

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)**

--	--	--	--	--

--	--	--	--	--

**Tuesday 11 June 2019**

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 ►

P55602A

©2019 Pearson Education Ltd.

6/7/1/1/1/1/1/

**.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.

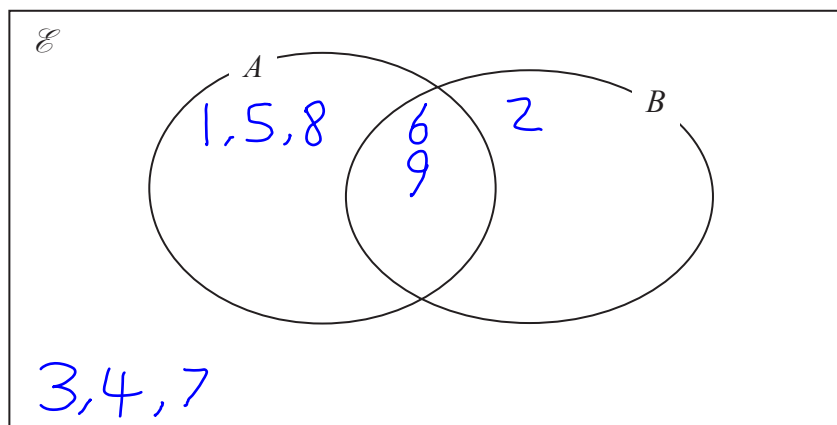
If you find any mistakes or have any requests or suggestions, please send an email to [curtis@cgmaths.co.uk](mailto:curtis@cgmaths.co.uk)

Answer ALL questions.

Write your answers in the spaces provided.

You must write down all the stages in your working.

- 1  $\mathcal{E} = \{1, 2, 3, 4, 5, 6, 7, 8, 9\}$   
 $A = \{1, 5, 6, 8, 9\}$   
 $B = \{2, 6, 9\}$



- (a) Complete the Venn diagram to represent this information.

(3)

A number is chosen at random from the universal set  $\mathcal{E}$ .

- (b) Find the probability that the number is in the set  $A \cap B$

Out of the 9 numbers, there are 2 in both A and B.

$\frac{2}{9}$

(2)

(Total for Question 1 is 5 marks)

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

- 2 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.

$$200000 \times 1.015^4 - 200000$$

Multiplying by 1.015 increases by 1.5%. Raising to the power of 4 does this 4 times. Subtracting the original value leaves the interest.

£ 12272.71

(Total for Question 2 is 3 marks)

3 The table shows information about the heights of 80 plants.

Height ( $h$ cm)	Frequency
$10 < h \leq 20$	7
$20 < h \leq 30$	13
$30 < h \leq 40$	14
$40 < h \leq 50$	12
$50 < h \leq 60$	16
$60 < h \leq 70$	18

Doing a cumulative frequency until it reaches over 40.5 works out which interval the medial is in.

7  
20  
34  
46

(a) Find the class interval that contains the median.

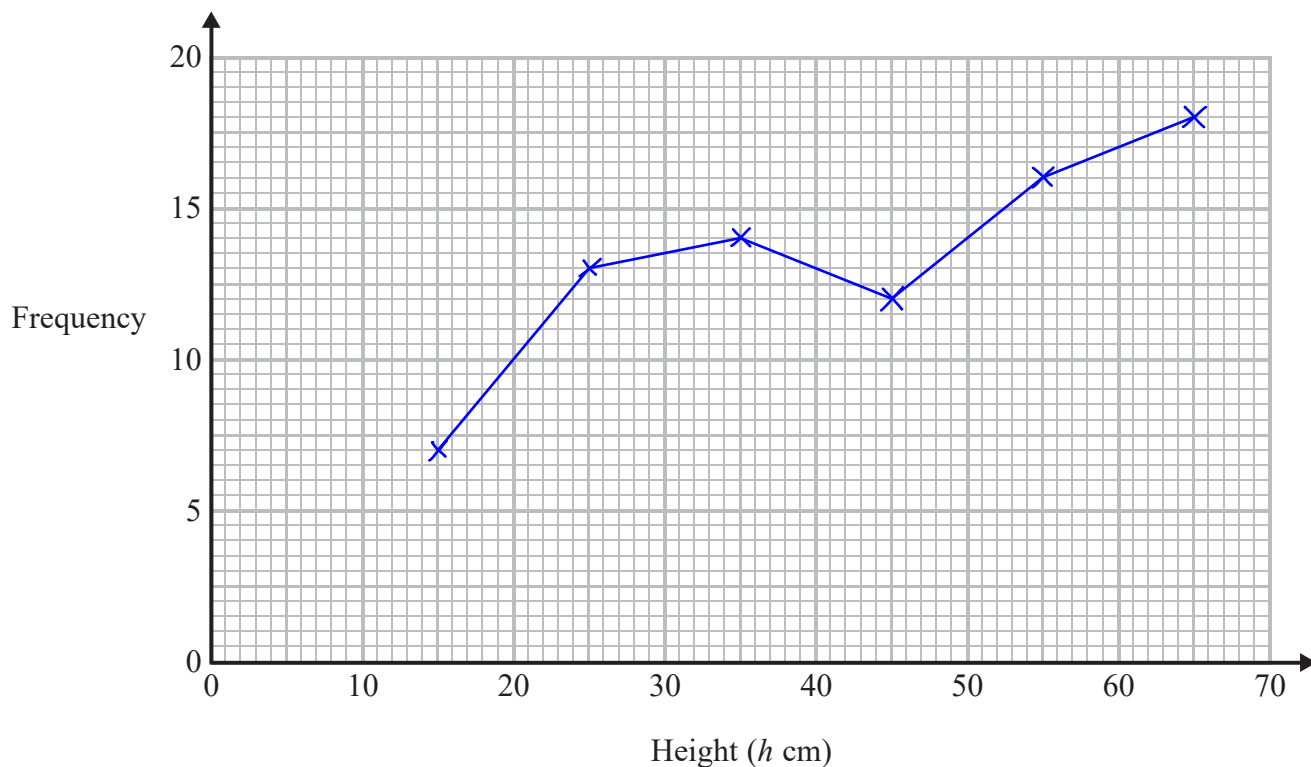
$$\frac{80+1}{2} = 40.5$$

So the value between the 40th and 41st value is the median.

$$40 < h \leq 50$$

(1)

(b) On the grid, draw a frequency polygon for the information in the table.



(2)

(Total for Question 3 is 3 marks)

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

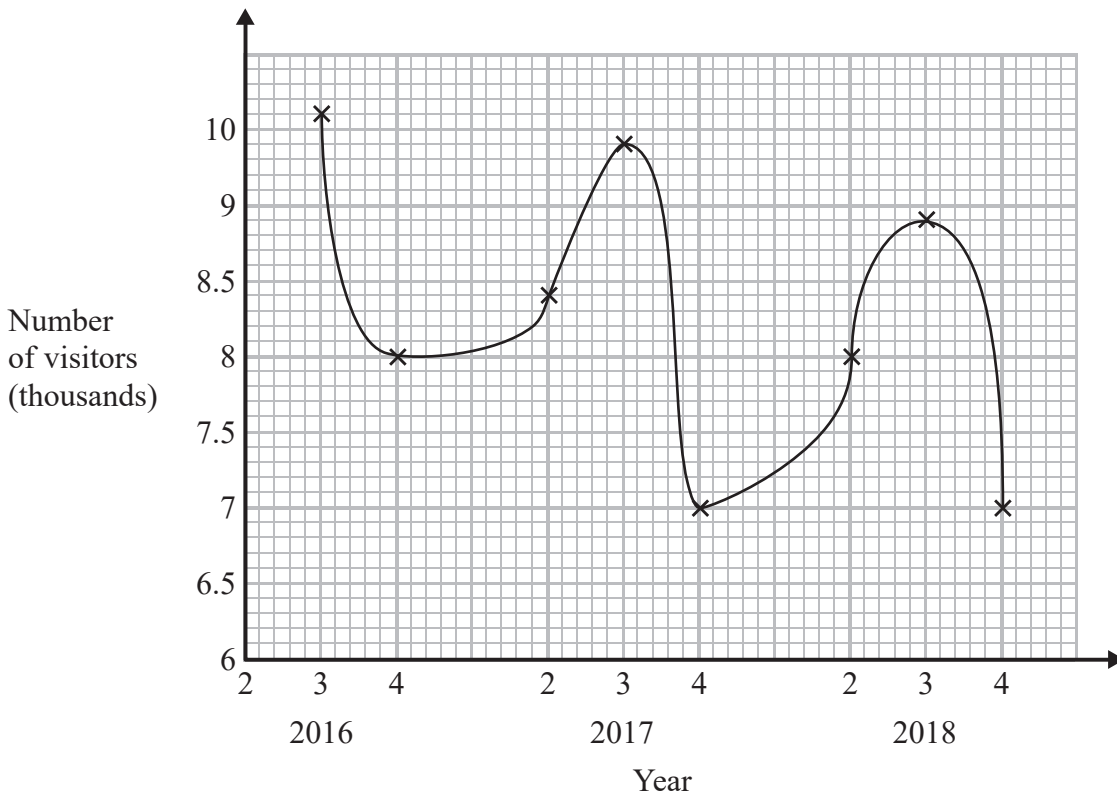
DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

4 Sean has drawn a time series graph to show the numbers, in thousands, of visitors to a fun park.



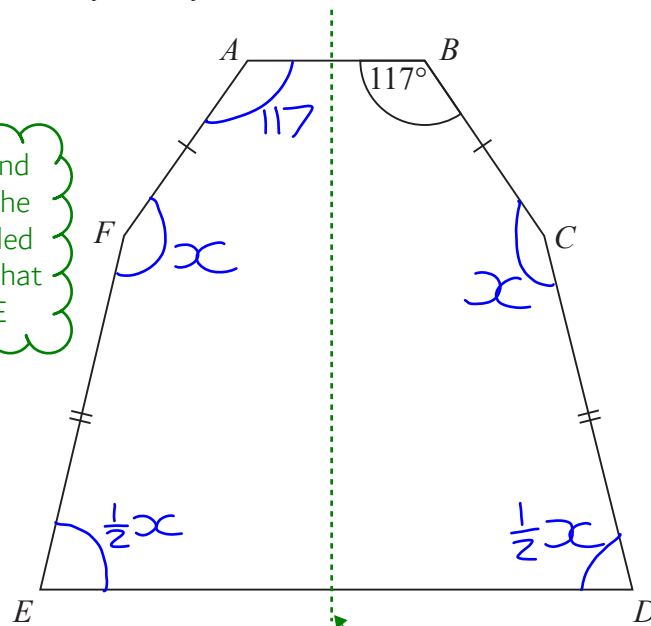
Write down two things that are wrong or could be misleading with this graph.

1 9.5 is missing on the y-axis.

2 It isn't clear what the numbers on the x-axis mean.

(Total for Question 4 is 2 marks)

- 5 The diagram shows a hexagon.  
The hexagon has one line of symmetry.



The angle we are trying to find has been labelled as  $x$  then the other angles have been labelled based on the symmetry and that angle  $BCD = 2 \times$  angle  $CDE$

$$FA = BC$$

$$EF = CD$$

$$\text{Angle } ABC = 117^\circ$$

$$\text{Angle } BCD = 2 \times \text{angle } CDE$$

Work out the size of angle  $AFE$ .  
You must show all your working.

$$(6-2)180 = 720$$

$(n - 2) \times 180$ , where  $n$  is the number of sides calculates how many degrees there are altogether in a hexagon.

$$117 \times 2 + 3x = 720$$

Adding up all the angles in the shape must give 720 degrees.

$$x = \frac{720 - 117 \times 2}{3}$$

Rearranging the equation to get  $x$  on its own solves the equation.

162

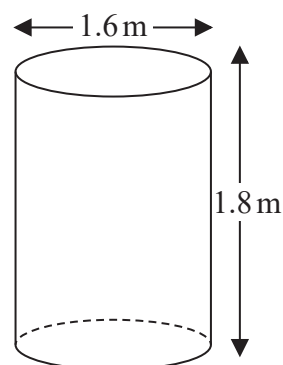
(Total for Question 5 is 4 marks)

6 Jeremy has to cover 3 tanks completely with paint.

Each tank is in the shape of a cylinder with a top and a bottom. The tank has a diameter of 1.6 m and a height of 1.8 m.

Jeremy has 7 tins of paint.  
Each tin of paint covers  $5 \text{ m}^2$

Has Jeremy got enough paint to cover completely the 3 tanks?  
You must show how you get your answer.



$$7 \times 5 = 35$$

Calculating how much area 7 tins of paint will cover.

$$3(\pi \times 1.6 \times 1.8 + 2(\pi \times (\frac{1.6}{2})^2)) = 39.2\dots$$

$\pi \times$  diameter gives the circumference. Multiplying this by the height gives the curved surface area.

2 lots of  $\pi r^2$  as there are 2 circular surfaces per tank. The radius is half of the diameter.

There are 3 tanks so multiplying the surface area of one of the tanks by 3.

$$39.21 > 35$$

No

The amount of paint needed is more than the paint he has.

(Total for Question 6 is 5 marks)



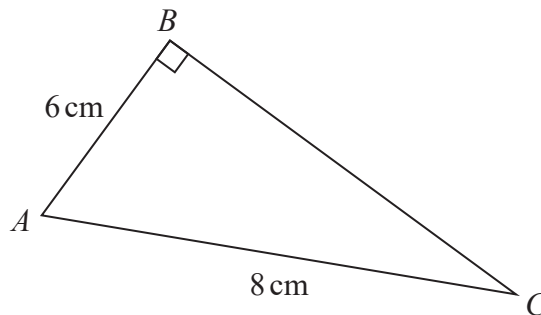
7 Work out

$$\sqrt{\frac{2.5 \times \sin 43^\circ}{8.2^2 - 50.5}} = 0.3191419855$$

Give your answer correct to 3 significant figures.

0.319

(Total for Question 7 is 2 marks)

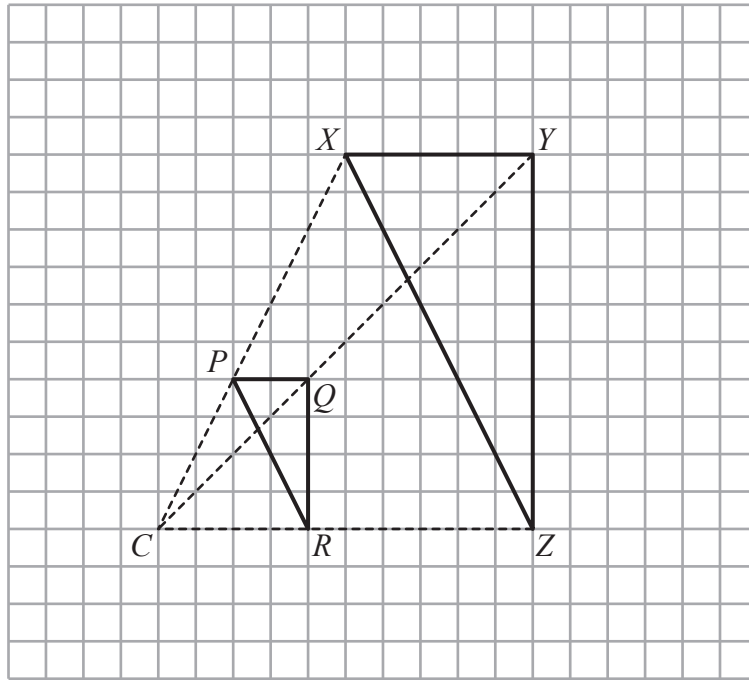
8  $ABC$  is a right-angled triangle.Here is Sarah's method to find the length of  $BC$ .

$$\begin{aligned} BC^2 &= AB^2 + AC^2 \\ &= 6^2 + 8^2 \\ &= 100 \\ BC &= 10 \end{aligned}$$

(a) What mistake has Sarah made in her method?

It should be  $BC^2 = AC^2 - AB^2$ .

(1)



Roy is going to enlarge triangle  $PQR$  with centre  $C$  and scale factor  $1\frac{1}{2}$

He draws triangle  $XYZ$ .

(b) Explain why Roy's diagram is **not** correct.

He has used scale factor  $2\frac{1}{2}$ .

(1)

(Total for Question 8 is 2 marks)

9 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
<b>Number of machines working</b>	3	4	5	6

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

$$6 \times 9 = 54$$

This calculates the number of machine days done by 6 machines in 9 days. It represents the amount of work which needs to be done.

$$54 - 3 - 4 - 5 = 42$$

Taking away the amount of machine days done in day 1, 2 and 3.

$$\frac{42}{6} = 7$$

Dividing the amount of machine days left by the machine days per day for all the other days leaves the amount of additional days required.

7 additional days are needed after days 1, 2 and 3.  $3 + 7 = 10$ .

10

(Total for Question 9 is 3 marks)

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

10 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.

$$\frac{28.80}{0.2} = 144$$

Interest  $\times$  0.2 = tax  
0.2 is equivalent to 20%  
Interest = tax/0.2

$$\frac{144}{8000} \times 100$$

Expressing the interest as a fraction of the original amount and multiplying by 100 to convert it into a percentage.

.....1.8.....%

(Total for Question 10 is 3 marks)

11 In May 2019, the distance between Earth and Mars was  $3.9 \times 10^7$  km.

In May 2019, a signal was sent from Earth to Mars.

Assuming that the signal sent from Earth to Mars travelled at a speed of  $3 \times 10^5$  km per second,

(a) how long did the signal take to get to Mars?

$$\frac{d}{s} = t$$

$$\frac{3.9 \times 10^7}{3 \times 10^5}$$

From the formula triangle,  
time = distance/speed

130 seconds  
(2)

The speed of the signal sent from Earth to Mars in May 2019 was actually less than  $3 \times 10^5$  km per second.

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

It will be greater

To work out the time, we divided distance by speed. If the speed is less, we are dividing by less so the time will be greater.

(1)

(Total for Question 11 is 3 marks)

12 Patrick has to work out the exact value of  $64^{\frac{1}{4}}$

Patrick says,

“ $\frac{1}{4}$  of 64 is 16 so  $64^{\frac{1}{4}} = 16$ ”

Explain what is wrong with what Patrick says.

He should find the fourth root of 64

(Total for Question 12 is 1 mark)

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

13 The density of ethanol is 1.09 g/cm<sup>3</sup>  
The density of propylene is 0.97 g/cm<sup>3</sup>

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.

$$\frac{M}{D \times V}$$

From the formula triangle,  
density = mass/volume  
mass = density x volume

$$\frac{1.09 \times 60 + 0.97 \times 128}{188}$$

1.09 x 60 works out the mass of the ethanol. 0.97 x 128 works out the mass of the propylene. Adding these together gives the total mass of the antifreeze. Dividing this by the volume gives the density.

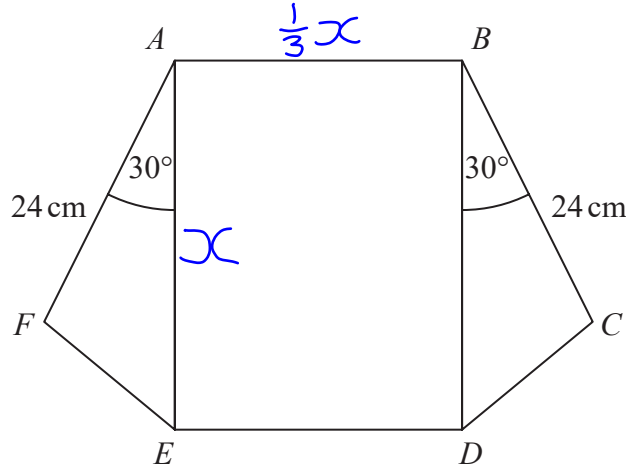
= 1.008297872...

Rounded to 2 decimal places.

..... 1.01 ..... g/cm<sup>3</sup>

(Total for Question 13 is 4 marks)

14 The diagram shows a rectangle,  $ABDE$ , and two congruent triangles,  $AFE$  and  $BCD$ .



Label  $AE$  as  $x$  as this is what we are trying to find. From the ratio, length  $AB$  is  $1/3$  of  $x$

area of rectangle  $ABDE$  = area of triangle  $AFE$  + area of triangle  $BCD$

$$AB : AE = 1 : 3$$

Work out the length of  $AE$ .

$$x \times \frac{1}{3}x = 2 \left( \frac{1}{2} \times 24 \times x \times \sin 30 \right)$$

Area of rectangle  $ABDE$ .  
Area of rectangle = length  $\times$  width

Area of triangle  $AFE$  + area of triangle  $BCD$ .  
Area of triangle =  $1/2 \times a \times b \times \sin A$   
Multiplied by 2 as both triangles are congruent

$$\frac{1}{3}x^2 = 12x$$

$$x^2 = 36x$$

$$x^2 - 36x = 0$$

$$x(x - 36) = 0$$

$$x = 0 \text{ or } x = 36$$

Factorising to find  $x$ .  
Either  $x = 0$  or  $x - 36 = 0$

The length cannot be 0

36 cm

(Total for Question 14 is 4 marks)

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

15 The graph of the curve C with equation  $y = f(x)$  is transformed to give the graph of the curve S with equation  $y = f(-x) - 3$

The point on C with coordinates (7, 2) is mapped to the point Q on S.

Find the coordinates of Q.

$f(-x)$  reflects the graph in the y axis so the x-coordinate becomes negative. The -3 translates the graph downwards by 3 so  $2 - 3$  gives the y-coordinate

(.....-7.....,.....-1.....)

(Total for Question 15 is 2 marks)

16 Here are the first six terms of a quadratic sequence.

-1    5    15    29    47    69

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

6    10

4

$2n^2$ :    2    8

          -3    -3

The difference between the first two terms is 6.  
The difference between the next two terms is 10

The second difference (difference of the differences) is 4

Halving the second difference tells us the number of  $n^2$ . Listing the sequence of  $2n^2$

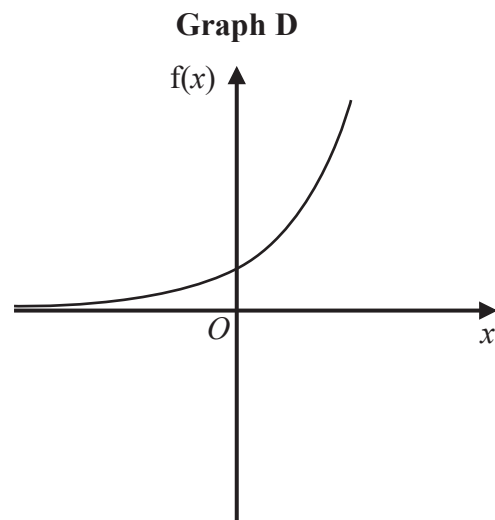
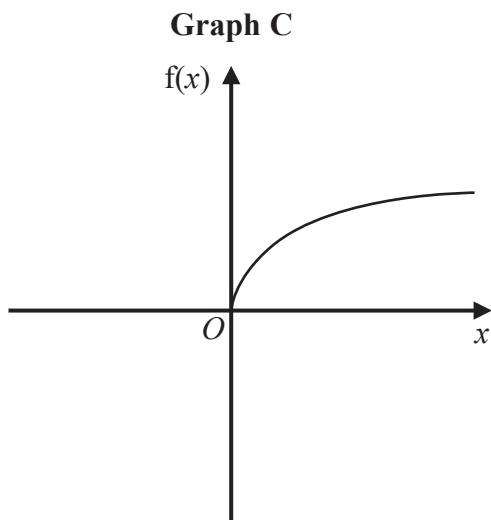
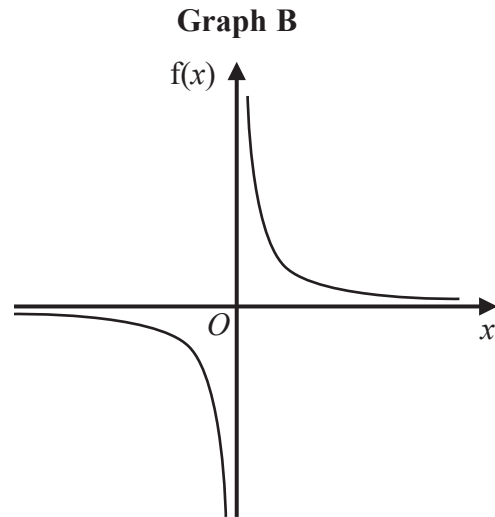
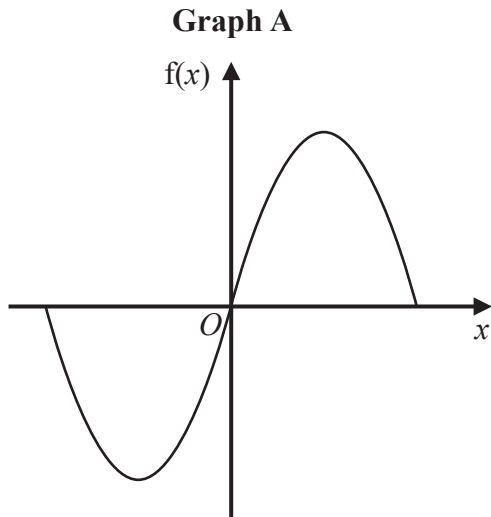
Working out what needs to be added to  $2n^2$  to get the sequence

$2n^2 - 3$

(Total for Question 16 is 3 marks)



17 Here are four graphs.



The graphs represent four different types of function  $f$ .

Match each description of the function in the table to the letter of its graph.

These are typical functions for each type

A trigonometrical function could be sin, cos or tan

Description of function	Graph
$f(x)$ is inversely proportional to $x$	B
$f(x)$ is a trigonometrical function	A
$f(x)$ is an exponential function	D
$f(x)$ is directly proportional to $\sqrt{x}$	C

$f(x) = 1/x$

$f(x) = 2^x$

$f(x) = \sqrt{x}$

(Total for Question 17 is 2 marks)

Use table mode on the calculator (press Menu then 3) and put in the functions to work out what the graphs look like. Start: -5, End: 5, Step: 1. Leave the trigonometrical function until last.

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

18 (a) Show that  $(2x + 1)(x + 3)(3x + 7)$  can be written in the form  $ax^3 + bx^2 + cx + d$  where  $a, b, c$  and  $d$  are integers.

$2x^2 + 6x + x + 3$

Expand the first two brackets

$(2x^2 + 7x + 3)(3x + 7)$

Simplify the expression and write it multiplied by the third bracket

$6x^3 + 14x^2 + 21x^2 + 49x + 9x + 21$

Expand the two new brackets

$6x^3 + 35x^2 + 58x + 21$

Simplify by collecting like terms

(3)

(b) Solve  $(1 - x)^2 < \frac{9}{25}$

$1 - x = \pm \frac{3}{5}$

First solve as an equation. Square root both sides

$-x = \frac{3}{5} - 1$

$-x = -\frac{3}{5} - 1$

Subtract 1 from both sides and write out both possibilities for the equation

$x = \frac{2}{5}$

$x = \frac{8}{5}$

Solve both equations

When expanding out  $(1 - x)^2$ , the  $x^2$  term will be positive. Therefore the graph would be u-shaped and the values of  $x$  where it is less than  $9/25$  will be between the solutions

$\frac{2}{5} < x < \frac{8}{5}$

(3)

(Total for Question 18 is 6 marks)

$$19 \quad D = \frac{u^2}{2a}$$

$u = 26.2$  correct to 3 significant figures

$a = 4.3$  correct to 2 significant figures

- (a) Calculate the upper bound for the value of  $D$ .  
Give your answer correct to 6 significant figures.  
You must show all your working.

$$\frac{26.25^2}{2(4.25)}$$

The upper bound for  $D$  is the highest possible value, which happens when  $u$  is the greatest and  $a$  is the smallest. The upper bound of  $u$  is calculated by adding 0.05, as this is half of 0.1 (which is the degree it has been rounded to). The lower bound of  $a$  is calculated by subtracting 0.05, as this is half of 0.1 (which is the degree it has been rounded to)

$$81.0662$$

(3)

The lower bound for the value of  $D$  is 78.6003 correct to 6 significant figures.

- (b) By considering bounds, write down the value of  $D$  to a suitable degree of accuracy.  
You must give a reason for your answer.

80, as both the lower and upper bound round to this amount when rounded to the nearest 10

(2)

(Total for Question 19 is 5 marks)

20 Solve algebraically the simultaneous equations

$$\begin{aligned}x^2 - 4y^2 &= 9 \\ 3x + 4y &= 7\end{aligned}$$

$$x = \frac{7-4y}{3}$$

Rearrange the second equation to make x the subject. Subtract 4y then divide by 3

$$\left(\frac{7-4y}{3}\right)^2 - 4y^2 = 9$$

Substitute for x so that the first equation is now only in terms of y

$$\frac{49 - 56y + 16y^2}{9} - 4y^2 = 9$$

Expand the square bracket using 'square the first term, double the product, square the last term' for the numerator

$$49 - 56y + 16y^2 - 36y^2 = 81$$

Multiply everything by 9 to eliminate the denominator

$$-20y^2 - 56y - 32 = 0$$

Bring all terms to the left side, collect like terms and simplify

$$y = \frac{-(-56) \pm \sqrt{(-56)^2 - 4(-20)(-32)}}{2(-20)}$$

Use the quadratic formula. It is possible to simplify and factorise but this is easier when a calculator is allowed

$$y = \frac{-4}{5} \quad y = -2$$

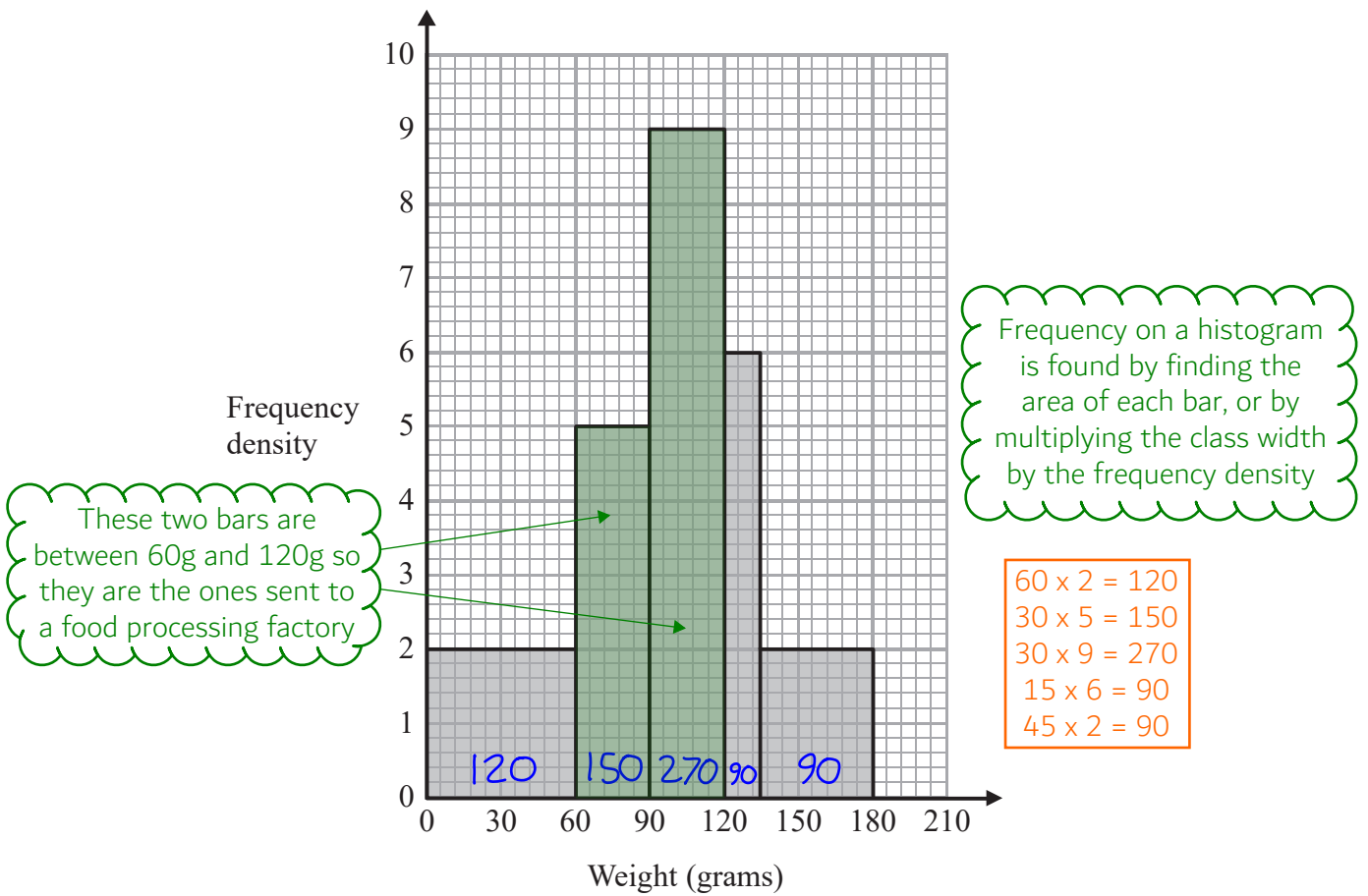
$$x = \frac{7-4\left(\frac{-4}{5}\right)}{3} \quad x = \frac{7-4(-2)}{3}$$

Substitute the values of y into the original rearranged linear equation to work out the values of x

$$x = \frac{17}{5}, y = \frac{-4}{5} \quad \text{or} \quad x = 5, y = -2$$

(Total for Question 20 is 5 marks)

21 The histogram gives information about the distribution of the weights of some onions grown by a farmer.



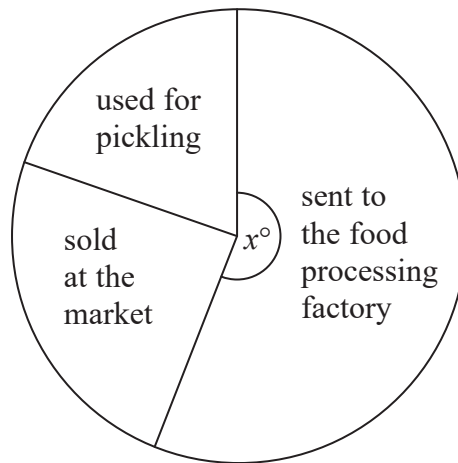
Onions less than 60 grams in weight are used for pickling.  
 Onions greater than 120 grams in weight are sold at the market.  
 The rest of the onions are sent to a food processing factory.

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

A pie chart is drawn using the information opposite to show what the farmer does with the onions he grows.



The angle of the sector for the onions sent to the food processing factory is  $x^\circ$ .

Work out the value of  $x$ .

$$\frac{150 + 270}{120 + 150 + 270 + 90 + 90} \times 360$$

Working out the number of onions sent to the food processing factory as a fraction of the total number of onions, then working out that fraction of 360 degrees (there are 360 degrees in total in a pie chart)

$x = \dots\dots\dots 210$

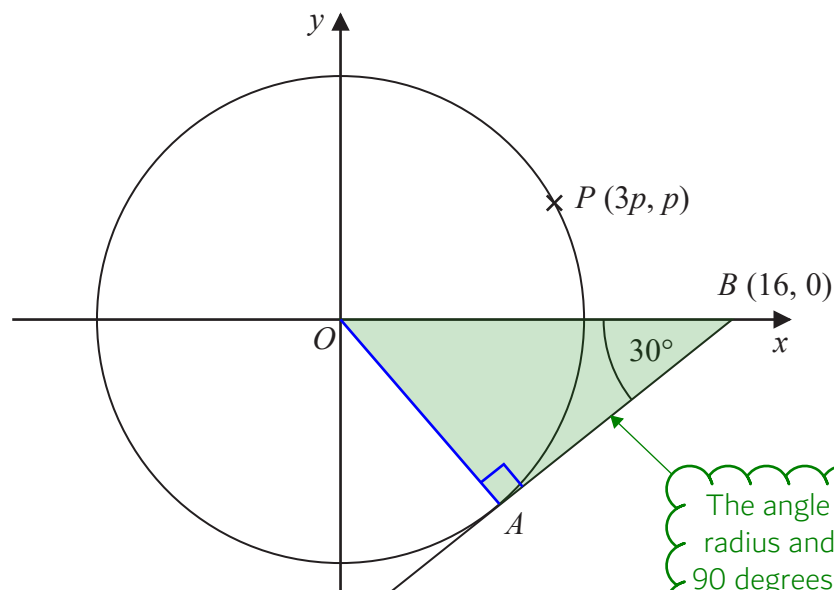
(Total for Question 21 is 4 marks)

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

22 The diagram shows a circle, centre  $O$ .



$AB$  is the tangent to the circle at the point  $A$ .  
Angle  $OBA = 30^\circ$

Point  $B$  has coordinates  $(16, 0)$

Point  $P$  has coordinates  $(3p, p)$

Find the value of  $p$ .

Give your answer correct to 1 decimal place.

You must show all your working.

SOH CAH TOA      S O H

Using SOH CAH TOA to find the radius  $OA$ , which is the opposite.  $OB$  is the hypotenuse and has length of 16

$$\sin 30 \times 16 = 8$$

By covering  $O$  in the formula triangle, opposite (the radius) is  $\sin$  of the angle multiplied by the hypotenuse

$$(3p)^2 + p^2 = 64$$

The general equation of a circle is  $x^2 + y^2 = r^2$ . Substituting in the  $x$ -coordinate,  $y$ -coordinate and the length of the radius into the equation gives this

$$10p^2 = 64$$

Simplifying the left side of the equation to get one term involving  $p$

$$p = \sqrt{\frac{64}{10}}$$

Rearranging to make  $p$  the subject

The answer of 2.529822128 is rounded to 1 decimal place

$p = \dots\dots\dots 2.5$

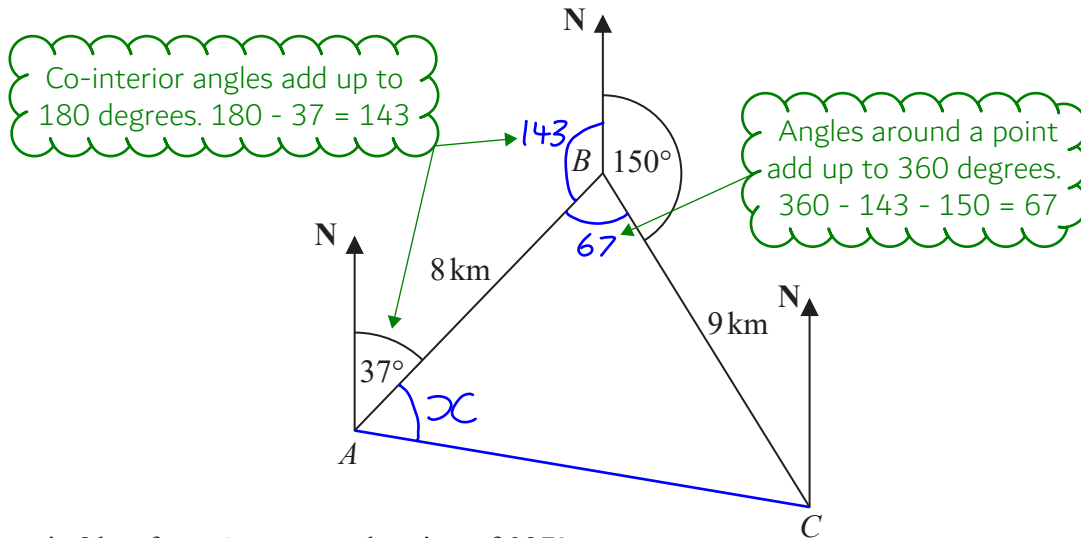
(Total for Question 22 is 4 marks)

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

23 The diagram shows the positions of three towns, Acton ( $A$ ), Barston ( $B$ ) and Chorlton ( $C$ ).



Barston is 8 km from Acton on a bearing of  $037^\circ$   
Chorlton is 9 km from Barston on a bearing of  $150^\circ$

Find the bearing of Chorlton from Acton.  
Give your answer correct to 1 decimal place.  
You must show all your working.

The triangle ABC is not a right angled triangle so non-right angled trigonometry will be needed. The sine rule can be used to find angle  $x$  once side AC is found as there will be opposite pairs of sides and angles

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

The cosine rule can be used to find side AC as there are two sides and an angle between them

$$AC = \sqrt{8^2 + 9^2 - 2(8)(9)\cos 67}$$

Store the answer of 9.419910695 onto the calculator

$$\frac{\sin A}{a} = \frac{\sin B}{b}$$

The sine rule is quoted with the angles as the numerators to make it easier to rearrange to find angle A

$$A = \sin^{-1}\left(\frac{a \sin B}{b}\right)$$

$$x = \sin^{-1}\left(\frac{9 \sin 67}{AC}\right)$$

$$= 61.57868521$$

Added 37 degrees to angle  $x$  to get the bearing then rounded to 1 decimal place

098.6

(Total for Question 23 is 5 marks)

TOTAL FOR PAPER IS 80 MARKS