

Please check the examination details below before entering your candidate information

Candidate surname

Other names

Centre Number

Candidate Number

**Pearson Edexcel**  
**Level 1/Level 2 GCSE (9–1)**

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**Monday 8 June 2020**

Morning (Time: 1 hour 30 minutes)

Paper Reference **1MA1/3H**

**Mathematics**

**Paper 3 (Calculator)**  
**Higher Tier**

**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.*
- You must **show all your working.**
- Diagrams are **NOT** accurately drawn, unless otherwise indicated.
- **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 80
- The marks for **each** question are shown in brackets – *use this as a guide as to how much time to spend on each question.*

## 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.

Turn over ►

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**.CG Maths.**

Hints



Pearson

Please note that these worked solutions have neither been provided nor approved by Pearson Education and may not necessarily constitute the only possible solutions. Please refer to the original mark schemes for full guidance.

Any writing in blue indicates what must be written in order to answer the questions and get the marks. The worked solutions have been designed to show the smallest amount of work which needs to be done to answer the question.

Anything written in green in a cloud doesn't have to be written in the exam.

Anything written in orange in a rectangle doesn't have to be written in the exam and is there to show what should be put into a calculator or measured using a ruler or protractor.

If you find any mistakes or have any requests or suggestions, please send an email to [curtis@cgmaths.co.uk](mailto:curtis@cgmaths.co.uk)

Answer ALL questions.

Write your answers in the spaces provided.

You must write down all the stages in your working.

1 (a) Simplify  $n^3 \times n^5$

$$a^x \times a^y = a^{x+y}$$

.....  
(1)

(b) Simplify  $\frac{c^3d^4}{c^2d}$

$$a^x/a^y = a^{x-y}$$

d is basically  $d^1$

.....  
(2)

(c) Solve  $\frac{5x}{2} > 7$

This inequality solves in a similar way to an equation. Do the opposite operation to both sides of the inequality until x is on its own

.....  
(2)

(Total for Question 1 is 5 marks)

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2 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.

$s$   $d$   $t$

This is a distance, speed, time problem so we can start with writing the formula triangle

Use the formula triangle to work out the formula for time. Adding the two times gives the total time

**FACT B** Convert the total time from hours to hours and minutes by pressing the button on the left

..... hours ..... minutes

(Total for Question 2 is 3 marks)

3 A number,  $m$ , is rounded to 1 decimal place.  
The result is 9.4

Complete the error interval for  $m$ .

Add and subtract half of the resolution to get the upper and lower bounds. The resolution is 0.1 as it is to 1 decimal place

Lower bound .....  $\leq m <$  ..... Upper bound

(Total for Question 3 is 2 marks)

- 4 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.

Area of rectangle = length  $\times$  width. Work out the area of the lawn she wants and the area of the lawn made by 3kg of grass seed. Work out how many lots of the area of the lawn made by 3kg of grass seed goes into the area of the lawn she wants. This many lots of 3kg are needed to make the lawn she wants. Work out the mass of the grass seed needed. Work out how many boxes this would need. Compare this to the 5 boxes she has to decide if she has enough

(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?

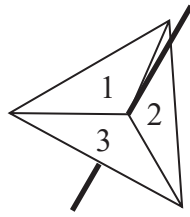
Give a reason for your answer.

1kg is half of 2kg so is worth half of one of the original boxes the calculation to the previous question was based on

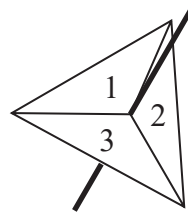
(1)

(Total for Question 4 is 5 marks)

5 Amanda has two fair 3-sided spinners.



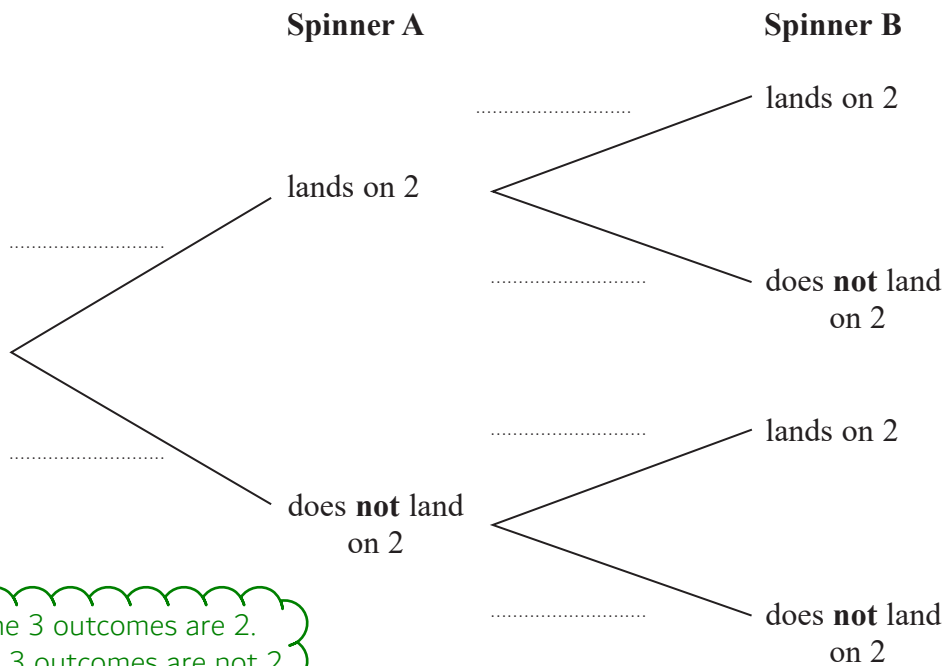
Spinner A



Spinner B

Amanda spins each spinner once.

(a) Complete the probability tree diagram.



1 out of the 3 outcomes are 2.  
2 out of the 3 outcomes are not 2

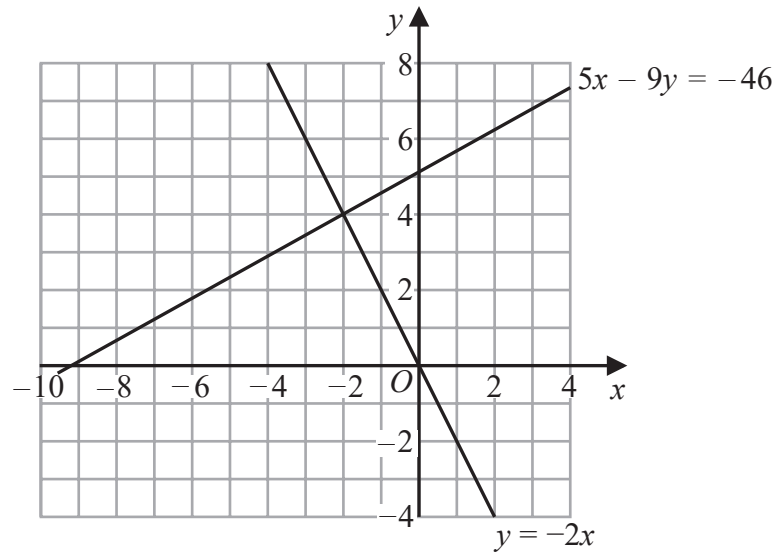
(2)

(b) Work out the probability that Spinner A lands on 2 and Spinner B does **not** land on 2

AND means to multiply the probabilities

(2)

(Total for Question 5 is 4 marks)



(a) Use these graphs to solve the simultaneous equations

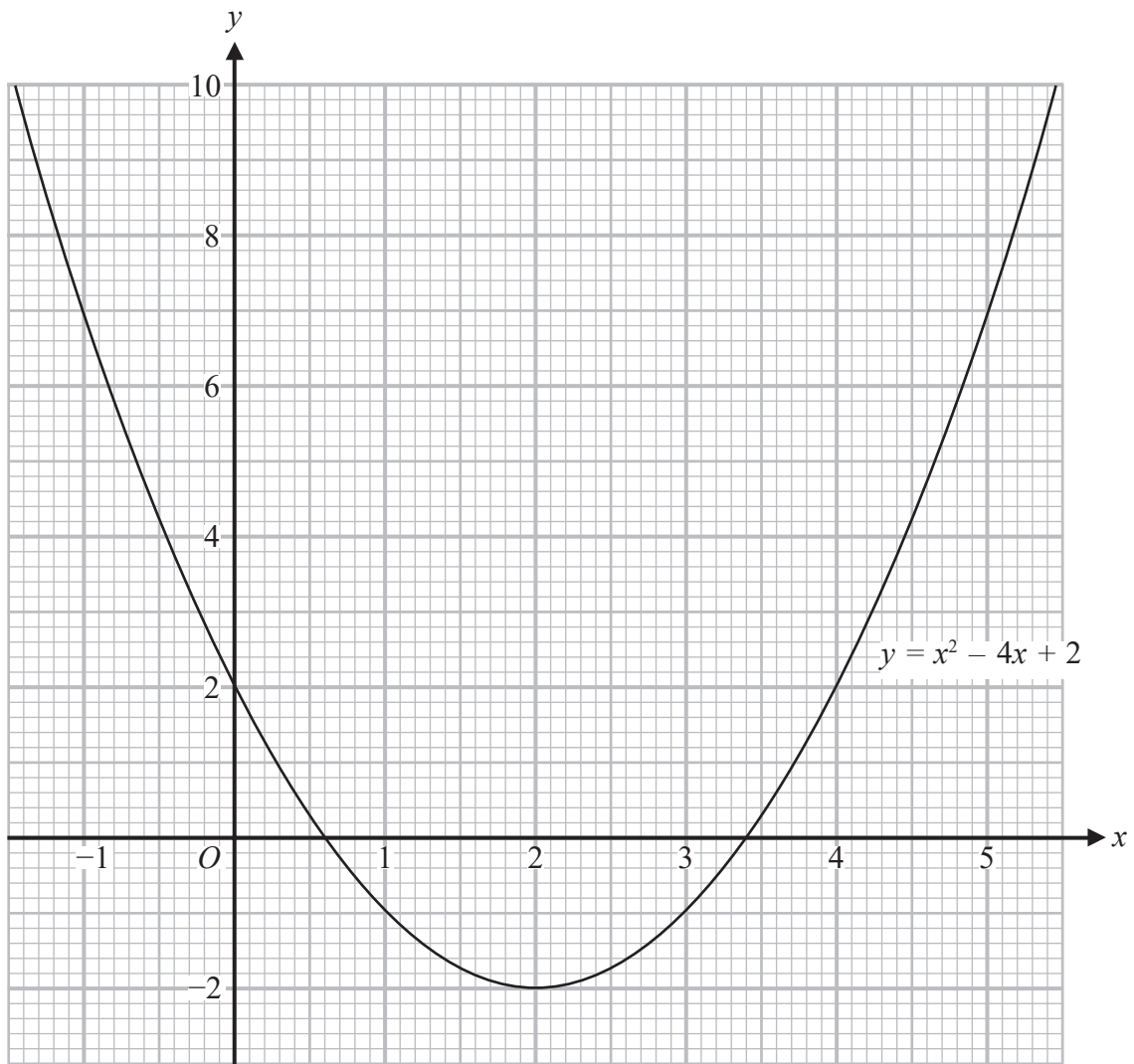
$$\begin{aligned} 5x - 9y &= -46 \\ y &= -2x \end{aligned}$$

The solutions are where the graphs cross as the  $x$  and  $y$  coordinates satisfy both equations at the same time at that point

$$x = \dots\dots\dots$$

$$y = \dots\dots\dots$$

(1)



(b) Use this graph to find estimates for the solutions of the quadratic equation  $x^2 - 4x + 2 = 0$

It is basically asking what x is when y = 0

(2)

(Total for Question 6 is 3 marks)

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7 There is a total of 45 boys and girls in a choir.

The mean age of the 18 boys is 16.2 years.

The mean age of the 27 girls is 16.7 years.

Calculate the mean age of all 45 boys and girls.

$m$   $t$   
 $n$

Mean = total/number. Writing this as a formula triangle

The total can be worked out by adding the total age of all the boys and all the girls. The number is the number of boys and girls

..... years

(Total for Question 7 is 3 marks)

- 8 There are some counters in a bag.  
The counters are blue or green or red or yellow.

The table shows the probabilities that a counter taken at random from the bag will be blue or will be green.

<b>Colour</b>	blue	green	red	yellow
<b>Probability</b>	0.32	0.20		

The probability that a counter taken at random from the bag will be red is five times the probability that the counter will be yellow.

There are 300 counters in the bag.

Work out the number of yellow counters in the bag.

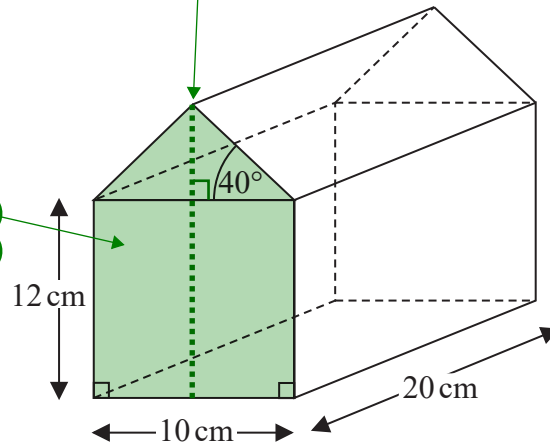
Multiplying the probability of an outcome by the number of events gives the number of times that outcome will happen. Let  $x$  be the probability it will be yellow. Express the probability of it being red. Adding together these two probabilities gives the probability of it being red or yellow. It is certain to get one of the colours so all of the probabilities must add to 1. Make an equation using these facts and the probabilities from the table to create an equation in terms of  $x$  which can be solved

.....  
(Total for Question 8 is 3 marks)

9 The diagram shows a prism.

This must be the line of symmetry so drawing on the height of the triangle would create a right angled triangle

The highlighted area is the cross section of the prism



The cross section of the prism has exactly one line of symmetry.

Work out the volume of the prism.

Give your answer correct to 3 significant figures.

S O H C A H T O

Right angled trigonometry can be used to work out the height of the triangle. Writing SOH CAH TOA as formula triangles.

Tick what we have and what we are trying to find. Two ticks on the formula triangle means that it can be used. To use the formula triangle, cover over what we are trying to find and it will tell us what to do. S: sin of the angle. C: cos of the angle.

T: tan of the angle. O: opposite. H: hypotenuse. A: adjacent

Volume of prism = cross sectional area x length

Area of rectangle = length x width

Area of triangle =  $\frac{1}{2}$  x base x height

..... cm<sup>3</sup>

(Total for Question 9 is 5 marks)

10 A person's heart beats approximately  $10^5$  times each day.  
A person lives for approximately 81 years.

- (a) Work out an estimate for the number of times a person's heart beats in their lifetime.  
Give your answer in standard form correct to 2 significant figures.

Multiplying the  $10^5$  by the number of days in a year works out approximately how many times a person's heart beats in a year. Multiplying this by 81 works out approximately how many times a person's heart beats in 81 years

In this case, pressing ENG converts it into standard form

.....  
(2)

$2 \times 10^{12}$  red blood cells have a total mass of 90 grams.

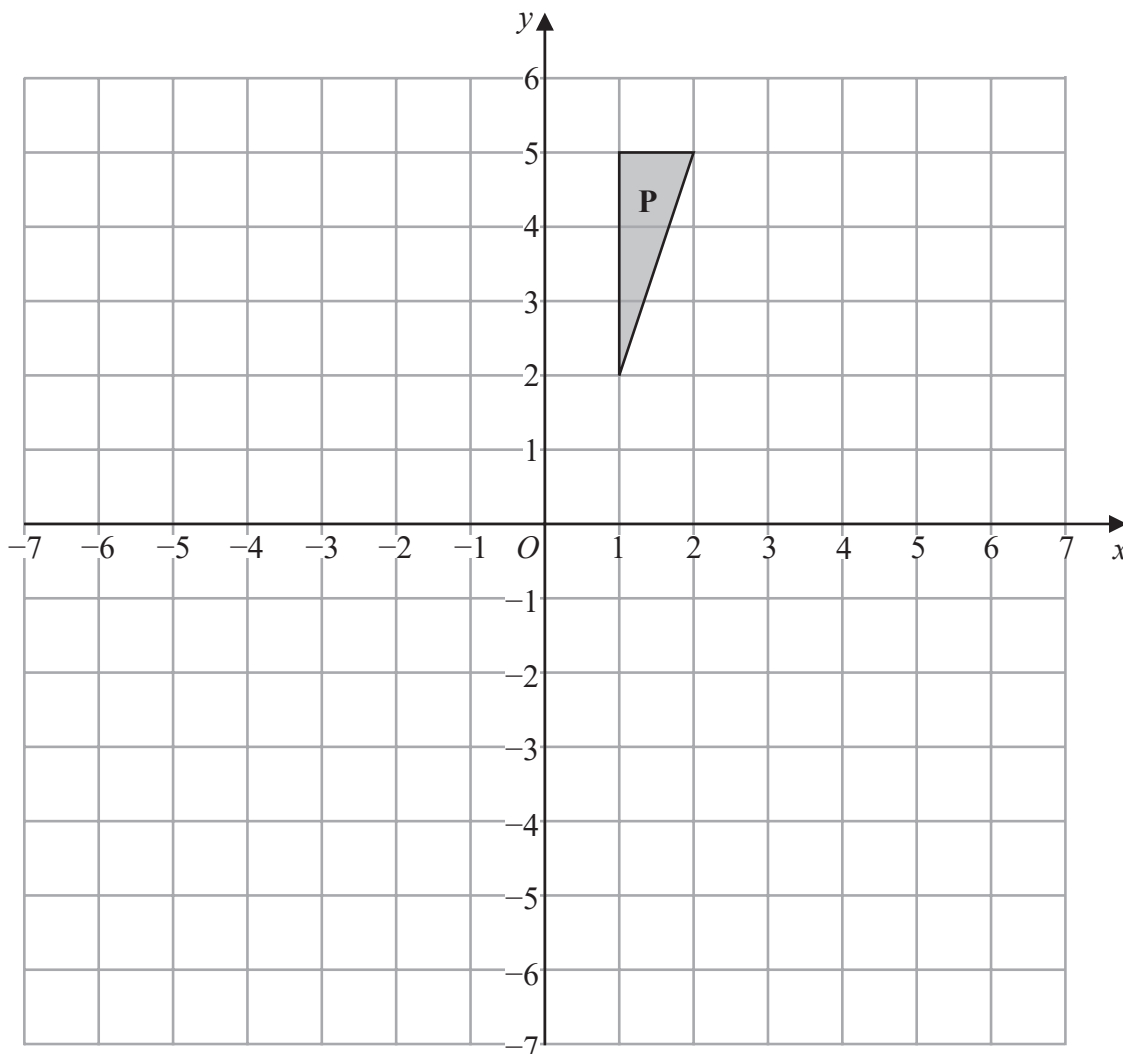
- (b) Work out the average mass of 1 red blood cell.  
Give your answer in standard form.

Mean = total/number

..... grams  
(2)

(Total for Question 10 is 4 marks)

11 The diagram shows a triangle **P** on a grid.



Triangle **P** is rotated  $180^\circ$  about  $(0, 0)$  to give triangle **Q**.

Triangle **Q** is translated by  $\begin{pmatrix} 5 \\ -2 \end{pmatrix}$  to give triangle **R**.

(a) Describe fully the single transformation that maps triangle **P** onto triangle **R**.

Rotation...

Use tracing paper to sketch around **P** then rotate the paper  $180^\circ$  about  $(0, 0)$  to give **Q**

Translating **Q** by 5 in the x direction and -2 in the y direction to give **R**. This means 5 to the right and 2 down

(3)

Under the transformation that maps triangle **P** onto triangle **R**, the point **A** is invariant.

(b) Write down the coordinates of point **A**.

The point which the shapes rotate about does not move

(....., .....)

(1)

(Total for Question 11 is 4 marks)

- 12 (a) Express  $\frac{x}{x+2} + \frac{2x}{x-4}$  as a single fraction in its simplest form.

To add fractions the denominators need to be the same. A common denominator can be found by multiplying the two denominators. The numerators need to be multiplied by the same as their denominator to keep the fractions equivalent. Once the denominators are the same the numerators can be added together and put over the same denominator. Expand any brackets on the numerators. Collect like terms on the numerator. Expanding any brackets on the denominator will not make it simpler so it can be left in factorised form, in brackets

.....  
(3)

- (b) Expand and simplify  $(x-3)(2x+3)(4x+5)$

Expand out the first two brackets. Simplify the expansion by collecting like terms then write it multiplied by the third bracket. Expand out these two brackets. Then simplify again by collecting the like terms

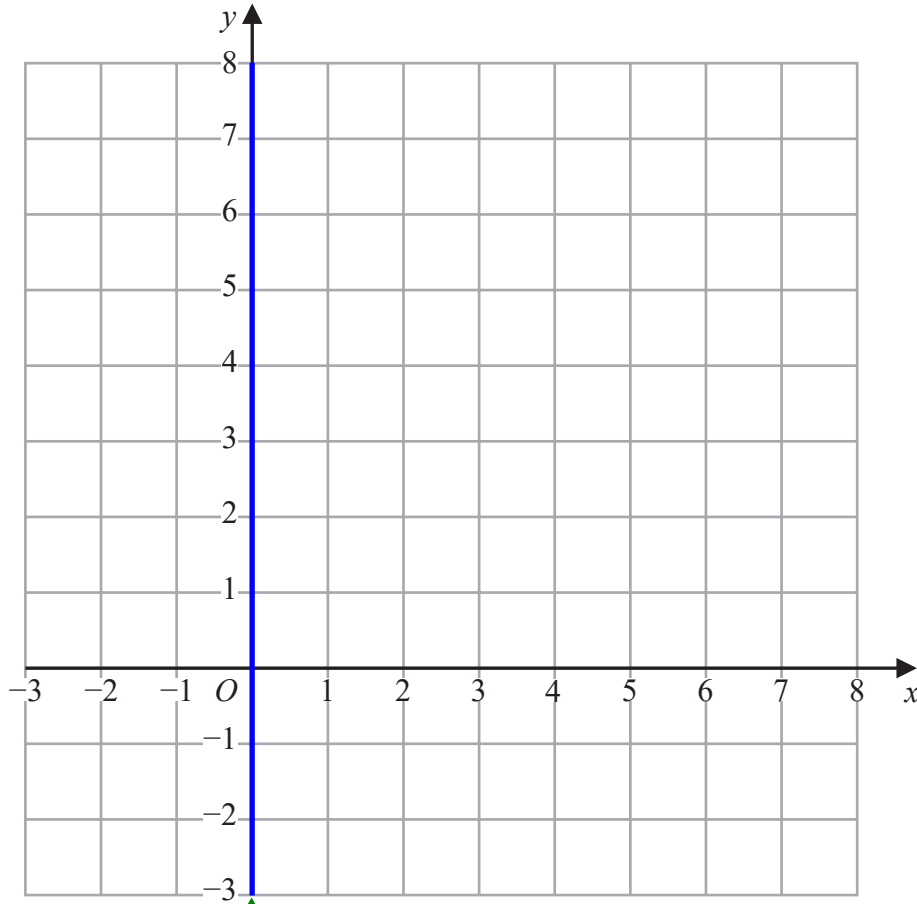
.....  
(3)

(Total for Question 12 is 6 marks)

13 (a) On the grid show, by shading, the region that satisfies all these inequalities.

$$x \geq 0 \quad x \leq 2 \quad y \leq x + 3 \quad 2x + 3y \geq 6$$

Label the region **R**.



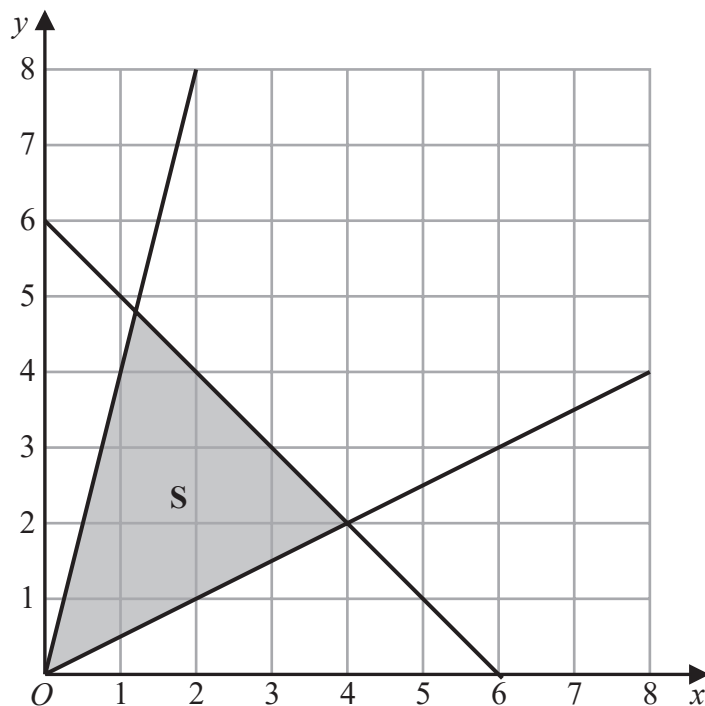
(4)

Drawing the line of  $x = 0$ . As  $x$  is greater, the region must be on the right of the line so crossing out all of the space on the left of the line

All of the lines are solid lines, not dashed, because they can also be equal. The region not crossed out must be the region

(b) The diagram below shows the region S that satisfies the inequalities

$$y \leq 4x \quad y \geq \frac{1}{2}x \quad x + y \leq 6$$



Geoffrey says that the point with coordinates (2, 4) does not satisfy all the inequalities because it does not lie in the shaded region.

Is Geoffrey correct?

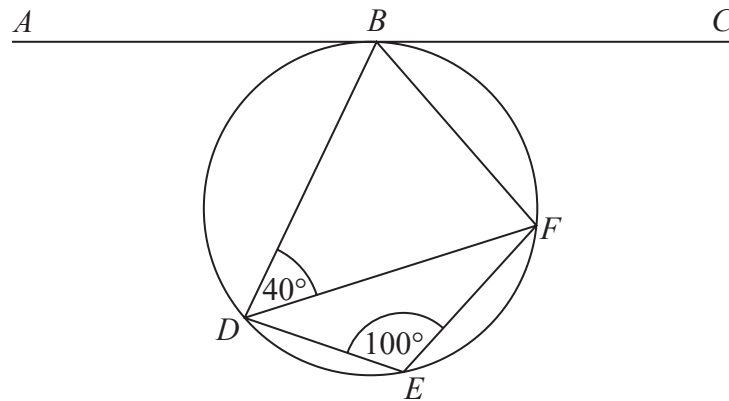
You must give a reason for your answer.

Values on solid lines are included in the region which satisfies the inequalities. The lines would have to be dashed to not include the values on the lines

(1)

(Total for Question 13 is 5 marks)





Points  $B$ ,  $D$ ,  $E$  and  $F$  lie on a circle.  
 $ABC$  is the tangent to the circle at  $B$ .

Find the size of angle  $ABD$ .

You must give a reason for each stage of your working.

The angle can be found using the following reasons: opposite angles in a cyclic quadrilateral add to 180, angles in a triangle add to 180, the alternate segment theorem

(Total for Question 14 is 4 marks)

15 Prove algebraically that  $0.7\dot{3}$  can be written as  $\frac{11}{15}$

Let  $x$  equal to the recurring decimal. There is one recurring digit so multiplying it by 10 once can line up the recurring digit in the same decimal place. Subtracting  $x$  from  $10x$  leaves  $9x$ . The decimals are also subtracted and this eliminates the recurring digit. Rearrange to express  $x$  as a fraction

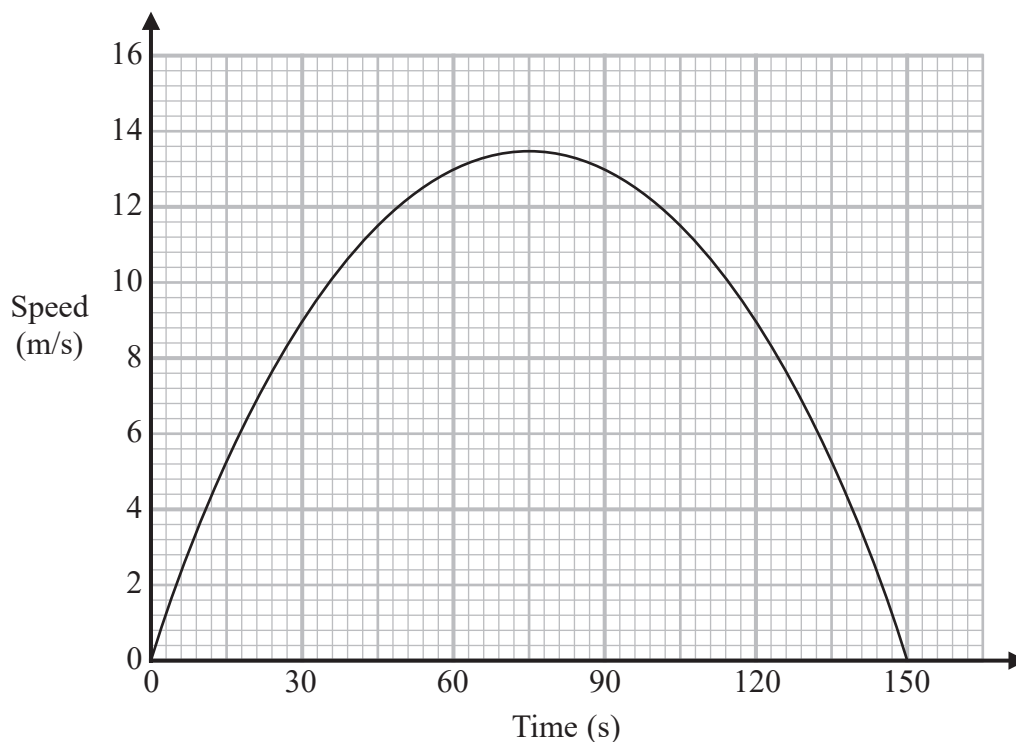
(Total for Question 15 is 2 marks)

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16 Here is a speed-time graph for a car.



- (a) Work out an estimate for the distance the car travelled in the first 30 seconds.

The area underneath the line on a speed-time graph is the distance travelled. Draw a shape underneath the curve which is about the same and which we can work out the area for

..... m

(2)

- (b) Is your answer to part (a) an underestimate or an overestimate of the actual distance the car travelled in the first 30 seconds?

Give a reason for your answer.

Not all of the area was included in the estimate for the previous part

(1)

Julian used the graph to answer this question.

Work out an estimate for the acceleration of the car at time 60 seconds.

Here is Julian's working.

$$\begin{aligned}\text{acceleration} &= \text{speed} \div \text{time} \\ &= 13 \div 60 \\ &= 0.21\dot{6} \text{ m/s}^2\end{aligned}$$

Julian's method does not give a good estimate of the acceleration at time 60 seconds.

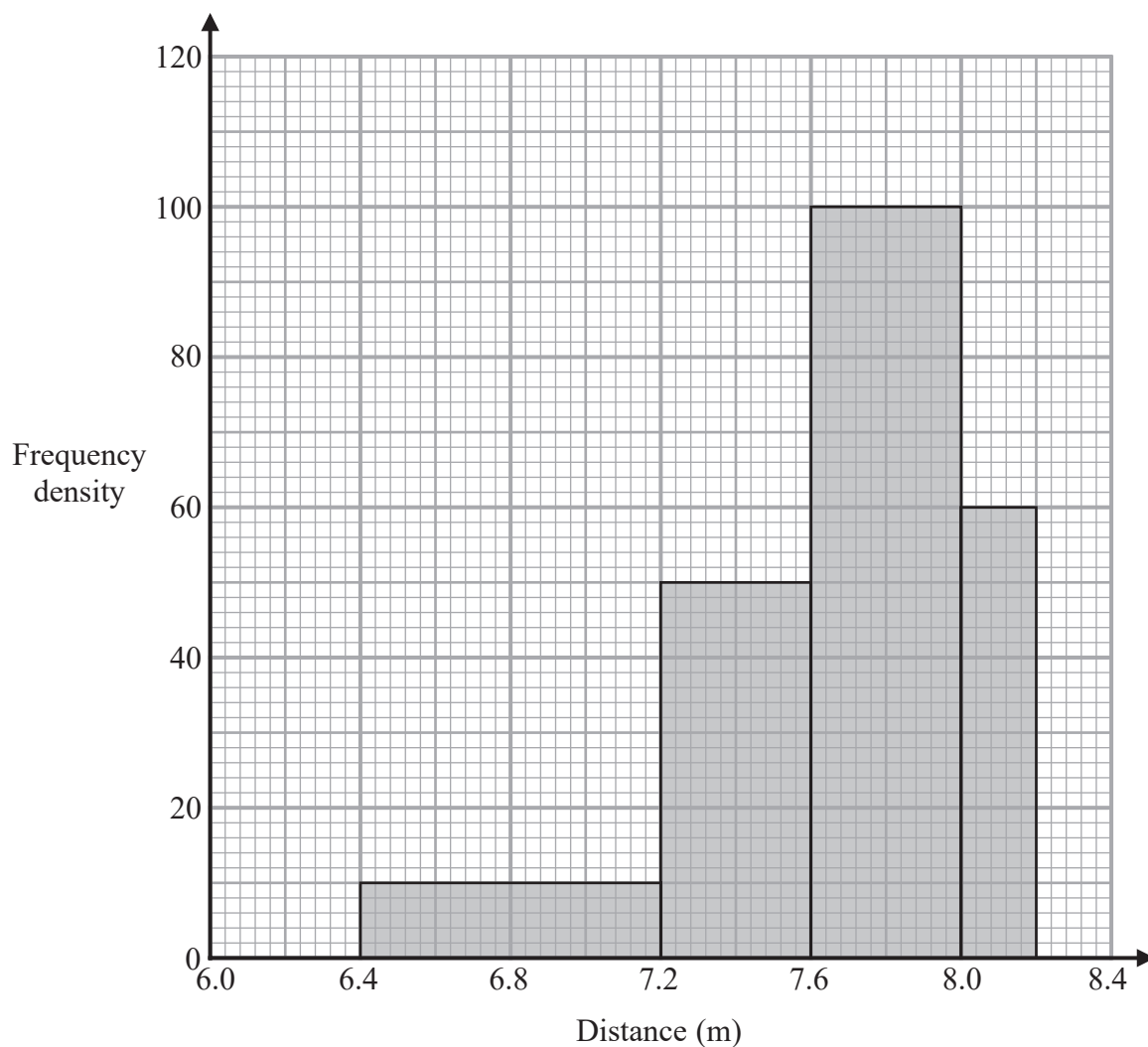
(c) Explain why.

The gradient is acceleration on a speed-time graph

(1)

(Total for Question 16 is 4 marks)

- 17 The histogram gives information about the distances 80 competitors jumped in a long jump competition.



Calculate an estimate for the mean distance.

Mean = total/number. Total is estimated by multiplying the midpoint of each class by its frequency then adding them all together. Number is the total frequency. Frequency = class width x frequency density. Subtracting the smallest distance from the largest distance for each bar works out the class width

..... m

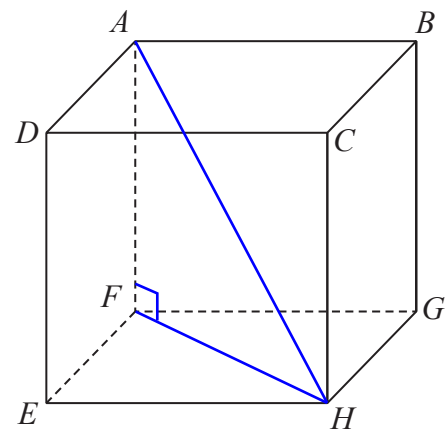
(Total for Question 17 is 4 marks)

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18 The diagram shows a cube.



$AH = 11.3$  cm correct to the nearest mm.

Calculate the lower bound for the length of an edge of the cube.  
You must show all your working.

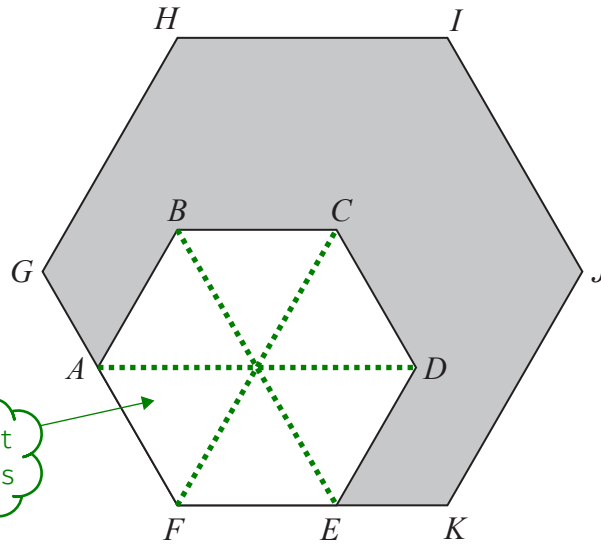
$a^2 + b^2 = c^2$

Let  $x$  be the length of an edge of the cube. Pythagoras' Theorem can be used to express length  $FH$  and then  $AH$  in terms of  $x$

Simplify the expression of  $AH$  in terms of  $x$  and set it equal to the lower bound of  $AH$ , which can be found by subtracting half of its resolution. Solve the equation to find  $x$

..... cm

(Total for Question 18 is 4 marks)



The hexagons can be split into 6 equilateral triangles

$ABCDEF$  is a regular hexagon with sides of length  $x$ .

This hexagon is enlarged, centre  $F$ , by scale factor  $p$  to give hexagon  $FGHIJK$ .

Show that the area of the shaded region in the diagram is given by  $\frac{3\sqrt{3}}{2}(p^2 - 1)x^2$

Subtracting the smaller hexagon from the larger hexagon leaves the shaded area. The area of each of the triangles is found by using the formula  $\frac{1}{2} ab \sin C$

(Total for Question 19 is 4 marks)

20 Here is a list of five numbers.

$98^{53}$

$98^{64}$

$98^{73}$

$98^{88}$

$98^{91}$

Find the lowest common multiple of these five numbers.

They are all powers of 98. Therefore they can all be multiplied by 98 a number of times to get a higher power of 98

(Total for Question 20 is 1 mark)



21  $5c + d = c + 4d$

(a) Find the ratio  $c : d$

Rearrange to get all of the  $c$  terms on one side and the  $d$  terms on the other. Give values of  $c$  and  $d$  which could work to make the equation work then write these values as a ratio

.....  
(2)

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

(b) Find the ratio  $x : y$

We are finding a ratio rather than solutions of  $x$  and  $y$  so we can let  $x$  be any value greater than 0 then work out what  $y$  would be. Doing this leaves an equation in terms of  $y$  which can then be rearranged into the quadratic form and solved using the quadratic formula. Then put both values of  $x$  and  $y$  into a ratio

.....  
(3)

(Total for Question 21 is 5 marks)

TOTAL FOR PAPER IS 80 MARKS