



Maths Questions By Topic:

**Ratio, Proportion & Rates of
Change**

Edexcel GCSE (Higher)

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Table Of Contents

New Spec

Paper 1	Page 1
Paper 2	Page 41
Paper 3	Page 92

Old Spec A (Linear)

Paper 1	Page 142
Paper 2	Page 183

- 1** At the end of 2017
the value of Tamara's house was £220 000
the value of Rahim's house was £160 000

At the end of 2019
the value of Tamara's house had decreased by 20%
the value of Rahim's house had increased by 30%

At the end of 2019, whose house had the greater value?
You must show how you get your answer.

(Total for Question 1 is 4 marks)

2 Rosie, Matilda and Ibrahim collect stickers.

$$\begin{array}{l} \text{number of stickers} \\ \text{Rosie has} \end{array} : \begin{array}{l} \text{number of stickers} \\ \text{Matilda has} \end{array} : \begin{array}{l} \text{number of stickers} \\ \text{Ibrahim has} \end{array} = 4:7:15$$

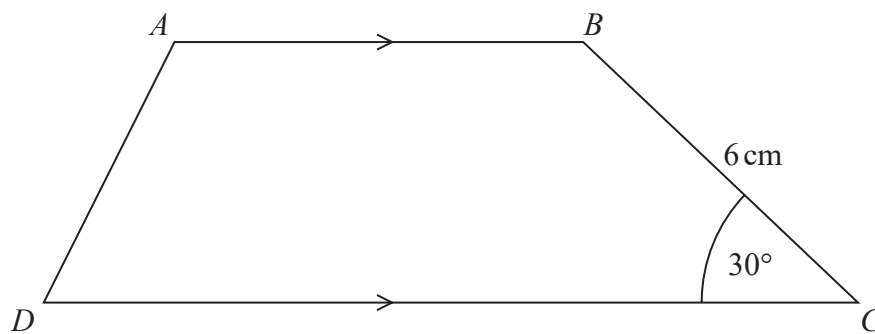
Ibrahim has 24 more stickers than Matilda.

Ibrahim has more stickers than Rosie.

How many more?

.....
(Total for Question 2 is 3 marks)

3 Here is trapezium $ABCD$.



The area of the trapezium is 66 cm^2

the length of AB : the length of $CD = 2 : 3$

Find the length of AB .

..... cm

(Total for Question 3 is 5 marks)

4 Sean pays £10 for 24 chocolate bars.

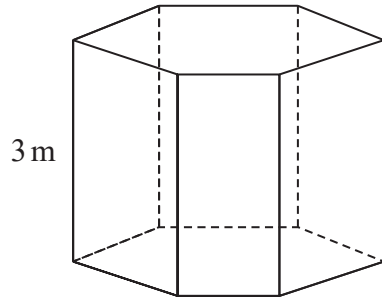
He sells all 24 chocolate bars for 50p each.

Work out Sean's percentage profit.

..... %

(Total for Question 4 is 3 marks)

5 The diagram shows a prism placed on a horizontal floor.



$$\text{pressure} = \frac{\text{force}}{\text{area}}$$

The prism has height 3 m
The volume of the prism is 18 m^3

The pressure on the floor due to the prism is 75 newtons/m^2

Work out the force exerted by the prism on the floor.

..... newtons

(Total for Question 5 is 3 marks)

6 Given that $\frac{a}{b} = \frac{2}{5}$ and $\frac{b}{c} = \frac{3}{4}$

find $a:b:c$

.....
(Total for Question 6 is 3 marks)

7 Liquid **A** and liquid **B** are mixed to make liquid **C**.

Liquid **A** has a density of 70 kg/m^3

Liquid **A** has a mass of 1400 kg

Liquid **B** has a density of 280 kg/m^3

Liquid **B** has a volume of 30 m^3

Work out the density of liquid **C**.

..... kg/m^3

(Total for Question 7 is 3 marks)

8 x is proportional to \sqrt{y} where $y > 0$

y is increased by 44%

Work out the percentage increase in x .

.....%

(Total for Question 8 is 3 marks)

9 There are four types of cards in a game.

Each card has a black circle or a white circle or a black triangle or a white triangle.



$$\begin{array}{l} \text{number of cards} \\ \text{with a black shape} \end{array} : \begin{array}{l} \text{number of cards} \\ \text{with a white shape} \end{array} = 3:5$$

$$\begin{array}{l} \text{number of cards} \\ \text{with a circle} \end{array} : \begin{array}{l} \text{number of cards} \\ \text{with a triangle} \end{array} = 2:7$$

Express the total number of cards with a black shape as a fraction of the total number of cards with a triangle.

.....
(Total for Question 9 is 3 marks)

- 10** There are 60 people in a choir.
Half of the people in the choir are women.

The number of women in the choir is 3 times the number of men in the choir.
The rest of the people in the choir are children.

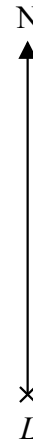
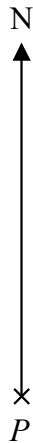
the number of children in the choir : the number of men in the choir = $n : 1$

Work out the value of n .
You must show how you get your answer.

$n = \dots\dots\dots$

(Total for Question 10 is 4 marks)

11 The accurate scale drawing shows the positions of port P and a lighthouse L .



Scale: 1 cm represents 4 km.

Aleena sails her boat from port P on a bearing of 070°

She sails for $1\frac{1}{2}$ hours at an average speed of 12 km/h to a port Q .

Find

- (i) the distance, in km, of port Q from lighthouse L ,
- (ii) the bearing of port Q from lighthouse L .

distance $QL = \dots\dots\dots$ km

bearing of Q from $L = \dots\dots\dots^\circ$

(Total for Question 11 is 5 marks)

12 A car travels for 18 minutes at an average speed of 72 km/h.

(a) How far will the car travel in these 18 minutes?

..... km

(2)

David says,

“72 kilometres per hour is faster than 20 metres per second.”

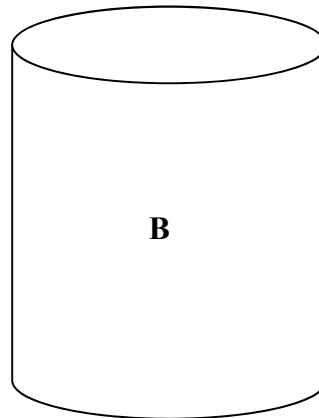
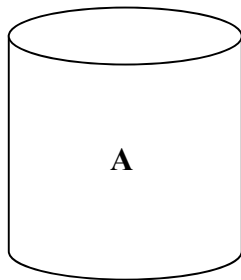
(b) Is David correct?

You must show how you get your answer.

(2)

(Total for Question 12 is 4 marks)

13 **A** and **B** are two similar cylindrical containers.



the surface area of container **A** : the surface area of container **B** = 4 : 9

Tyler fills container **A** with water.

She then pours all the water into container **B**.

Tyler repeats this and stops when container **B** is full of water.

Work out the number of times that Tyler fills container **A** with water.

You must show all your working.

.....
(Total for Question 13 is 4 marks)

14 Deon needs 50 g of sugar to make 15 biscuits.

She also needs

three times as much flour as sugar

two times as much butter as sugar

Deon is going to make 60 biscuits.

(a) Work out the amount of flour she needs.

..... g

(3)

Deon has to buy all the butter she needs to make 60 biscuits.

She buys the butter in 250 g packs.

(b) How many packs of butter does Deon need to buy?

.....

(2)

(Total for Question 14 is 5 marks)

15 A shop sells packs of black pens, packs of red pens and packs of green pens.

There are

2 pens in each pack of black pens

5 pens in each pack of red pens

6 pens in each pack of green pens

On Monday,

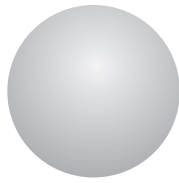
number of packs of black pens sold : number of packs of red pens sold : number of packs of green pens sold = 7:3:4

A total of 212 pens were sold.

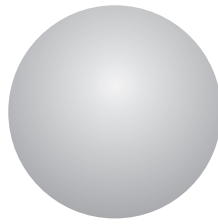
Work out the number of green pens sold.

.....
(Total for Question 15 is 4 marks)

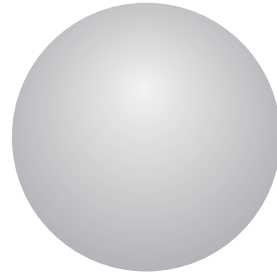
16 Here are three spheres.



P



Q



R

The volume of sphere **Q** is 50% more than the volume of sphere **P**.

The volume of sphere **R** is 50% more than the volume of sphere **Q**.

Find the volume of sphere **P** as a fraction of the volume of sphere **R**.

.....
(Total for Question 16 is 3 marks)

17 h is inversely proportional to p
 p is directly proportional to \sqrt{t}

Given that $h = 10$ and $t = 144$ when $p = 6$
find a formula for h in terms of t

.....
(Total for Question 17 is 4 marks)

- 18** A bonus of £2100 is shared by 10 people who work for a company.
40% of the bonus is shared equally between 3 managers.
The rest of the bonus is shared equally between 7 salesmen.

One of the salesmen says,

“If the bonus is shared equally between all 10 people I will get 25% more money.”

Is the salesman correct?

You must show how you get your answer.

(Total for Question 18 is 5 marks)

19 It would take 120 minutes to fill a swimming pool using water from 5 taps.

(a) How many minutes will it take to fill the pool if only 3 of the taps are used?

..... minutes
(2)

(b) State one assumption you made in working out your answer to part (a).

.....
.....
(1)

(Total for Question 19 is 3 marks)

20 A plane travels at a speed of 213 miles per hour.

(a) Work out an estimate for the number of seconds the plane takes to travel 1 mile.

..... seconds
(3)

(b) Is your answer to part (a) an underestimate or an overestimate?
Give a reason for your answer.

.....
.....
(1)

(Total for Question 20 is 4 marks)

21 Jack and Sadia work for a company that sells boxes of breakfast cereal.

The company wants to have a special offer.

Here is Jack's idea for the special offer.

Put 25% more cereal into each box and do **not** change the price.

Here is Sadia's idea.

Reduce the price and do **not** change the amount of cereal in each box.

Sadia wants her idea to give the same value for money as Jack's idea.

By what percentage does she need to reduce the price?

..... %

(Total for Question 21 is 3 marks)

22 Three solid shapes **A**, **B** and **C** are similar.

The surface area of shape **A** is 4 cm^2

The surface area of shape **B** is 25 cm^2

The ratio of the volume of shape **B** to the volume of shape **C** is $27:64$

Work out the ratio of the height of shape **A** to the height of shape **C**.

Give your answer in its simplest form.

.....
(Total for Question 22 is 4 marks)

23 In a village

the number of houses and the number of flats are in the ratio 7 : 4

the number of flats and the number of bungalows are in the ratio 8 : 5

There are 50 bungalows in the village.

How many houses are there in the village?

.....
(Total for Question 23 is 3 marks)

24 Renee buys 5 kg of sweets to sell.
She pays £10 for the sweets.

Renee puts all the sweets into bags.
She puts 250 g of sweets into each bag.
She sells each bag of sweets for 65p.

Renee sells all the bags of sweets.

Work out her percentage profit.

.....%

(Total for Question 24 is 4 marks)

25 The perimeter of a right-angled triangle is 72 cm.
The lengths of its sides are in the ratio 3 : 4 : 5

Work out the area of the triangle.

.....cm²

(Total for Question 25 is 4 marks)

26 y is inversely proportional to d^2

When $d = 10$, $y = 4$

d is directly proportional to x^2

When $x = 2$, $d = 24$

Find a formula for y in terms of x .

Give your answer in its simplest form.

.....
(Total for Question 26 is 5 marks)

- 27 Kiaria is 7 years older than Jay.
Martha is twice as old as Kiaria.
The sum of their three ages is 77

Find the ratio of Jay's age to Kiaria's age to Martha's age.

.....
(Total for Question 27 is 4 marks)

28 James and Peter cycled along the same 50 km route.

James took $2\frac{1}{2}$ hours to cycle the 50 km.

Peter started to cycle 5 minutes after James started to cycle.
Peter caught up with James when they had both cycled 15 km.

James and Peter both cycled at constant speeds.

Work out Peter's speed.

..... km/h

(Total for Question 28 is 5 marks)

29 A factory makes 450 pies every day.
The pies are chicken pies or steak pies.

Each day Milo takes a sample of 15 pies to check.

The proportion of the pies in his sample that are chicken is the same as the proportion of the pies made that day that are chicken.

On Monday Milo calculated that he needed exactly 4 chicken pies in his sample.

(a) Work out the total number of chicken pies that were made on Monday.

.....
(2)

On Tuesday, the number of steak pies Milo needs in his sample is 6 correct to the nearest whole number.

Milo takes at random a pie from the 450 pies made on Tuesday.

(b) Work out the lower bound of the probability that the pie is a steak pie.

.....
(2)

(Total for Question 29 is 4 marks)

30 The ratio $(y + x):(y - x)$ is equivalent to $k:1$

Show that $y = \frac{x(k + 1)}{k - 1}$

(Total for Question 30 is 3 marks)

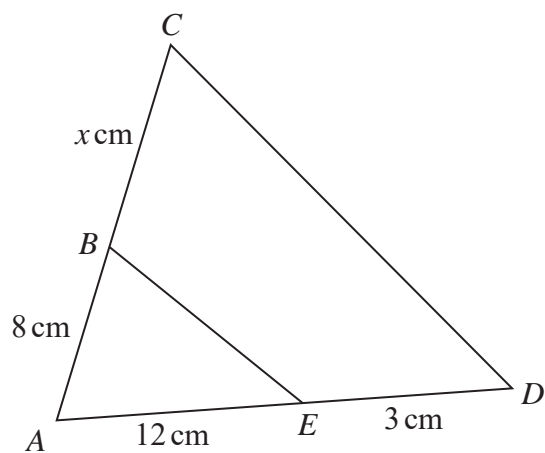
31 y is directly proportional to $\sqrt[3]{x}$

$y = 1\frac{1}{6}$ when $x = 8$

Find the value of y when $x = 64$

(Total for Question 31 is 3 marks)

32 The two triangles in the diagram are similar.



There are two possible values of x .

Work out each of these values.

State any assumptions you make in your working.

(Total for Question 32 is 5 marks)

33 Jules buys a washing machine.

20% VAT is added to the price of the washing machine.

Jules then has to pay a total of £600

What is the price of the washing machine with **no** VAT added?

£.....

(Total for Question 33 is 2 marks)

34 The table shows a set of values for x and y .

x	1	2	3	4
y	9	$2\frac{1}{4}$	1	$\frac{9}{16}$

y is inversely proportional to the square of x .

(a) Find an equation for y in terms of x .

.....
(2)

(b) Find the positive value of x when $y = 16$

.....
(2)

(Total for Question 34 is 4 marks)

35 White shapes and black shapes are used in a game.
Some of the shapes are circles.
All the other shapes are squares.

The ratio of the number of white shapes to the number of black shapes is 3:7

The ratio of the number of white circles to the number of white squares is 4:5

The ratio of the number of black circles to the number of black squares is 2:5

Work out what fraction of all the shapes are circles.

.....
(Total for Question 35 is 4 marks)

36 Gary drove from London to Sheffield.
It took him 3 hours at an average speed of 80km/h.

Lyn drove from London to Sheffield.
She took 5 hours.

Assuming that Lyn drove along the same roads as Gary"and did not take a break,

(a) work out Lyn's average speed from London to Sheffield.

.....km/h
(3)

(b) If Lyn did **not** drive along the same roads as Gary, explain how this could affect your answer to part (a).

.....
.....
(1)

(Total for Question 36 is 4 marks)

37 In a company, the ratio of the number of men to the number of women is 3:2

40% of the men are under the age of 25

10% of the women are under the age of 25

What percentage of all the people in the company are under the age of 25?

.....%

(Total for Question 37 is 4 marks)

38 Pressure = $\frac{\text{force}}{\text{area}}$

Find the pressure exerted by a force of 900 newtons on an area of 60 cm².

Give your answer in newtons/m².

..... newtons/m²

(Total for Question 38 is 2 marks)

39 In a shop, all normal prices are reduced by 20% to give the sale price.

The sale price of a TV set is then reduced by 30%.

Mary says,

“ $30 + 20 = 50$, so this means that the normal price of the TV set has been reduced by 50%.”

Is Mary right?

You must give a reason for your answer.

.....

.....

.....

(Total for Question 39 is 2 marks)

40 Solid **A** and solid **B** are mathematically similar.

The ratio of the surface area of solid **A** to the surface area of solid **B** is 4:9

The volume of solid **B** is 405 cm^3 .

Show that the volume of solid **A** is 120 cm^3 .

(Total for Question 40 is 3 marks)

- 41 A box exerts a force of 140 newtons on a table.
The pressure on the table is 35 newtons/m².

Calculate the area of the box that is in contact with the table.

$$p = \frac{F}{A}$$

p = pressure

F = force

A = area

.....
(Total for Question 41 is 2 marks)

- 42 There are some red counters and some yellow counters in a bag.
There are 30 yellow counters in the bag.
The ratio of the number of red counters to the number of yellow counters is 1 : 6

(a) Work out the number of red counters in the bag.

.....
(2)

Riza puts some more red counters into the bag.

The ratio of the number of red counters to the number of yellow counters is now 1 : 2

(b) How many red counters does Riza put into the bag?

.....
(2)

(Total for Question 42 is 2 marks)

43 Sean drives from Manchester to Gretna Green.

He drives at an average speed of 50 mph for the first 3 hours of his journey.

He then has 150 miles to drive to get to Gretna Green.

Sean drives these 150 miles at an average speed of 30 mph.

Sean says,

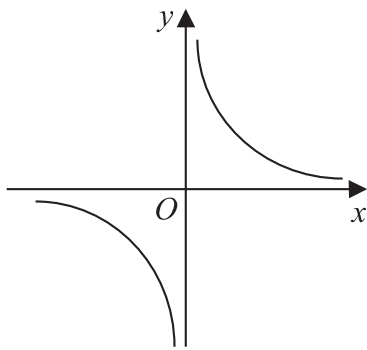
“My average speed from Manchester to Gretna Green was 40 mph.”

Is Sean right?

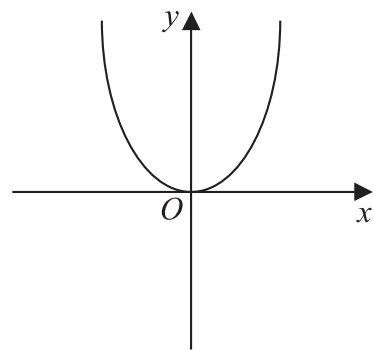
You must show how you get your answer.

(Total for Question 43 is 2 marks)

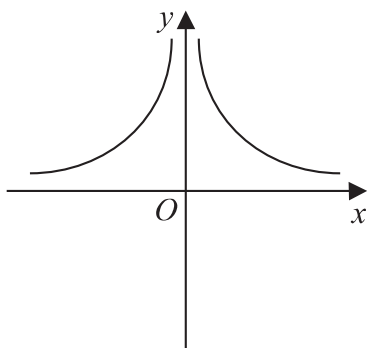
44 These graphs show four different proportionality relationships between y and x .



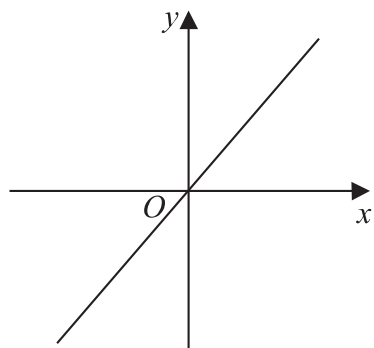
Graph A



Graph B



Graph C



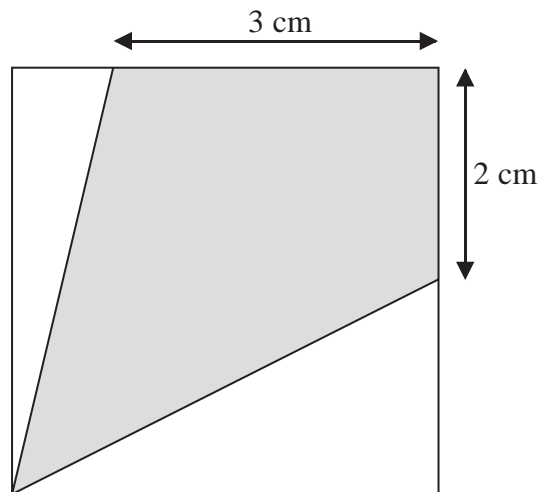
Graph D

Match each graph with a statement in the table below.

Proportionality relationship	Graph letter
y is directly proportional to x	
y is inversely proportional to x	
y is proportional to the square of x	
y is inversely proportional to the square of x	

(Total for Question 44 is 2 marks)

45 The diagram shows a square with perimeter 16 cm.



Work out the proportion of the area inside the square that is shaded.

.....
(Total for Question 45 is 5 marks)

46 A shop has a sale.

Microwave ovens

$\frac{1}{3}$ off normal price

Combination ovens

40% off normal price

A microwave oven has a sale price of £90

A combination oven has a sale price of £84

Which of these ovens has the greater normal price?

You must show all your working.

(Total for Question 46 is 4 marks)

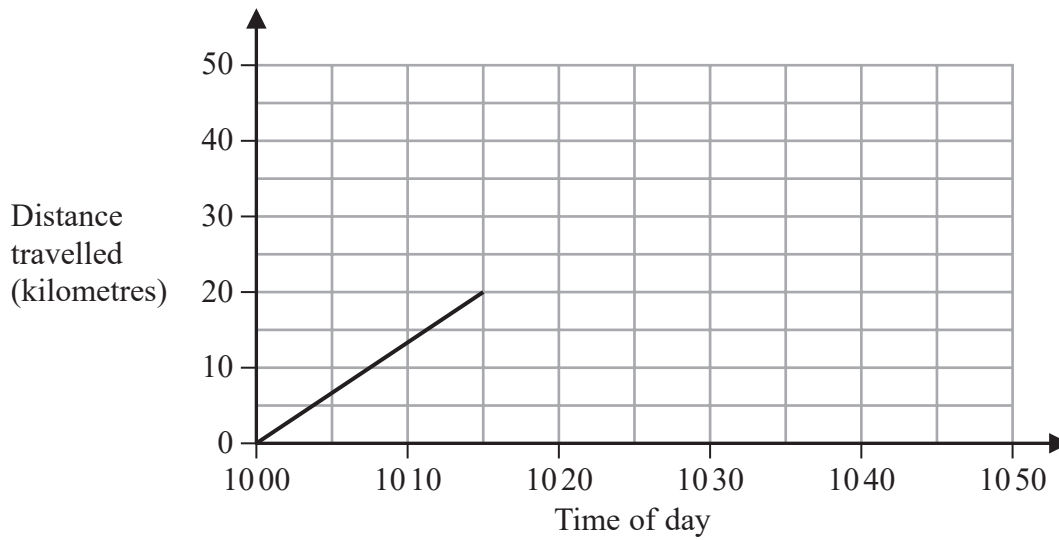
47 y is inversely proportional to x

When $x = 1.5$, $y = 36$

Find the value of y when $x = 6$

(Total for Question 47 is 3 marks)

- 48 Sam drives his car on a journey.
Here is the travel graph for the first 15 minutes of his journey.



- (a) Work out Sam's speed, in km/h, for the first 15 minutes of his journey.

..... km/h
(2)

At 1015 Sam stops for 10 minutes and then drives for 20 minutes at a speed of 75 km/h.

- (b) On the grid, complete the travel graph for Sam's journey.

(3)

(Total for Question 48 is 5 marks)

49 Liquid **A** has a density of 1.8 g/cm^3
Liquid **B** has a density of 1.2 g/cm^3

80 cm^3 of liquid **A** is mixed with 40 cm^3 of liquid **B** to make 120 cm^3 of liquid **C**.

Work out the density of liquid **C**.

..... g/cm^3

(Total for Question 49 is 3 marks)

50 Louise invests £ x in Better Investments for 3 years.
Sadiq invests £ x in County Bank for 3 years.

<p>Better Investments</p> <p>Compound Interest</p> <p>2.5% per annum</p>

<p>County Bank</p> <p>Compound Interest</p> <p>2% per annum for the first two years 3.5% per annum for each extra year</p>

At the end of the 3 years, the value of Louise's investment is £344 605

Work out the value of Sadiq's investment at the end of the 3 years.

£.....

(Total for Question 50 is 4 marks)

51 **A**, **B** and **C** are three spheres.

The volume of sphere **A** is 125 cm^3

The volume of sphere **B** is 27 cm^3

The ratio of the radius of sphere **B** to the radius of sphere **C** is $1:2$

Work out the ratio of the surface area of sphere **A** to the surface area of sphere **C**.

.....
(Total for Question 51 is 3 marks)

52 Carlo puts tins into small boxes and into large boxes.

He puts 6 tins into each small box.

He puts 20 tins into each large box.

Carlo puts a total of 3000 tins into the boxes so that

$$\text{number of tins in small boxes} : \text{number of tins in large boxes} = 2 : 3$$

Carlo says that less than 30% of the boxes filled with tins are large boxes.

Is Carlo correct?

You must show all your working.

(Total for Question 52 is 5 marks)

53 Tariq buys a laptop.

He gets a discount of 5% off the normal price.
Tariq pays £551 for the laptop.

(a) Work out the normal price of the laptop.

£.....
(2)

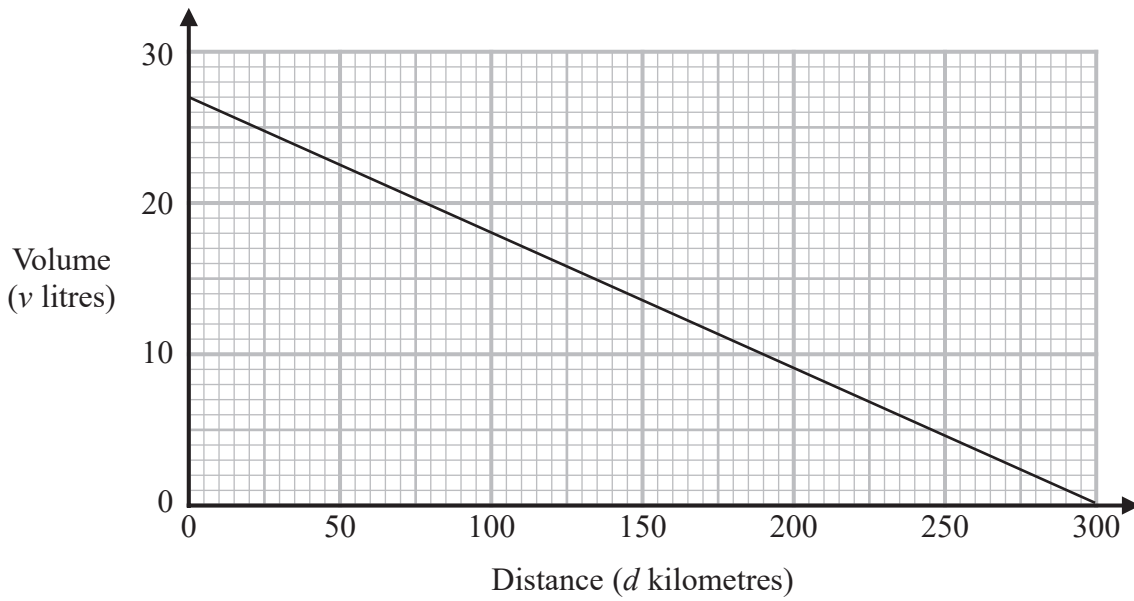
Joan invests £6000 in a savings account.
The savings account pays compound interest at a rate of
2.4% for the first year
1.7% for each extra year.

(b) Work out the value of Joan's investment at the end of 3 years.

£.....
(3)

(Total for Question 53 is 5 marks)

54 The graph gives information about the volume, v litres, of petrol in the tank of Jim's car after it has travelled a distance of d kilometres.



(a) Find the gradient of the graph.

.....
(2)

(b) Interpret what the gradient of the graph represents.

.....
.....
.....
(1)

(Total for Question 54 is 3 marks)

- 55 Tom and Adam have a total of 240 stamps.
The ratio of the number of Tom's stamps to the number of Adam's stamps is 3 : 7
- Tom buys some stamps from Adam.
The ratio of the number of Tom's stamps to the number of Adam's stamps is now 3 : 5
- How many stamps does Tom buy from Adam?
You must show all your working.

.....
(Total for Question 55 is 4 marks)

56 The number of days, d , that it will take to build a house is given by

$$d = \frac{720}{n}$$

where n is the number of workers used each day.

Ali's company will take 40 days to build the house.

Hayley's company will take 30 days to build the house.

Hayley's company will have to use more workers each day than Ali's company.

How many more?

.....
(Total for Question 56 is 3 marks)

57 Sakira invested £3550 in a savings account for 3 years.

She was paid 2.6% per annum compound interest for each of the first 2 years.
She was paid $R\%$ interest for the third year.

Sakira had £3819.21 in her savings account at the end of the 3 years.

Work out the value of R .

Give your answer correct to 1 decimal place.

.....

(Total for Question 57 is 3 marks)

58 The number of rabbits on a farm at the end of month n is P_n
The number of rabbits at the end of the next month is given by $P_{n+1} = 1.2P_n - 50$

At the end of March there are 200 rabbits on the farm.

(a) Work out how many rabbits there will be on the farm at the end of June.

.....
(3)

(b) Considering your results in part (a), suggest what will happen to the number of rabbits on the farm after a long time.

.....
.....
(1)

(Total for Question 58 is 4 marks)

59 £360 is shared between Abby, Ben, Chloe and Denesh.

The ratio of the amount Abby gets to the amount Ben gets is 2 : 7

Chloe and Denesh each get 1.5 times the amount Abby gets.

Work out the amount of money that Ben gets.

£.....

(Total for Question 59 is 4 marks)

60 The circumference of circle **B** is 90% of the circumference of circle **A**.

(a) Find the ratio of the area of circle **A** to the area of circle **B**.

.....
(2)

Square **E** has sides of length e cm.

Square **F** has sides of length f cm.

The area of square **E** is 44% greater than the area of square **F**.

(b) Work out the ratio $e:f$

.....
(2)

.....
(Total for Question 60 is 4 marks)

61 There are some small cubes and some large cubes in a bag.
The cubes are red or the cubes are yellow.

The ratio of the number of small cubes to the number of large cubes is 4:7

The ratio of the number of red cubes to the number of yellow cubes is 3:5

(a) Explain why the least possible number of cubes in the bag is 88

.....

.....

.....

(1)

All the small cubes are yellow.

(b) Work out the least possible number of large yellow cubes in the bag.

.....

(3)

(Total for Question 61 is 4 marks)

62 Northern Bank has two types of account.
Both accounts pay compound interest.

<p>Cash savings account Interest 2.5% per annum</p>
--

<p>Shares account Interest 3.5% per annum</p>
--

Ali invests £2000 in the cash savings account.
Ben invests £1600 in the shares account.

(a) Work out who will get the most interest by the end of 3 years.
You must show all your working.

(4)

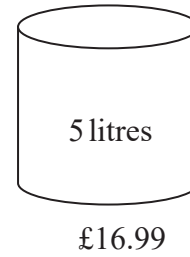
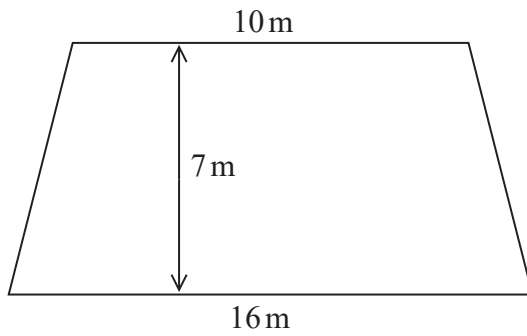
In the 3rd year the rate of interest for the shares account is changed to 4% per annum.

(b) Does this affect who will get the most interest by the end of 3 years?
Give a reason for your answer.

(1)

(Total for Question 62 is 5 marks)

63 The diagram shows a floor in the shape of a trapezium.



John is going to paint the floor.

Each 5 litre tin of paint costs £16.99
1 litre of paint covers an area of 2 m^2

John has £160 to spend on paint.

Has John got enough money to buy all the paint he needs?
You must show how you get your answer.

(Total for Question 63 is 5 marks)

64 Robert makes 50 litres of green paint by mixing litres of yellow paint and litres of blue paint in the ratio 2 : 3

Yellow paint is sold in 5 litre tins.
Each tin of yellow paint costs £26

Blue paint is sold in 10 litre tins.
Each tin of blue paint costs £48

Robert sells all the green paint he makes in 10 litre tins.
He sells each tin of green paint for £66.96

Work out Robert's percentage profit on each tin of green paint he sells.

.....%

(Total for Question 64 is 5 marks)

65 p and q are two numbers such that $p > q$

When you subtract 5 from p and subtract 5 from q the answers are in the ratio 5 : 1

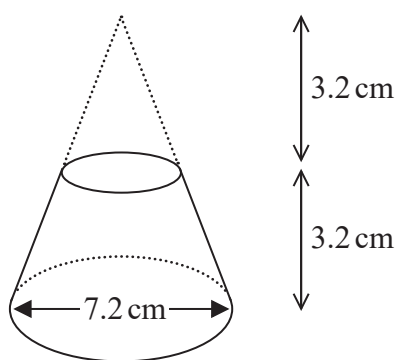
When you add 20 to p and add 20 to q the answers are in the ratio 5 : 2

Find the ratio $p : q$

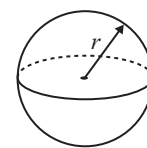
Give your answer in its simplest form.

.....
(Total for Question 65 is 5 marks)

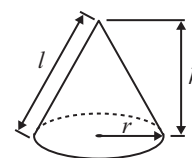
66 Here is a frustum of a cone.



$$\text{Volume of sphere} = \frac{4}{3} \pi r^3$$

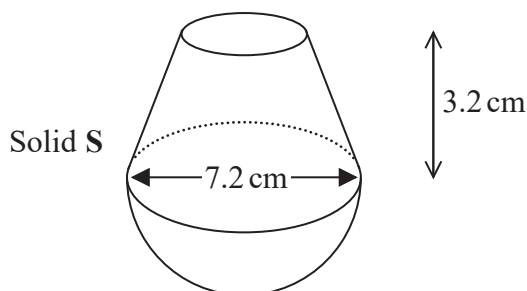


$$\text{Volume of cone} = \frac{1}{3} \pi r^2 h$$



The diagram shows that the frustum is made by removing a cone with height 3.2 cm from a solid cone with height 6.4 cm and base diameter 7.2 cm.

The frustum is joined to a solid hemisphere of diameter 7.2 cm to form the solid **S** shown below.



The density of the frustum is 2.4 g/cm^3

The density of the hemisphere is 4.8 g/cm^3

Calculate the average density of solid **S**.

.....g/cm³

(Total for Question 66 is 5 marks)

67 Raya buys a van for £8500 plus VAT at 20%

Raya pays a deposit for the van.

She then pays the rest of the cost in 12 equal payments of £531.25 each month.

Find the ratio of the deposit Raya pays to the total of the 12 equal payments.

Give your answer in its simplest form.

.....
(Total for Question 67 is 5 marks)

68 A force of 70 newtons acts on an area of 20 cm^2

The force is increased by 10 newtons.

The area is increased by 10 cm^2

Helen says,

“The pressure decreases by less than 20%”

Is Helen correct?

You must show how you get your answer.

$$\text{pressure} = \frac{\text{force}}{\text{area}}$$

(Total for Question 68 is 3 marks)

69 Jean invests £12 000 in an account paying compound interest for 2 years.

In the first year the rate of interest is $x\%$

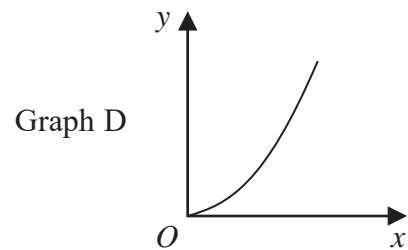
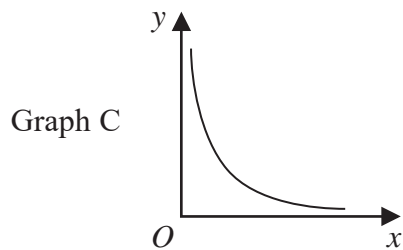
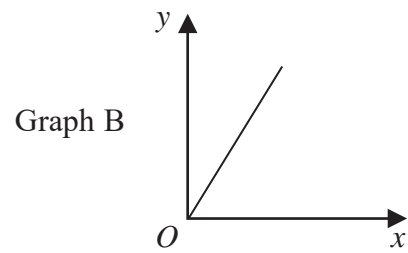
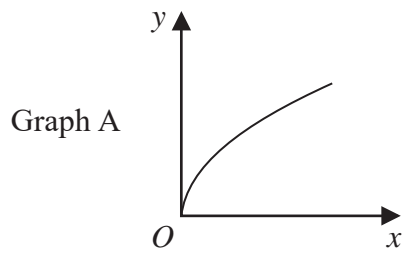
At the end of the first year the value of Jean's investment is £12 336

In the second year the rate of interest is $\frac{x}{2}\%$

What is the value of Jean's investment at the end of 2 years?

£.....

(Total for Question 69 is 4 marks)



The graphs of y against x represent four different types of proportionality.

Match each type of proportionality in the table to the correct graph.

Type of proportionality	Graph letter
$y \propto x$	
$y \propto x^2$	
$y \propto \sqrt{x}$	
$y \propto \frac{1}{x}$	

(Total for Question 70 is 2 marks)

71 " Emily buys a pack of 12 bottles of water.
The pack costs £5.64

Emily sells all 12 bottles for 50p each.

Work out Emily's percentage profit.
Give your answer correct to 1 decimal place.

.....%

(Total for Question 71 is 3 marks)

72 " There are only blue cubes, yellow cubes and green cubes in a bag.

There are

twice as many blue cubes as yellow cubes
and four times as many green cubes as blue cubes.

Hannah takes at random a cube from the bag.

Work out the probability that Hannah takes a yellow cube.

.....

(Total for Question 72 is 3 marks)

73 Yesterday it took 5 cleaners $4\frac{1}{2}$ hours to clean all the rooms in a hotel.

There are only 3 cleaners to clean all the rooms in the hotel today.

Each cleaner is paid £8.20 for each hour or part of an hour they work.

How much will each cleaner be paid today?

£

(Total for Question 73 is 3 marks)

74 "At the beginning of 2009, Mr Veale bought a company.
The value of the company was £50 000

Each year the value of the company increased by 2%.

- (a) Calculate the value of the company at the beginning of 2017
Give your answer correct to the nearest £100

£.....
(2)

At the beginning of 2009 the value of a different company was £250 000
In 6 years the value of this company increased to £325 000

This is equivalent to an increase of $x\%$ each year.

- (b) Find the value of x .
Give your answer correct to 2 significant figures.

.....
(3)

(Total for Question 74 is 5 marks)

75 "At time $t = 0$ hours a tank is full of water.

Water leaks from the tank.

At the end of every hour there is 2% less water in the tank than at the start of the hour.

The volume of water, in litres, in the tank at time t hours is V_t

Given that

$$V_0 = 2000$$

$$V_{t+1} = kV_t$$

write down the value of k .

$$k = \dots\dots\dots$$

(Total for Question 75 is 1 mark)

76 On Saturday, some adults and some children were in a theatre.
The ratio of the number of adults to the number of children was 5 : 2

Each person had a seat in the Circle or had a seat in the Stalls.

$\frac{3}{4}$ of the children had seats in the Stalls.

117 children had seats in the Circle.

There are exactly 2600 seats in the theatre.

On this Saturday, were there people on more than 60% of the seats?
You must show how you get your answer.

(Total for Question 76 is 5 marks)

77 Olly drove 56 km from Liverpool to Manchester.
He then drove 61 km from Manchester to Sheffield.

Olly's average speed from Liverpool to Manchester was 70 km/h.
Olly took 75 minutes to drive from Manchester to Sheffield.

(a) Work out Olly's average speed for his total drive from Liverpool to Sheffield.

..... km/h

(4)

Janie drove from Barnsley to York.

Janie's average speed from Barnsley to Leeds was 80 km/h.
Her average speed from Leeds to York was 60 km/h.

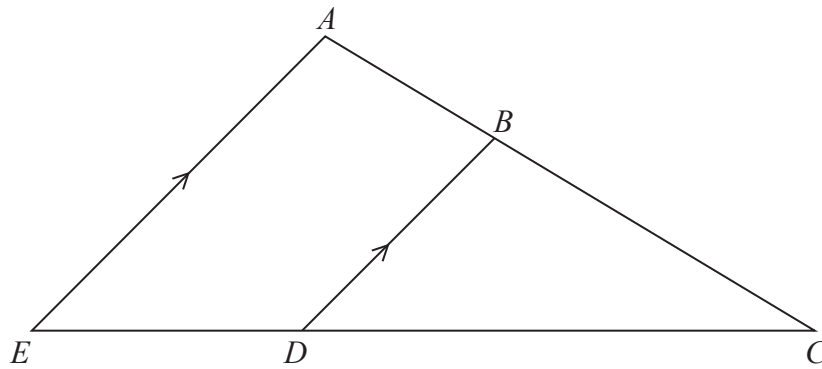
Janie says that the average speed from Barnsley to York can be found by working out the mean of 80 km/h and 60 km/h.

(b) If Janie is correct, what does this tell you about the two parts of Janie's journey?

.....
.....

(1)

(Total for Question 77 is 5 marks)



ABC and EDC are straight lines.

EA is parallel to DB .

$EC = 8.1$ cm.

$DC = 5.4$ cm.

$DB = 2.6$ cm.

(a) Work out the length of AE .

..... cm

(2)

$AC = 6.15$ cm.

(b) Work out the length of AB .

..... cm

(2)

(Total for Question 78 is 4 marks)

79 Anil wants to invest £25 000 for 3 years in a bank.

Personal Bank

Compound Interest

2% for each year

Secure Bank

Compound Interest

4.3% for the first year
0.9% for each extra year

Which bank will give Anil the most interest at the end of 3 years?
You must show all your working.

(Total for Question 79 is 3 marks)

80 Frank, Mary and Seth shared some sweets in the ratio $4 : 5 : 7$
Seth got 18 more sweets than Frank.

Work out the total number of sweets they shared.

.....
(Total for Question 80 is 3 marks)

81 Axel and Lethna are driving along a motorway.

They see a road sign.

The road sign shows the distance to Junction 8

It also shows the average time drivers take to get to Junction 8

To Junction 8 30 miles 26 minutes

The speed limit on the motorway is 70 mph.

Lethna says

“We will have to drive faster than the speed limit to drive 30 miles in 26 minutes.”

Is Lethna right?

You must show how you get your answer.

(Total for Question 81 is 3 marks)

82 In a box of pens, there are

three times as many red pens as green pens
and two times as many green pens as blue pens.

For the pens in the box, write down
the ratio of the number of red pens to the number of green pens to the number of blue pens.

.....
(Total for Question 82 is 2 marks)

83 Katy invests £2000 in a savings account for 3 years.

The account pays compound interest at an annual rate of

2.5% for the first year

$x\%$ for the second year

$x\%$ for the third year

There is a total amount of £2124.46 in the savings account at the end of 3 years.

(a) Work out the rate of interest in the second year.

.....
(4)

Katy goes to work by train.

The cost of her weekly train ticket increases by 12.5% to £225

(b) Work out the cost of her weekly train ticket before this increase.

£.....
(2)

(Total for Question 83 is 6 marks)

84 d is inversely proportional to c

When $c = 280$, $d = 25$

Find the value of d when $c = 350$

$d = \dots\dots\dots$

(Total for Question 84 is 3 marks)

85 Three companies sell the same type of furniture.

The price of the furniture from Pooles of London is £1480

The price of the furniture from Jardins of Paris is €1980

The price of the furniture from Outways of New York is \$2250

The exchange rates are

$$£1 = €1.34$$

$$£1 = \$1.52$$

Which company sells this furniture at the lowest price?

You must show how you get your answer.

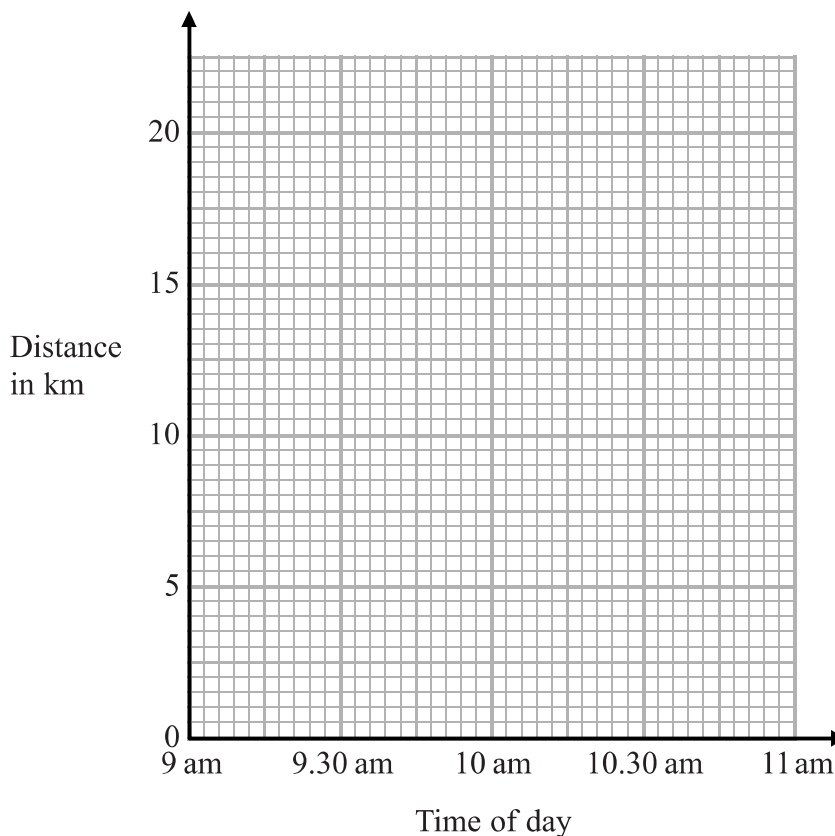
(Total for Question 85 is 3 marks)

86 At 9 am, Bradley began a journey on his bicycle.

From 9 am to 9.36 am, he cycled at an average speed of 15 km/h.

From 9.36 am to 10.45 am, he cycled a further 8 km.

(a) Draw a travel graph to show Bradley's journey.



(3)

From 10.45 am to 11 am, Bradley cycled at an average speed of 18 km/h.

(b) Work out the distance Bradley cycled from 10.45 am to 11 am.

..... km

(2)

(Total for Question 86 is 5 marks)

87 Toby invested £7500 for 2 years in a savings account.
He was paid 4% per annum compound interest.

How much money did Toby have in his savings account at the end of 2 years?

£

(Total for Question 87 is 2 marks)

88 Becky has some marbles.
Chris has two times as many marbles as Becky.
Dan has seven more marbles than Chris.

They have a total of 57 marbles.

Dan says,

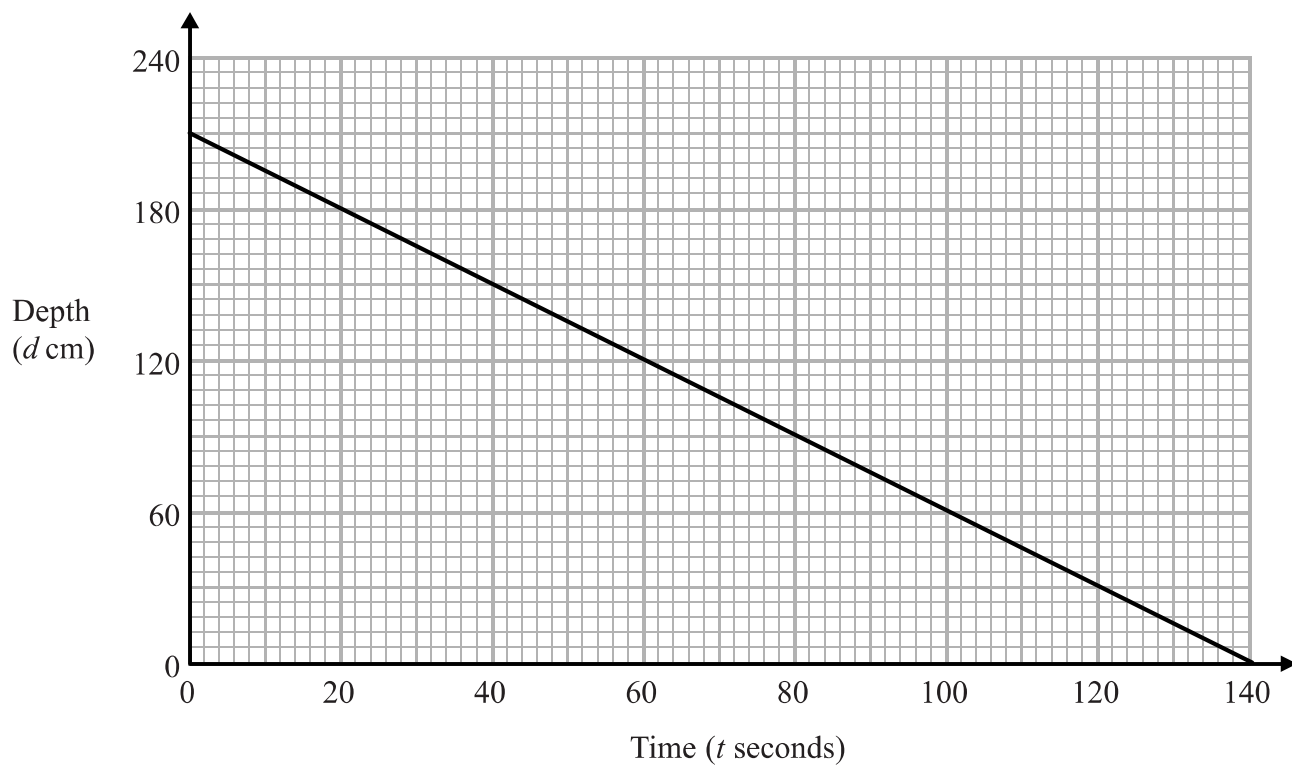
“If I give some marbles to Becky, each of us will have the same number of marbles.”

Is Dan correct?

You must show how you get your answer.

(Total for Question 88 is 3 marks)

89 The graph shows the depth, d cm, of water in a tank after t seconds.



(a) Find the gradient of this graph.

.....
(2)

(b) Explain what this gradient represents.

.....
.....
(1)

(Total for Question 89 is 3 marks)

; 2 A pendulum of length L cm has time period T seconds.
 T is directly proportional to the square root of L .

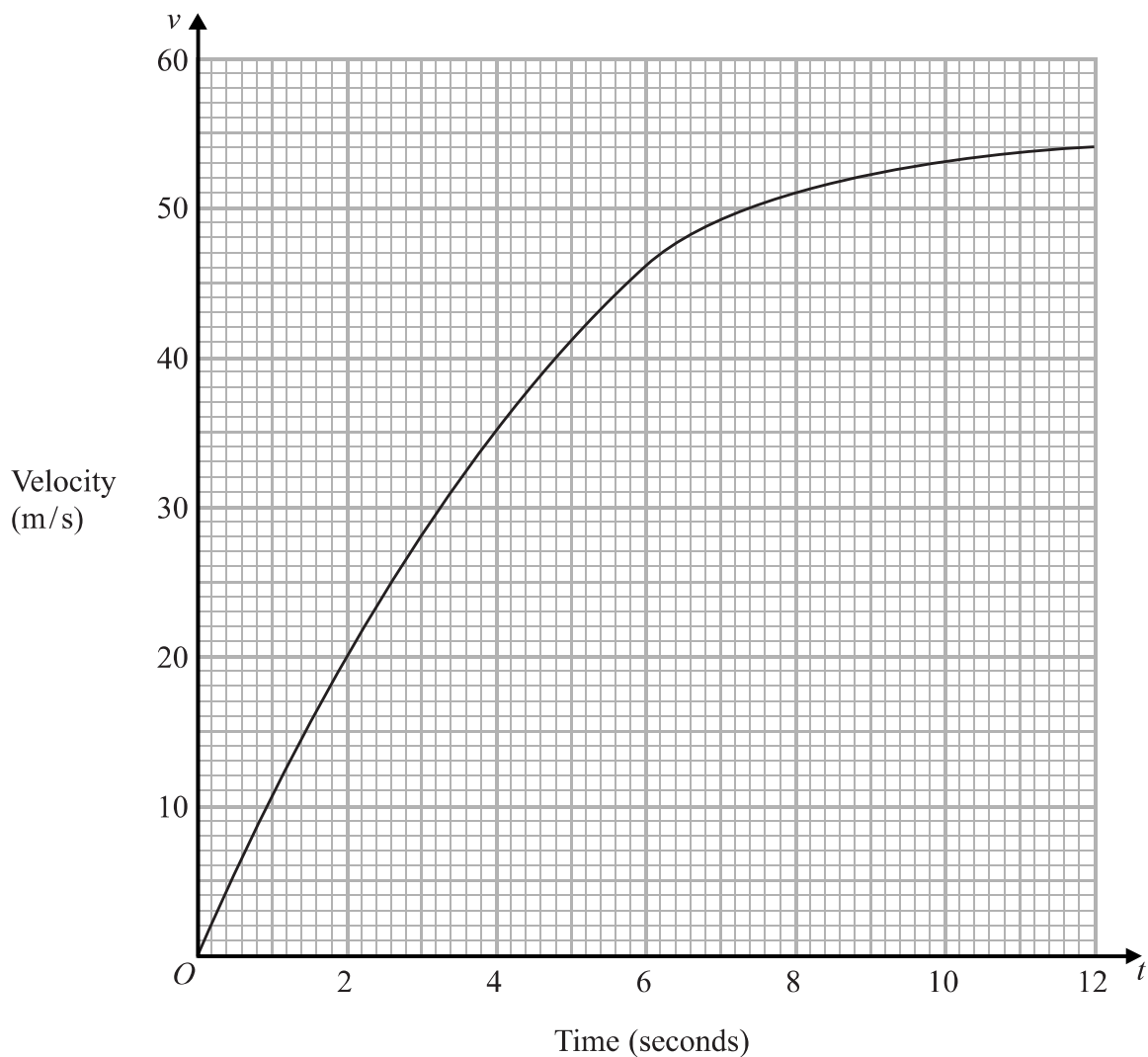
The length of the pendulum is increased by 40%.

Work out the percentage increase in the time period.

.....%

(Total for Question ; 2 is 3 marks)

91 The graph shows information about the velocity, v m/s, of a parachutist t seconds after leaving a plane.



(a) Work out an estimate for the acceleration of the parachutist at $t = 6$

..... m/s²
(2)

(b) Work out an estimate for the distance fallen by the parachutist in the first 12 seconds after leaving the plane.
Use 3 strips of equal width.

..... m
(3)

(Total for Question 91 is 5 marks)

- 92** The number of bees in a beehive at the start of year n is P_n .
The number of bees in the beehive at the start of the following year is given by

$$P_{n+1} = 1.05(P_n - 250)$$

At the start of 2015 there were 9500 bees in the beehive.

How many bees will there be in the beehive at the start of 2018?

.....
(Total for Question 92 is 3 marks)

93 On a farm

the number of cows and the number of sheep are in the ratio 6 : 5
the number of sheep and the number of pigs are in the ratio 2 : 1

The total number of cows, sheep and pigs on the farm is 189

How many sheep are there on the farm?

.....
(Total for Question 93 is 3 marks)

94 The functions f and g are such that

$$f(x) = 3(x - 4) \quad \text{and} \quad g(x) = \frac{x}{5} + 1$$

(a) Find the value of $f(10)$

.....
(1)

(b) Find $g^{-1}(x)$

$$g^{-1}(x) = \text{.....}$$

(2)

(c) Show that $fg(x) = 9x - 48$

(2)

(Total for Question 94 is 5 marks)

95 The population of a city increased by 5.2% for the year 2014

At the beginning of 2015 the population of the city was 1 560 000

Lin assumes that the population will continue to increase at a constant rate of 5.2% each year.

- (a) Use Lin's assumption to estimate the population of the city at the beginning of 2017
Give your answer correct to 3 significant figures.

.....
(3)

- (b) (i) Use Lin's assumption to work out the year in which the population of the city will reach 2 000 000

-
(ii) If Lin's assumption about the rate of increase of the population is too low, how might this affect your answer to (b)(i)?

.....
(3)

(Total for Question 95 is 6 marks)

96 D is directly proportional to the cube of n .

Mary says that when n is doubled, the value of D is multiplied by 6

Mary is wrong.

Explain why.

.....

.....

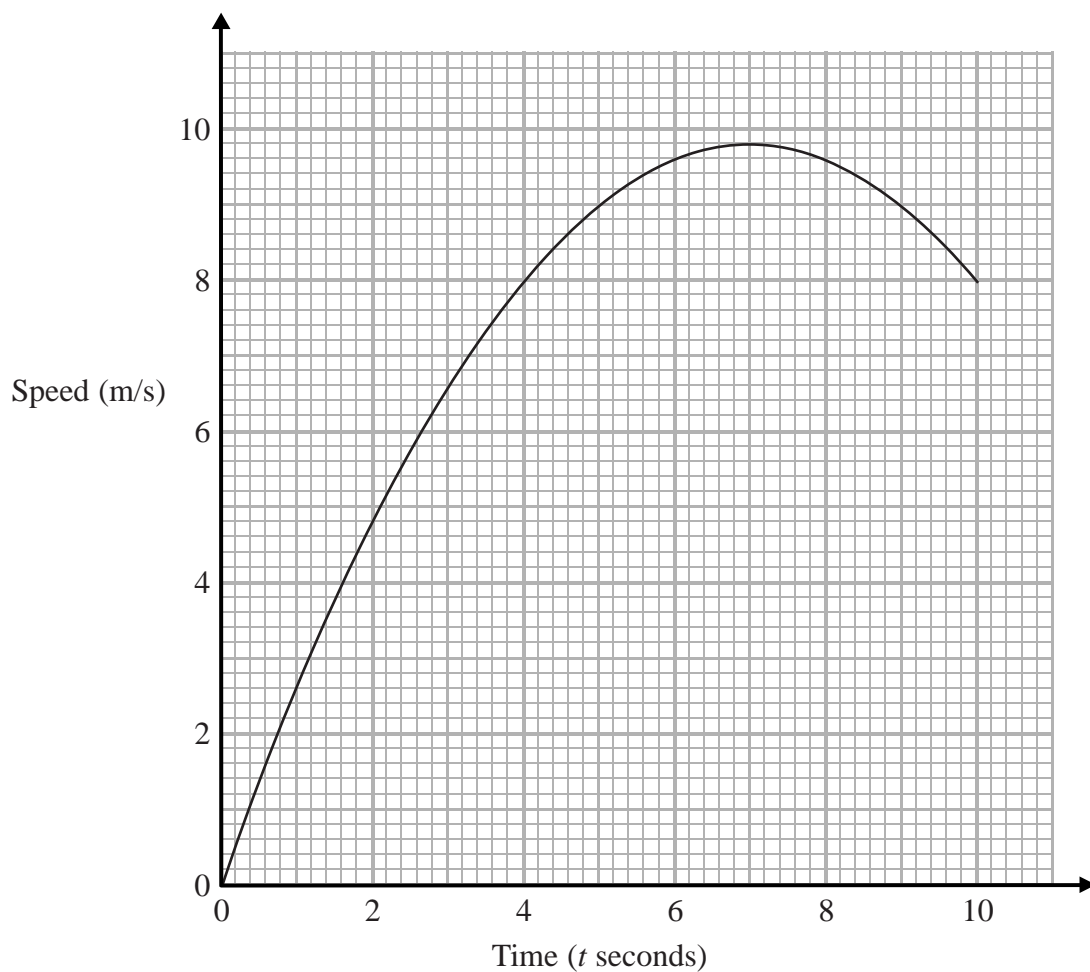
.....

(1)

(Total for Question 96 is 1 mark)

97 Karol runs in a race.

The graph shows her speed, in metres per second, t seconds after the start of the race.



- (a) Calculate an estimate for the gradient of the graph when $t = 4$
You must show how you get your answer.

.....
(3)

(b) Describe fully what your answer to part (a) represents.

.....
.....

(2)

(c) Explain why your answer to part (a) is only an estimate.

.....
.....

(1)

(Total for Question 97 is 6 marks)

98 Given that

$$2x - 1 : x - 4 = 16x + 1 : 2x - 1$$

find the possible values of x .

.....
(Total for Question 98 is 5 marks)

99 Natalie makes potato cakes in a restaurant.

She mixes potato, cheese and onion so that

weight of potato : weight of cheese : weight of onion = 9 : 2 : 1

Natalie needs to make 6000 g of potato cakes.

Cheese costs £2.25 for 175 g.

Work out the cost of the cheese needed to make 6000 g of potato cakes.

£.....

(Total for Question 99 is 4 marks)

100 A water tank is empty.
Anil needs to fill the tank with 2400 litres of water.

Company **A** supplies water at a rate of 8 litres in 1 minute 40 seconds.

Company **B** supplies water at a rate of 2.2 gallons per minute.

1 gallon = 4.54 litres

Company **A** would take more time to fill the tank than Company **B** would take to fill the tank.

How much more time?

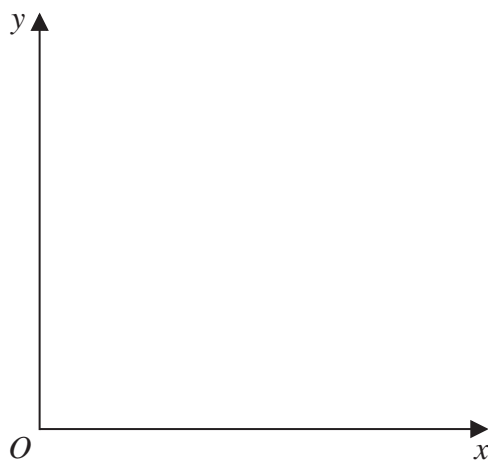
Give your answer in minutes correct to the nearest minute.

..... minutes

(Total for Question 100 is 4 marks)

101 (a) Using the axes below, sketch a graph to represent the statement

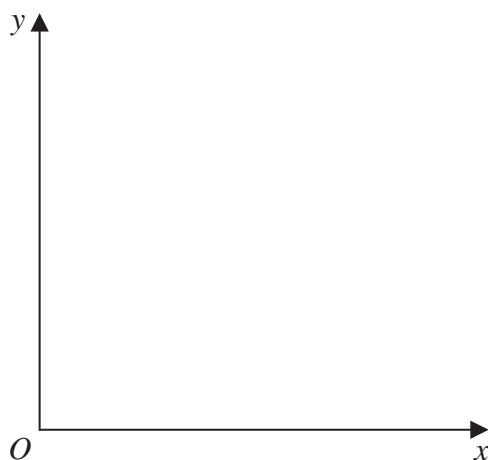
y is directly proportional to x



(1)

(b) Using the axes below, sketch a graph to represent the statement

y is inversely proportional to x



(1)

(Total for Question 101 is 2 marks)

102 Olivia and Jessica have in total half as many sweets as Fran and Gary have in total.

Fran and Gary share their sweets in the ratio 2:3

Olivia and Jessica share their sweets in the ratio 9:1

Fran got w sweets.

Gary got x sweets.

Olivia got y sweets.

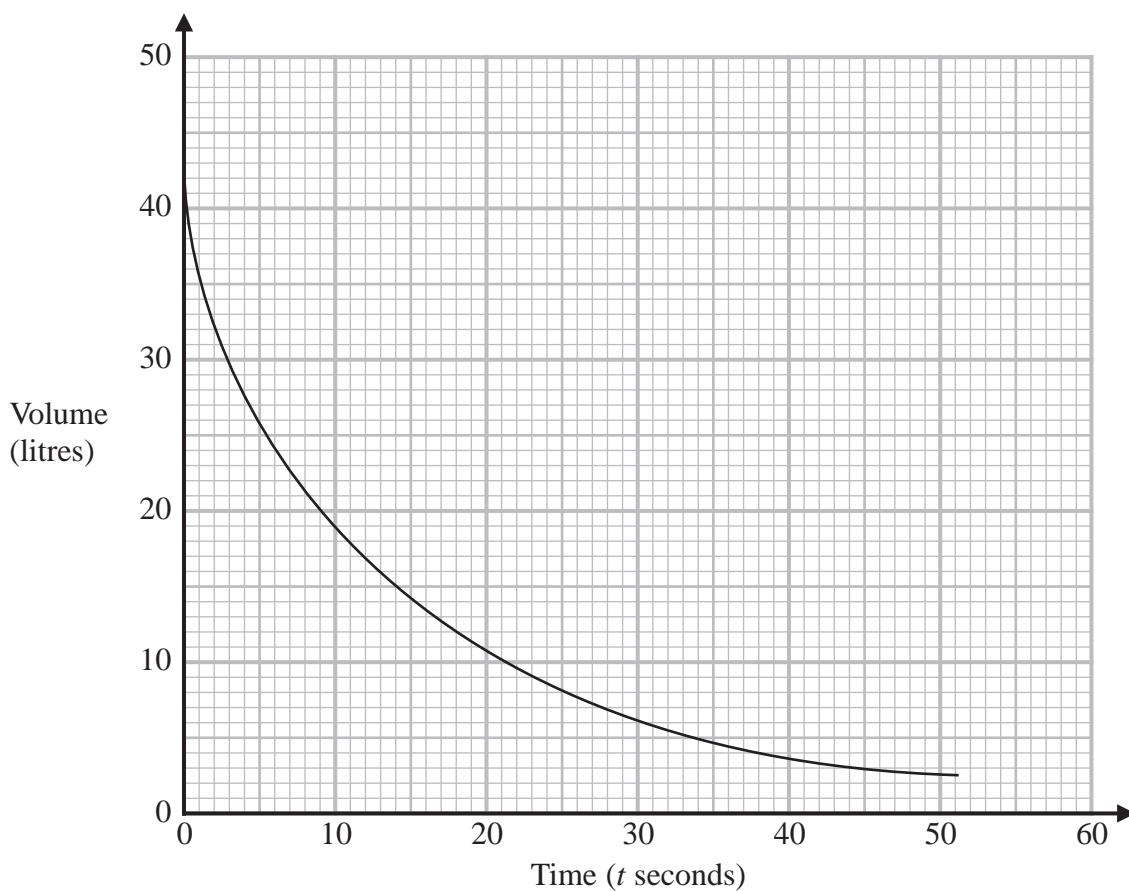
Jessica got z sweets.

Find, in its simplest form, $w:x:y:z$

.....

(Total for Question 102 is 4 marks)

103 The graph gives the volume of water, in litres, in a container at time t seconds after the water started to flow out of the container.



Using the graph, work out an estimate for the rate at which the water is flowing out of the container when $t = 12$

You must show your working.

..... litres per second

(Total for Question 103 is 3 marks)

104 x is directly proportional to the square of y .
 y is directly proportional to the cube of z .

$$z = 2 \text{ when } x = 32$$

Find a formula for x in terms of z .

.....
(Total for Question 104 is 4 marks)

105 At the start of year n , the number of animals in a population is P_n

At the start of the following year, the number of animals in the population is P_{n+1} where

$$P_{n+1} = kP_n$$

At the start of 2017 the number of animals in the population was 4000

At the start of 2019 the number of animals in the population was 3610

Find the value of the constant k .

.....
(Total for Question 105 is 3 marks)

106 Andy cycles a distance of 30 km at an average speed of 24 km/h.
He then runs a distance of 12 km at an average speed of 8 km/h.

Work out the total time Andy takes.
Give your answer in hours and minutes.

..... hours minutes

(Total for Question 106 is 3 marks)

107 Maisie knows that she needs 3 kg of grass seed to make a rectangular lawn 5 m by 9 m.

Grass seed is sold in 2 kg boxes.

Maisie wants to make a rectangular lawn 10 m by 14 m.

She has 5 boxes of grass seed.

(a) Has Maisie got enough grass seed to make a lawn 10 m by 14 m?

You must show all your working.

(4)

Maisie opens the 5 boxes of grass seed.

She finds that 4 of the boxes contain 2 kg of grass seed.

The other box contains 1 kg of grass seed.

(b) Does this affect whether Maisie has enough grass seed to make her lawn?

Give a reason for your answer.

(1)

(Total for Question 107 is 5 marks)

108 $5c + d = c + 4d$

(a) Find the ratio $c : d$

.....
(2)

$6x^2 = 7xy + 20y^2$ where $x > 0$ and $y > 0$

(b) Find the ratio $x : y$

.....
(3)

(Total for Question 108 is 5 marks)

109 Write 37 cm^3 in mm^3

..... mm^3

(Total for Question 109 is 1 mark)

110 Nimer was driving to a hotel.
He looked at his Sat Nav at 13 30

Time	13 30
Distance to destination	65 miles

Nimer arrived at the hotel at 14 48

Work out the average speed of the car from 13 30 to 14 48
You must show all your working.

..... mph

(Total for Question 110 is 4 marks)

111 Liquid A and liquid B are mixed together in the ratio 2 : 13 by volume to make liquid C.

Liquid A has density 1.21 g/cm^3

Liquid B has density 1.02 g/cm^3

A cylindrical container is filled completely with liquid C.

The cylinder has radius 3 cm and height 25 cm.

Work out the mass of the liquid in the container.

Give your answer correct to 3 significant figures.

You must show all your working.

..... g

(Total for Question 111 is 4 marks)

112 A group of people went to a restaurant.
Each person chose one starter and one main course.

starter	main course
soup	lasagne
prawns	curry

the number of people who chose soup : the number of people who chose prawns = 2 : 3

Of those who chose soup,
the number of people who chose lasagne : the number of people who chose curry = 5 : 3

Of those who chose prawns,
the number of people who chose lasagne : the number of people who chose curry = 1 : 5

What fraction of the people chose curry?
You must show how you get your answer.

.....
(Total for Question 112 is 4 marks)

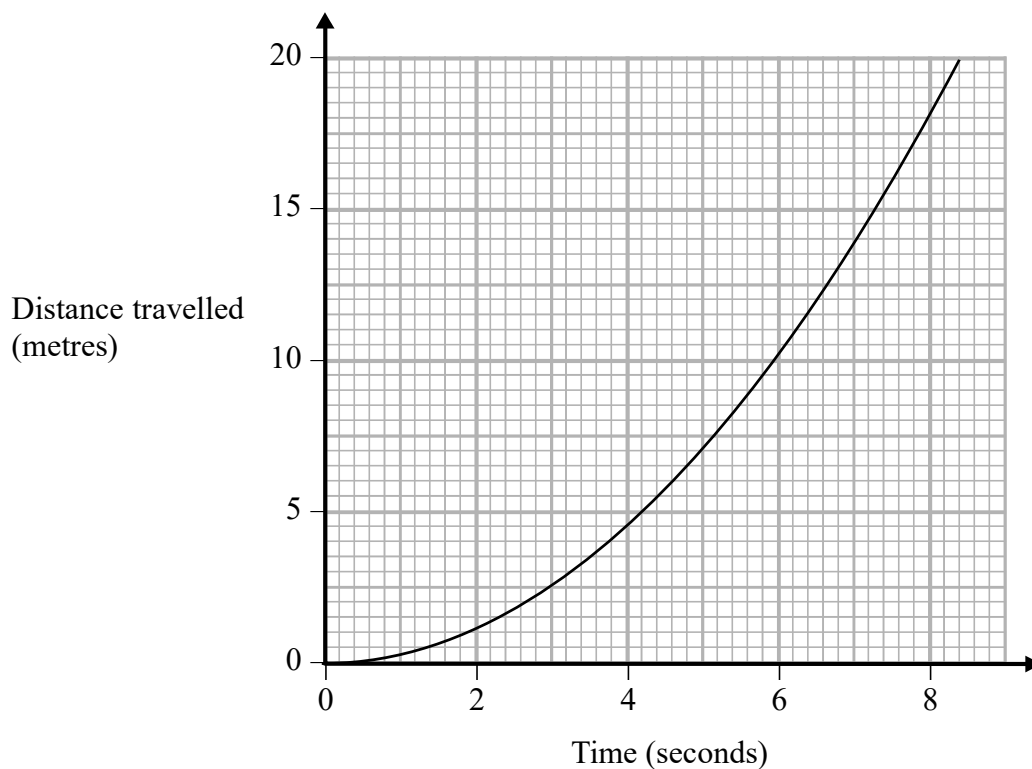
113 y is inversely proportional to the square of x .

$$y = 8 \text{ when } x = 2.5$$

Find the negative value of x when $y = \frac{8}{9}$

(Total for Question 113 is 3 marks)

114 The graph shows information about part of a cyclist's journey.



Work out an estimate of the speed, in m/s, of the cyclist at time 6 seconds.

..... m/s

(Total for Question 114 is 3 marks)

115 Katy invests £200 000 in a savings account for 4 years.
The account pays compound interest at a rate of 1.5% per annum.

Calculate the total amount of interest Katy will get at the end of 4 years.

£.....

(Total for Question 115 is 3 marks)

116 A company has to make a large number of boxes.

The company has 6 machines.

All the machines work at the same rate.

When all the machines are working, they can make all the boxes in 9 days.

The table gives the number of machines working each day.

	day 1	day 2	day 3	all other days
Number of machines working	3	4	5	6

Work out the total number of days taken to make all the boxes.

.....
(Total for Question 116 is 3 marks)

117" Marie invests £8000 in an account for one year.
At the end of the year, interest is added to her account.

Marie pays tax on this interest at a rate of 20%
She pays £28.80 tax.

Work out the percentage interest rate for the account.

..... %

(Total for Question 117 is 3 marks)

118 The density of ethanol is 1.09 g/cm^3
The density of propylene is 0.97 g/cm^3

60 litres of ethanol are mixed with 128 litres of propylene to make 188 litres of antifreeze.

Work out the density of the antifreeze.
Give your answer correct to 2 decimal places.

..... g/cm^3

(Total for Question 118 is 4 marks)

119 Last year Jo paid £245 for her car insurance.
This year she has to pay £883 for her car insurance.

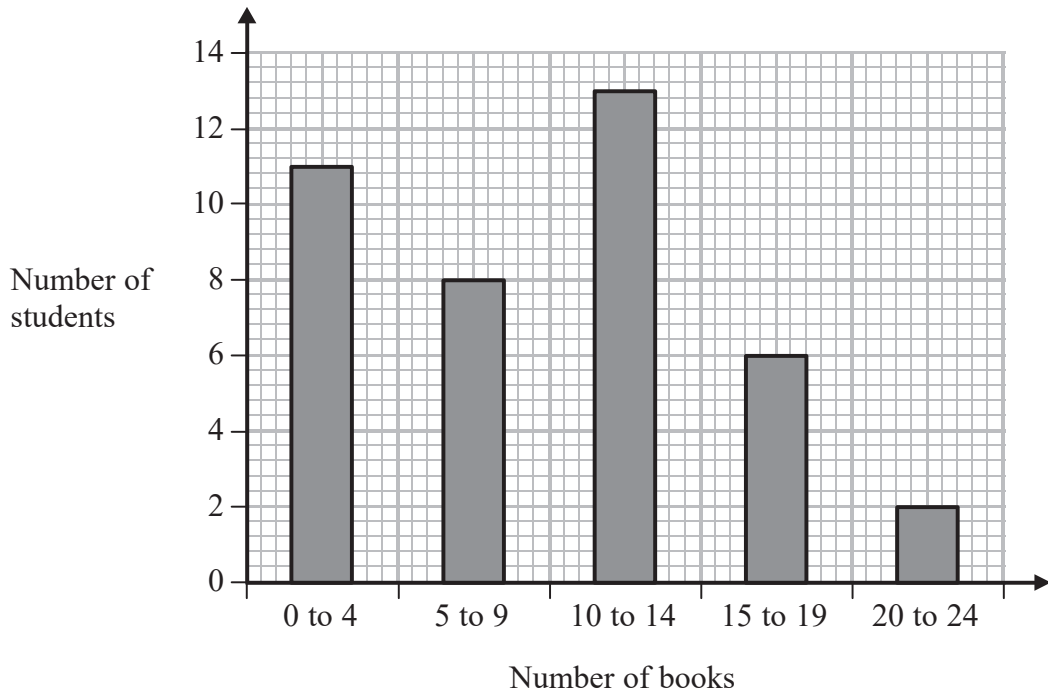
Work out the percentage increase in the cost of her car insurance.

.....%

(Total for Question 119 is 3 marks)

120 Fran asks each of 40 students how many books they bought last year.

The chart below shows information about the number of books bought by each of the 40 students.



Work out the percentage of these students who bought 20 or more books. (2)

.....%

(Total for Question 120 is 2 marks)

121 Lara is a skier.

She completed a ski race in 1 minute 54 seconds.
The race was 475 m in length.

Lara assumes that her average speed is the same for each race.

- (a) Using this assumption, work out how long Lara should take to complete a 700 m race.
Give your answer in minutes and seconds.

..... minutes seconds
(3)

Lara's average speed actually increases the further she goes.

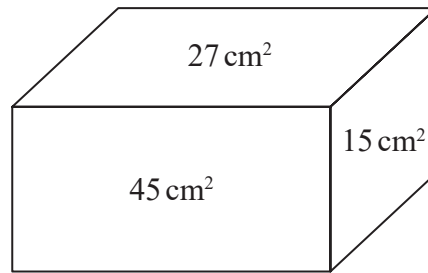
- (b) How does this affect your answer to part (a)?

.....
.....
(1)

(Total for Question 121 is 4 marks)

122 The diagram shows a solid metal cuboid.

The areas of three of the faces are marked on the diagram.
The lengths, in cm, of the edges of the cuboid are whole numbers.



The metal cuboid is melted and made into cubes.
Each of the cubes has sides of length 2.5 cm.

Work out the greatest number of these cubes that can be made.

.....
(Total for Question 122 is 5 marks)

- 123** The number of animals in a population at the start of year t is P_t
The number of animals at the start of year 1 is 400

Given that

$$P_{t+1} = 1.01P_t$$

work out the number of animals at the start of year 3

.....
(Total for Question 123 is 2 marks)

- 124** y is inversely proportional to x^3

$$y = 44 \text{ when } x = a$$

Show that $y = 5.5$ when $x = 2a$

(Total for Question 124 is 3 marks)

125 $T = \sqrt{\frac{w}{d^3}}$

$w = 5.6 \times 10^{-5}$

$d = 1.4 \times 10^{-4}$

(a) Work out the value of T .

Give your answer in standard form correct to 3 significant figures.

$T = \dots\dots\dots$
(2)

w is increased by 10%

d is increased by 5%

Lottie says,

“The value of T will increase because both w and d are increased.”

(b) Lottie is wrong.

Explain why.

.....
.....
(2)

(Total for Question 125 is 4 marks)

126 In 2003, Jerry bought a house.

In 2007, Jerry sold the house to Mia.
He made a profit of 20%

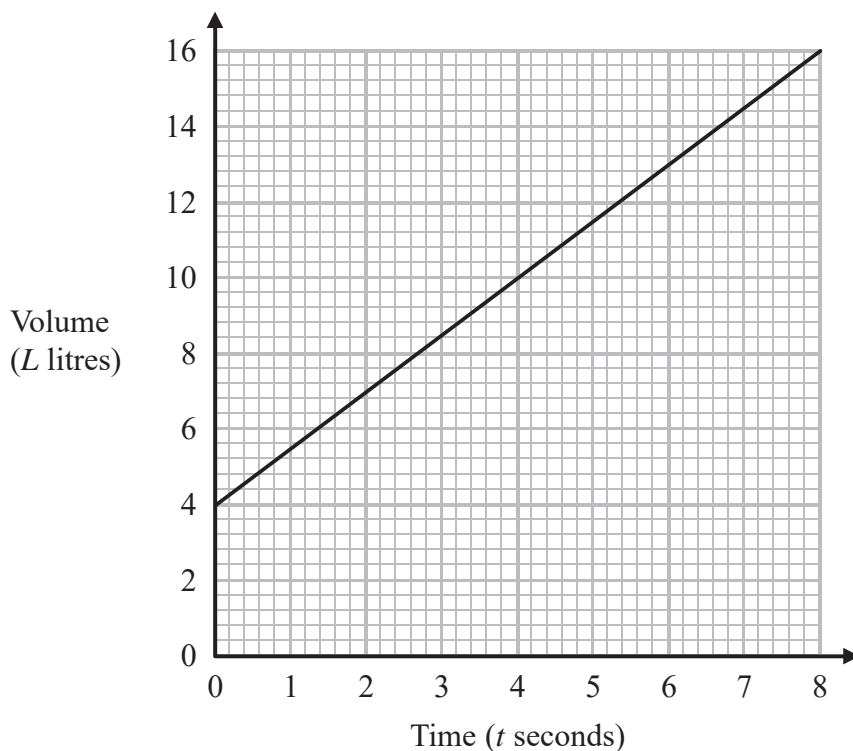
In 2012, Mia sold the house for £162 000
She made a loss of 10%

Work out how much Jerry paid for the house in 2003

£.....

(Total for Question 126 is 3 marks)

127 The graph shows the volume of liquid (L litres) in a container at time t seconds.



(a) Find the gradient of the graph.

.....
(2)

(b) Explain what this gradient represents.

.....
.....
(1)

The graph intersects the volume axis at $L = 4$

(c) Explain what this intercept represents.

.....
.....
(1)

(Total for Question 127 is 4 marks)

128 Here are two similar solid shapes.

A



B



surface area of shape A : surface area of shape B = 3 : 4

The volume of shape B is 10 cm^3

Work out the volume of shape A.

Give your answer correct to 3 significant figures.

..... cm^3

(Total for Question 128 is 3 marks)

- 129** In London, 1 litre of petrol costs 108.9p
In New York, 1 US gallon of petrol costs \$2.83

1 US gallon = 3.785 litres
£1 = \$1.46

In which city is petrol better value for money, London or New York?
You must show your working.

(Total for Question 129 is 3 marks)

- 130** A gold bar has a mass of 12.5 kg."

The density of gold is 19.3 g/cm³

Work out the volume of the gold bar.
Give your answer correct to 3 significant figures.

..... cm³

(Total for Question 130 is 3 marks)

131 There are only blue pens, green pens and red pens in a box.

The ratio of the number of blue pens to the number of green pens is 2 : 5

The ratio of the number of green pens to the number of red pens is 4 : 1

There are less than 100 pens in the box.

What is the greatest possible number of red pens in the box?

.....
(Total for Question 131 is 3 marks)

132 Jack bought a new boat for £12 500

The value, £ V , of Jack's boat at the end of n years is given by the formula

$$V = 12\,500 \times (0.85)^n$$

- (a) At the end of how many years was the value of Jack's boat first less than 50% of the value of the boat when it was new?

.....
(2)

A savings account pays interest at a rate of $R\%$ per year.

Jack invests £5500 in the account for one year.

At the end of the year, Jack pays tax on the interest at a rate of 40%.

After paying tax, he gets £79.20

- (b) Work out the value of R .

.....
(3)

(Total for Question 132 is 5 marks)

133 Cone **A** and cone **B** are mathematically similar.

The ratio of the volume of cone **A** to the volume of cone **B** is $27 : 8$

The surface area of cone **A** is 297 cm^2

Show that the surface area of cone **B** is 132 cm^2

(Total for Question 133 is 3 marks)

134 Daniel bakes 420 cakes.

He bakes only vanilla cakes, banana cakes, lemon cakes and chocolate cakes.

$\frac{2}{7}$ of the cakes are vanilla cakes.

35% of the cakes are banana cakes.

The ratio of the number of lemon cakes to the number of chocolate cakes is 4:5

Work out the number of lemon cakes Daniel bakes.

.....
(Total for Question 134 is 5 marks)

135 The density of apple juice is 1.05 grams per cm^3 .

The density of fruit syrup is 1.4 grams per cm^3 .

The density of carbonated water is 0.99 grams per cm^3 .

25 cm^3 of apple juice are mixed with 15 cm^3 of fruit syrup and 280 cm^3 of carbonated water to make a drink with a volume of 320 cm^3 .

Work out the density of the drink.

Give your answer correct to 2 decimal places.

..... g/cm^3

(Total for Question 135 is 4 marks)

136 Naoby invests £6000 for 5 years.
The investment gets compound interest of $x\%$ per annum.
At the end of 5 years the investment is worth £8029.35
Work out the value of x .

.....
(Total for Question 136 is 3 marks)

137 The points A , B , C and D lie in order on a straight line.

$$AB:BD = 1:5$$
$$AC:CD = 7:11$$

Work out $AB:BC:CD$

..... : :
(Total for Question 137 is 3 marks)

138 Using $x_{n+1} = -2 - \frac{4}{x_n^2}$

with $x_0 = -2.5$

(a) find the values of x_1 , x_2 and x_3

$x_1 = \dots\dots\dots$

$x_2 = \dots\dots\dots$

$x_3 = \dots\dots\dots$

(3)

(b) Explain the relationship between the values of x_1 , x_2 and x_3 and the equation $x^3 + 2x^2 + 4 = 0$

.....
.....
.....
.....

(2)

(Total for Question 138 is 5 marks)

139 Asif is going on holiday to Turkey.

The exchange rate is $\text{£}1 = 3.5601$ lira.

Asif changes $\text{£}550$ to lira.

- (a) Work out how many lira he should get.
Give your answer to the nearest lira.

..... lira
(2)

Asif sees a pair of shoes in Turkey.
The shoes cost 210 lira.

Asif does not have a calculator.
He uses $\text{£}2 = 7$ lira to work out the approximate cost of the shoes in pounds.

- (b) Use $\text{£}2 = 7$ lira to show that the approximate cost of the shoes is $\text{£}60$

(2)

- (c) Is using $\text{£}2 = 7$ lira instead of using $\text{£}1 = 3.5601$ lira a sensible start to Asif's method to work out the cost of the shoes in pounds?

You must give a reason for your answer.

.....
.....
(1)

(Total for Question 139 is 5 marks)

140 Henry is thinking of having a water meter.

These are the two ways he can pay for the water he uses.

Water Meter

A charge of £28.20 per year

plus

91.22p for every cubic metre of water used

1 cubic metre = 1000 litres

No Water Meter

A charge of £107 per year

Henry uses an average of 180 litres of water each day.

Use this information to determine whether or not Henry should have a water meter.

(Total for Question 140 is 5 marks)

141 Liz buys packets of coloured buttons.

There are 8 red buttons in each packet of red buttons.

There are 6 silver buttons in each packet of silver buttons.

There are 5 gold buttons in each packet of gold buttons.

Liz buys equal numbers of red buttons, silver buttons and gold buttons.

How many packets of each colour of buttons did Liz buy?

.....packets of red buttons

.....packets of silver buttons

.....packets of gold buttons

(Total for Question 141 is 3 marks)

142 Louis and Robert are investigating the growth in the population of a type of bacteria. They have two flasks A and B.

At the start of day 1, there are 1000 bacteria in flask A.

The population of bacteria grows exponentially at the rate of 50% per day.

- (a) Show that the population of bacteria in flask A at the start of each day forms a geometric progression.

(2)

The population of bacteria in flask A at the start of the 10th day is k times the population of bacteria in flask A at the start of the 6th day.

- (b) Find the value of k .

.....
(2)

At the start of day 1 there are 1000 bacteria in flask B.

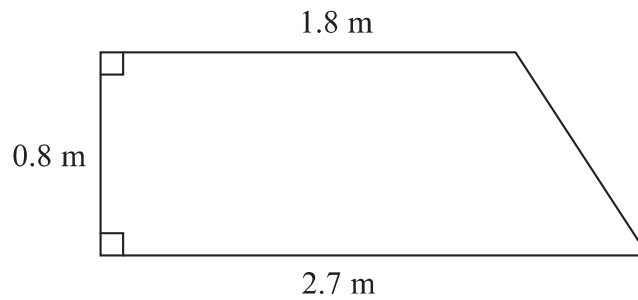
The population of bacteria in flask B grows exponentially at the rate of 30% per day.

- (c) Sketch a graph to compare the size of the population of bacteria in flask A and in flask B.

(1)

(Total for Question 142 is 5 marks)

143 The diagram shows a wall in the shape of a trapezium.



Karen is going to cover this part of the wall with tiles.
Each tile is rectangular, 15 cm by 7.5 cm

Tiles are sold in packs.
There are 9 tiles in each pack.

Karen divides the area of this wall by the area of a tile to work out an estimate for the number of tiles she needs to buy.

- (a) Use Karen's method to work out the estimate for the number of packs of tiles she needs to buy.

.....
(5)

Karen is advised to buy 10% more tiles than she estimated.
Buying 10% more tiles will affect the number of the tiles Karen needs to buy.
She assumes she will need to buy 10% more packs of tiles.

- (b) Is Karen's assumption correct?
You must show your working.

(2)

(Total for Question 143 is 7 marks)

144 Ian invested an amount of money at 3% per annum compound interest.
At the end of 2 years the value of the investment was £2652.25

(a) Work out the amount of money Ian invested.

£.....

(3)

Noah has an amount of money to invest for five years.

Saver Account

4% per annum
compound interest.

Investment Account

21% interest paid at the
end of 5 years.

Noah wants to get the most interest possible.

(b) Which account is best?

You must show how you got your answer.

(2)

(Total for Question 144 is 5 marks)

145 Mark has made a clay model.

He will now make a clay statue that is mathematically similar to the clay model.

The model has a base area of 6 cm^2

The statue will have a base area of 253.5 cm^2

Mark used 2 kg of clay to make the model.

Clay is sold in 10kg bags.

Mark has to buy all the clay he needs to make the statue.

How many bags of clay will Mark need to buy?

.....
(Total for Question 145 is 3 marks)

146 The ratio of the number of boys to the number of girls in a school is 4:5
There are 95 girls in the school.

Work out the total number of students in the school.

.....
(Total for Question 146 is 3 marks)

- 147 At a depth of x metres, the temperature of the water in an ocean is $T^\circ\text{C}$.
At depths below 900 metres, T is inversely proportional to x .

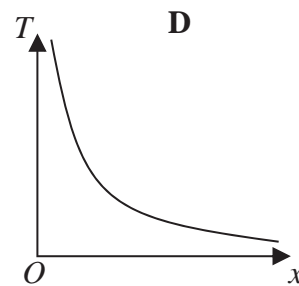
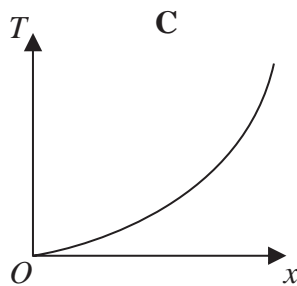
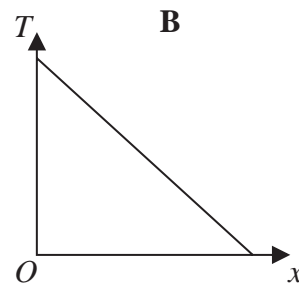
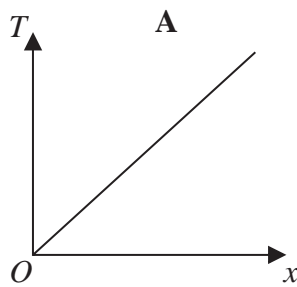
T is given by

$$T = \frac{4500}{x}$$

- (a) Work out the difference in the temperature of the water at a depth of 1200 metres and the temperature of the water at a depth of 2500 metres.

..... $^\circ\text{C}$
(3)

Here are four graphs.



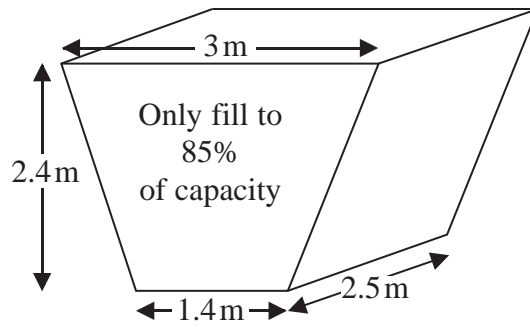
One of the graphs could show that T is inversely proportional to x .

- (b) Write down the letter of this graph.

.....
(1)

(Total for Question 147 is 4 marks)

- 148 The diagram shows an oil tank in the shape of a prism.
The cross section of the prism is a trapezium.



The tank is empty.

Oil flows into the tank.

After one minute there are 300 litres of oil in the tank.

Assume that oil continues to flow into the tank at this rate.

- (a) Work out how many **more** minutes it takes for the tank to be 85% full of oil.
(1 m³ = 1000 litres)

..... minutes
(5)

The assumption about the rate of flow of the oil could be wrong.

- (b) Explain how this could affect your answer to part (a).

.....
.....
(1)

(Total for Question 148 is 6 marks)

149 Ibrar bought a house for £145 000

The value of the house depreciated by 4% in the first year.

The value of the house depreciated by 2.5% in the second year.

Ibrar says,

“ $4 + 2.5 = 6.5$ so in two years the value of my house depreciated by 6.5%”

(a) Is Ibrar right?

You must give a reason for your answer.

.....
.....
.....
(2)

The value of Ibrar’s house increases by $x\%$ in the third year.

At the end of the third year the value of Ibrar’s house is £140 000

(b) Work out the value of x .

Give your answer correct to 3 significant figures.

.....
(3)

(Total for Question 149 is 5 marks)

150 The surface gravity of a planet can be worked out using the formula

$$g = \frac{6.67 \times 10^{-11} m}{r^2}$$

where

m kilograms is the mass of the planet

r metres is the radius of the planet

For the Earth and Jupiter here are the values of m and r .

Earth	Jupiter
$m = 5.98 \times 10^{24}$	$m = 1.90 \times 10^{27}$
$r = 6.378 \times 10^6$	$r = 7.149 \times 10^7$

Work out the ratio of the surface gravity of Earth to the surface gravity of Jupiter.
Write your answer in the form 1: n

.....
(Total for Question 150 is 3 marks)

151 Zahra mixes 150 g of metal A and 150 g of metal B to make 300 g of an alloy.

Metal A has a density of 19.3 g/cm^3 .

Metal B has a density of 8.9 g/cm^3 .

Work out the density of the alloy.

..... g/cm^3

(Total for Question 151 is 4 marks)

***152** Bill buys and sells laptops.

Last month Bill bought 50 laptops.
He paid £400 for each laptop.

He sold

40 of these laptops at a profit of 30% on each laptop

10 of these laptops at a profit of 15% on each laptop

Bill's target last month was to sell all 50 laptops for a total of at least £25 000

Did Bill reach this target?

(Total for Question 152 is 5 marks)

153 Babajan makes breakfast cereal.
She mixes nuts, raisins and oats in the ratio 3 : 2 : 5 by weight.

On Monday, Babajan uses 60 grams of nuts.

(a) Work out the weight of raisins and the weight of oats she uses to make the breakfast cereal.

raisinsgrams

oats.....grams

(3)

On Tuesday, Babajan makes 300 grams of the breakfast cereal.

500 grams of nuts cost £8

(b) Work out the cost of the nuts used to make 300 grams of the breakfast cereal.

£.....

(3)

(Total for Question 153 is 6 marks)

154 There are some red counters and some yellow counters in a bag in the ratio 1:5
There are 20 yellow counters in the bag.

(a) Work out the number of red counters in the bag.

.....
(2)

Janet puts some more red counters into the bag.

The ratio of the number of red counters to the number of yellow counters is now 1:2

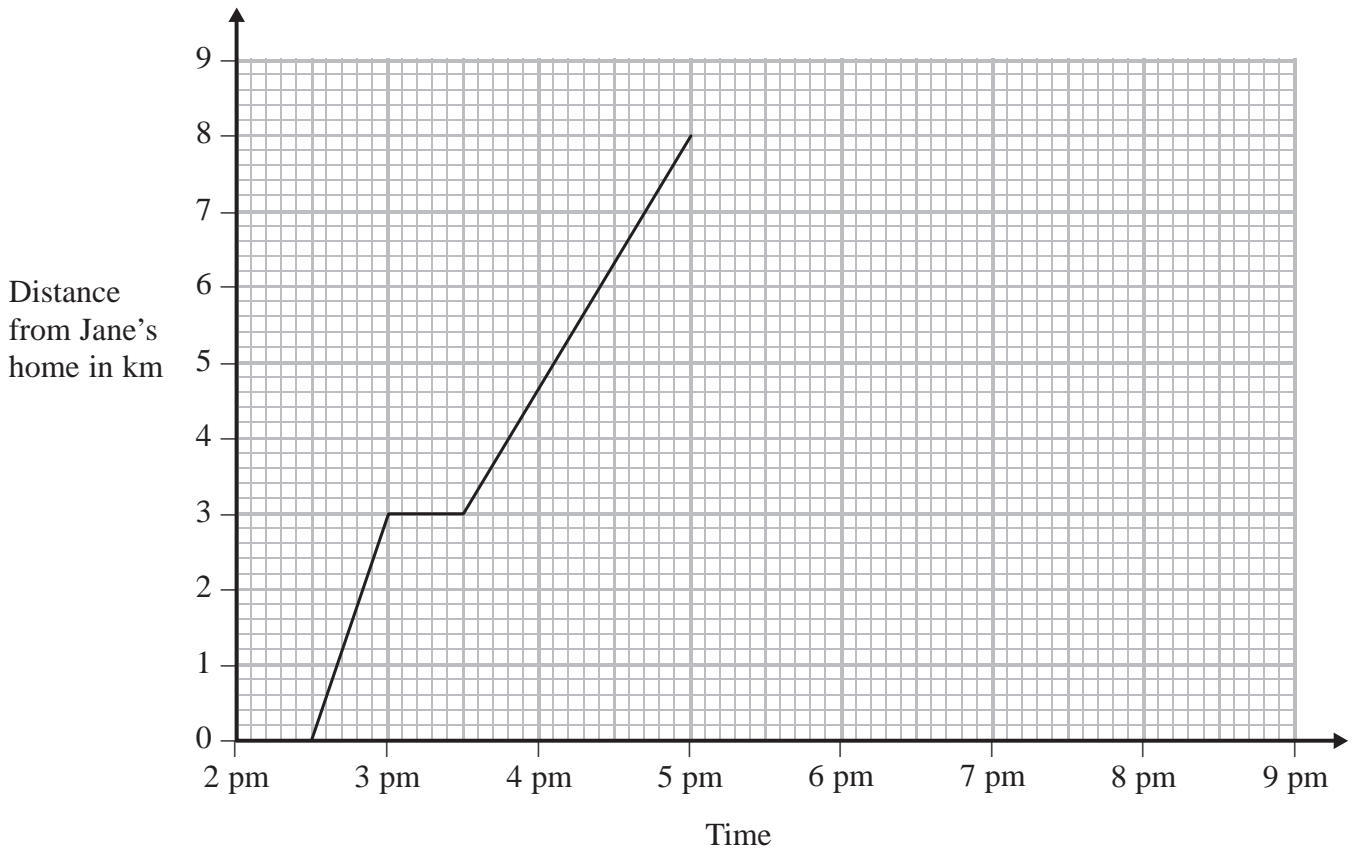
(b) How many red counters does Janet put into the bag?

.....
(2)

(Total for Question 154 is 4 marks)

155 Jane walked from her home to the ice rink.

The travel graph for Jane's journey to the ice rink is shown below.



On the way to the ice rink Jane stopped at her friend's house.

(a) How far is it from her friend's house to the ice rink?

..... km
(1)

Jane was at the ice rink for 1 hour 30 minutes.
She then walked home at a steady speed.
Jane took 2 hours to walk home.

(b) Complete the travel graph for this information.

(2)

(Total for Question 155 is 3 marks)

*156 Two shops, Mega Bathrooms and Bathroom Mart, each have a sale.

<p style="text-align: center;">Mega Bathrooms</p> <p style="text-align: center;">Sale</p> <p style="text-align: center;">60% off normal price then 15% off</p>
--

<p style="text-align: center;">Bathroom Mart</p> <p style="text-align: center;">Sale</p> <p style="text-align: center;">$\frac{2}{3}$ off normal price</p>
--

Sally wants to buy some bathroom units.
The units have a normal price of £1500

Sally wants to buy the units as cheaply as possible.

Which shop should she buy the units from?
You must show all your working.

(Total for Question 156 is 4 marks)

157 William is building a planetary path for people to walk along.
The planetary path will have a model of the Sun and models of the planets.

William uses two different scales.

He uses

1 cm to 1000 km for the diameter of each planet

1 m to 1 000 000 km for the distance from the Sun to each planet

William makes a model of the planet Venus.

The model has a diameter of 12.1 cm.

- (a) Work out the real diameter of the planet Venus.
Give your answer in standard form.

..... km
(2)

William works out the distance from the model of the Sun to the model of the planet Neptune.

The real distance from the Sun to the planet Neptune is 4.503×10^9 km.

- (b) Work out the distance from the model of the Sun to the model of the planet Neptune.
Give your answer in km, correct to 1 decimal place.

..... km
(3)

(Total for Question 157 is 5 marks)

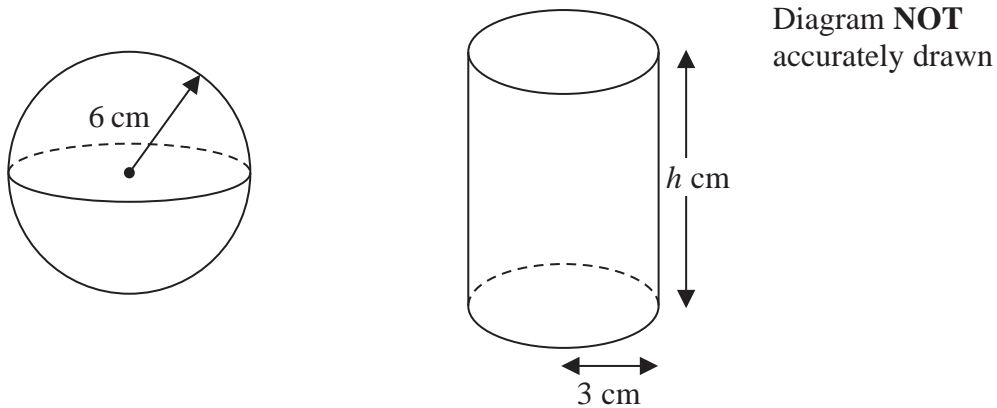
158 The intensity of the sound, I watts/m², received from a loudspeaker is inversely proportional to the square of the distance, d metres, from the loudspeaker.

When $d = 2$, $I = 30$

Work out the value of I when $d = 10$

.....
(Total for Question 158 is 3 marks)

159 The diagram shows a sphere and a solid cylinder.



The sphere has radius 6 cm.

The solid cylinder has a base radius of 3 cm and a height of h cm.

The total surface area of the cylinder is twice the total surface area of the sphere.

Work out the ratio of the volume of the sphere to the volume of the cylinder.

Give your answer in its simplest form.

You must show all your working.

.....
(Total for Question 159 is 5 marks)

160 The table gives information about Ali's spending last month.

Item	Percentage of total spending
rent	30%
food	15%
transport	12%
other	43%

Ali's total spending last month was £800

Next month Ali's rent, in pounds, is going to rise by 20%.
His total spending will still be the same.

Express the amount of money Ali will spend on rent next month as a percentage of £800

.....%

(Total for Question 160 is 3 marks)

161 Given that $y \propto \frac{1}{x^2}$, complete this table of values.

x	1	2	5	10
y				1

(Total for Question 161 is 4 marks)

162 Sean wants to go on holiday.
He is going to get a loan of £720 to help pay for the holiday.

Sean will have to pay back the £720 plus interest of 15%.
He will pay this back in 12 equal monthly installments.

How much money will Sean pay back each month?

£

(Total for Question 162 is 4 marks)

163 Here are the ingredients needed to make 8 shortbread biscuits.

Shortbread biscuits makes 8 biscuits 120 g butter 60 g caster sugar 180 g flour

Tariq is going to make some shortbread biscuits.
He has the following ingredients

330 g butter 200 g caster sugar 450 g flour

Work out the greatest number of shortbread biscuits that Tariq can make with his ingredients.

You must show all your working.

..... biscuits

(Total for Question 163 is 3 marks)

***164** Tom is going to buy 25 plants to make a hedge.

Here is information about the cost of buying the plants.

<p>Kirsty's Plants</p> <p>£2.39 each</p>

<p>Hedge World</p> <p>Pack of 25</p> <p>£52.50 plus VAT at 20%</p>

Tom wants to buy the 25 plants as cheaply as possible.

Should Tom buy the plants from Kirsty's Plants or from Hedge World?

You must show all your working.

(Total for Question 164 is 5 marks)

- 165 The distance from Fulbeck to Ganby is 10 miles.
The distance from Ganby to Horton is 18 miles.



Raksha is going to drive from Fulbeck to Ganby.
Then she will drive from Ganby to Horton.

Raksha leaves Fulbeck at 10:00
She drives from Fulbeck to Ganby at an average speed of 40 mph.

Raksha wants to get to Horton at 10:35

Work out the average speed Raksha must drive at from Ganby to Horton.

..... mph

(Total for Question 165 is 3 marks)

166 Ria is going to buy a caravan.
The total cost of the caravan is £7000 **plus** VAT at 20%.

Ria pays a deposit of £3000

She pays the rest of the total cost in 6 equal monthly payments.

Work out the amount of each monthly payment.

£.....

(Total for Question 166 is 4 marks)

167 Suha has a full 600 ml bottle of wallpaper remover.
She is going to mix some of the wallpaper remover with water.

Here is the information on the label of the bottle.

Wallpaper remover
600 ml

Mix $\frac{1}{4}$ of the wallpaper remover
with 4500 ml of water

Suha is going to use 750 ml of water.

How many millilitres of wallpaper remover should Suha use?
You must show your working.

..... ml

(Total for Question 167 is 4 marks)

168 Mr Brown and his 2 children are going to London by train.

An adult ticket costs £24

A child ticket costs £12

Mr Brown has a Family Railcard.

Family Railcard gives

$\frac{1}{3}$ off adult tickets

60% off child tickets

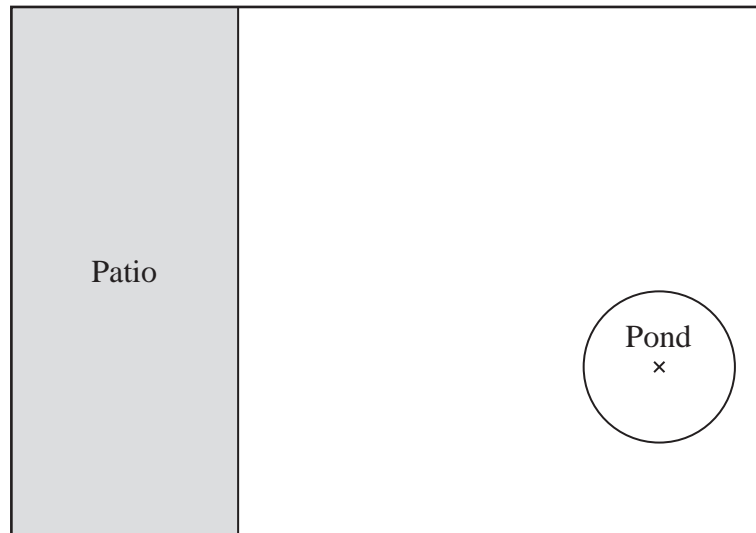
Work out the total cost of the tickets when Mr Brown uses his Family Railcard.

£.....

(Total for Question 168 is 4 marks)

169 The diagram shows a garden in the shape of a rectangle.

The scale of the diagram is 1 cm represents 2 m.



Scale: 1 cm represents 2 m

Irfan is going to plant a tree in the garden.

The tree must be

and more than 3 metres from the patio
more than 6 metres from the centre of the pond.

On the diagram, shade the region where Irfan can plant the tree.

(Total for Question 169 is 3 marks)

170 This is a list of ingredients for making chicken soup for 4 people.

Ingredients for **4** people

60 g butter
300 g chicken
150 ml cream
1 onion
640 ml chicken stock

Bill is going to make chicken soup for 6 people.

Work out the amount of each ingredient he needs.

..... g butter

..... g chicken

..... ml cream

..... onion

..... ml chicken stock

(Total for Question 170 is 3 marks)

171 Each day a company posts some small letters and some large letters.

The company posts all the letters by first class post.

The tables show information about the cost of sending a small letter by first class post and the cost of sending a large letter by first class post.

Small Letter

Weight	First Class Post
0–100 g	60p

Large Letter

Weight	First Class Post
0–100 g	£1.00
101–250 g	£1.50
251–500 g	£1.70
501–750 g	£2.50

One day the company wants to post 200 letters.

The ratio of the number of small letters to the number of large letters is 3 : 2

70% of the large letters weigh 0–100 g.

The rest of the large letters weigh 101–250 g.

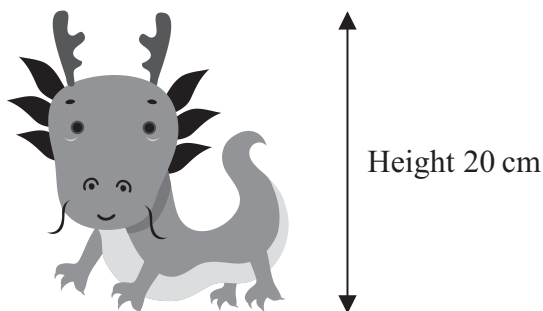
Work out the total cost of posting the 200 letters by first class post.

£.....

(Total for Question 171 is 5 marks)

172 A company makes monsters.

The company makes small monsters with a height of 20 cm.



A small monster has a surface area of 300 cm^2 .

The company also makes large monsters with a height of 120 cm.

A small monster and a large monster are mathematically similar.

Work out the surface area of a large monster.

..... cm^2

(Total for Question 172 is 3 marks)

173 y is directly proportional to the square of x .

When $x = 3$, $y = 36$

Find the value of y when $x = 5$

.....
(Total for Question 173 is 4 marks)

174 Mr Mason asks 240 Year 11 students what they want to do next year.

15% of the students want to go to college.

$\frac{3}{4}$ of the students want to stay at school.

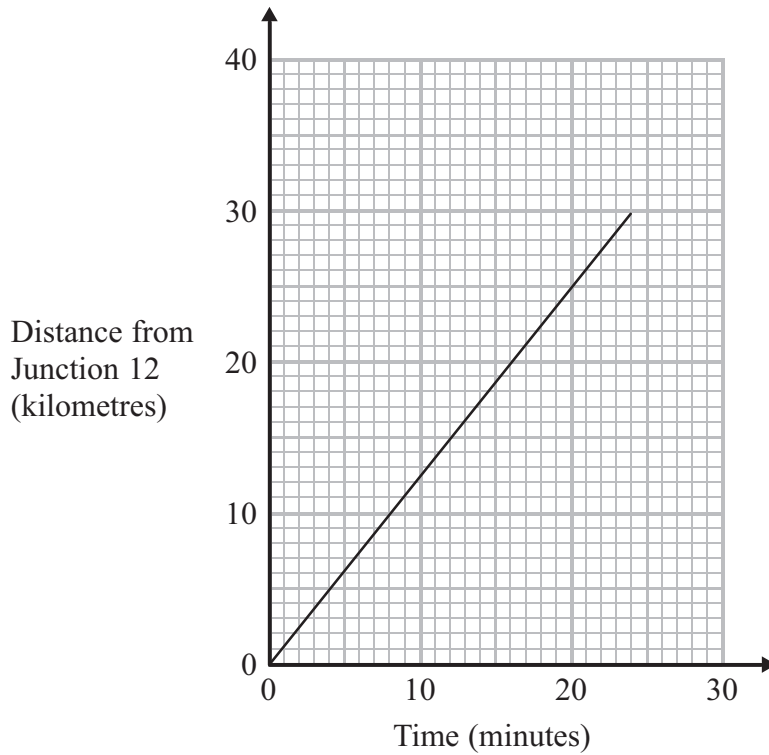
The rest of the students do not know.

Work out the number of students who do not know.

.....
(Total for Question 174 is 4 marks)

*175 Debbie drove from Junction 12 to Junction 13 on a motorway.

The travel graph shows Debbie's journey.

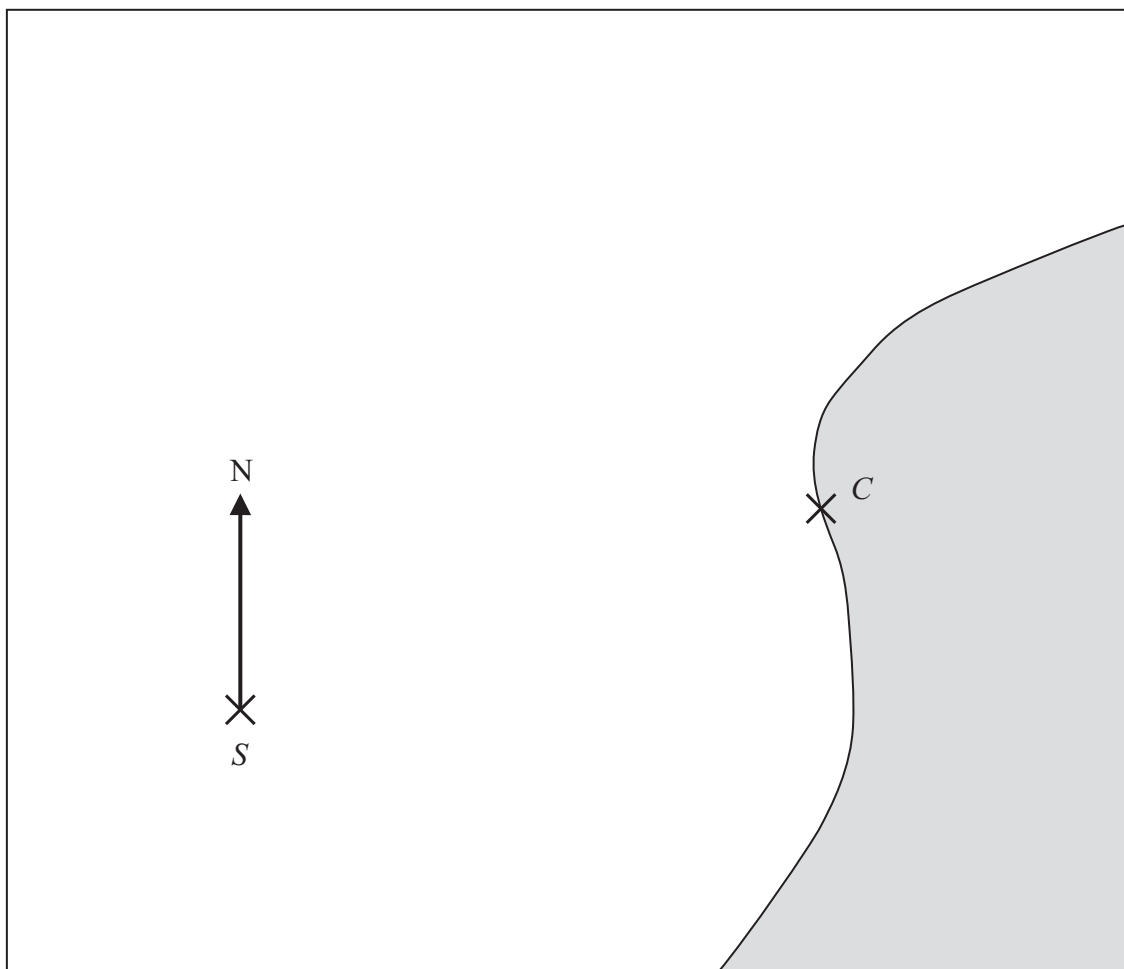


Ian also drove from Junction 12 to Junction 13 on the same motorway. He drove at an average speed of 66 km/hour.

Who had the faster average speed, Debbie or Ian?
You must explain your answer.

(Total for Question 175 is 4 marks)

- *176 Here is a map.
The position of a ship, S , is marked on the map.



Scale 1 cm represents 100 m

Point C is on the coast.
Ships must not sail closer than 500 m to point C .

The ship sails on a bearing of 037°

Will the ship sail closer than 500 m to point C ?
You must explain your answer.

(Total for Question 176 is 3 marks)

177 The normal price of a television is reduced by 30% in a sale.

The sale price of the television is £350

Work out the normal price of the television.

£.....

(Total for Question 177 is 3 marks)

178 Sumeet has a pond in the shape of a prism.

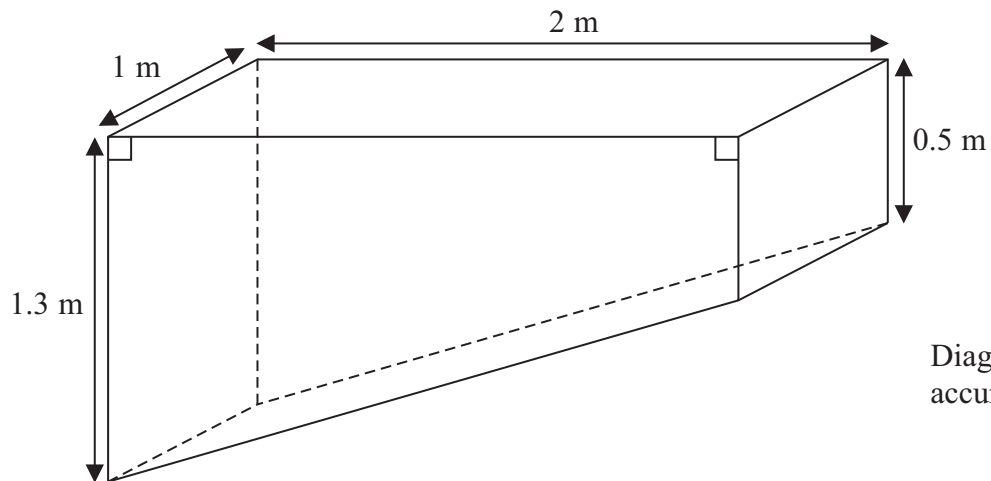


Diagram **NOT**
accurately drawn

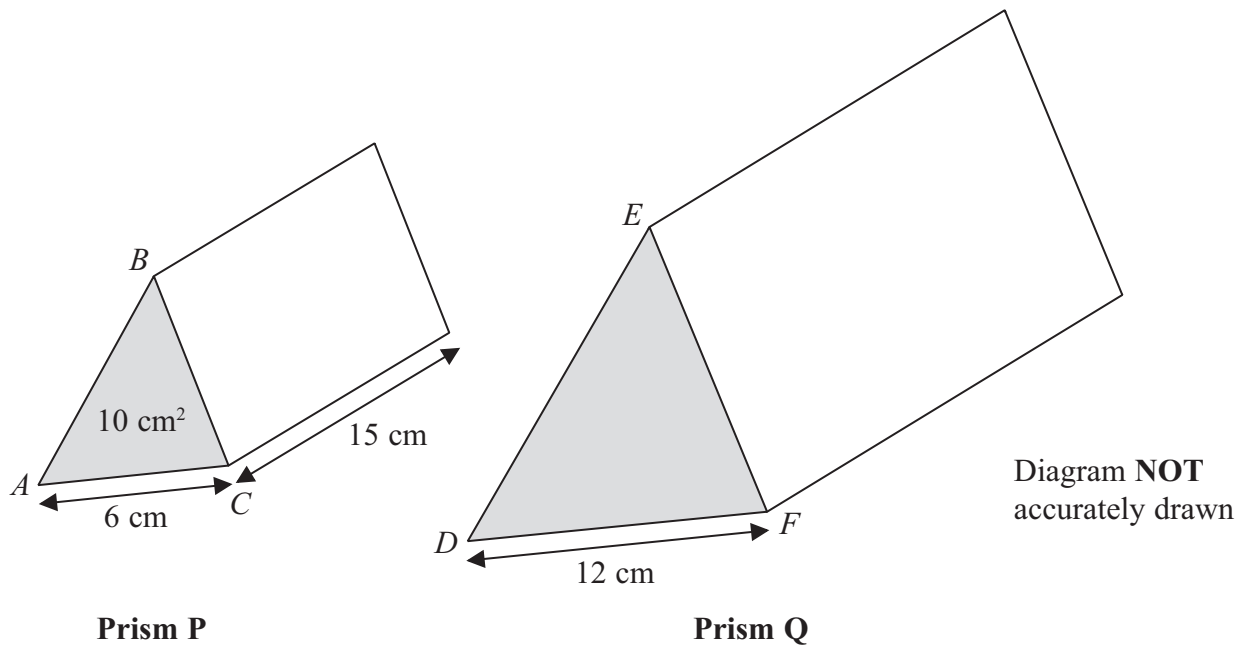
The pond is completely full of water.
Sumeet wants to empty the pond so he can clean it.
Sumeet uses a pump to empty the pond.

The volume of water in the pond decreases at a constant rate.
The level of the water in the pond goes down by 20 cm in the first 30 minutes.

Work out how much more time Sumeet has to wait for the pump to empty the pond completely.

.....
(Total for Question 178 is 6 marks)

179 P and Q are two triangular prisms that are mathematically similar.



Prism **P** has triangle ABC as its cross section.
Prism **Q** has triangle DEF as its cross section.

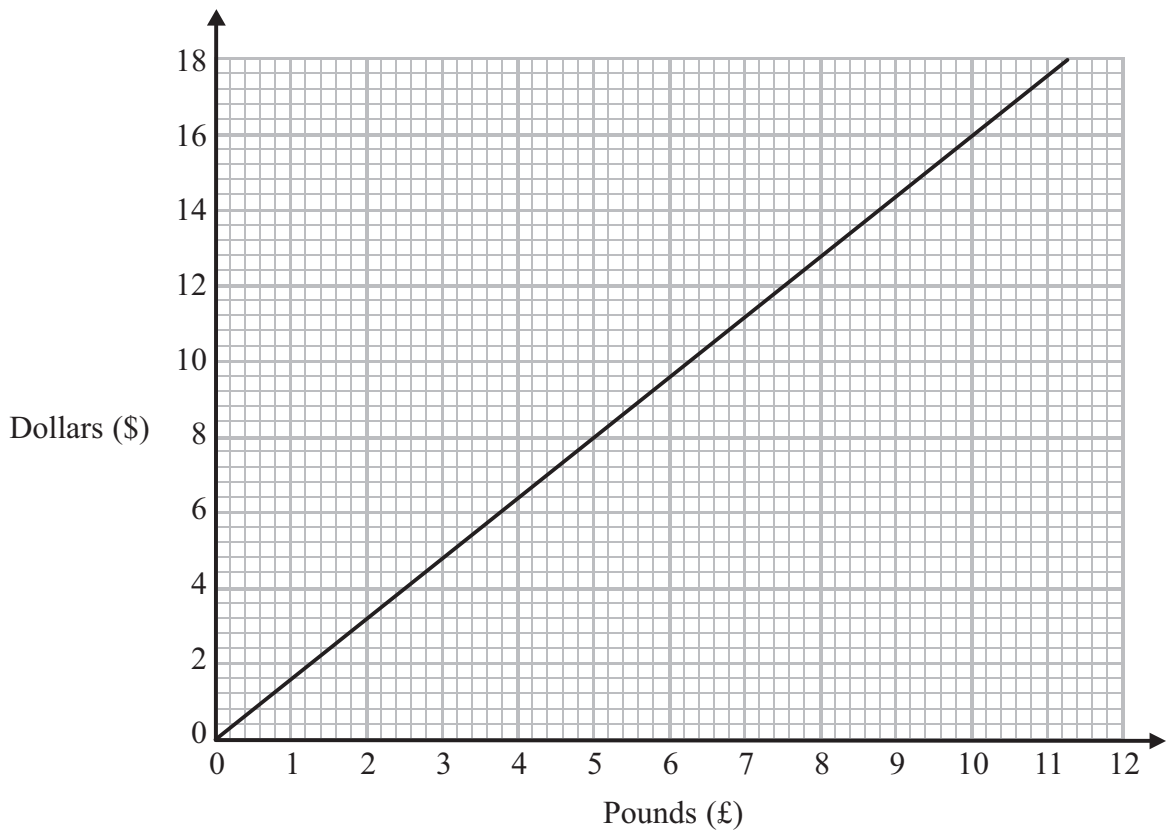
$AC = 6 \text{ cm}$
 $DF = 12 \text{ cm}$

The area of the cross section of prism **P** is 10 cm^2 .
The length of prism **P** is 15 cm.

Work out the volume of prism **Q**.

(Total for Question 179 is 4 marks)

180 You can use this conversion graph to change between pounds (£) and dollars (\$).



(a) Use the conversion graph to change £5 to dollars.

\$
(1)

Ella has \$200 and £800
Her hotel bill is \$600

Ella pays the bill with the \$200 and some of the pounds.

(b) Use the conversion graph to work out how many pounds she has left.

£
(4)

(Total for Question 180 is 5 marks)

181 Greg sells car insurance and home insurance."

The table shows the cost of these insurances.

Insurance	car insurance	home insurance
Cost	£200	£350

Each month Greg earns

£530 basic pay
5% of the cost of all the car insurance he sells
and 10% of the cost of all the home insurance he sells

In May Greg sold

6 car insurances
and 4 home insurances

Work out the total amount of money Greg earned in May.

£

(Total for Question 181 is 5 marks)

182 5 schools sent some students to a conference.

One of the schools sent both boys and girls.

This school sent 16 boys.

The ratio of the number of boys it sent to the number of girls it sent was 1 : 2

The other 4 schools sent only girls.

Each of the 5 schools sent the same number of students.

Work out the total number of students sent to the conference by these 5 schools.

.....
(Total for Question 182 is 4 marks)

183 Here is a scale drawing of a rectangular garden $ABCD$.



Scale: 1 cm represents 1 metre.

Jane wants to plant a tree in the garden
at least 5 m from point C ,
nearer to AB than to AD
and less than 3 m from DC .

On the diagram, shade the region where Jane can plant the tree.

(Total for Question 183 is 4 marks)

184 Here are the ingredients needed to make 16 gingerbread men.

Ingredients
to make **16** gingerbread men

180 g flour
40 g ginger
110 g butter
30 g sugar

Hamish wants to make 24 gingerbread men.

Work out how much of each of the ingredients he needs.

.....g flour

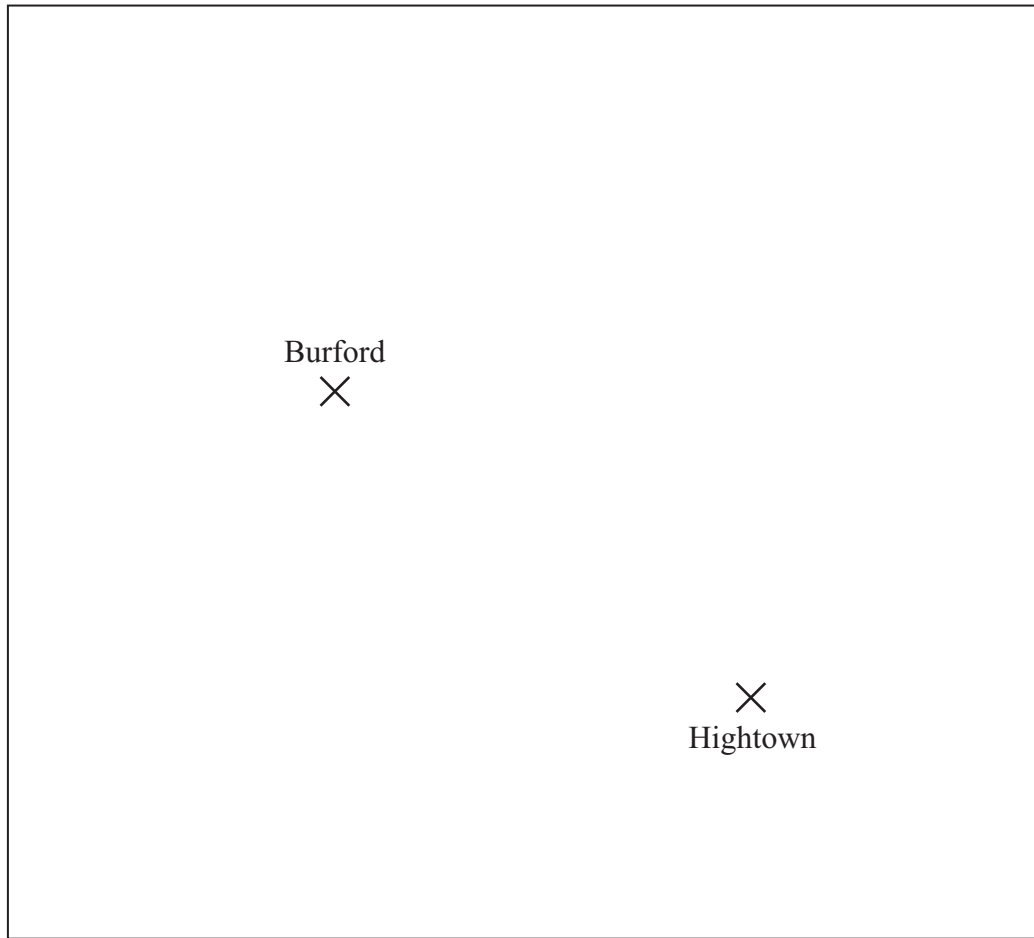
.....g ginger

.....g butter

.....g sugar

(Total for Question 184 is 3 marks)

185 Here is a map.
The map shows two towns, Burford and Hightown.



Scale: 1 cm represents 10 km

A company is going to build a warehouse.

The warehouse will be less than 30 km from Burford **and** less than 50 km from Hightown.

Shade the region on the map where the company can build the warehouse.

(Total for Question 185 is 3 marks)

***186** Talil is going to make some concrete mix.

He needs to mix cement, sand and gravel in the ratio 1 : 3 : 5 by weight.

Talil wants to make 180 kg of concrete mix.

Talil has

15 kg of cement

85 kg of sand

100 kg of gravel

Does Talil have enough cement, sand and gravel to make the concrete mix?

(Total for Question 186 is 4 marks)

187 The diagram shows two similar solids, A and B.

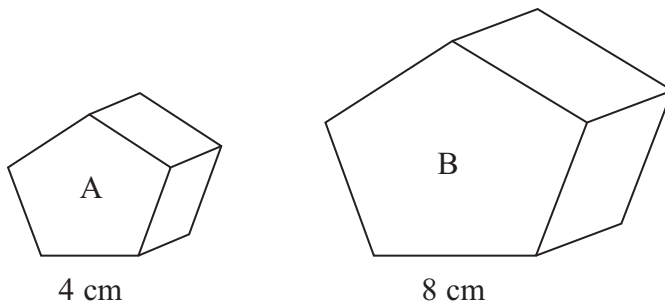


Diagram **NOT** accurately drawn

Solid A has a volume of 80 cm^3 .

(a) Work out the volume of solid B.

..... cm^3
(2)

Solid B has a total surface area of 160 cm^2 .

(b) Work out the total surface area of solid A.

..... cm^2
(2)

(Total for Question 187 is 4 marks)

188 Here are the ingredients needed to make 12 shortcakes.

Shortcakes

Makes 12 shortcakes

50 g of sugar
200 g of butter
200 g of flour
10 m/ of milk

Liz makes some shortcakes.
She uses 25 m/ of milk.

(a) How many shortcakes does Liz make?

.....
(2)

Robert has 500 g of sugar
 1000 g of butter
 1000 g of flour
 500 m/ of milk

(b) Work out the greatest number of shortcakes Robert can make.

.....
(2)

(Total for Question 188 is 4 marks)

***189** Railtickets and Cheaptrains are two websites selling train tickets.

Each of the websites adds a credit card charge and a booking fee to the ticket price.

Railtickets

Credit card charge: 2.25% of ticket price

Booking fee: 80 pence

Cheaptrains

Credit card charge: 1.5% of ticket price

Booking fee: £1.90

Nadia wants to buy a train ticket.

The ticket price is £60 on each website.

Nadia will pay by credit card.

Will it be cheaper for Nadia to buy the train ticket from Railtickets or from Cheaptrains?

(Total for Question 189 is 4 marks)

***190** Jennie's council has a target of $\frac{1}{5}$ for households to recycle their waste.

In January, Jennie recycled $\frac{1}{10}$ of her household waste.

In February, she recycled 15 kg of her 120 kg of household waste.

Her result for March was 13 % recycled out of 112 kg of household waste.

Has Jennie met the council's target?

Which was her best month for recycling?

Show clearly how you got your answers.

(Total for Question 190 is 4 marks)

191 " Last year Sasha was paid £15400 after deductions from her gross salary.
She was paid 70% of her gross salary.
This year Sasha's gross salary increased by 2%.

Work out the increase in Sasha's gross salary. Give your answer in pounds.

£

(Total for Question 191 is 4 marks)

- 192** 30% of the people at a concert are female.
1295 of the people at the concert are male.

Work out the number of people at the concert who are female.

.....
(Total for Question 192 is 3 marks)

193 Identical pairs of boots are sold in London, in Geneva and in Paris.

These boots have a price of

£115 in London

189 Swiss francs in Geneva

174 euros in Paris

The exchange rates are

£1 = 1.39 Swiss francs

£1 = 1.27 euros

Are the boots the best value for money in London or in Geneva or in Paris?

You must show how you get your answer.

.....
(Total for Question 193 is 3 marks)

194 George wants to watch all 23 games that a football team will play at home next season.

He can buy

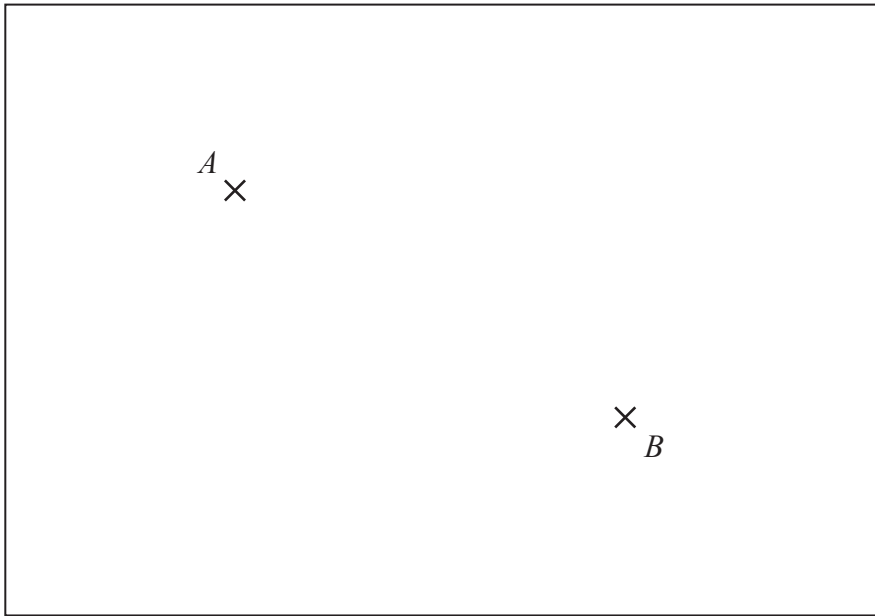
- a season ticket costing £425
- or 23 separate tickets costing £24 each ticket.

What percentage of the total cost of 23 separate tickets does George save by buying a season ticket?

.....%

(Total for Question 194 is 3 marks)

- 195 Here is a map.
The map shows two airports, A and B .



Scale: 1 cm represents 10 km

Sophie is going to have a hotel built.

The hotel
will be closer to airport A than to airport B
will be less than 40 km from airport B

On the map, shade the region where the hotel can be built.

(Total for Question 195 is 3 marks)

***196** Jack has £15 000 to invest in a savings account for 3 years.

He finds information about two savings accounts.

Simple	Compound
Simple interest	Compound interest
2.3% each year	2.15% each year

Jack wants to have as much money as possible in his savings account at the end of the 3 years.

Which of these two savings accounts should he choose?

(Total for Question 196 is 4 marks)

197 Ibrar mixes 74 g of lead and 126 g of tin to make 200 g of an alloy.

Lead has a density of 11.34 g/cm^3 .

Tin has a density of 7.31 g/cm^3 .

Work out the density of the alloy.

Give your answer correct to 1 decimal place.

..... g/cm^3

(Total for Question 197 is 3 marks)

198 T is inversely proportional to d^2

$T = 12$ when $d = 8$

Find the value of T when $d = 0.5$

.....

(Total for Question 198 is 3 marks)

199 Jon shares £700 equally between his two children, Ellie and Maddie.

Ellie gives £125 of her share of the money to Maddie.

- (a) Write down the ratio of the amount of money Ellie now has to the amount of money Maddie now has.

.....
(2)

Jenny shares £630 between her two children, Daniel and Rose, in the ratio 5 : 13

- (b) Work out how much money Jenny gives to each child.

Daniel £.....

Rose £.....

(3)

(Total for Question 199 is 5 marks)

***200** Colin is on holiday in France.
He buys a wallet.
The wallet costs 31 euros.

In London a wallet costs £23.50

The exchange rate is £1 = 1.34 euros.

Compare the cost of the wallet in France with the cost of the wallet in London.

(Total for Question 200 is 3 marks)

201 Emma has a digital photo.

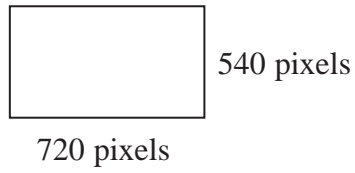


Diagram **NOT** accurately drawn

The photo has a width of 720 pixels.
The photo has a height of 540 pixels.

- (a) Write down the ratio of the width of the photo to the height of the photo.
Give your ratio in its simplest form.

.....
(2)

Emma wants the ratio of the width of the photo to the height of the photo to be 3 : 2
She reduces the number of pixels in the height of the photo.
The width of the photo is still 720 pixels.

The ratio of the width of the photo to the new height of the photo is 3 : 2

- (b) Work out the new height of the photo.

..... pixels
(2)

(Total for Question 201 is 4 marks)

202 Colin works on 5 days each week.
Each day he drives from his home to work and from work to his home.

Colin pays £3.50 each day to use the car park at work.

The distance from Colin's home to work is 18 miles.
Colin's car uses one gallon of petrol every 45.2 miles.

1 litre of petrol costs 136.9p

1 gallon = 4.546 litres

Work out the total cost for Colin to use his car for work each week.
You must show all your working.

£

(Total for Question 202 is 5 marks)

***203** This notice was in a car magazine.

Most new cars lose more than half of their value
in the first three years

Paul bought a new car.

The value of the car was £15 000

In the first year, the value of the car depreciated by 23%.

After the first year, the value of the car depreciated by 18% each year.

Work out if Paul's car lost more than half of its value by the end of three years.

(Total for Question 203 is 4 marks)

204 There are 18500 gallons of fuel in a fuel tank.

The fuel is pumped from the fuel tank into a plane at a rate of 1700 litres per minute.

1 gallon = 4.5 litres.

How many minutes will it take to empty the fuel tank completely?

Give your answer to the nearest minute.

..... minutes

(Total for Question 204 is 3 marks)

205 Celina and Zoe both sing in a band.

One evening the band plays for 80 minutes.
Celina sings for 65% of the 80 minutes.

Zoe sings for $\frac{5}{8}$ of the 80 minutes.

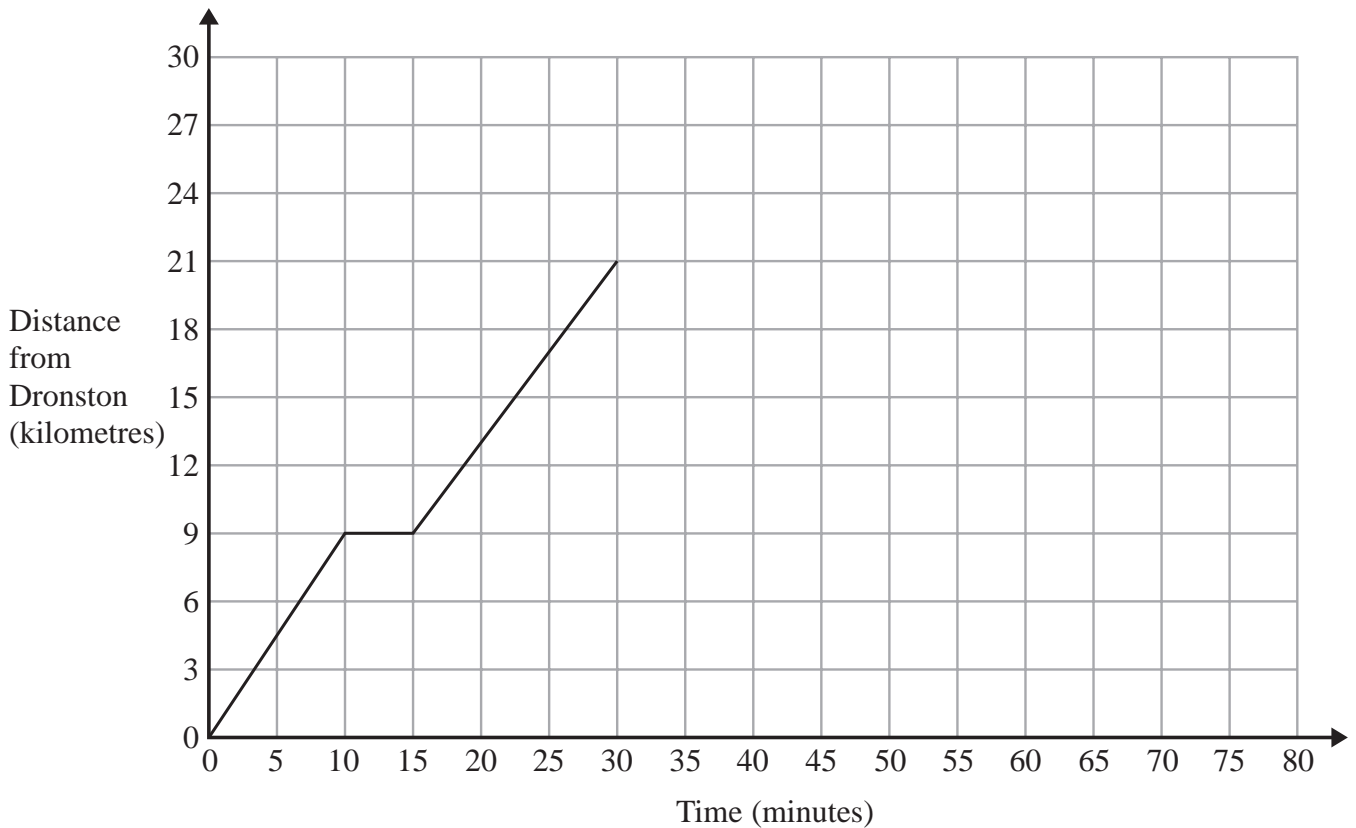
Celina sings for more minutes than Zoe sings.

Work out for how many more minutes.
You must show all your working.

..... minutes

(Total for Question 205 is 4 marks)

206 A coach travels from Dronston to Luscoe.
The travel graph for this journey is shown below.



(a) Work out the average speed of the coach, in kilometres per hour, for the first 10 minutes of the journey.

..... km/h
(2)

The coach stops in Luscoe for 15 minutes.
The coach then returns to Dronston at a constant speed of 42 km/h.

(b) Show this information on the travel graph.

(3)

(Total for Question 206 is 5 marks)

207 Each year Wenford Hospital records how long patients wait to be treated in the Accident and Emergency department.

In 2015 patients waited 11% less time than in 2014
In 2015 the average time patients waited was 68 minutes.

- (a) Work out the average time patients waited in 2014
Give your answer to the nearest minute.

..... minutes
(3)

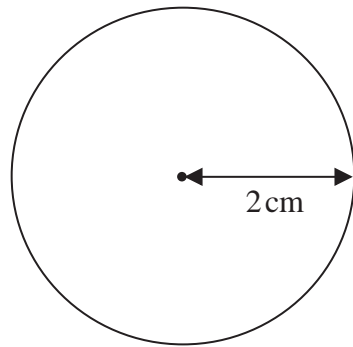
The hospital has a target to reduce the average time patients wait to be treated in the Accident and Emergency department to 60 minutes in 2016

- (b) Work out the percentage decrease from 68 minutes to 60 minutes.

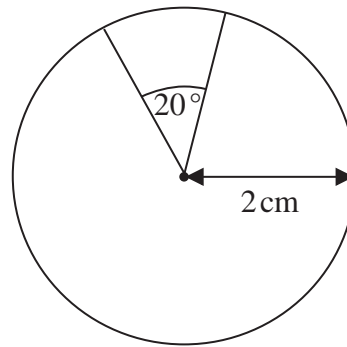
.....%
(2)

(Total for Question 207 is 5 marks)

208 Here are two watch faces, **A** and **B**.



face **A**



face **B**

Diagram **NOT**
accurately drawn

Both watch faces are circular with radius 2 cm.

The materials used to make both watch faces have the same thickness.

A is made entirely of plastic.

B has a 20° sector of metal and a 340° sector of plastic.

The ratio of the cost per cm^2 of the metal to the cost per cm^2 of the plastic is 3:2

Work out the ratio of the cost of the materials for **A** to the cost of the materials for **B**.

Give your answer in its simplest form.

You must show all your working.

.....
(Total for Question 208 is 4 marks)

209 Sandra has a piece of string 153 cm long.
She cuts the string into three lengths in the ratio 4:2:3

Work out the length, in centimetres, of each piece of string.

..... cm

..... cm

..... cm

(Total for Question 209 is 3 marks)

210 Here is a scale drawing of an office.
The scale is 1 cm to 2 metres.



A photocopier is going to be put in the office.
The photocopier has to be closer to *B* than it is to *A*.
The photocopier also has to be less than 8 metres from *C*.

Show, by shading, the region where the photocopier can be put.

(Total for Question 210 is 3 marks)

211 Liquid A has a density of 0.7 g/cm^3 .
Liquid B has a density of 1.6 g/cm^3 .

140 g of liquid A and 128 g of liquid B are mixed to make liquid C.

Work out the density of liquid C.

..... g/cm^3

(Total for Question 211 is 4 marks)

212 Fred is making two rectangular flower beds.
The dimensions of the larger rectangle will be three times the dimensions of the smaller rectangle.

There is going to be the same depth of soil in each flower bed.

Fred needs 180 kg of soil for the smaller flower bed.

Work out how much soil Fred needs for the larger flower bed.

..... kg

(Total for Question 212 is 2 marks)

213 Claire is making a loaf of bread.
A loaf of bread loses 12% of its weight when it is baked.
Claire wants the baked loaf of bread to weigh 1.1 kg.
Work out the weight of the loaf of bread before it is baked.

..... kg

(Total for Question 213 is 3 marks)

214 Here are the ingredients needed to make 10 pancakes.

Pancakes	
Ingredients to make 10 pancakes	
300 ml	of milk
120 g	of flour
2	eggs

Matthew makes 30 pancakes.

(a) Work out how much flour he uses.

.....g
(2)

Tara makes some pancakes.
She uses 750 ml of milk.

(b) Work out how many pancakes she makes.

.....
(2)

(Total for Question 214 is 4 marks)

215 Margaret is on holiday in France.

She buys an English newspaper.

The cost of the newspaper is 5 euros.

In England, the cost of the same newspaper is £2.50

The exchange rate is £1 = 1.16 euros.

Work out the difference between the cost of the newspaper in France and the cost of the newspaper in England.

.....
(Total for Question 215 is 3 marks)

***216** The table gives some information about student attendance at a school on Friday.

Year	Number of students		
	Present	Absent	Total
Year 7	192	16	208
Year 8	219	22	241
Year 9	234	28	262
Year 10	233	28	261
Year 11	214	24	238

The school has a target of 94% of students being present each day.

Did the school meet its target on Friday?

(Total for Question 216 is 3 marks)

*217 Peter has £20 000 to invest in a savings account for 2 years.

He finds information about two savings accounts.

Bonus Saver

Compound interest

4% for the first year

then

1.5% each year

Fixed Rate

Compound interest

2.5% each year

Peter wants to have as much money as possible in his savings account at the end of 2 years.

Which of these savings accounts should he choose?

(Total for Question 217 is 4 marks)

218 Here is a plan of Martin's driveway.

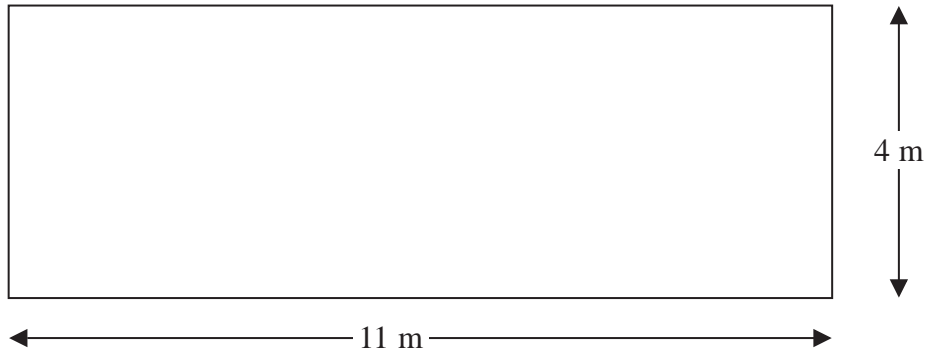


Diagram **NOT**
accurately drawn

Martin is going to cover his driveway with gravel.
The gravel will be 6 cm deep.

Gravel is sold in bags.
There are 0.4 m^3 of gravel in each bag.
Each bag of gravel costs £38

Martin gets a discount of 30% off the cost of the gravel.

Work out the total amount of money Martin pays for the gravel.

£.....

(Total for Question 218 is 5 marks)

219 Katie invests £200 in a savings account for 2 years.

The account pays compound interest at an annual rate of 3.3% for the first year
1.5% for the second year

(a) Work out the total amount of money in Katie's account at the end of 2 years.

£.....
(3)

Katie travels to work by train.

The cost of her weekly train ticket increases by 12.5% to £225

Katie's weekly pay increases by 5% to £535.50

*(b) Compare the increase in the amount of money Katie has to pay for her weekly train ticket with the increase in her weekly pay.

(3)

(Total for Question 219 is 6 marks)

220 p is inversely proportional to t .

When $t = 4$, $p = 12$

Find the value of p when $t = 6$

.....
(Total for Question 220 is 3 marks)

221 Pavel and Katie share some sweets in the ratio 3 : 8
Katie gets 32 sweets.

(a) How many sweets does Pavel get?

.....
(2)

Katie also has a tin of chocolates.
There are 80 chocolates in the tin.
45% of the chocolates have toffee in the middle.

(b) Work out the number of chocolates that have toffee in the middle.

.....
(2)

(Total for Question 221 is 4 marks)

222 Ben goes on holiday to Hong Kong.

In Hong Kong, Ben sees a camera costing HK\$3179.55

In London, an identical camera costs £285

The exchange rate is £1 = HK\$12.30

Ben buys the camera in Hong Kong.

How much cheaper is the camera in Hong Kong than in London?

.....
(Total for Question 222 is 3 marks)

223 Sasha takes a music exam.

The table shows the result that Sasha can get for different percentages in her music exam.

Percentage	Result
50% – 69%	Pass
70% – 84%	Merit
85% – 100%	Distinction

Sasha gets 62 out of 80 in her music exam.

What result does Sasha get?

You must show your working.

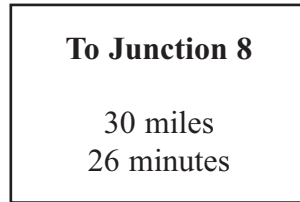
.....
(Total for Question 223 is 3 marks)

***224** Axel and Lethna are driving along a motorway.

They see a road sign.

The road sign shows the distance to Junction 8

It also shows the average time drivers will take to get to Junction 8



The speed limit on the motorway is 70 mph.

Lethna says,

‘We will have to drive faster than the speed limit to go 30 miles in 26 minutes.’

Is Lethna right?

You must show how you got your answer.

(Total for Question 224 is 3 marks)

225 In a sale normal prices are reduced by 20%.

A washing machine has a sale price of £464

By how much money is the normal price of the washing machine reduced?

£

(Total for Question 225 is 3 marks)

*226 Here is a list of ingredients for making 18 mince pies.

Ingredients for 18 mince pies

225 g of butter
350 g of flour
100 g of sugar
280 g of mincemeat
1 egg

Elaine wants to make 45 mince pies.

Elaine has

1 kg of butter
1 kg of flour
500 g of sugar
600 g of mincemeat
6 eggs

Does Elaine have enough of each ingredient to make 45 mince pies?
You must show clearly how you got your answer.

(Total for Question 226 is 4 marks)

227 Colin, Dave and Emma share some money.

Colin gets $\frac{3}{10}$ of the money.

Emma and Dave share the rest of the money in the ratio 3 : 2

What is Dave's share of the money?

.....
(Total for Question 227 is 4 marks)

***228** Viv wants to invest £2000 for 2 years in the same bank.

The International Bank

Compound Interest

4% for the first year

1% for each extra year

The Friendly Bank

Compound Interest

5% for the first year

0.5% for each extra year

At the end of 2 years, Viv wants to have as much money as possible.

Which bank should she invest her £2000 in?

(Total for Question 228 is 4 marks)

229 h is inversely proportional to the square of r .

When $r = 5$, $h = 3.4$

Find the value of h when $r = 8$

$h = \dots\dots\dots$

(Total for Question 229 is 3 marks)

***230** 225 grams of flour are needed to make 9 cakes.

Marian wants to make 20 of these cakes.
She has 475 grams of flour.

Does Marian have enough flour to make 20 cakes?
You must show all your working.

(Total for Question 230 is 3 marks)

231 Mr Watkins needs to buy some oil for his central heating.

Mr Watkins can put up to 1500 litres of oil in his oil tank.

There are already 850 litres of oil in the tank.

Mr Watkins is going to fill the tank with oil.

The price of oil is 67.2p per litre.

Mr Watkins gets 5% off the price of the oil.

How much does Mr Watkins pay for the oil he needs to buy?

£.....

(Total for Question 231 is 5 marks)

232* Peter goes for a walk.
He walks 15 miles in 6 hours.

- (a) Work out Peter's average speed.
Give your answer in miles per hour.

..... mph
(2)

5 miles = 8 km.
Sunita says that Peter walked more than 20 km.

- *(b) Is Sunita right?
You must show all your working.

(2)

(Total for Question 232 is 4 marks)

233 Derek buys a house for £150 000
He sells the house for £154 500

(a) Work out Derek's percentage profit.

..... %
(3)

Derek invests £154 500 for 2 years at 4% per year compound interest.

(b) Work out the value of the investment at the end of 2 years.

£
(3)

(Total for Question 233 is 6 marks)

***234** A company sells boxes to factories.
Fred buys boxes.
The boxes are sold in packs of 1000
Each pack costs £193.86

Fred orders 3 packs of boxes.
He gets a discount on his total order.

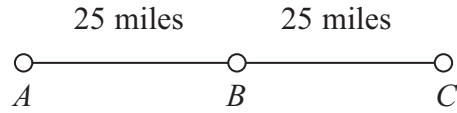
The table shows the discount he will get.

Total Order	Discount
£100 - £300	5%
£301 - £400	10%
£401 and above	15%

Work out the total cost of the order after the discount.
You must show your working.

(Total for Question 234 is 5 marks)

235



A , B and C are 3 service stations on a motorway.

$AB = 25$ miles

$BC = 25$ miles

Aysha drives along the motorway from A to C .

Aysha drives at an average speed of 50 mph from A to B .

She drives at an average speed of 60 mph from B to C .

Work out the difference in the time Aysha takes to drive from A to B and the time Aysha takes to drive from B to C .

Give your answer in minutes.

..... minutes

(Total for Question 235 is 3 marks)

***236** In the UK, petrol cost £1.24 per litre.
In the USA, petrol cost 3.15 dollars per US gallon.

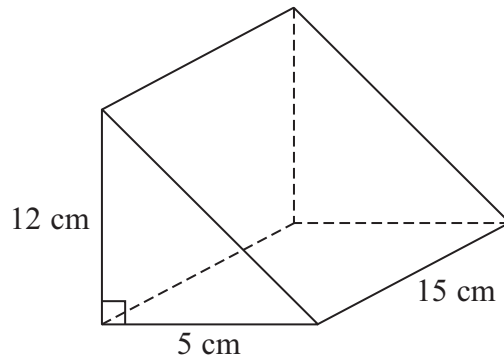
1 US gallon = 3.79 litres
£1 = 1.47 dollars

Was petrol cheaper in the UK or in the USA?

(Total for Question 236 is 4 marks)

237 The diagram shows a solid triangular prism.

Diagram **NOT** accurately drawn



The prism is made from metal.
The density of the metal is 6.6 grams per cm^3 .

Calculate the mass of the prism.

..... grams

(Total for Question 237 is 3 marks)

238 Bill's weight decreases from 64.8 kg to 59.3 kg.

Calculate the percentage decrease in Bill's weight.
Give your answer correct to 3 significant figures.

.....%

(Total for Question 238 is 3 marks)

239 Rob is learning about the planets.

Rob makes a model of the Sun.
He also makes a model of the planet Jupiter.

Rob is going to hang the two models in the school hall.

Rob wants a distance of 16 m between the two models.
The real distance between the planet Jupiter and the Sun is 8×10^8 km.

Work out the scale Rob should use.
Give your answer in the form 1 : n

.....

(Total for Question 239 is 3 marks)

*240 Mr Weaver's garden is in the shape of a rectangle.

There is a patio in the shape of a rectangle and two ponds in the shape of circles with diameter 3.8 m.

The rest of the garden is grass.

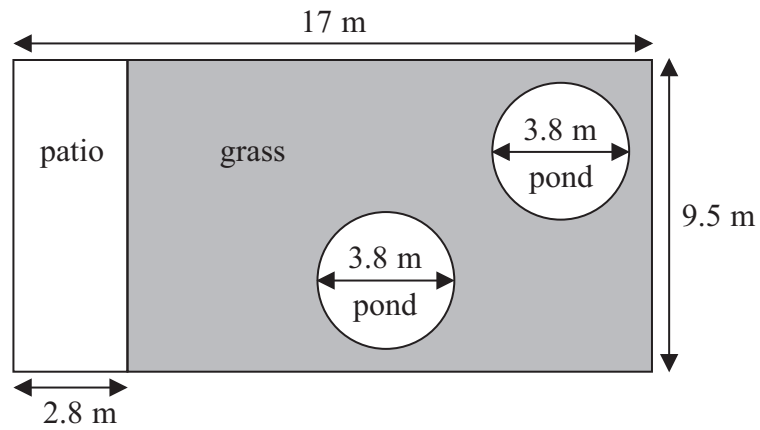


Diagram NOT accurately drawn

Mr Weaver is going to spread fertiliser over all the grass.
One box of fertiliser will cover 25 m^2 of grass.

How many boxes of fertiliser does Mr Weaver need?
You must show your working.

(Total for Question 240 is 5 marks)

***241** Potatoes cost £9 for a 12.5 kg bag at a farm shop.
The same type of potatoes cost £1.83 for a 2.5 kg bag at a supermarket.
Where are the potatoes the better value, at the farm shop or at the supermarket?
You must show your working.

(Total for Question 241 is 4 marks)

242 Linda is going on holiday to the Czech Republic.
She needs to change some money into koruna.

She can only change her money into 100 koruna notes.

Linda only wants to change up to £200 into koruna.
She wants as many 100 koruna notes as possible.

The exchange rate is £1 = 25.82 koruna.

How many 100 koruna notes should she get?

.....
(Total for Question 242 is 3 marks)

***243** Henry is thinking about having a water meter.

These are the two ways he can pay for the water he uses.

Water Meter

A charge of £28.20 per year

plus

91.22p for every cubic metre of water used

1 cubic metre = 1000 litres

No Water Meter

A charge of £107 per year

Henry uses an average of 180 litres of water each day.

Henry wants to pay as little as possible for the water he uses.

Should Henry have a water meter?

(Total for Question 243 is 5 marks)

244 Liam invests £6200 for 3 years in a savings account.
He gets 2.5% per annum compound interest.

How much money will Liam have in his savings account at the end of 3 years?

£.....

(Total for Question 244 is 3 marks)