

Write your name here

Surname

Other names

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

Centre Number

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Candidate Number

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# Mathematics

## Paper 2 (Calculator)

**Higher Tier**

Thursday 8 June 2017 – Morning  
**Time: 1 hour 30 minutes**

Paper Reference

**1MA1/2H**

**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.**  
Worked Solutions



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 The table shows the probabilities that a biased dice will land on 2, on 3, on 4, on 5 and on 6

Number on dice	1	2	3	4	5	6
Probability		0.17	0.18	0.09	0.15	0.1

Neymar rolls the biased dice 200 times.

Work out an estimate for the total number of times the dice will land on 1 or on 3

$$1 - 0.17 - 0.09 - 0.15 - 0.1 = 0.49$$

$$0.49 \times 200$$

Multiplying the probability by the total frequency gives an estimate for the number of times it will land on a 1 or 3.

Subtracting the probabilities for 2, 4, 5 and 6 leaves us with the probability of 1 or 3.

98

(Total for Question 1 is 3 marks)

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- 2 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.

$$0.6 \times 2600 = 1560$$

Multiplying by 0.6 finds 60% of the total number of seats so tells us how many people would be needed for the condition to be met.

$$\frac{117 \times 4}{2} \times 7 = 1638$$

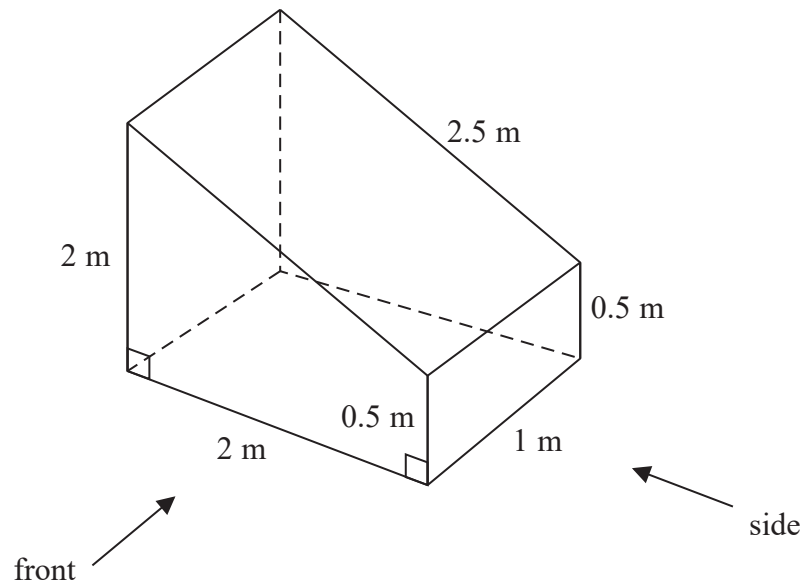
117 must be a quarter of the children so multiplying by 4 gives the total number. This is represented by 2 parts in the ratio so if we divide by 2 this tells us the value of 1 part. Multiplying by 7 (as there are 7 parts in the ratio in total) gives the total number of people on the seats.

Yes

1638 people were in the seats and this is greater than 1560, which is the minimum needed to fill 60% so the conditions have been met.

(Total for Question 2 is 5 marks)

- 3 The diagram shows a prism with a cross section in the shape of a trapezium.



On the centimetre grid below, draw the front elevation and the side elevation of the prism.  
Use a scale of 2 cm to 1 m.

If 1m is represented by 2cm, 2m must be represented by 4cm, 0.5m by 1cm. Front elevation removes the width, side elevation removes the length.

Front

side

(Total for Question 3 is 4 marks)

4 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.

$$S = \frac{d}{t} = \frac{56 + 61}{\frac{75}{60} + \frac{56}{70}}$$

km/h : this means divide distance in km by time in hours. The units tell us what to do.

Adding the distances gives the total distance. Dividing 75 by 60 converts the minutes into hours. Time for Liverpool to Manchester = distance/speed. Adding both of the times for the separate journeys together gives the total amount of time taken for the whole journey.

..... 57.1 ..... 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.

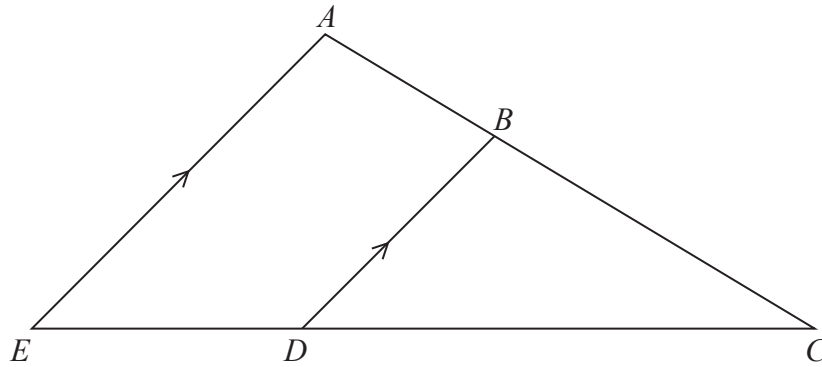
(b) If Janie is correct, what does this tell you about the two parts of Janie's journey?

Both journeys must have taken the same amount of time.

(1)

If she went 80km/h for a longer duration than 60km/h, the average would be closer to 80 than 60.

(Total for Question 4 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  $AE$ .

$$2.6 \times \frac{8.1}{5.4}$$

5.4 multiplied by the scale factor gives 8.1. So  $8.1/5.4$  gives the scale factor.

The triangles  $ACE$  and  $BCD$  are similar as all the angles are the same.  $ACE$  is a scaled up version of  $BDC$ . We need to multiply 2.6 by the scale factor as this is the corresponding side to  $AE$ .

3.9

(2)

$AC = 6.15$  cm.

(b) Work out the length of  $AB$ .

$$6.15 - \frac{6.15}{\left(\frac{8.1}{5.4}\right)}$$

Dividing the longer side,  $AC$ , by the scale factor gives the shorter corresponding side,  $BC$ .

$$AB = AC - BC$$

2.05

(2)

(Total for Question 5 is 4 marks)

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6 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.

$$25000 \times 1.02^3 = \cancel{26530.20}$$

Multiplying by 1.02 increases the original amount by 2%. This will be done three times so we can raise to the power of 3.

$$25000 \times 1.043 \times 1.009^2 = \cancel{26546.46}$$

100% + 4.3% = 104.3% so multiplying by 1.043 give the increase of 4.3%. Multiplying by 1.009 twice (to the power of 2) increases the amount by 0.9% for two years.

Secure Bank

(Total for Question 6 is 3 marks)

7 A number,  $n$ , is rounded to 2 decimal places.  
The result is 4.76

Using inequalities, write down the error interval for  $n$ .

The third decimal place will determine whether the second decimal place rounds up or down. If it went lower than 4.755 it would round down to 4.75. If it is as high as 4.765 it would round up to 4.77.

$$4.755 \leq n < 4.765$$

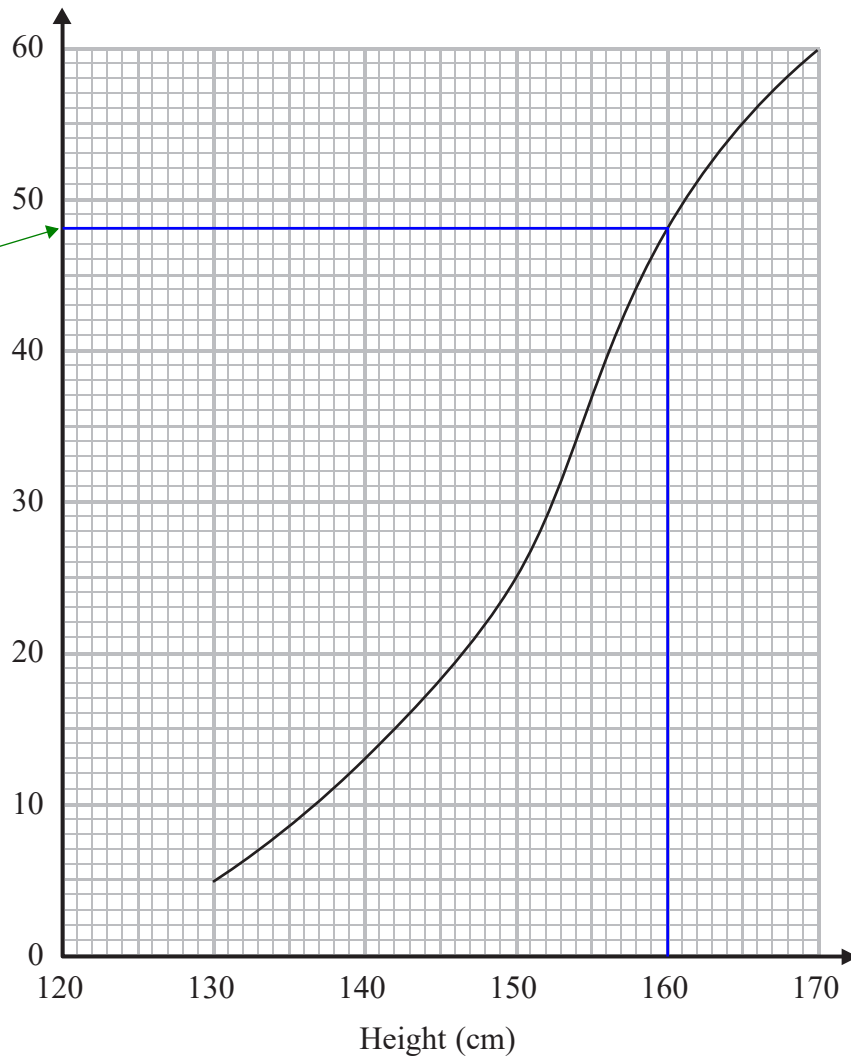
(Total for Question 7 is 2 marks)



- 8 The cumulative frequency graph shows some information about the heights, in cm, of 60 students.

The 48th student is 160cm tall according to the graph.

Cumulative frequency



Work out an estimate for the number of these students with a height greater than 160 cm.

$$60 - 48 = 12$$

12

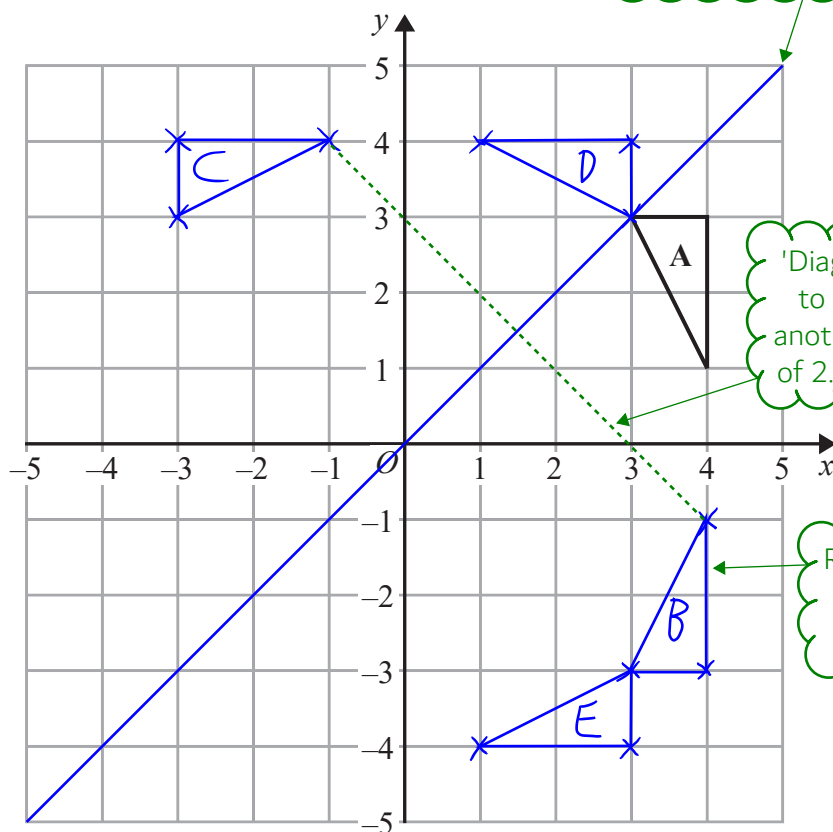
(Total for Question 8 is 2 marks)

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9 The diagram shows triangle A drawn on a grid.



If  $x$  is 1,  $y$  would be 1. If  $x$  is 2,  $y$  would be 2 etc. This must be the line of  $y = x$

'Diagonal distance of 2.5 to the line so must be another diagonal distance of 2.5 on the other side'

Reflect each corner one at a time then join them up and label the triangle.

Kyle reflects triangle A in the  $x$ -axis to get triangle B. He then reflects triangle B in the line  $y = x$  to get triangle C.

Amy reflects triangle A in the line  $y = x$  to get triangle D. She is then going to reflect triangle D in the  $x$ -axis to get triangle E.

Amy says that triangle E should be in the same position as triangle C.

Is Amy correct?  
You must show how you get your answer.

No

(Total for Question 9 is 3 marks)

10 The table shows some information about eight planets.

Planet	Distance from Earth (km)	Mass (kg)
Earth	0	$5.97 \times 10^{24}$
Jupiter	$6.29 \times 10^8$	$1.898 \times 10^{27}$
Mars	$7.83 \times 10^7$	$6.42 \times 10^{23}$
Mercury	$9.17 \times 10^7$	$3.302 \times 10^{23}$
Neptune	$4.35 \times 10^9$	$1.024 \times 10^{26}$
Saturn	$1.28 \times 10^9$	$5.68 \times 10^{26}$
Uranus	$2.72 \times 10^9$	$8.683 \times 10^{25}$
Venus	$4.14 \times 10^7$	$4.869 \times 10^{24}$

This has the highest power of ten and they are all in Standard form.

(a) Write down the name of the planet with the greatest mass.

Jupiter

(1)

(b) Find the difference between the mass of Venus and the mass of Mercury.

$$4.869 \times 10^{24} - 3.302 \times 10^{23}$$

Largest - smallest = difference  
Standard form can be put into the calculator and the answer can be given in standard form.

$$4.5388 \times 10^{24} \text{ kg}$$

(1)

Nishat says that Neptune is over a hundred times further away from Earth than Venus is.

(c) Is Nishat right?

You must show how you get your answer.

$$\frac{4.35 \times 10^9}{4.14 \times 10^7} = 105 \dots$$

Neptune is over 105 times further away.

Yes

(2)

(Total for Question 10 is 4 marks)

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11 Solve  $\frac{3x-2}{4} - \frac{2x+5}{3} = \frac{1-x}{6}$

$$\frac{3(3x-2)}{12} - \frac{4(2x+5)}{12} = \frac{2(1-x)}{12}$$

12 is a common denominator for all of the fractions. As with normal fractions, we need to multiply both the numerator and denominator by the same amount to keep them equivalent.

$$(9x-6) - (8x+20) = (2-2x)$$

Expanding the brackets and multiplying all terms on both sides by 12 to eliminate the denominators.

$$x - 26 = 2 - 2x$$

$$3x = 28$$

Simplifying then bringing all x-terms to one side and all the constants to the other. Be careful that the +20 becomes negative.

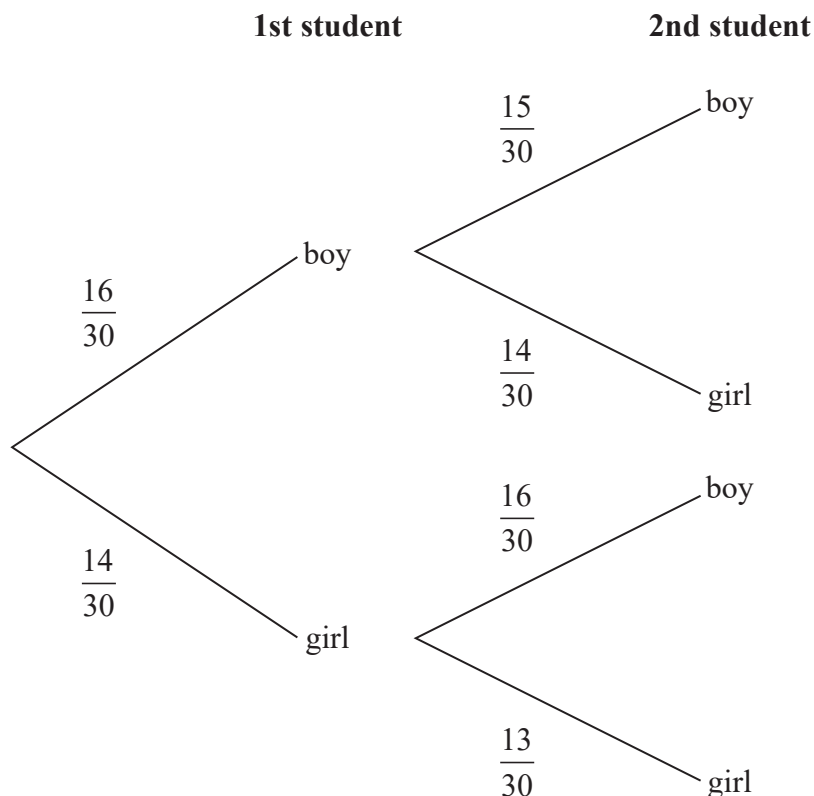
$$x = \frac{28}{3}$$

(Total for Question 11 is 4 marks)

12 There are 30 students in Mr Lear’s class.  
16 of the students are boys.

Two students from the class are chosen at random.

Mr Lear draws this probability tree diagram for this information.



(a) Write down **one** thing that is wrong with the probabilities in the probability tree diagram.

Denominators should be 29 for the 2nd student

One of the students has been picked and can't be picked again so there are 29 students for the 2nd event.

(1)

Owen and Wasim play for the school football team.

The probability that Owen will score a goal in the next match is 0.4  
The probability that Wasim will score a goal in the next match is 0.25

Mr Slater says,

“The probability that both boys will score a goal in the next match is  $0.4 + 0.25$ ”

(b) Is Mr Slater right?

Give a reason for your answer.

No as the probabilities should be multiplied

(1)

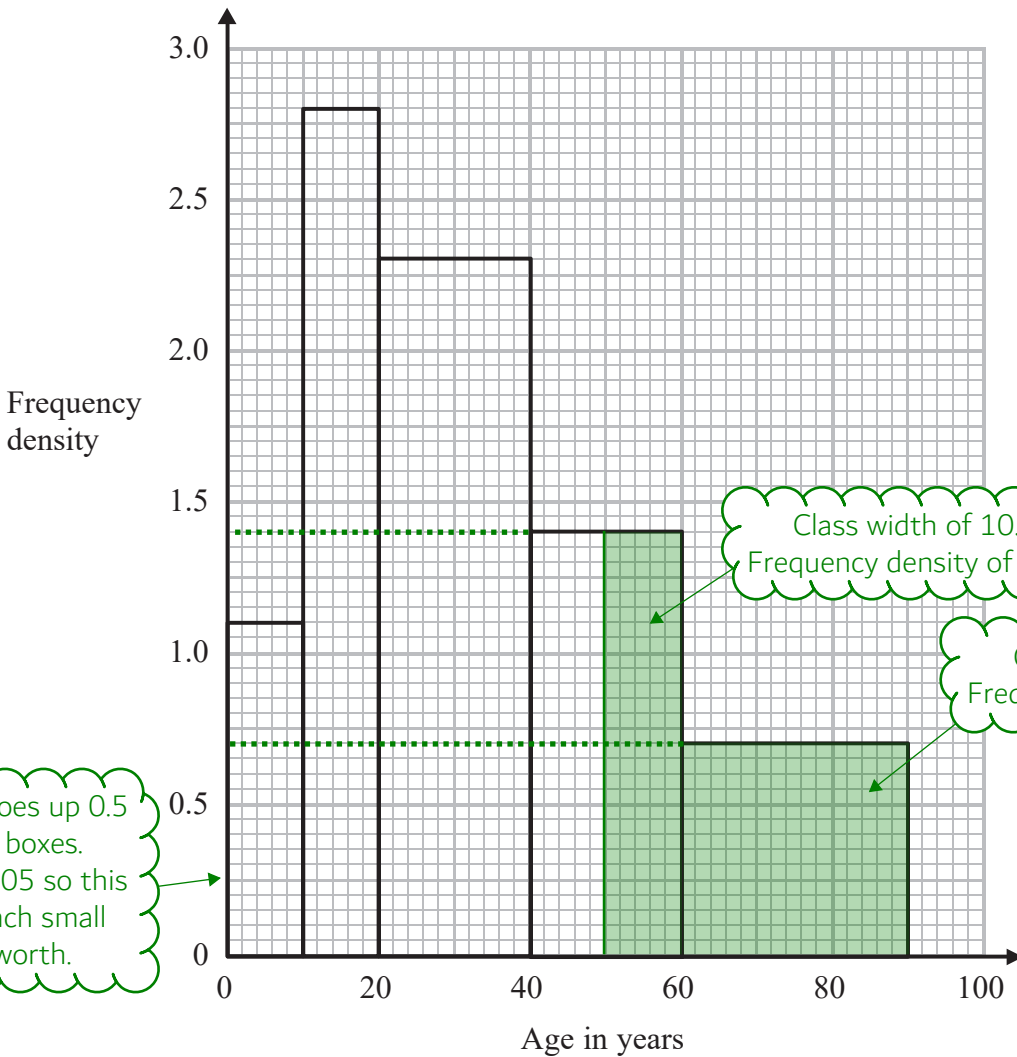
(Total for Question 12 is 2 marks)

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13 The histogram shows some information about the ages of the 134 members of a sports club.



The scale goes up 0.5 over 10 boxes.  
 $0.5/10 = 0.05$  so this is what each small box is worth.

Class width of 10.  
 Frequency density of 1.4.

Class width of 30.  
 Frequency density of 0.7.

20% of the members of the sports club who are over 50 years of age are female.

Work out an estimate for the number of female members who are over 50 years of age.

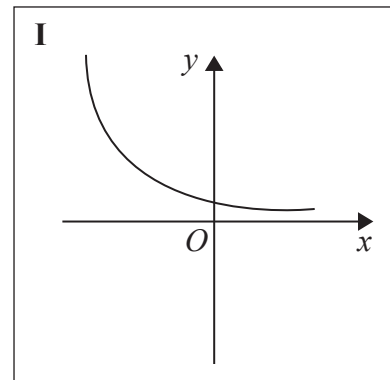
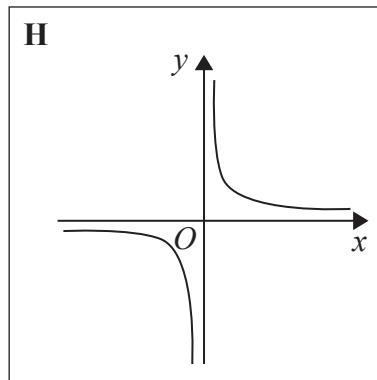
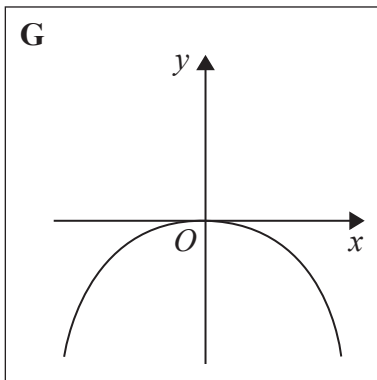
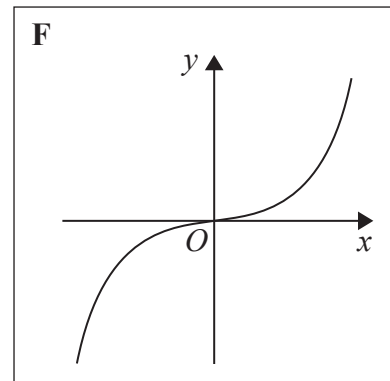
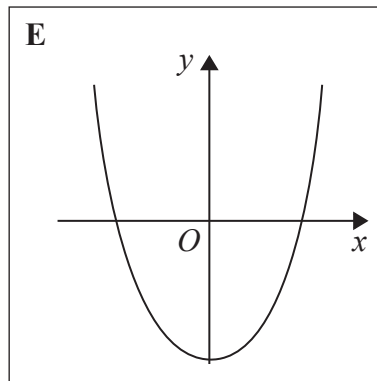
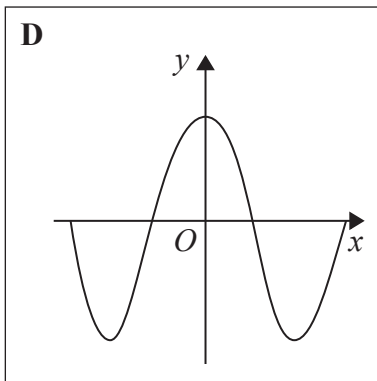
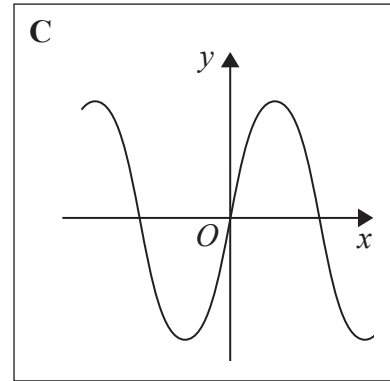
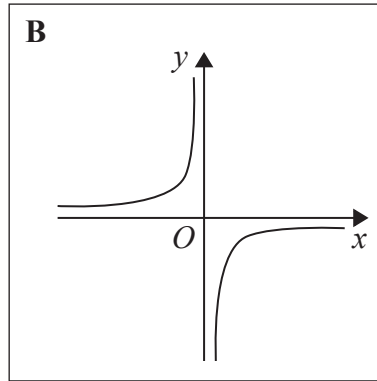
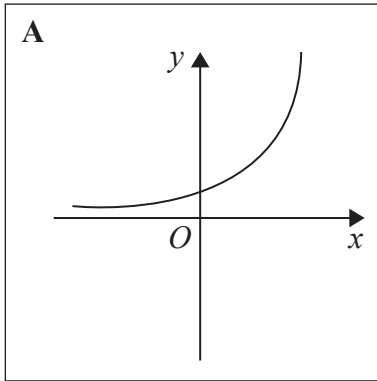
$$(30 \times 0.7 + 10 \times 1.4) \times 0.2$$

Class width  $\times$  frequency density = frequency  
 Multiplying the estimated frequency by 0.2 finds 20%

>

(Total for Question 13 is 3 marks)

14 Here are some graphs.



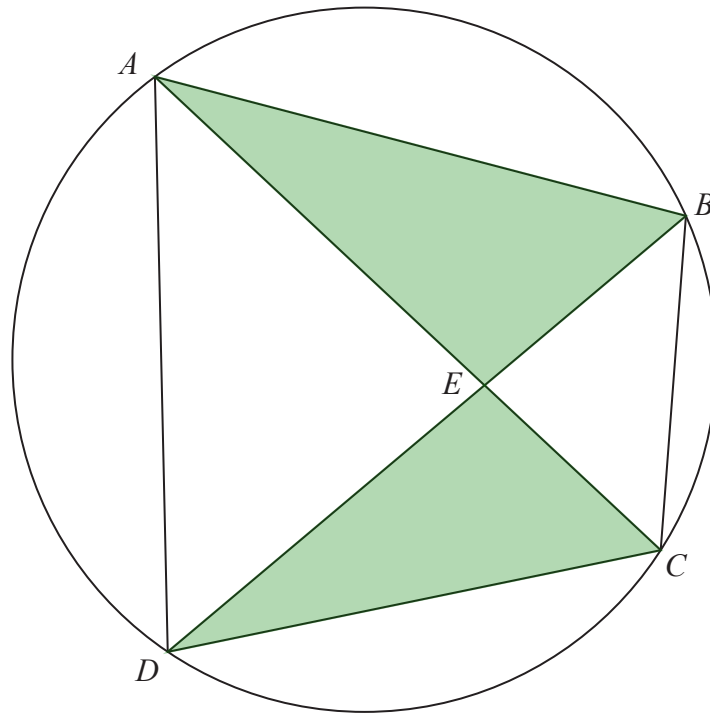
In the table below, match each equation with the letter of its graph.

Equation	Graph
$y = \sin x$	C
$y = x^3 + 4x$	F
$y = 2^x$	A
$y = \frac{4}{x}$	H

These are common graphs and the curves are typical of the type of equation. Otherwise using table mode on the calculator gives tables of values and we can get an idea of what the curves look like.

(Total for Question 14 is 3 marks)

15  $A, B, C$  and  $D$  are four points on the circumference of a circle.



$AEC$  and  $BED$  are straight lines.

Prove that triangle  $ABE$  and triangle  $DCE$  are similar.  
You must give reasons for each stage of your working.

$DEC = AEB$  as opposite angles

$CAB = CDB$  and  $ABD = ACD$  as  
angles in the same segment

The triangles are similar as  
all the angles are equal.

(Total for Question 15 is 3 marks)



16 Using algebra, prove that  $0.1\dot{3}\dot{6} \times 0.\dot{2}$  is equal in value to  $\frac{1}{33}$

$$\begin{aligned}x &= 0.1\dot{3}\dot{6} \\100x &= 13.\dot{6}\dot{3}\dot{6} \\99x &= 13.5 \\x &= \frac{13.5}{99}\end{aligned}$$

Multiplying the recurring decimal by 10 twice (multiplying by 100) moves the recurring digits into the same decimal place so that when the original is subtracted, a decimal without recurring digits is left.

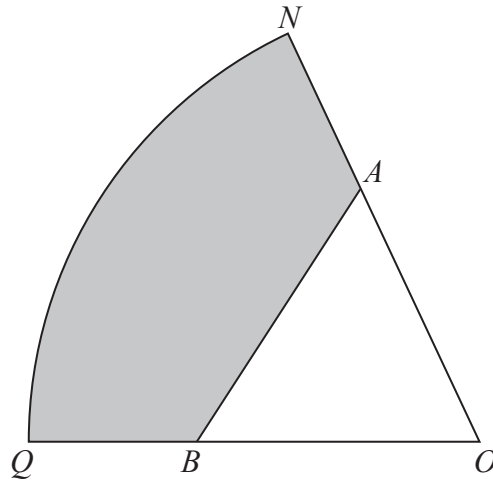
$$\begin{aligned}y &= 0.\dot{2} \\10y &= 2.\dot{2} \\9y &= 2 \\y &= \frac{2}{9}\end{aligned}$$

Multiplying the recurring decimal by 10 once moves the recurring digits into the same decimal place so that when the original is subtracted, a decimal without recurring digits is left.

$$\frac{13.5}{99} \times \frac{2}{9} = \frac{1}{33}$$

Once the recurring decimals are converted into fractions (which do not need to be in their simplest form), we can just show them multiplied together to get  $1/33$  without having to show all the steps.

(Total for Question 16 is 3 marks)



$ONQ$  is a sector of a circle with centre  $O$  and radius 11 cm.

$A$  is the point on  $ON$  and  $B$  is the point on  $OQ$  such that  $AOB$  is an equilateral triangle of side 7 cm.

Calculate the area of the shaded region as a percentage of the area of the sector  $ONQ$ .  
Give your answer correct to 1 decimal place.

(1 - the proportion of the shape which is unshaded)  $\times$  100 = percentage shaded.  
 Proportion of the shape unshaded = area of triangle/area of sector.  
 Area of triangle =  $\frac{1}{2} \times ab \sin C$   
 Area of sector =  $\frac{x}{360} \times \pi r^2$  where  $x$  is the number of degrees and  $r$  is the radius.  
 There are  $60^\circ$  in each angle of an equilateral triangle.

$$\left( 1 - \frac{\frac{1}{2} \times 7^2 \times \sin 60}{\frac{60}{360} \times \pi \times 11^2} \right) \times 100$$

66.5 %

(Total for Question 17 is 5 marks)

18  $16^{\frac{1}{5}} \times 2^x = 8^{\frac{3}{4}}$

Work out the exact value of  $x$ .

$$(2^4)^{\frac{1}{5}} \times 2^x = (2^3)^{\frac{3}{4}}$$

$$\frac{4}{5} + x = \frac{9}{4}$$

$$x = \frac{9}{4} - \frac{4}{5}$$

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

Converting 16 and 8 into powers of 2 allow us to use this law to form a linear equation which can be solved.

$$(a^x)^y = a^{xy}$$

$\frac{29}{20}$

(Total for Question 18 is 3 marks)

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19  $2 - \frac{x+2}{x-3} - \frac{x-6}{x+3}$  can be written as a single fraction in the form  $\frac{ax+b}{x^2-9}$  where  $a$  and  $b$  are integers.

Work out the value of  $a$  and the value of  $b$ .

Multiplying all the denominators together finds a common denominator. The numerators have to be multiplied by the same as the denominators. The fractions can then be combined into a single fraction.

$$\frac{2(x-3)(x+3) - (x+2)(x+3) - (x-6)(x-3)}{(x-3)(x+3)}$$

Expanding the brackets but being mindful of the negative before the brackets. This flips the sign of each of the terms when expanding.

$$\frac{2x^2 + 6x - 6x - 18 - x^2 - 3x - 2x - 6 - x^2 + 3x + 6x - 18}{x^2 + 3x - 3x - 9}$$

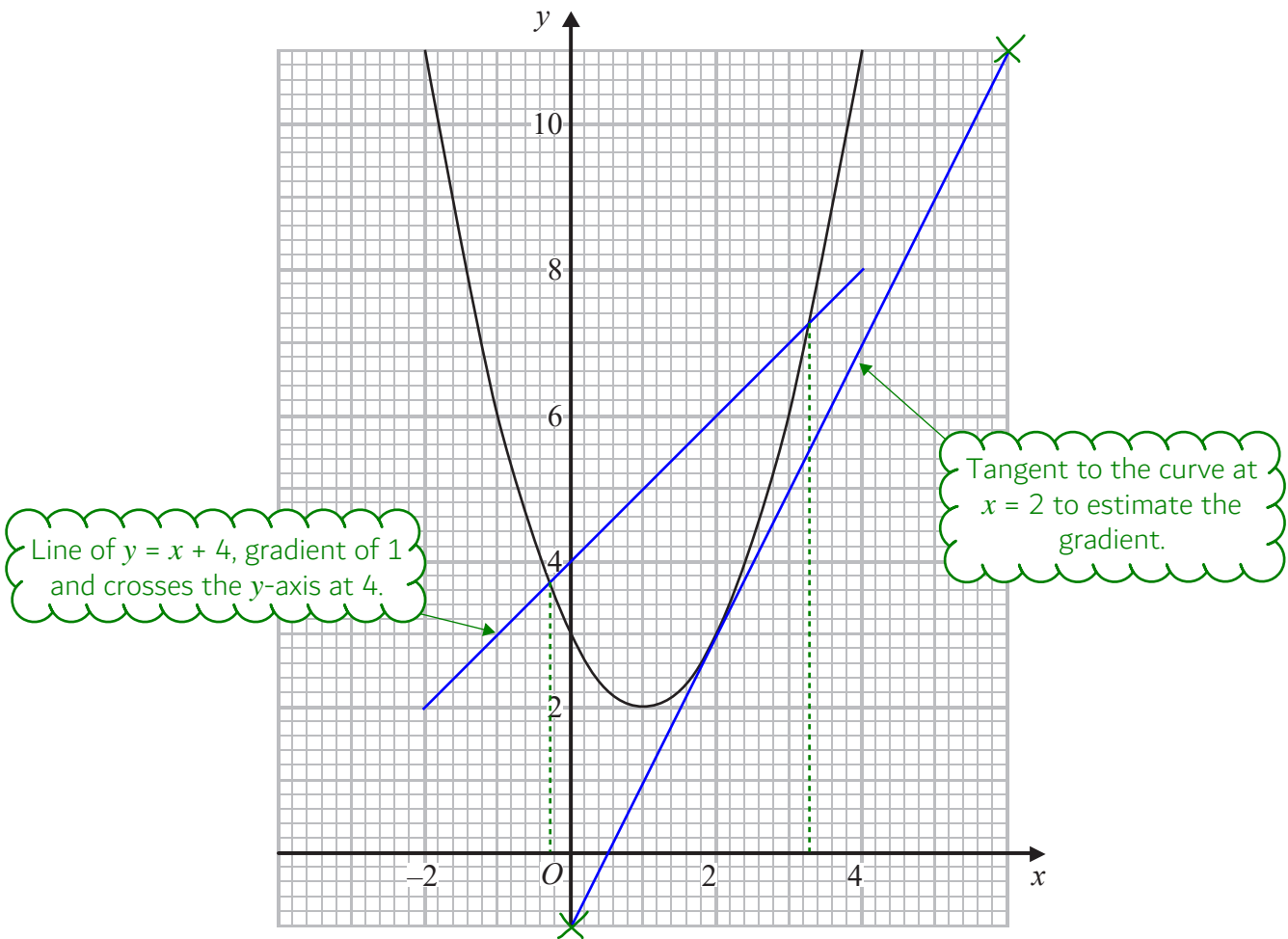
$$\frac{4x - 42}{x^2 - 9}$$

Collecting like terms and simplifying into the desired form.

$a = 4$   
 $b = -42$

(Total for Question 19 is 4 marks)

20 The diagram shows part of the graph of  $y = x^2 - 2x + 3$



- (a) By drawing a suitable straight line, use your graph to find estimates for the solutions of  $x^2 - 3x - 1 = 0$

Subtracting  $x + 4$  from the equation in the graph would give 0. Sketching the line  $y = x + 4$  and reading the  $x$ -coordinates of where they cross gives the estimates for the solutions.

$-0.25, 3.3$

(2)

$P$  is the point on the graph of  $y = x^2 - 2x + 3$  where  $x = 2$

- (b) Calculate an estimate for the gradient of the graph at the point  $P$ .

$$\frac{1 - (-1)}{6 - 0}$$

Up/across or (change in  $y$ )/(change in  $x$ ) calculates the gradient. The gradient can also be visually seen on the graph but we need to show how we get the answer.

2

(3)

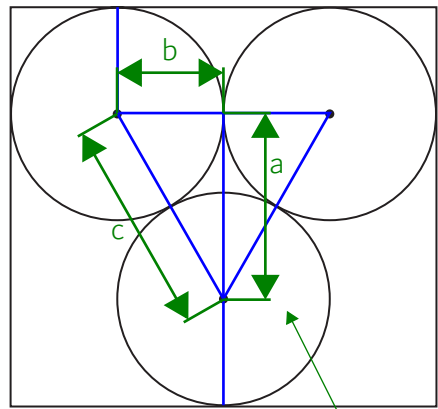
(Total for Question 20 is 5 marks)

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21 The diagram shows 3 identical circles inside a rectangle.  
 Each circle touches the other two circles and the sides of the rectangle, as shown in the diagram.



The radius of each circle is 24 mm.  
 Work out the area of the rectangle.  
 Give your answer correct to 3 significant figures.

Area of rectangle = length x width  
 Length is 4 lots of the radius.  
 Width is 2 radii + height of the triangle.  
 Height of the triangle can be found using Pythagoras by splitting it into a right-angled triangle.

$$(24 \times 4) (24 \times 2 + \sqrt{(24 \times 2)^2 - 24^2}) = 8598.645061$$

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

$$a = \sqrt{c^2 - b^2}$$

8600 ..... mm<sup>2</sup>

(Total for Question 21 is 4 marks)

22 Here are the first five terms of a sequence.

4      11      22      37      56

Find an expression, in terms of  $n$ , for the  $n$ th term of this sequence.

Listing the first difference and then the second difference. The second difference is constant: it must be a quadratic sequence. Half of the second difference is the coefficient of  $n^2$ .

$$2n^2 \quad 2 \quad 8 \quad 18$$
$$2 \quad 3 \quad 4$$

Listing the sequence of  $2n^2$  then working out what needs to be added to it to get the original sequence. It is a linear sequence which can be expressed in terms of  $n$ .

$$n+1$$

The sequence is increasing by 1 between terms so the coefficient of  $n$  must be 1. Adding 1 to the sequence of  $n$  gives the linear sequence.

$$2n^2 + n + 1$$

(Total for Question 22 is 3 marks)

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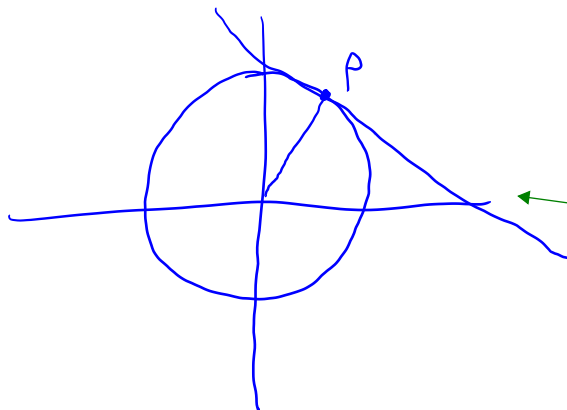
23 L is the circle with equation  $x^2 + y^2 = 4$

$P\left(\frac{3}{2}, \frac{\sqrt{7}}{2}\right)$  is a point on L.

Find an equation of the tangent to L at the point P.

$(x - h)^2 + (y - k)^2 = r^2$ , centre is  $(h, k)$  and  $r$  is radius

This is the form of the equation of a circle. The centre must be at the origin as there is no  $h$  or  $k$  value (they are 0)



A very quick and rough sketch of what is going on.

The tangent is a straight line so must be in the form of the general equation for a straight line.

$$y = mx + c$$

$$m = \frac{-1}{\left(\frac{\frac{\sqrt{7}}{2} - 0}{\frac{3}{2} - 0}\right)} = \frac{-3\sqrt{7}}{7}$$

$$\begin{aligned} c &= y - mx \\ &= \frac{\sqrt{7}}{2} - \left(\frac{-3\sqrt{7}}{7}\right) \times \frac{3}{2} \end{aligned}$$

The tangent and the radius are perpendicular (circle theorem) so the gradient of the tangent must be the negative reciprocal of the gradient of the radius. Up/across finds the gradient of the radius.

Rearranging to make  $c$  the subject then substituting in  $m$ , the gradient, and then  $x$  and  $y$ -coordinates from point  $P$  as they must satisfy the equation.

$$y = \frac{-3\sqrt{7}}{7}x + \frac{8\sqrt{7}}{7}$$

(Total for Question 23 is 3 marks)

TOTAL FOR PAPER IS 80 MARKS

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