

Write your name here

Surname

Other names

Centre Number

Candidate Number

**Edexcel GCSE**

# Applications of Mathematics

## Unit 2: Applications 2

*For Approved Pilot Centres ONLY*

**Higher Tier**

Monday 14 November 2011 – Morning

**Time: 1 hour 45 minutes**

Paper Reference

**5AM2H/01**

**You must have:** Ruler graduated in centimetres and millimetres, protractor, pair of compasses, pen, HB pencil, eraser, calculator. Tracing paper may be used.

Total Marks

### Instructions

- Use **black** ink or ball-point pen.
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions.
- Answer the questions in the spaces provided – *there may be more space than you need.*
- **Calculators may be used.**
- If your calculator does not have a  $\pi$  button, take the value of  $\pi$  to be 3.142 unless the question instructs otherwise.



### Information

- The total mark for this paper is 100
- The marks for **each** question are shown in brackets – *use this as a guide as to how much time to spend on each question.*
- Questions labelled with an **asterisk** (\*) are ones where the quality of your written communication will be assessed.

### Advice

- Read each question carefully before you start to answer it.
- Keep an eye on the time.
- Try to answer every question.
- Check your answers if you have time at the end.

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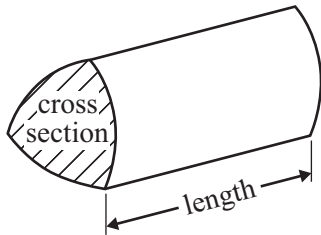
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# GCSE Mathematics 2AM01

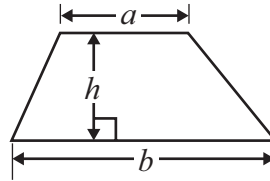
## Formulae – Higher Tier

**You must not write on this formulae page.**  
**Anything you write on this formulae page will gain NO credit.**

**Volume of prism** = area of cross section  $\times$  length

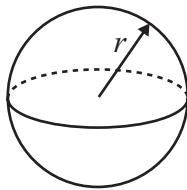


**Area of trapezium** =  $\frac{1}{2}(a + b)h$



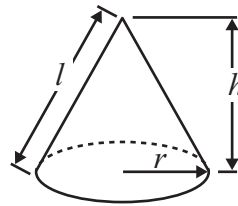
**Volume of sphere** =  $\frac{4}{3}\pi r^3$

**Surface area of sphere** =  $4\pi r^2$

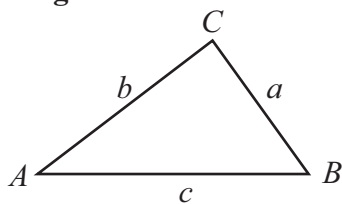


**Volume of cone** =  $\frac{1}{3}\pi r^2 h$

**Curved surface area of cone** =  $\pi r l$



**In any triangle ABC**



**The Quadratic Equation**

The solutions of  $ax^2 + bx + c = 0$

where  $a \neq 0$ , are given by

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

**Sine Rule**  $\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$

**Cosine Rule**  $a^2 = b^2 + c^2 - 2bc \cos A$

**Area of triangle** =  $\frac{1}{2}ab \sin C$



**Answer ALL questions.**

**Write your answers in the spaces provided.**

**You must write down all stages in your working.**

1  $T = \frac{kx}{a}$  is a formula used to work out the tension  $T$  in a spring.

(a) Work out the value of  $T$  when  $k=10$ ,  $x = 0.8$  and  $a = 2$

.....  
(2)

$h = ut - 4.9t^2$  is a formula used to work out the height  $h$  of a ball thrown upwards.

(b) Work out the value of  $h$  when  $u = 30$  and  $t = 5$

.....  
(2)

**(Total for Question 1 is 4 marks)**



2 A circular flower bed is in the shape of a circle, radius 4.5 metres.

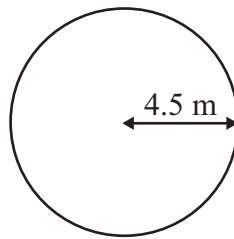


Diagram **NOT**  
accurately drawn

- (a) Work out the area of the flower bed.  
Give your answer correct to 3 significant figures.

..... m<sup>2</sup>  
(2)

The council plants 1000 flower bulbs in the flower bed.

$\frac{1}{4}$  of the bulbs are daffodil bulbs.

The other bulbs are hyacinth bulbs and tulip bulbs in the ratio 2 : 3

- (b) Work out how many of each bulb the council plants.

..... daffodil bulbs  
..... hyacinth bulbs  
..... tulip bulbs  
(4)

(Total for Question 2 is 6 marks)



- 3 Jason works in a factory.  
He is paid £9 per hour and also gets a bonus.

Jason works  $h$  hours in a week and gets a bonus of £60  
The total pay Jason gets is £ $P$ .

Write a formula for  $P$  in terms of  $h$ .

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

- 4 Ali makes a model of a boat to a scale of 1 : 50

The model is 23 cm long.

- (a) Work out the length, in metres, of the real boat.

..... m  
(2)

The real boat is 2.4 m wide.

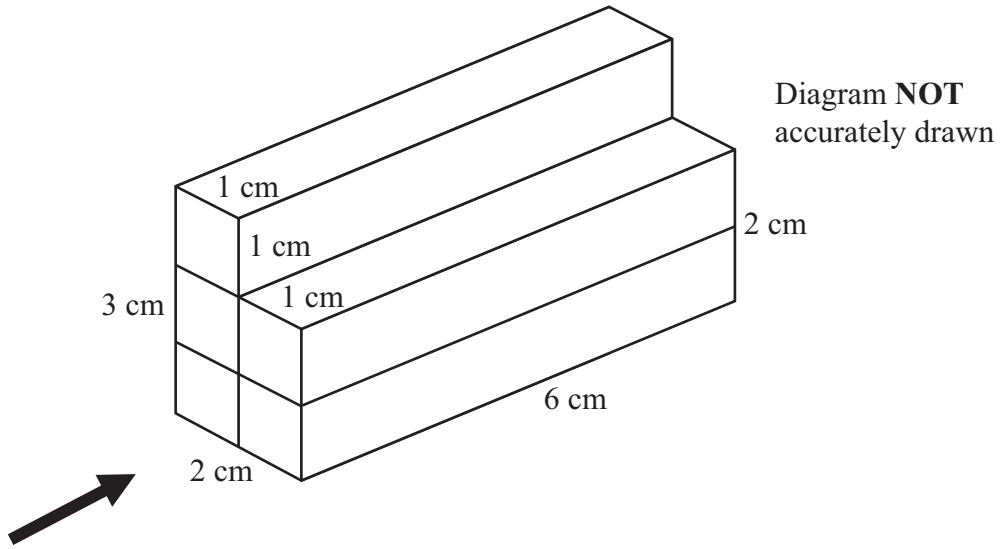
- (b) Work out the width, in centimetres, of the model boat.

..... cm  
(2)

**(Total for Question 4 is 4 marks)**



5 The diagram shows a sketch of a plastic block.



(a) Draw the side elevation of the plastic block in the direction of the arrow.


(2)

(b) Draw a plan of the plastic block.


(2)

(Total for Question 5 is 4 marks)



6 A factory makes metal bottle tops.  
When a bottle top is too big or too small it does not fit the bottle.

The probability that a bottle top is too big is 0.008

The probability that a bottle top is too small is 0.015

A bottle top is taken at random.

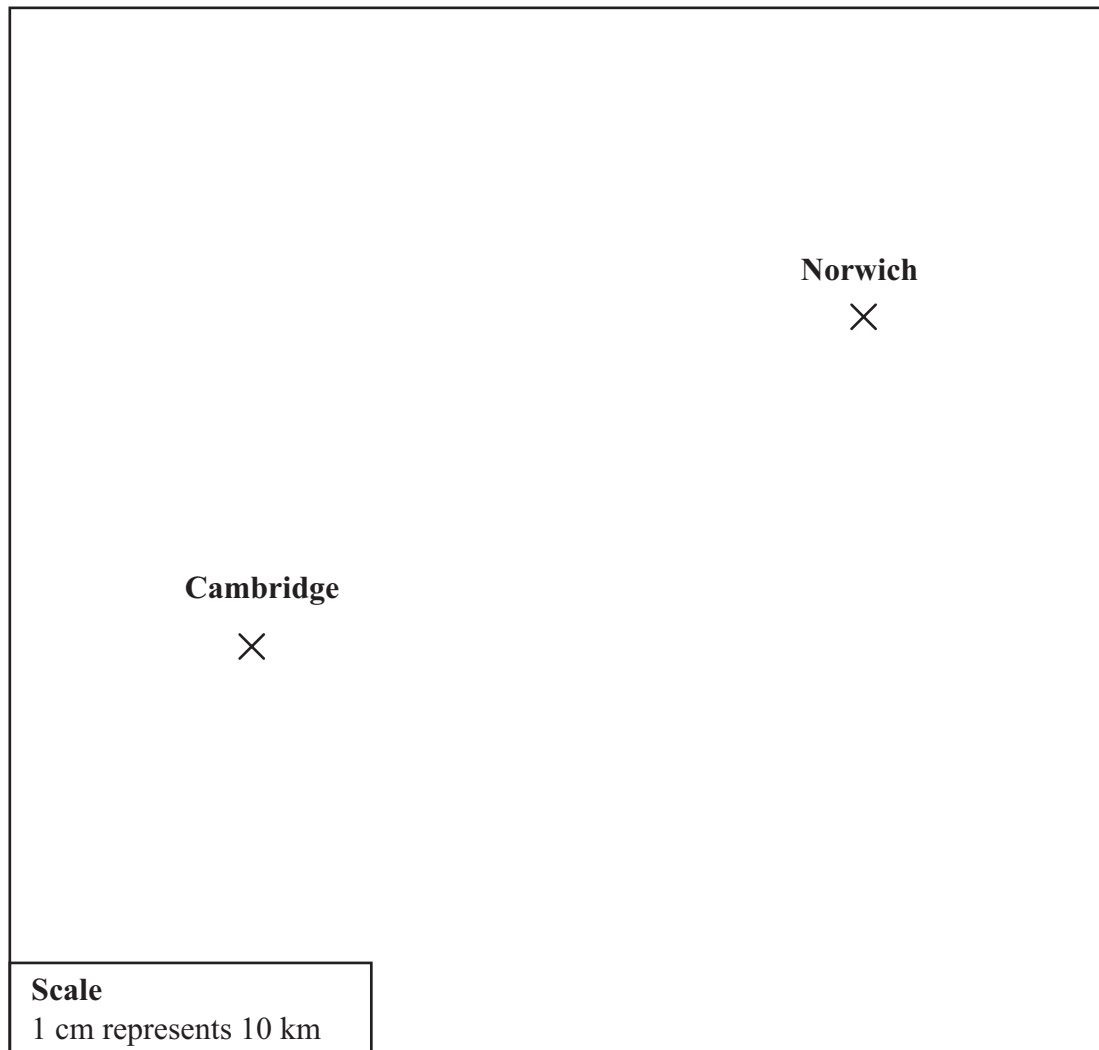
Work out the probability that the bottle top **does** fit the bottle.

.....  
(Total for Question 6 is 2 marks)

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7 The map shows 2 cities, Cambridge and Norwich.



A new hotel is going to be built.

The hotel will be nearer to Norwich than to Cambridge.  
It will be less than 60 kilometres from Cambridge.

Shade the region on the map where the hotel could be built.

**(Total for Question 7 is 3 marks)**





\*8 The diagram shows a fish tank.

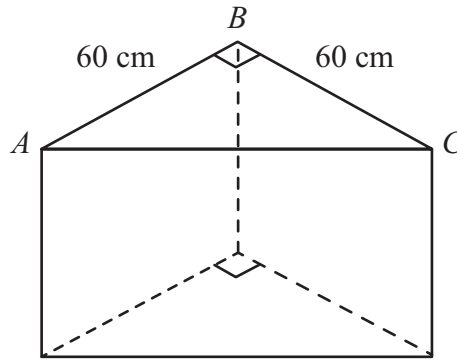


Diagram **NOT**  
accurately drawn

The fish tank is a triangular prism.

$ABC$  is a right-angled triangle.

$AB = BC = 60$  cm.

Kate fills the tank with water to a depth of 50 cm.

Once a month, Kate puts water treatment tablets into the water.

She uses one tablet for every 15 litres of water.

Kate buys a pack of 100 water treatment tablets.

Work out if she will have enough tablets to last a whole year.

You must show **all** of your working.

(Total for Question 8 is 5 marks)



9 The diagram shows the position of two trees,  $A$  and  $B$ .



A mobile phone mast,  $M$ , has a bearing of  $130^\circ$  from tree  $A$ .  
Mast  $M$  has a bearing  $240^\circ$  from tree  $B$ .

In the space above, draw an accurate diagram to show the position of mast  $M$ .  
Mark the position of mast  $M$  with a cross ( $\times$ ). Label it  $M$ .

(Total for Question 9 is 3 marks)



10 The diagram shows a shape made out of solid wood.

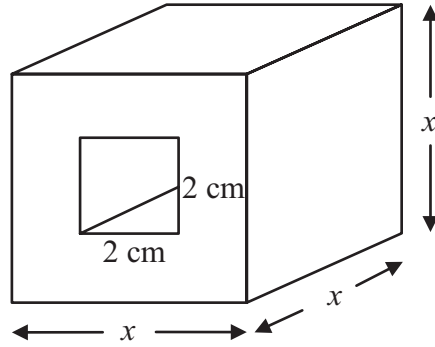


Diagram **NOT** accurately drawn

The shape is made by cutting a hole all the way through a wooden cube.

The cube has edges of length  $x$  cm.

The hole has a square cross section of side 2 cm.

The volume of the wood in the shape is  $80 \text{ cm}^3$ .

(a) Show that  $x^3 - 4x = 80$

(2)

The equation  $x^3 - 4x = 80$  has a solution between 4 and 5

(b) Use a trial and improvement method to find this solution.  
Give your answer correct to 1 decimal place.

You must show **all** your working.

$x = \dots\dots\dots$

(4)

(Total for Question 10 is 6 marks)



**11** Tom works in a bicycle repair shop.

He puts a strip of tape around the circumference of bicycle wheels.  
Each wheel he has to tape has a diameter of 70 cm.

Tom has 10 m of tape.

What is the greatest number of wheels he can tape?

.....  
**(Total for Question 11 is 4 marks)**

---



- 12 Sephina threw a biased dice 500 times.  
The scores are shown in the table.

Score	Frequency
1	105
2	85
3	120
4	48
5	80
6	62

Sephina then throws the same dice 80 times.

Estimate how many times Sephina will score an even number.

.....  
**(Total for Question 12 is 3 marks)**



**13** A publisher runs a competition for readers of a magazine.  
Each copy of the magazine has a number printed on its front cover.  
Readers can enter this number on the magazine's website to see if they have won a £15 prize.

The probability of winning a prize is  $\frac{1}{40}$

The magazine publisher estimates that only 10% of the people buying the magazine will try to win a prize.

The publisher expects 350 000 copies of the magazine to be sold.  
Estimate how much money the publisher will pay in prize money.

£.....

**(Total for Question 13 is 3 marks)**

---



14 The diagram shows part of a bicycle frame.

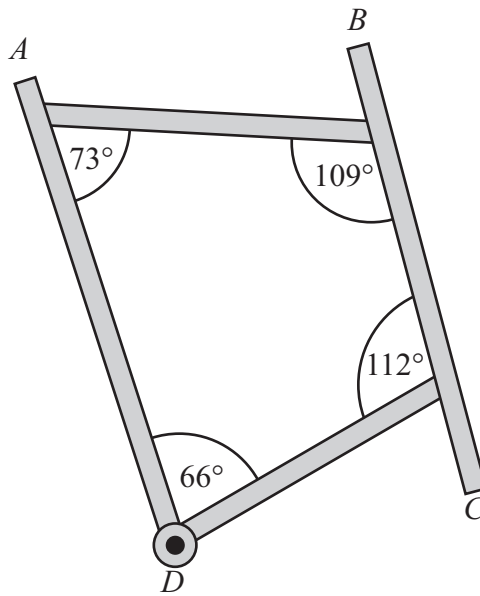


Diagram **NOT** accurately drawn

Are the lines  $AD$  and  $BC$  parallel?  
You must explain your answer.

.....

.....

.....

.....

(Total for Question 14 is 2 marks)



- 15 The diagram shows a cheese carton in the shape of a triangular prism. The front of the carton is an equilateral triangle of side 5 cm.

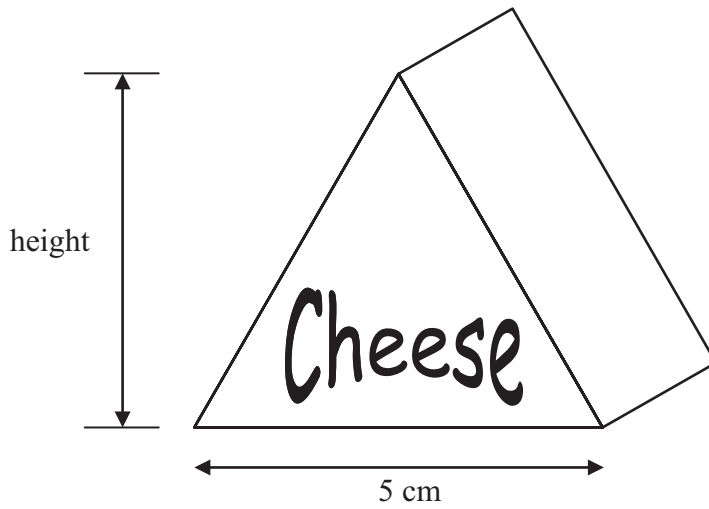


Diagram **NOT** accurately drawn

Work out the height of the carton.  
Give your answer correct to 3 significant figures.

..... cm

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





- \*16** Frank and Steven take penalties for their football team.  
The table gives information about the number of goals they scored and the number of goals they missed when taking penalties last year.

<b>Player</b>	<b>Goals scored</b>	<b>Goals missed</b>
Frank	17	8
Steven	21	9

Using this information, work out which player has the greater probability of scoring a goal when taking the next penalty.

---

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

- 17** A company sells circular mirrors.  
The price  $P$  pounds of a mirror is proportional to the square of its radius  $r$  cm.  
A mirror with radius 20 cm has a price of £36  
Find a formula for  $P$  in terms of  $r$ .

$P =$  .....

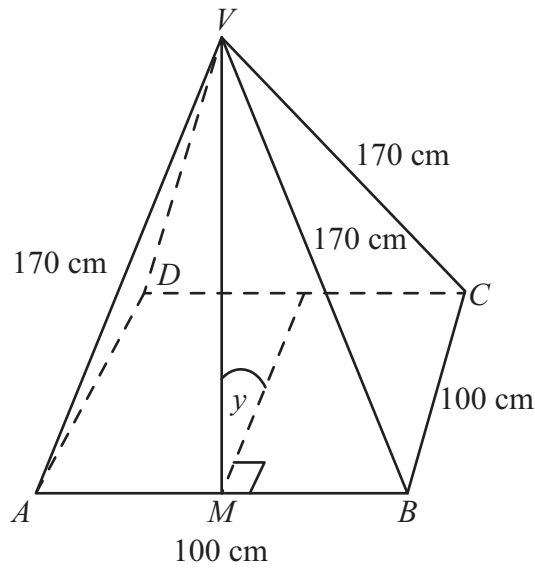
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**(Total for Question 17 is 3 marks)**



18 The diagram shows a child's tent which is in the shape of a square-based pyramid.

Diagram **NOT** accurately drawn



The base of the tent is a square  $ABCD$  with sides of length 100 cm. Each of the sloping edges of the tent has length 170 cm.

$V$  is the vertex of the pyramid.  
 $M$  is the midpoint of  $AB$ .  
 There is a straight zip along the line  $VM$ .

Work out the size of the angle marked  $y$ .  
 Write your answer to 3 significant figures.

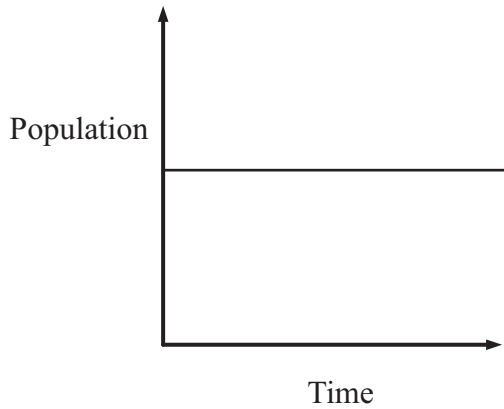
o

(Total for Question 18 is 5 marks)

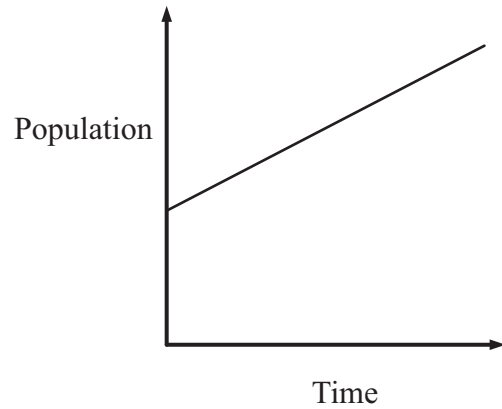


19 Each of the 4 graphs A, B, C and D shows population plotted against time.

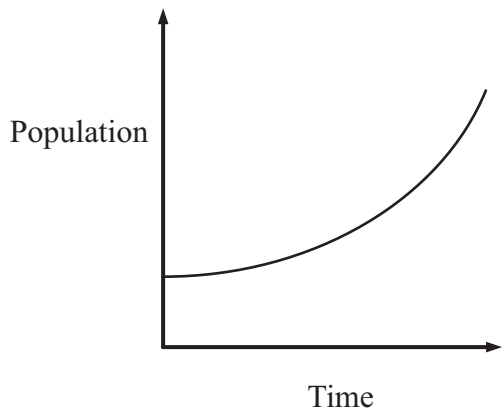
**Graph A**



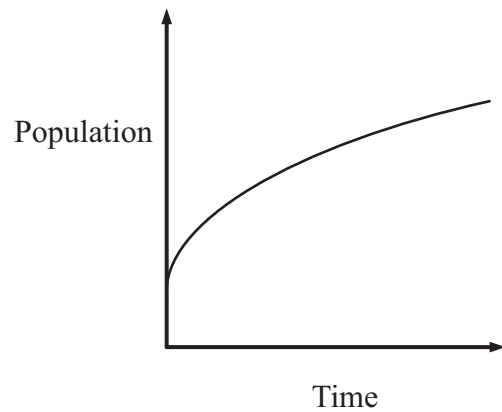
**Graph B**



**Graph C**



**Graph D**



Match the correct graph to each description of the rate of population growth.

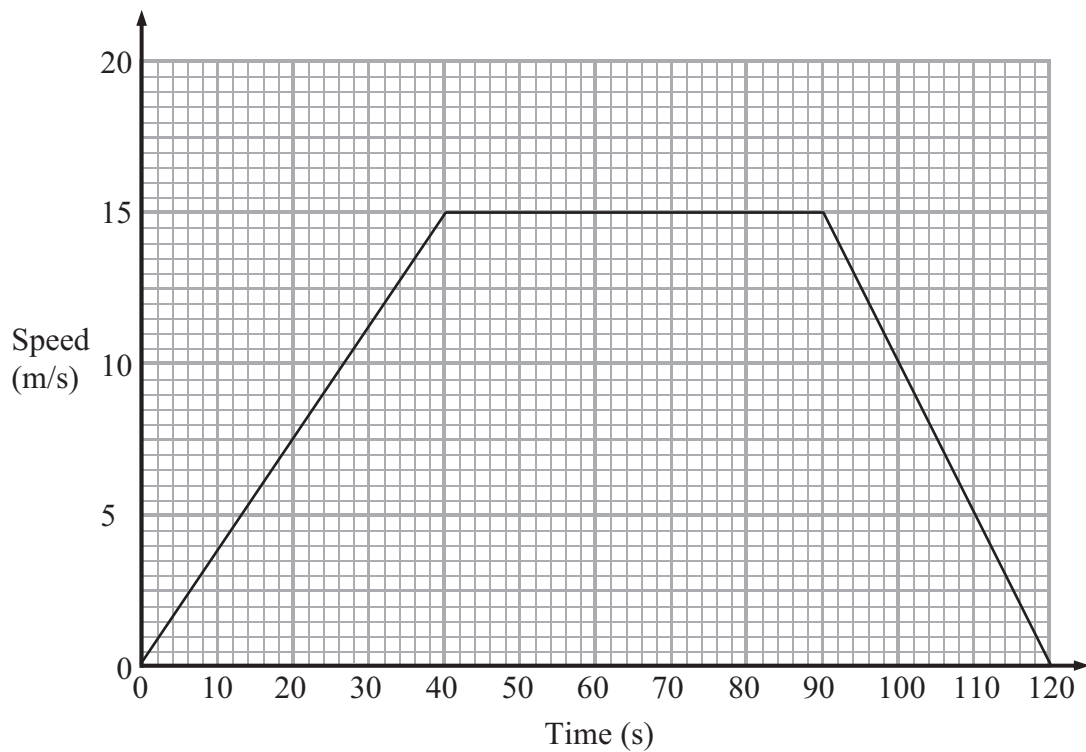
Rate of population growth	Graph
Zero	.....
Increasing	.....
Decreasing	.....
Constant	.....

(Total for Question 19 is 2 marks)



20 A car travels along a straight road between 2 sets of traffic lights.

Here is the speed time graph for this journey.



(a) Work out the acceleration of the car during the first 40 seconds.

..... m/s<sup>2</sup>  
(2)

(b) Describe what happens to the speed of the car between the times of 40 s and 120 s.

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

(c) Find the total distance, in metres, that the car travels between the two sets of traffic lights.

..... m  
(2)



(d) Work out the average speed of the car in kilometres per hour between the two sets of traffic lights.

..... km/h

(3)

**(Total for Question 20 is 9 marks)**

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21 The table shows information about the carbohydrate content of Choco Crunch biscuits.

	per 100 g	per biscuit
Carbohydrate	62.1 g	10.8 g

Choco Crunch biscuits are sold in 400 g packs.

(a) Work out how many biscuits there are in a pack.

.....  
(2)

Snack size Choco Crunch biscuits are made with the same recipe.

Snack size biscuits are sold in 120 g packs.

There are 18 biscuits in each pack.

(b) Complete the table for snack size biscuits.

	per 100 g	per snack size biscuit
Carbohydrate	62.1 g	..... g

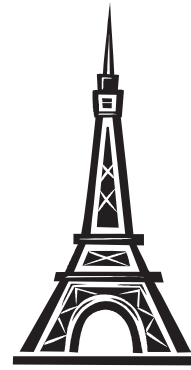
(3)

**(Total for Question 21 is 5 marks)**



**22** Two metal models of the Eiffel Tower are mathematically similar.

Model A has a height of 12 cm.  
Model B has a height of 18 cm.



Model A and model B are made of the same metal.  
Model A has a weight of 80g.

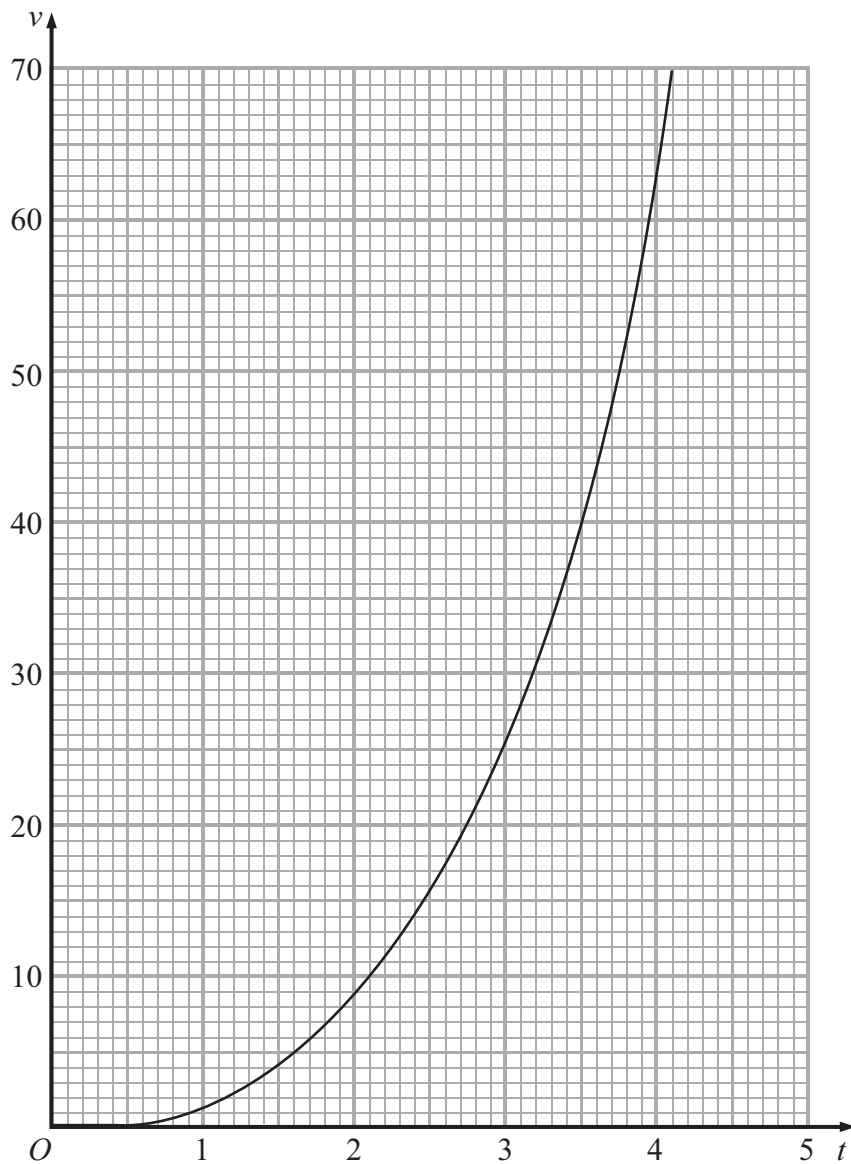
Work out the weight of model B.

..... g

**(Total for Question 22 is 3 marks)**



23 The graph shows the velocity,  $v$  metres per second, of a rocket at time  $t$  seconds.



Find an estimate for the rate of change of the velocity of the rocket at  $t = 2$

..... m/s<sup>2</sup>

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





24 Hayley ran a distance of 400 m in a time of 52.64 seconds.

The distance of 400 m was measured to the nearest metre.

The time of 52.64 seconds was measured to the nearest one hundredth of a second.

(a) (i) Write down the upper bound for the distance 400 m.

..... m

(ii) Write down the lower bound for the time 52.64 seconds.

..... s

(iii) Work out the upper bound for Hayley's average speed.

..... m/s

(4)

(b) Work out the lower bound for Hayley's average speed.

..... m/s

(2)

(c) Write down an appropriate estimate for Hayley's average speed.

..... m/s

(1)

(Total for Question 24 is 7 marks)



**25** A new shopping centre is opened and 500 new jobs are created.  
After 2 years, the number of jobs has increased to 700

Assuming that the number of jobs in the shopping centre increases exponentially, work out how many jobs there will be 5 years after the shopping centre first opened.

.....  
**(Total for Question 25 is 5 marks)**

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**TOTAL FOR PAPER IS 100 MARKS**



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