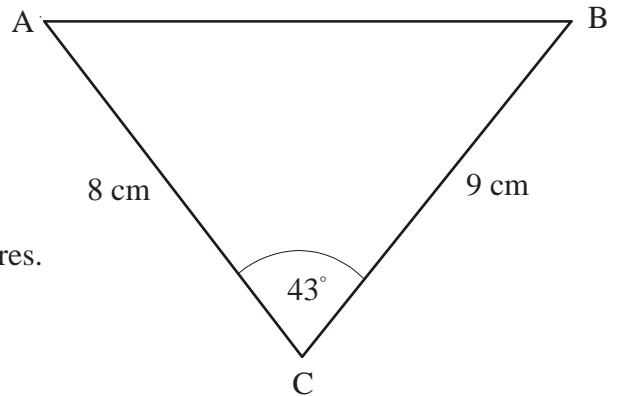
$$y = \frac{x^2 + 9}{6}$$

- 1) Work out the size of the angle marked x .
Give your answer correct to one decimal place.

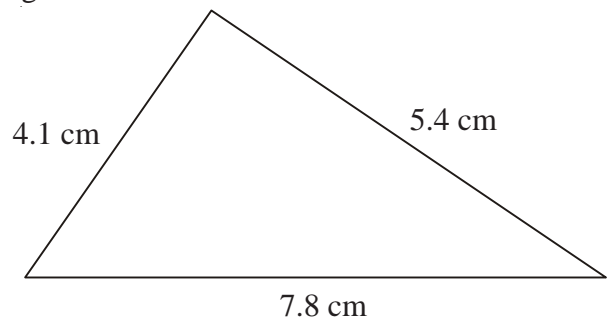


- 2) ABC is a triangle.
AC = 8 cm
BC = 9 cm
Angle ACB = 43°

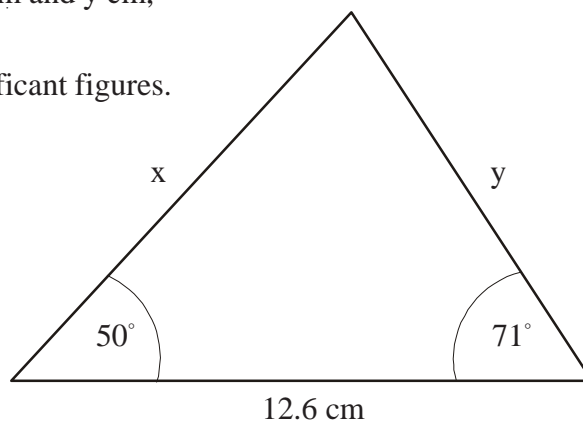
Calculate the length of AB.
Give your answer correct to 3 significant figures.



- 3) The lengths of the sides of a triangle are 4.1 cm, 5.4 cm and 7.8 cm.
Calculate the size of the largest angle of the triangle.
Give your answer correct to 1 decimal place.

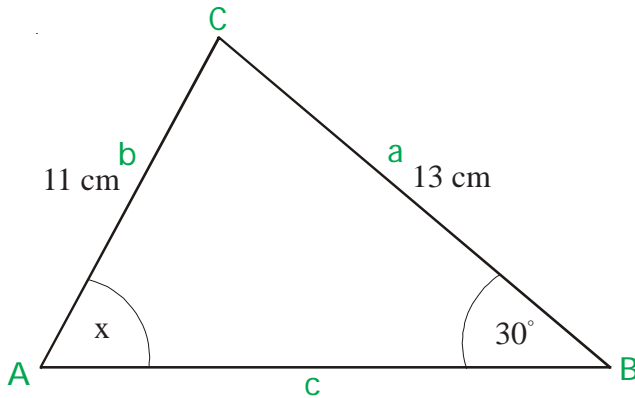


- 4) Find the missing lengths, x cm and y cm,
in this triangle.
Give your answers to 3 significant figures.



Sine and Cosine rules

- 1) Work out the size of the angle marked x. **36.2°**
Give your answer correct to one decimal place.



$$\frac{\sin A}{a} = \frac{\sin B}{b}$$

$$\frac{\sin A}{13} = \frac{\sin 30}{11}$$

$$\sin A = \frac{13 \times \sin 30}{11}$$

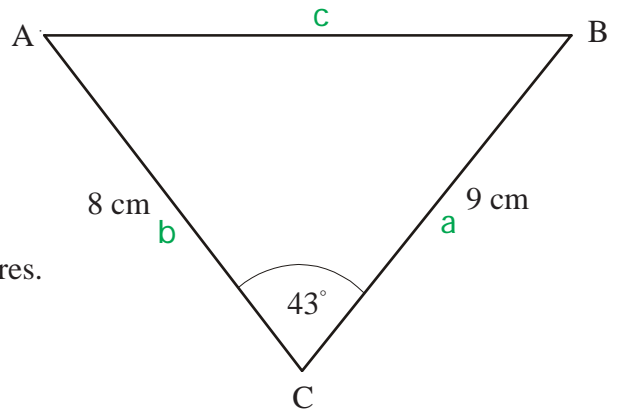
- 2) ABC is a triangle.
AC = 8 cm
BC = 9 cm
Angle ACB = 43°

Calculate the length of AB. **6.30 cm**
Give your answer correct to 3 significant figures.

$$c^2 = a^2 + b^2 - 2ab \cos C$$

$$c^2 = 9^2 + 8^2 - 2 \times 9 \times 8 \times \cos 43$$

$$c^2 = 39.6851$$



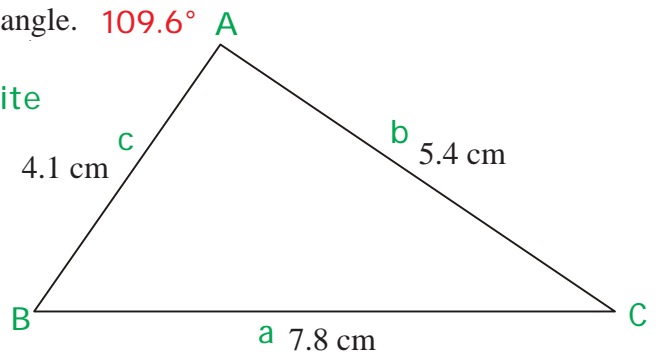
- 3) The lengths of the sides of a triangle are 4.1 cm, 5.4 cm and 7.8 cm.

Calculate the size of the largest angle of the triangle. **109.6°**
Give your answer correct to 1 decimal place.

A is the largest angle because it is opposite the largest side.

$$\cos A = \frac{b^2 + c^2 - a^2}{2bc}$$

$$\cos A = \frac{5.4^2 + 4.1^2 - 7.8^2}{2 \times 5.4 \times 4.1}$$



- 4) Find the missing lengths, x cm and y cm, in this triangle. **x = 13.9 cm** **y = 11.3 cm**

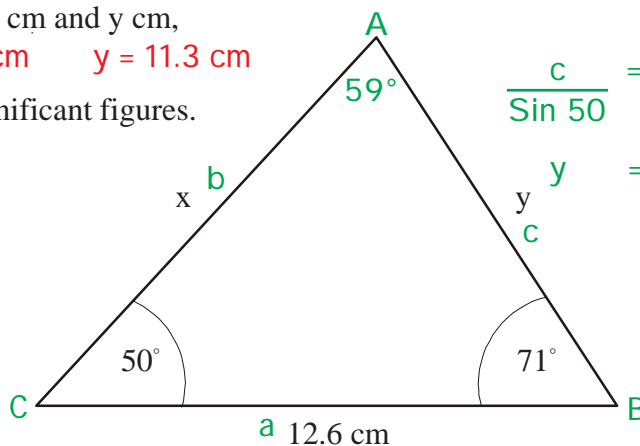
Give your answers to 3 significant figures.

$$\frac{b}{\sin 71} = \frac{12.6}{\sin 59}$$

$$x = \frac{12.6 \times \sin 71}{\sin 59}$$

$$\frac{c}{\sin 50} = \frac{12.6}{\sin 59}$$

$$y = \frac{12.6 \times \sin 50}{\sin 59}$$

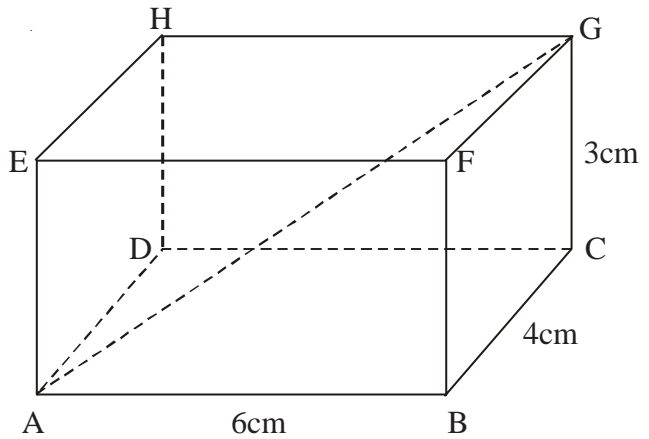


Pythagoras in 3 Dimensions

- 1) The diagram shows a box in the shape of a cuboid.
 $AB = 6\text{cm}$, $BC = 4\text{cm}$, $CG = 3\text{cm}$

A string runs diagonally across the box from A to G.

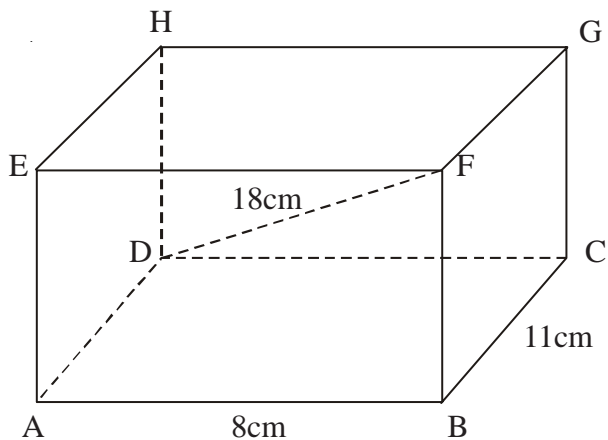
Calculate the length of the string AG.
 Give your answer correct to 3 significant figures.



- 2) The diagram shows a box in the shape of a cuboid.
 $AB = 8\text{cm}$, $BC = 11\text{cm}$

A string runs diagonally across the box from D to F and is 18cm long.

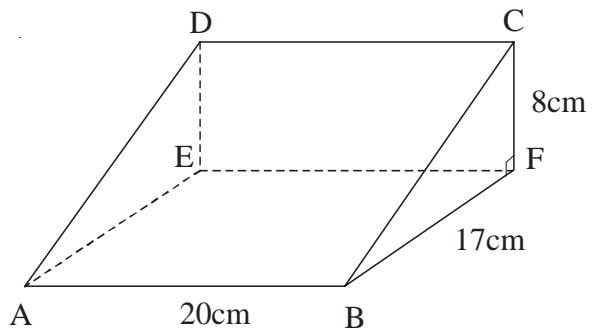
Calculate the length AE.
 Give your answer correct to 3 significant figures.



- 3) The diagram shows a wedge in the shape of a prism.
 Angle BFC is a right angle.

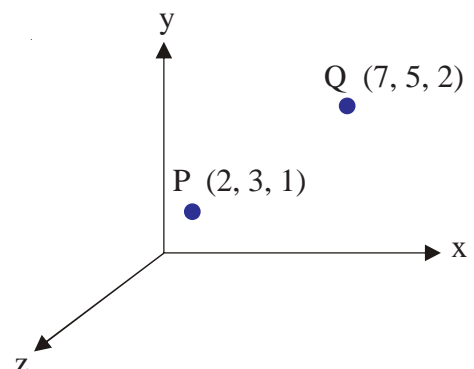
String runs diagonally across the wedge from A to C.

Calculate the length AC.
 Give your answer correct to 3 significant figures.



- 4) Two points, P and Q, lie on coordinate axes.

Find the distance PQ to 1 decimal place.



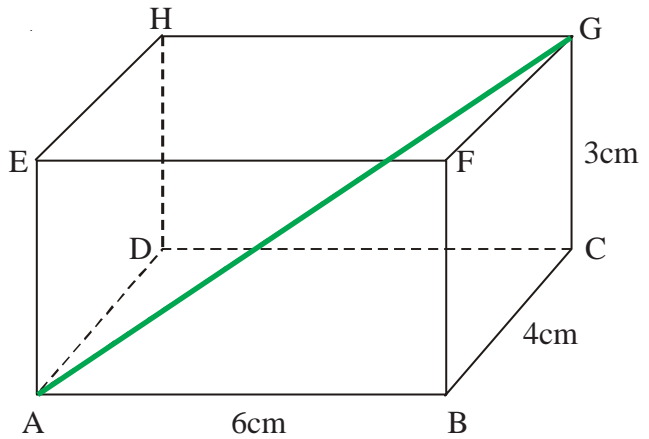
Pythagoras in 3 Dimensions

- 1) The diagram shows a box in the shape of a cuboid.
 $AB = 6\text{cm}$, $BC = 4\text{cm}$, $CG = 3\text{cm}$

A string runs diagonally across the box from A to G.

Calculate the length of the string AG.
 Give your answer correct **7.81 cm** to 3 significant figures.

$$AG = \sqrt{6^2 + 4^2 + 3^2}$$

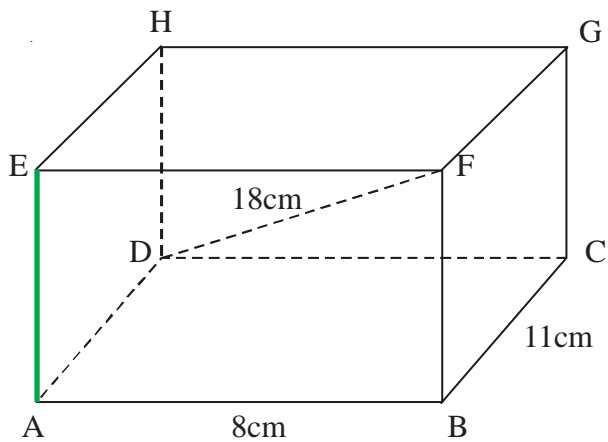


- 2) The diagram shows a box in the shape of a cuboid.
 $AB = 8\text{cm}$, $BC = 11\text{cm}$

A string runs diagonally across the box from D to F and is 18cm long.

Calculate the length AE. **11.8 cm**
 Give your answer correct to 3 significant figures.

$$AE = \sqrt{18^2 - 11^2 - 8^2}$$



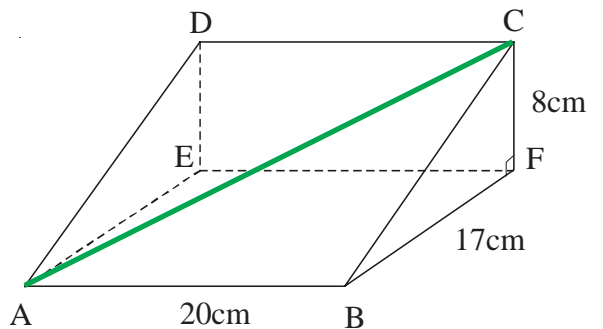
- 3) The diagram shows a wedge in the shape of a prism.
 Angle BFC is a right angle.

String runs diagonally across the wedge from A to C.

Calculate the length AC **27.4 cm**

Give your answer correct to 3 significant figures.

$$AC = \sqrt{20^2 + 17^2 + 8^2}$$



- 4) Two points, P and Q, lie on coordinate axes.

Find the distance PQ to 1 decimal place. **5.5**

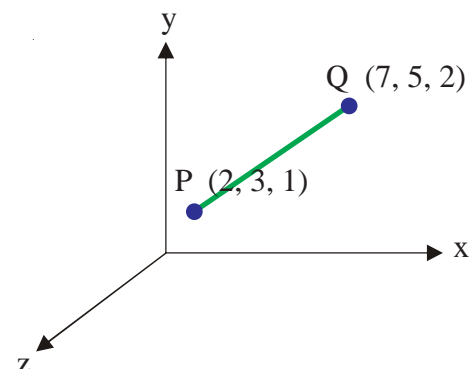
$$D^2 = x^2 + y^2 + z^2$$

$$Q (7, 5, 2) \quad P (2, 3, 1)$$

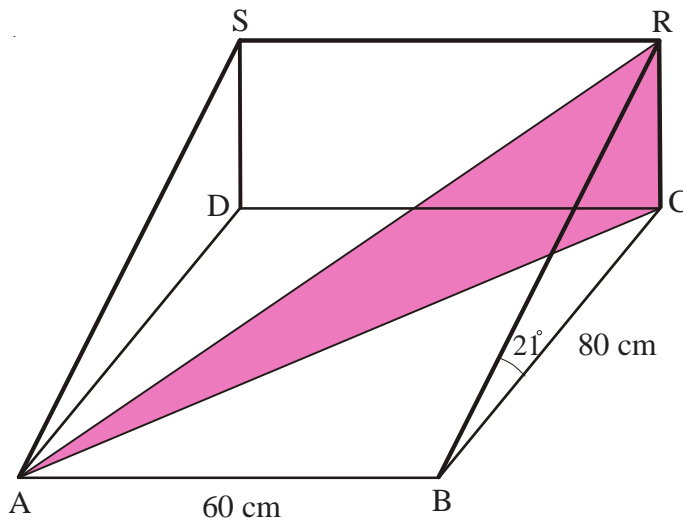
$$D^2 = (7 - 2)^2 + (5 - 3)^2 + (2 - 1)^2$$

$$D^2 = 5^2 + 2^2 + 1^2$$

$$D = \sqrt{30}$$

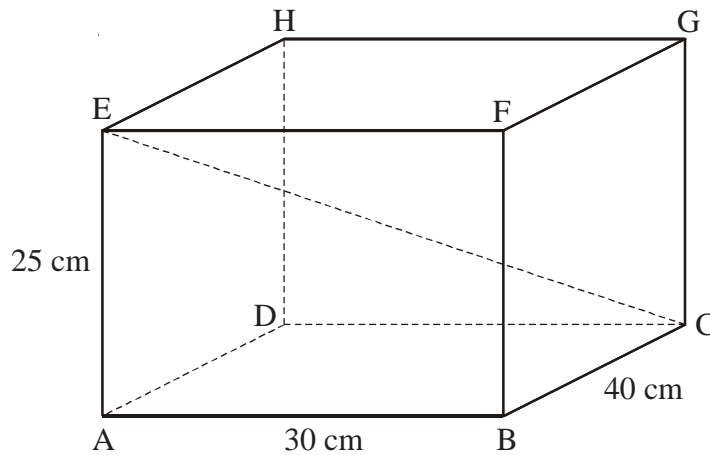


- 1) The diagram shows a wedge.
 The base of the wedge is a horizontal rectangle measuring 80 cm by 60 cm.
 The sloping face ABRS makes an angle of 21° to the horizontal.



Calculate the angle that AR makes with the horizontal plane ABCD.
 Give your answer correct to 1 decimal place.

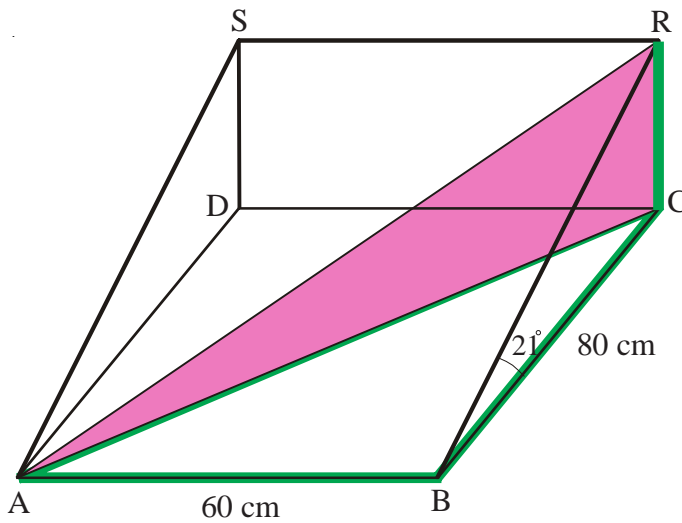
- 2) The diagram shows a box in the shape of a cuboid.
 A string runs diagonally across the box from C to E.



- a) Work out the length of the string CE.
 Give your answer correct to 1 decimal place.
- b) Work out the angle between the string CE and the horizontal plane ABCD.
 Give your answer correct to 1 decimal place.

Trigonometry in 3 Dimensions

- 1) The diagram shows a wedge.
 The base of the wedge is a horizontal rectangle measuring 80 cm by 60 cm.
 The sloping face ABRS makes an angle of 21° to the horizontal.



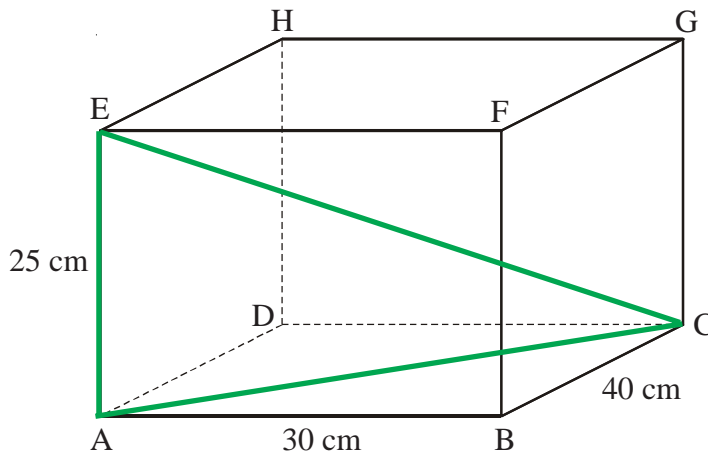
Step 1:
 Find AC using Pythagoras in triangle ABC.
 Answer: $AC = 100$ cm

Step 2:
 Find CR using Tan 21 in triangle BCR.
 Answer: $CR = 30.71$ cm

Step 3:
 Find angle RAC using Tan in triangle RAC.
 Answer: Angle RAC = 17.1°

Calculate the angle that AR makes with the horizontal plane ABCD. 17.1°
 Give your answer correct to 1 decimal place.

- 2) The diagram shows a box in the shape of a cuboid.
 A string runs diagonally across the box from C to E.



a) Work out the length of the string CE. 55.9 cm $CE = \sqrt{30^2 + 40^2 + 25^2}$
 Give your answer correct to 1 decimal place.

b) Work out the angle between the string CE and the horizontal plane ABCD.
 Give your answer correct to 1 decimal place. 26.6°

In triangle CAE we have $CE = 55.9$ cm and $AE = 25$ cm.
 It has a right angle at A.
 Use Sin to find the required angle.

Area of Triangles Using $\frac{1}{2}ab\sin C$

1)

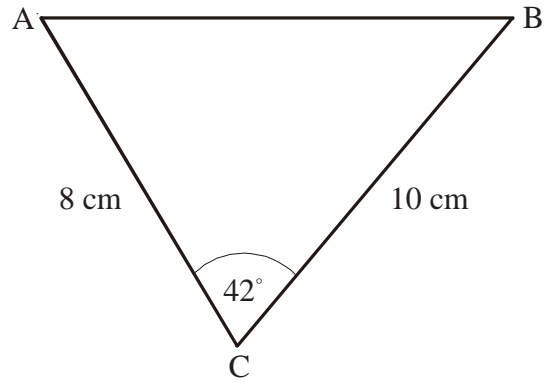


Diagram **NOT** accurately drawn.

ABC is a triangle.
 AC = 8 cm.
 BC = 10 cm
 Angle ACB = 42°

Calculate the area of triangle ABC.
 Give your answer correct to 3 significant figures.

2)

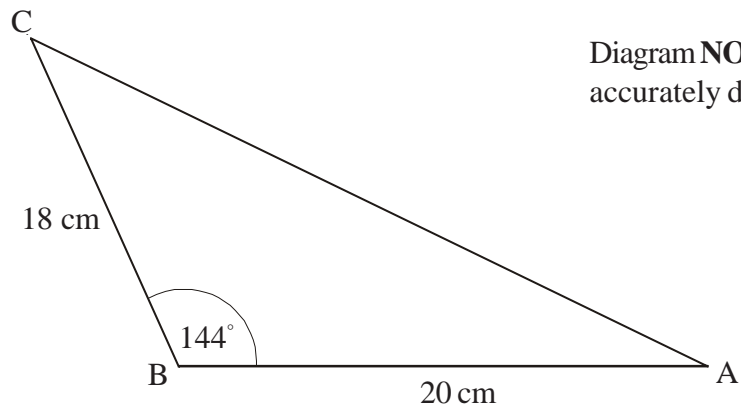


Diagram **NOT** accurately drawn.

ABC is a triangle.
 AB = 20 cm.
 BC = 18 cm
 Angle ABC = 144°

Calculate the area of triangle ABC.
 Give your answer correct to 3 significant figures.

3)

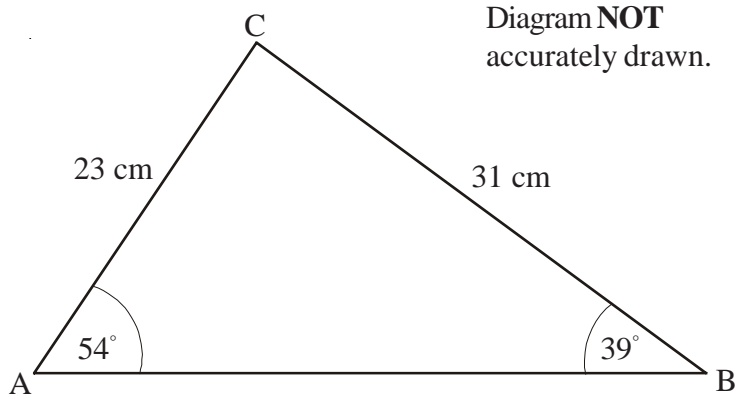


Diagram **NOT** accurately drawn.

ABC is a triangle.
 AC = 23 cm.
 BC = 31 cm
 Angle BAC = 54°
 Angle ABC = 39°

Calculate the area of triangle ABC.
 Give your answer correct to 3 significant figures.

Area of Triangles Using $\frac{1}{2}ab\sin C$

1)

$A = \frac{1}{2}ab\sin C$

ABC is a triangle.
 AC = 8 cm.
 BC = 10 cm
 Angle ACB = 42°

Calculate the area of triangle ABC. **26.8 cm^2**
 Give your answer correct to 3 significant figures.

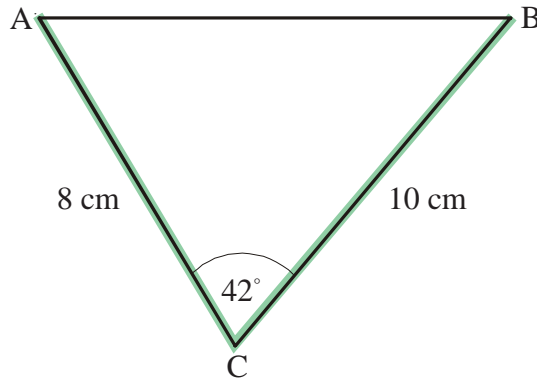


Diagram **NOT** accurately drawn.

2)

$A = \frac{1}{2}ab\sin C$

ABC is a triangle.
 AB = 20 cm.
 BC = 18 cm
 Angle ABC = 144°

Calculate the area of triangle ABC. **106 cm^2**
 Give your answer correct to 3 significant figures.

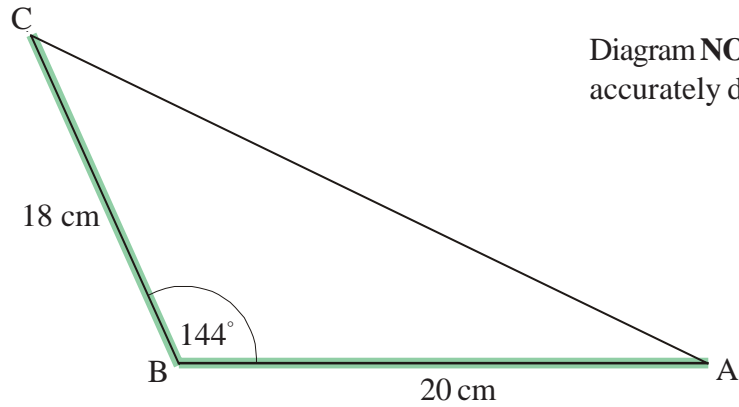


Diagram **NOT** accurately drawn.

3)

$A = \frac{1}{2}ab\sin C$

ABC is a triangle.
 AC = 23 cm.
 BC = 31 cm
 Angle BAC = 54°
 Angle ABC = 39°

Calculate the area of triangle ABC. **356 cm^2**
 Give your answer correct to 3 significant figures.

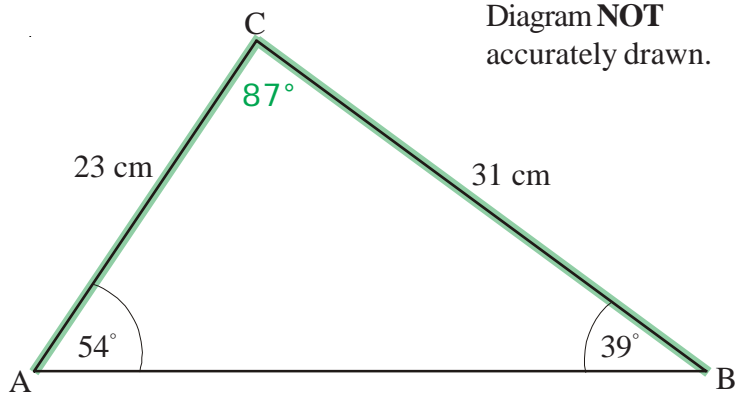
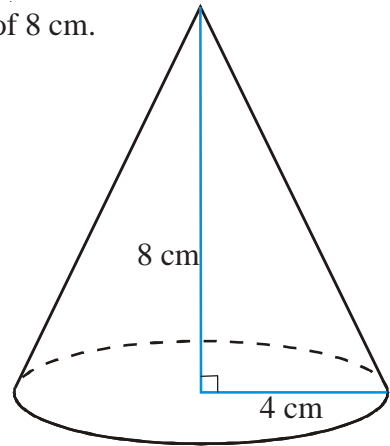


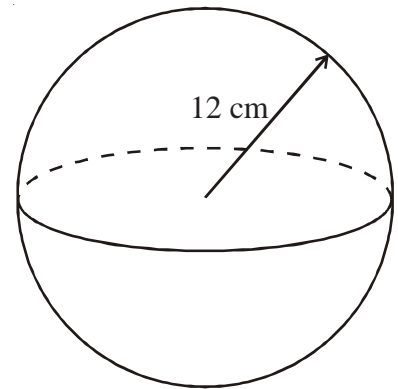
Diagram **NOT** accurately drawn.

Cones and Spheres

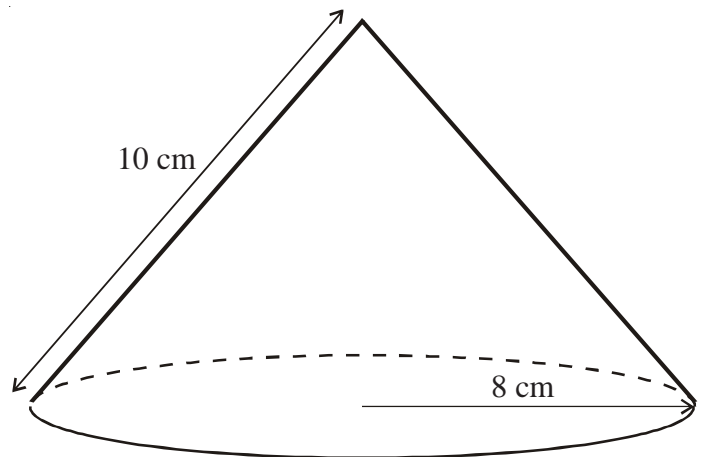
- 1) A cone has a base radius of 4 cm and a vertical height of 8 cm.
- a) Calculate the volume of the cone.
Give your answer correct to 3 significant figures.
 - b) Use Pythagoras' Theorem to find the slant height of the cone.
Give your answer correct to 1 decimal place.
 - c) Find the curved surface area of the cone.
Give your answer correct to 3 significant figures.



- 2) A sphere has a radius of 12cm.
- a) Calculate the volume of the sphere.
Give your answer correct to 3 significant figures.
 - b) Find the curved surface area of the sphere.
Give your answer correct to 3 significant figures.



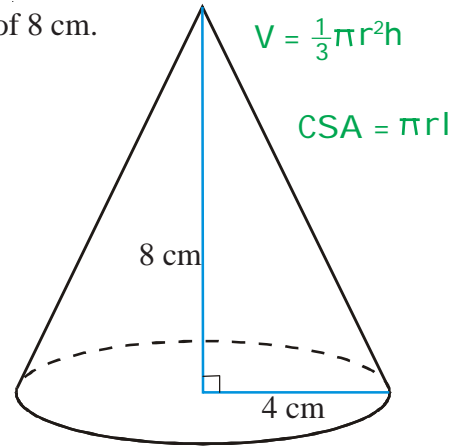
- 3) A cone has a base radius of 8 cm and a slant height of 10 cm.
- Calculate the volume of the cone.
Leave your answer in terms of π



Cones and Spheres

1) A cone has a base radius of 4 cm and a vertical height of 8 cm.

- a) Calculate the volume of the cone. **134 cm³**
Give your answer correct to 3 significant figures.
- b) Use Pythagoras' Theorem to find the slant height of the cone. **8.9 cm**
Give your answer correct to 1 decimal place.
- c) Find the curved surface area of the cone. **112 cm²**
Give your answer correct to 3 significant figures.

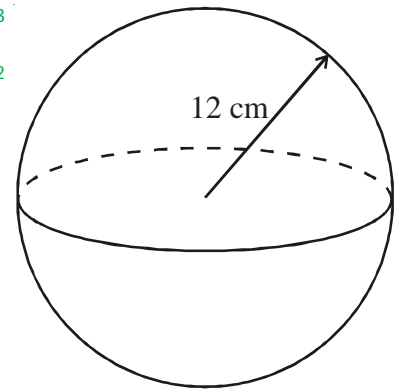


2) A sphere has a radius of 12cm.

- a) Calculate the volume of the sphere. **7240 cm³**
Give your answer correct to 3 significant figures.
- b) Find the curved surface area of the sphere. **1810 cm²**
Give your answer correct to 3 significant figures.

$V = \frac{4}{3}\pi r^3$

$CSA = 4\pi r^2$



3) A cone has a base radius of 8 cm and a slant height of 10 cm.

Calculate the volume of the cone. **128π cm³**
Leave your answer in terms of π

Find height using Pythagoras

$$10^2 = 100$$

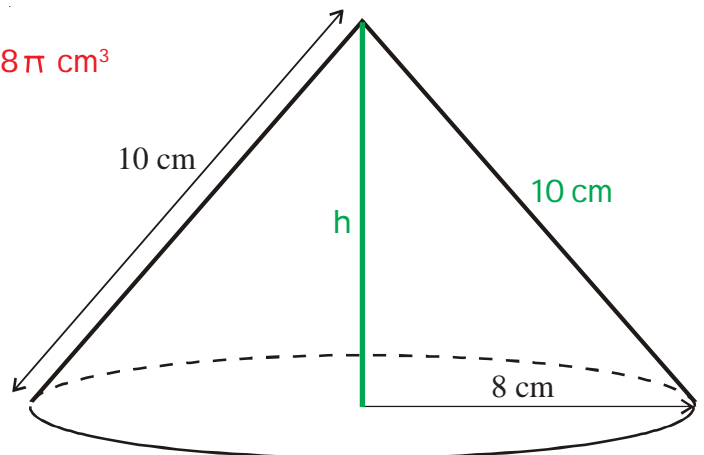
$$8^2 = \frac{64}{36}$$

$$\sqrt{36} = 6$$

$$V = \frac{1}{3}\pi r^2 h$$

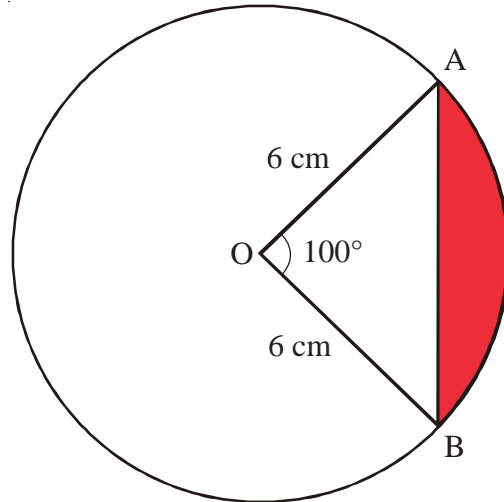
$$= \frac{1}{3} \times \pi \times 8^2 \times 6$$

$$= 128\pi$$

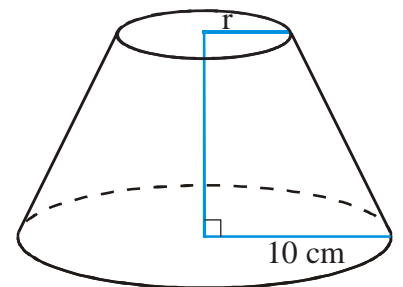
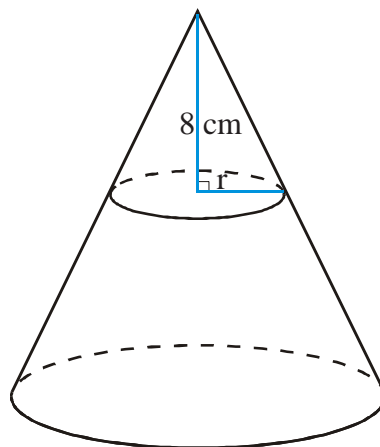
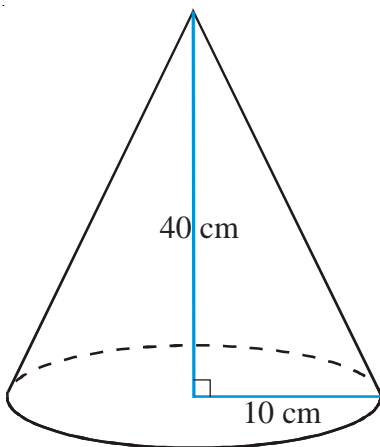


Segments and Frustums

- 1) Find the area of the segment shaded in the diagram below.
Give your answer to 3 significant figures.



- 2) The diagram shows a cone of height 40 cm and base radius 10 cm.
A smaller cone of height 8 cm is removed to form a frustum.



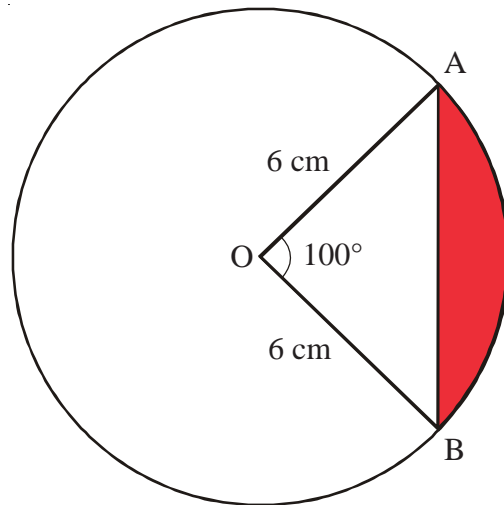
- a) Work out the radius r of the base of the smaller cone.

Calculate, to the nearest cm^3

- b) The volume of the larger cone.
c) The volume of the smaller cone.
d) The volume of the frustum.

Segments and Frustums

- 1) Find the area of the segment shaded in the diagram below. **13.7 cm²**
Give your answer to 3 significant figures.



Area of sector AOB

$$\frac{100}{360} \times 3.142 \times 6^2 = 31.42$$

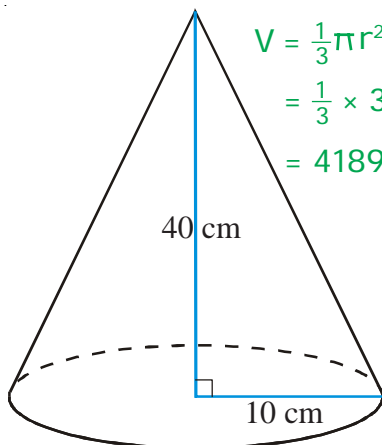
Area of triangle AOB

$$\frac{1}{2} \times 6 \times 6 \times \sin 100 = 17.73$$

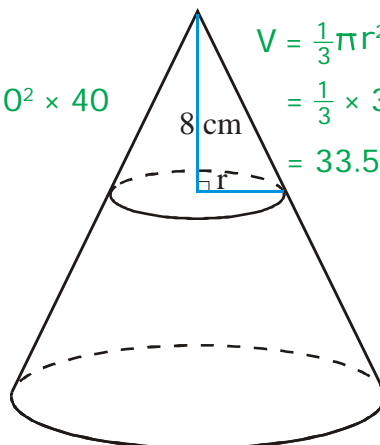
Area of shaded segment

$$31.42 - 17.73 = 13.7 \text{ to 3 sig figs.}$$

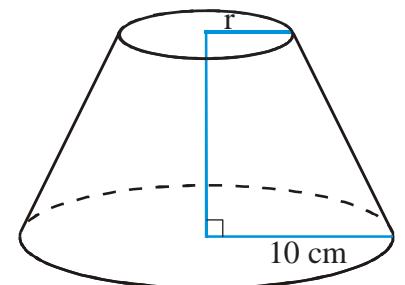
- 2) The diagram shows a cone of height 40 cm and base radius 10 cm.
A smaller cone of height 8 cm is removed to form a frustum.



$$\begin{aligned} V &= \frac{1}{3} \pi r^2 h \\ &= \frac{1}{3} \times 3.142 \times 10^2 \times 40 \\ &= 4189.3 \end{aligned}$$



$$\begin{aligned} V &= \frac{1}{3} \pi r^2 h \\ &= \frac{1}{3} \times 3.142 \times 2^2 \times 8 \\ &= 33.51 \end{aligned}$$

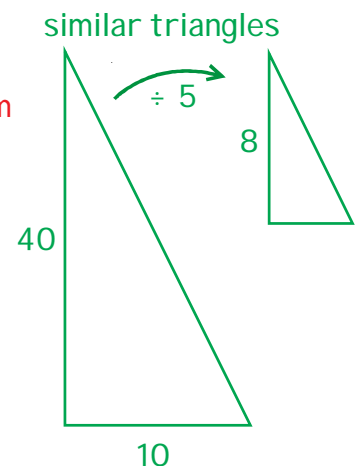


$$\begin{aligned} V &= 4189.33 - 33.51 \\ &= 4155.82 \end{aligned}$$

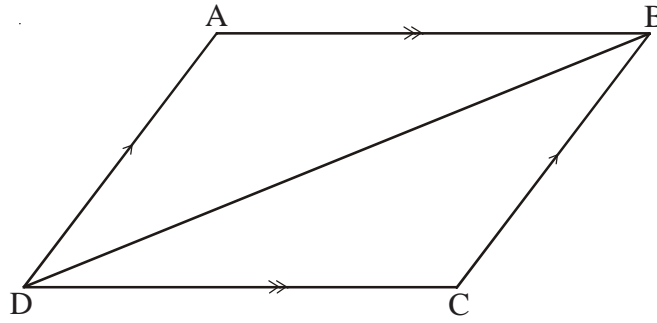
- a) Work out the radius r of the base of the smaller cone. **2 cm**

Calculate, to the nearest cm^3

- b) The volume of the larger cone. **4189 cm³**
c) The volume of the smaller cone. **34 cm³**
d) The volume of the frustum. **4156 cm³**



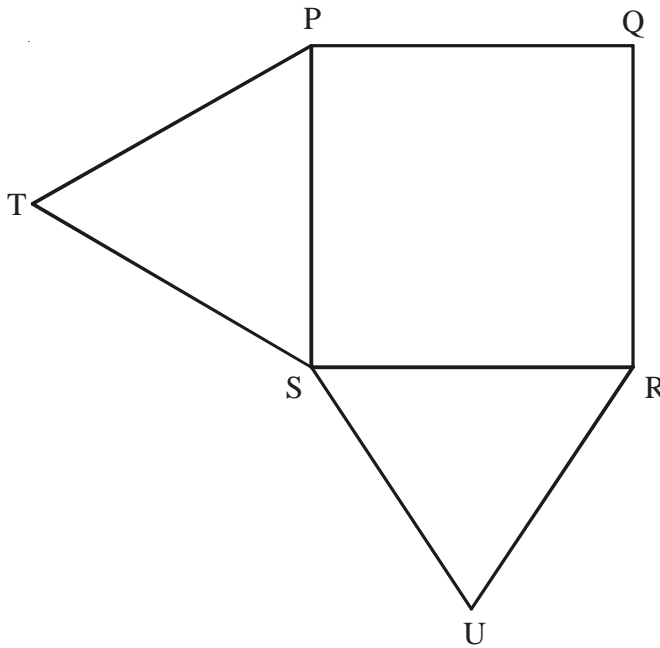
1) ABCD is a quadrilateral.



AB is parallel to DC.
DA is parallel to CB.

Prove that triangle ABD is congruent to triangle CDB.

2)



PQRS is a square.
PTS and SUR are equilateral triangles.

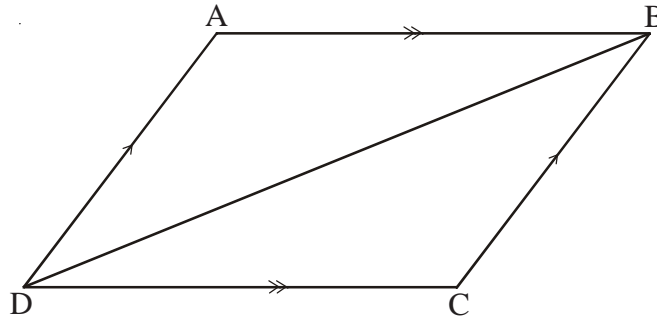
a) Prove that triangle USP is congruent to triangle TSR.

X is the point such that RUXT is a parallelogram.

b) Prove that $UP = UX$

Congruent triangles

1) ABCD is a quadrilateral.

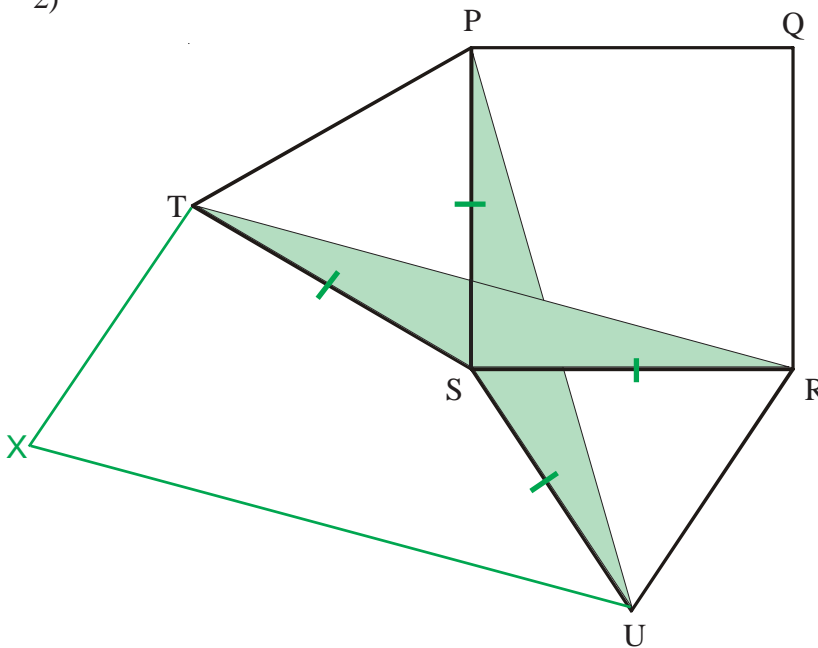


AB is parallel to DC.
DA is parallel to CB.

Prove that triangle ABD is congruent to triangle CDB.

AB = CD (opp. sides of parallelogram are equal)
AD = CB (opp. sides of parallelogram are equal)
DB is a shared side.
Therefore ABD is congruent to CDB (SSS)

2)



PQRS is a square.
PTS and SUR are equilateral triangles.

US = TS
SP = SR
Angle USP = $60^\circ + 90^\circ = 150^\circ$
Angle TSR = $60^\circ + 90^\circ = 150^\circ$
USP is congruent to TSR (SAS)

a) Prove that triangle USP is congruent to triangle TSR.

X is the point such that RUXT is a parallelogram.

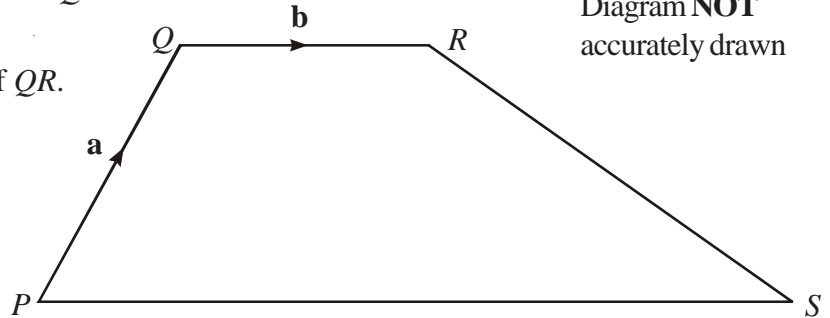
b) Prove that $UP = UX$
 $UP = RT$ (corresponding sides of congruent triangles)
 $RT = UX$ (opp. sides of parallelogram are equal)
 Therefore $UP = UX$

- 1) The diagram shows a trapezium $PQRS$.

$\vec{PQ} = \mathbf{a}$ and $\vec{QR} = \mathbf{b}$.

PS is three times the length of QR .

Diagram **NOT** accurately drawn



Find, in terms of \mathbf{a} and \mathbf{b} , expressions for

- a) \vec{QP} b) \vec{PR} c) \vec{PS} d) \vec{QS}

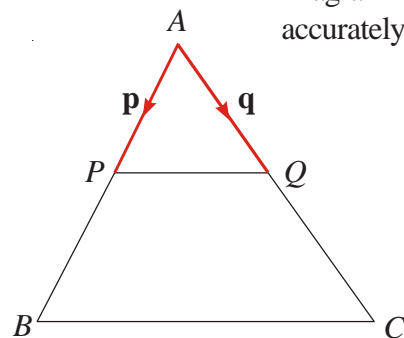
- 2) In triangle ABC , P and Q are the midpoints of AB and AC .

$\vec{AP} = \mathbf{p}$ and $\vec{AQ} = \mathbf{q}$.

Diagram **NOT** accurately drawn

a) Find, in terms of \mathbf{p} and \mathbf{q} , expressions for

- (i) \vec{PQ} (ii) \vec{AB} (iii) \vec{AC} (iv) \vec{BC}



- b) Use your results from (a) to prove that PQ is parallel to BC .

- 3)

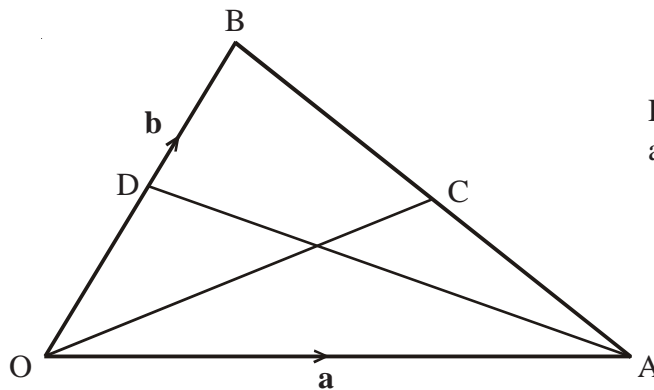


Diagram **NOT** accurately drawn

OAB is a triangle.

D is the midpoint of OB .

C is the midpoint of AB .

$\vec{OA} = \mathbf{a}$ and $\vec{OB} = \mathbf{b}$

- (i) Find \vec{OC} in terms of \mathbf{a} and \mathbf{b} .

- (ii) Show that DC is parallel to OA .

- 1) The diagram shows a trapezium PQRS.

$\vec{PQ} = \mathbf{a}$ and $\vec{QR} = \mathbf{b}$.

PS is three times the length of QR.

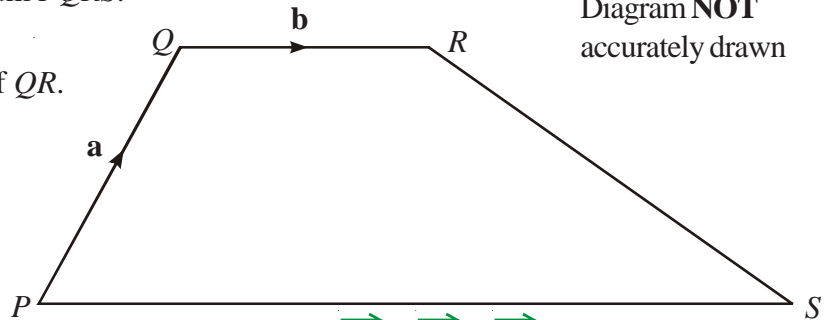


Diagram NOT accurately drawn

$\vec{QS} = \vec{QP} + \vec{PS}$

$= -\mathbf{a} + 3\mathbf{b}$

Find, in terms of \mathbf{a} and \mathbf{b} , expressions for

- a) $\vec{QP} = -\mathbf{a}$ b) $\vec{PR} = \mathbf{a} + \mathbf{b}$ c) $\vec{PS} = 3\mathbf{b}$ d) $\vec{QS} = 3\mathbf{b} - \mathbf{a}$

- 2) In triangle ABC, P and Q are the midpoints of AB and AC.

$\vec{AP} = \mathbf{p}$ and $\vec{AQ} = \mathbf{q}$.

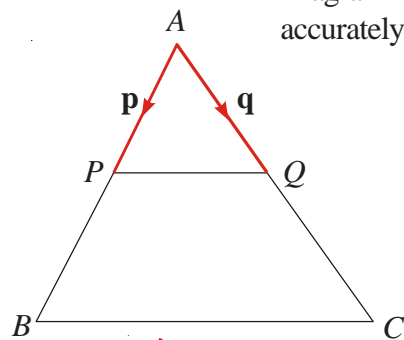


Diagram NOT accurately drawn

- a) Find, in terms of \mathbf{p} and \mathbf{q} , expressions for

- (i) $\vec{PQ} = \mathbf{q} - \mathbf{p}$ (ii) $\vec{AB} = 2\mathbf{p}$ (iii) $\vec{AC} = 2\mathbf{q}$ (iv) $\vec{BC} = 2\mathbf{q} - 2\mathbf{p}$

- b) Use your results from (a) to prove that PQ is parallel to BC.

$\vec{PQ} = \mathbf{q} - \mathbf{p}$

$\vec{BC} = 2\mathbf{q} - 2\mathbf{p}$

$= 2(\mathbf{q} - \mathbf{p})$

Therefore \vec{PQ} is parallel to \vec{BC}

- 3)

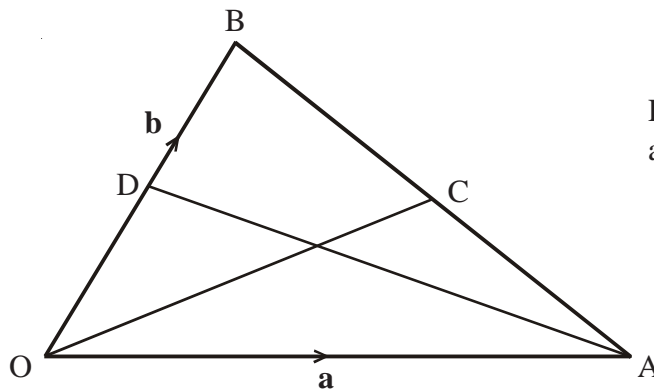


Diagram NOT accurately drawn

OAB is a triangle.
D is the midpoint of OB.
C is the midpoint of AB.
 $\vec{OA} = \mathbf{a}$ and $\vec{OB} = \mathbf{b}$

$\vec{OC} = \vec{OA} + \vec{AC}$

$\vec{AC} = \frac{1}{2}\vec{AB}$

$\vec{AB} = -\mathbf{a} + \mathbf{b}$

$\vec{OC} = \mathbf{a} + \frac{1}{2}(-\mathbf{a} + \mathbf{b})$

$\vec{OC} = \frac{1}{2}(\mathbf{a} + \mathbf{b})$

- (i) Find \vec{DC} in terms of \mathbf{a} and \mathbf{b} .

$\vec{DC} = \frac{1}{2}(\mathbf{a} + \mathbf{b})$

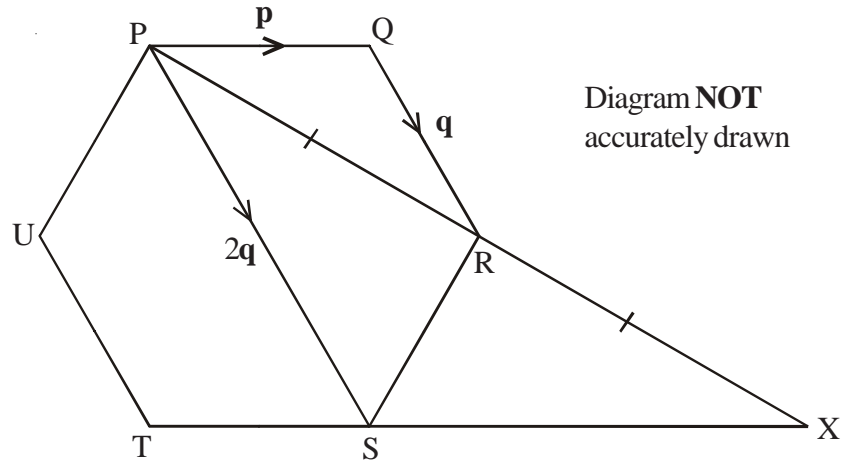
$\vec{DC} = \vec{DO} + \vec{OC}$

$= -\frac{1}{2}\mathbf{b} + \frac{1}{2}(\mathbf{a} + \mathbf{b})$

$= \frac{1}{2}\mathbf{a}$

$\vec{OA} = \mathbf{a}$ Therefore \vec{DC} is parallel to \vec{OA}

1)



PQRSTU is a regular hexagon.

$$\vec{PQ} = \mathbf{p} \quad \vec{QR} = \mathbf{q} \quad \vec{PS} = 2\mathbf{q}$$

a) Find the vector PR in terms of \mathbf{p} and \mathbf{q} .

$$\vec{PR} = \vec{RX}$$

b) Prove that PQ is parallel to SX

2)

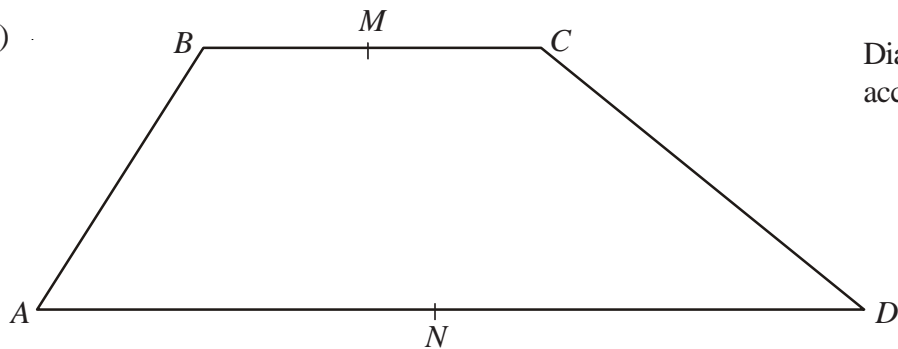


Diagram NOT accurately drawn

ABCD is a trapezium with BC parallel to AD.

$$\vec{AB} = 3\mathbf{b} \quad \vec{BC} = 3\mathbf{a} \quad \vec{AD} = 9\mathbf{a}$$

M is the midpoint of BC and N is the midpoint of AD.

a) Find the vector MN in terms of \mathbf{a} and \mathbf{b} .

X is the midpoint of MN and Y is the midpoint of CD.

b) Prove that XY is parallel to AD.

1)

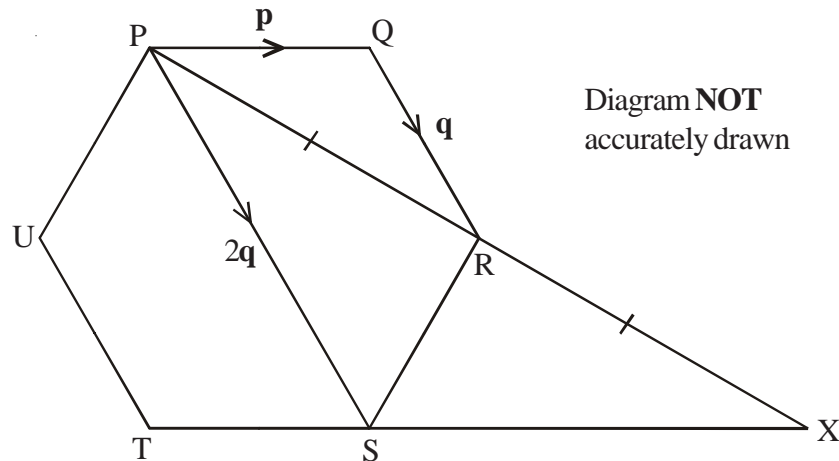


Diagram **NOT** accurately drawn

PQRSTU is a regular hexagon.

$$\vec{PQ} = \mathbf{p} \quad \vec{QR} = \mathbf{q} \quad \vec{PS} = 2\mathbf{q}$$

a) Find the vector PR in terms of \mathbf{p} and \mathbf{q} .

$$\begin{aligned} \vec{PR} &= \mathbf{p} + \mathbf{q} \\ \vec{SX} &= \vec{SP} + \vec{PX} \\ &= \vec{SP} + 2\vec{PR} \\ &= -2\mathbf{q} + 2(\mathbf{p} + \mathbf{q}) \\ &= -2\mathbf{q} + 2\mathbf{p} + 2\mathbf{q} \\ &= 2\mathbf{p} \end{aligned}$$

$$\vec{PR} = \vec{RX}$$

b) Prove that PQ is parallel to SX

$$\vec{PQ} = \mathbf{p} \quad \text{Therefore } \vec{PQ} \text{ is parallel to } \vec{SX}$$

2)

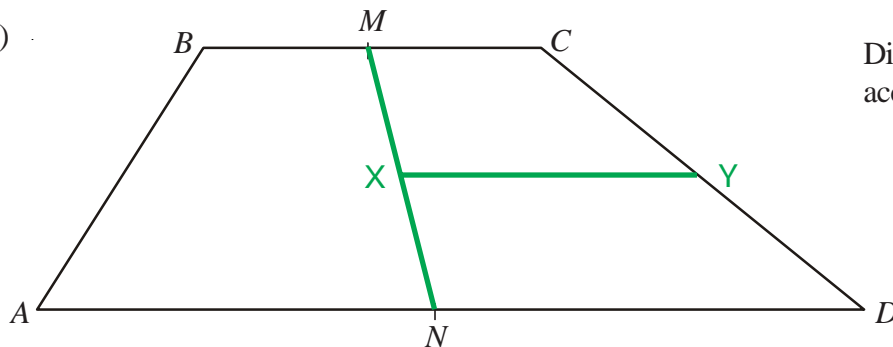


Diagram **NOT** accurately drawn

ABCD is a trapezium with BC parallel to AD.

$$\vec{AB} = 3\mathbf{b} \quad \vec{BC} = 3\mathbf{a} \quad \vec{AD} = 9\mathbf{a}$$

M is the midpoint of BC and N is the midpoint of AD.

a) Find the vector MN in terms of \mathbf{a} and \mathbf{b} .

$$\vec{MN} = 3\mathbf{a} - 3\mathbf{b}$$

X is the midpoint of MN and Y is the midpoint of CD.

b) Prove that XY is parallel to AD.

Working for part b)

$$\begin{aligned} \vec{XY} &= \vec{XN} + \vec{ND} + \vec{DY} \\ &= \frac{1}{2}\vec{MN} + \vec{ND} + \vec{DY} \\ &= \frac{1}{2}(3\mathbf{a} - 3\mathbf{b}) + 4\frac{1}{2}\mathbf{a} + \vec{DY} \\ &= 6\mathbf{a} - 1\frac{1}{2}\mathbf{b} + \vec{DY} \\ \vec{DY} &= \frac{1}{2}\vec{DC} \\ &= \frac{1}{2}(\vec{DA} + \vec{AB} + \vec{BC}) \\ &= -4\frac{1}{2}\mathbf{a} + 1\frac{1}{2}\mathbf{b} + 1\frac{1}{2}\mathbf{a} \\ &= 1\frac{1}{2}\mathbf{b} - 3\mathbf{a} \\ \vec{XY} &= 6\mathbf{a} - 1\frac{1}{2}\mathbf{b} + 1\frac{1}{2}\mathbf{b} - 3\mathbf{a} \\ &= 3\mathbf{a} \end{aligned}$$

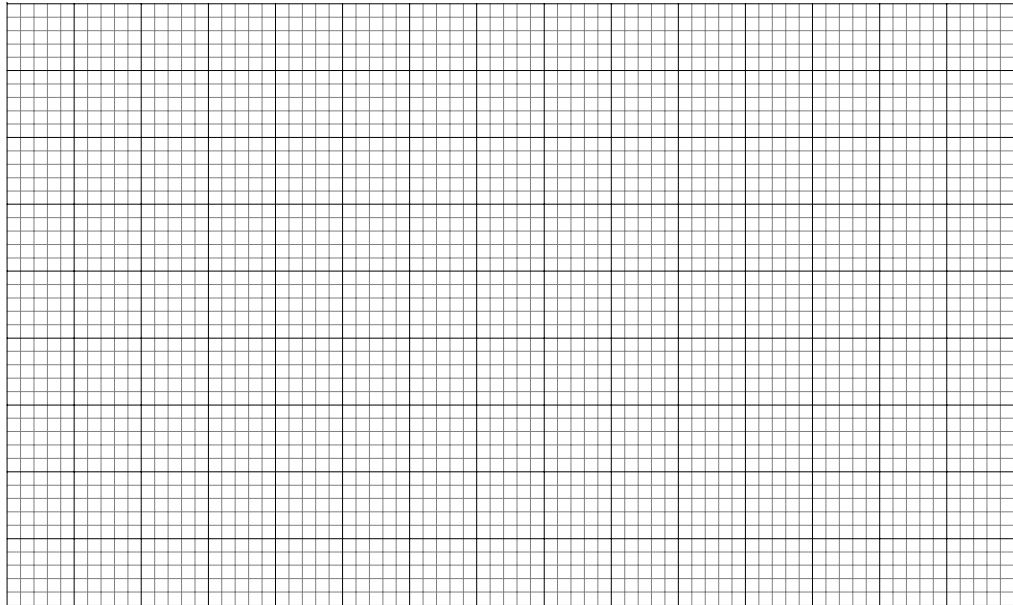
Therefore \vec{XY} is parallel to \vec{AD}

Histograms

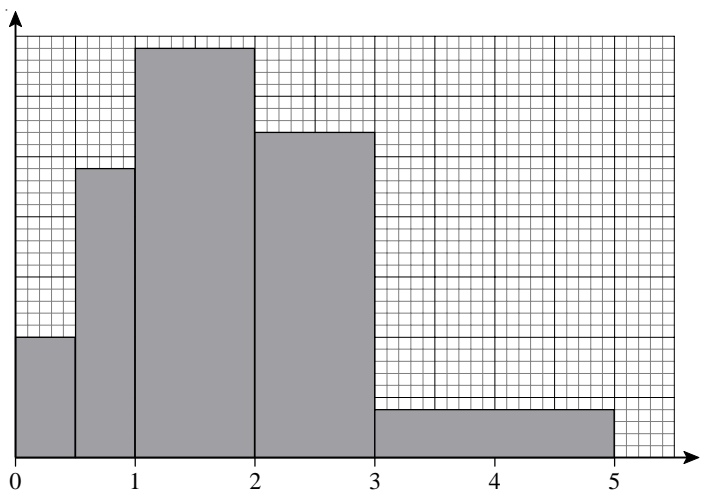
1. The table gives information about the heights, in centimetres, of some 18 year old students.

Height (h cm)	Frequency
$135 < h < 145$	12
$145 < h \leq 165$	46
$165 < h \leq 180$	45
$180 < h < 190$	25
$190 < h < 195$	4

Use the table to draw a histogram.



2. The histogram shows the amount of time, in hours, that students spend on their homework per week.



Use the histogram to complete the table.

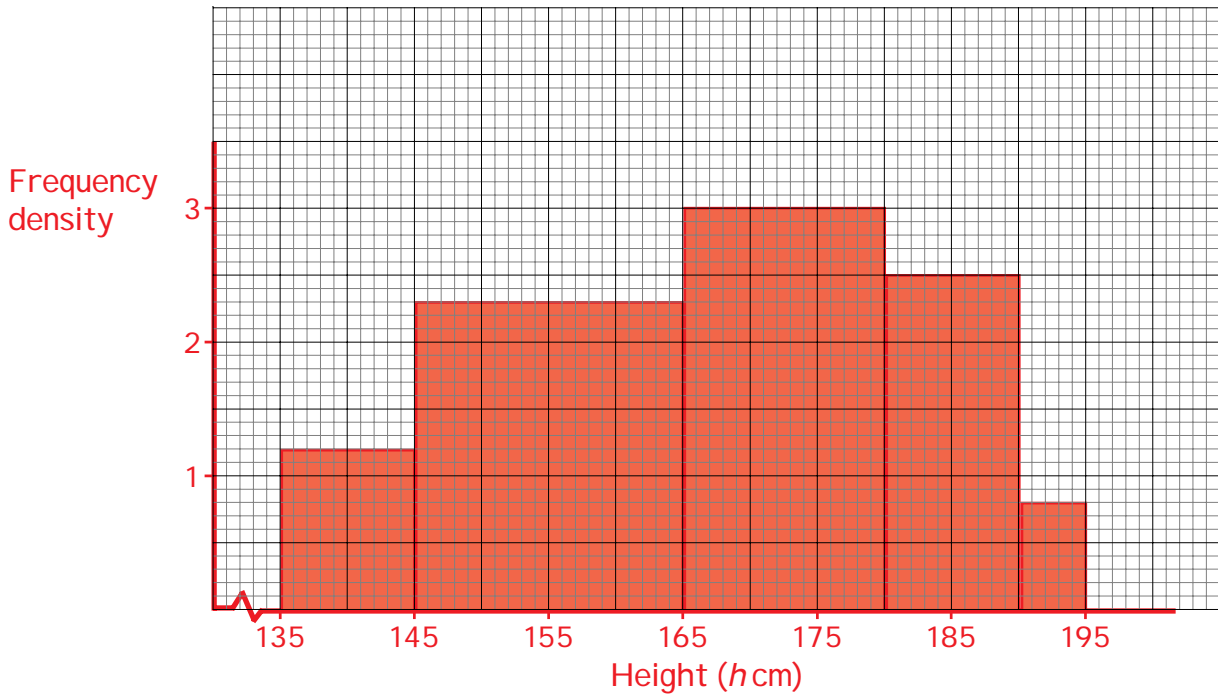
Time (t hours)	Frequency
$0 < t < \frac{1}{2}$	
$\frac{1}{2} < t < 1$	
$1 < t < 2$	
$2 < t < 3$	27
$3 < t < 5$	

Histograms

1. The table gives information about the heights, in centimetres, of some 18 year old students.

Height (h cm)	Frequency
$135 < h < 145$	12
$145 < h < 165$	46
$165 < h < 180$	45
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Use the table to draw a histogram.

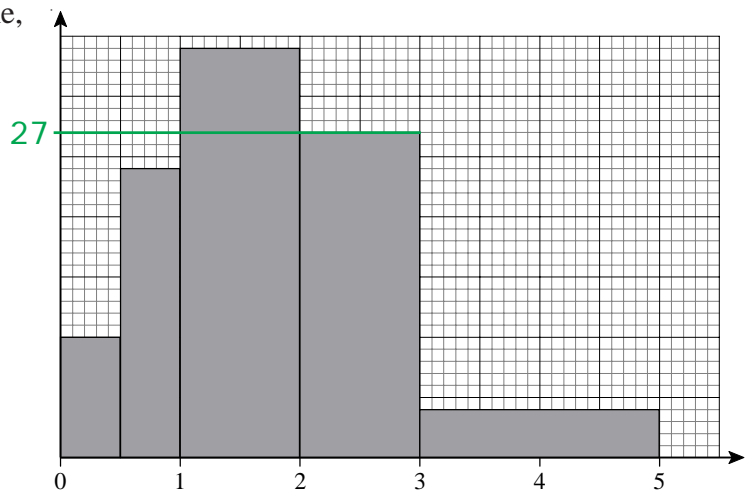


2. The histogram shows the amount of time, in hours, that students spend on their homework per week.

$$\text{Frequency density} = \frac{\text{Frequency}}{\text{Class width}}$$

From the numbers in the table:

$$\text{Frequency density} = \frac{27}{1} = 27$$



Use the histogram to complete the table.

Time (t hours)	Frequency
$0 < t < \frac{1}{2}$	5
$\frac{1}{2} < t < 1$	12
$1 < t < 2$	34
$2 < t < 3$	27
$3 < t < 5$	8

And & Or Questions

- 1) Jordan designs a game for a school fair.

He has two 8-sided spinners.

The spinners are equally likely to land on each of their sides.

One spinner has 3 blue sides, 2 yellow sides and 3 white sides.

The other spinner has 2 blue sides, 2 green sides and 4 white sides.

Calculate the probability that the two spinners will land on the same colour.

- 2) The probability that it will snow in Paris on Christmas day is 0.06.

a) Work out the probability that it will snow in Paris on **both** Christmas day 2008 **and** Christmas day 2009.

b) Work out the probability that it will snow in Paris on **either** Christmas Day 2008 **or** Christmas Day 2009, but **not** on both.

- 3) A bag contains 2 black beads, 5 yellow beads and 3 red beads.

Natalie takes a bead at random from the bag, records its colour and replaces it.

She does this two more times.

Work out the probability that, of the three beads Natalie takes, exactly two are the same colour.

- 1) Jordan designs a game for a school fair.
He has two 8-sided spinners.
The spinners are equally likely to land on each of their sides.

One spinner has 3 blue sides, 2 yellow sides and 3 white sides.
The other spinner has 2 blue sides, 2 green sides and 4 white sides.

Calculate the probability that the two spinners will land on the same colour. $\frac{18}{64}$ or $\frac{9}{32}$

Blue and Blue: $\frac{3}{8} \times \frac{2}{8} = \frac{6}{64}$

Blue and Blue OR White and White

$$\frac{6}{64} + \frac{12}{64} = \frac{18}{64}$$

White and White: $\frac{3}{8} \times \frac{4}{8} = \frac{12}{64}$

- 2) The probability that it will snow in Paris on Christmas day is 0.06.
- a) Work out the probability that it will snow in Paris on **both** Christmas day 2008 **and** Christmas day 2009. 0.0036 0.06×0.06
- b) Work out the probability that it will snow in Paris on **either** Christmas Day 2008 **or** Christmas Day 2009, but **not** on both. 0.1128 $0.06 \times 0.94 + 0.94 \times 0.06$
snow not snow not snow snow

- 3) A bag contains 2 black beads, 5 yellow beads and 3 red beads.
Natalie takes a bead at random from the bag, records its colour and replaces it.
She does this two more times.

Work out the probability that, of the three beads Natalie takes, exactly two are the same colour. $\frac{750}{1000}$ (or any equivalent fraction)

$$\begin{aligned} P(\text{two same colour}) &= 1 - P(\text{BBB}) - P(\text{YYY}) - P(\text{RRR}) - P(\text{BYR}) - P(\text{YBR}) - P(\text{RBY}) \\ &= 1 - \frac{8}{1000} - \frac{125}{1000} - \frac{27}{1000} - \frac{30}{1000} - \frac{30}{1000} - \frac{30}{1000} \\ &= 1 - \frac{250}{1000} \end{aligned}$$

Stratified Sampling

$$\frac{\text{Sample size}}{\text{Population size}} \times \text{Stratum size}$$

- 1) The table below shows the number of employees in each section of a company.

Department	Managerial	Sales	Technical	Production
Number of employees	18	45	288	549

A survey on job satisfaction is to be carried out.

- a) Explain why a simple random sample of employees is unsuitable.
- b) A stratified random sample of 100 is used. Complete the table below to show how many employees from each department will be included.

Department	Managerial	Sales	Technical	Production
Number of employees in sample				

- 2) MathsWatch High-School has 798 pupils.
The size of each year group is shown below.

Year Group	Boys	Girls
7	77	72
8	74	79
9	72	74
10	93	107
11	85	65

The headteacher wants to find out the opinions of the pupils on changing the timing of the school day. A stratified sample of 80 pupils is taken.

- a) Complete the table below to show the numbers of pupils to be sampled.

Year Group	Boys in Sample	Girls in Sample
7		
8		
9		
10		
11		

The table below shows the number of pupils in the sample who answered YES to a change in the timing of the school day.

Year Group	Boys in Sample who answered YES	Girls in Sample who answered YES
7	2	3
8	3	5
9	2	1
10	1	4
11	0	1

- b) Use the table to estimate the percentage of pupils in the school who would answer YES to the question.

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