Candidate surname   Other names

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

Centre Number   Candidate Number

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 π button, take the value of π 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 ▶

.CG Maths.
Hints

Pearson

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.
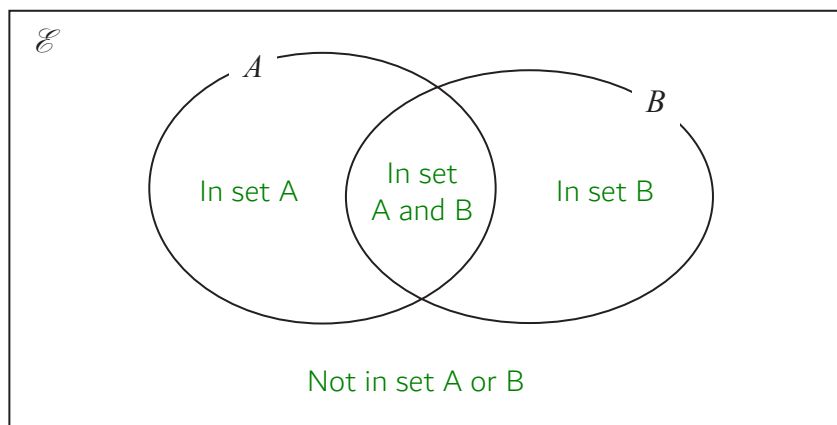
If you find any mistakes or have any requests or suggestions, please send an email to curtis@cgmaths.co.uk

.CG Maths.

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

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

(3)

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

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

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

....

(2)

(Total for Question 1 is 5 marks)

.CG Maths.

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.

> Multiplying by 1.015 increases by 1.5%. Subtracting the original value leaves the interest.

£...

(Total for Question 2 is 3 marks)

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

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

(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.

....

(1)

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

Plot all the points at the midpoints then join them up with straight lines.

Frequency

Height (h cm)

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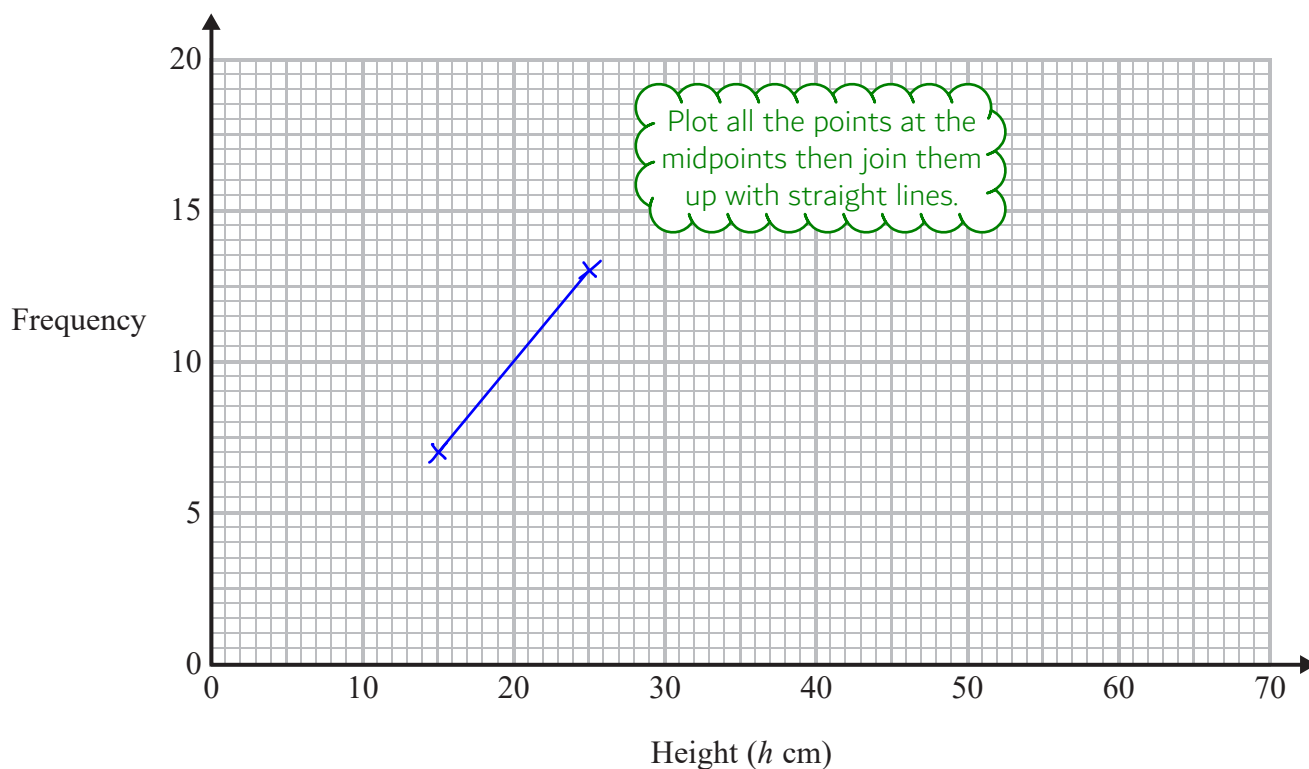
(Total for Question 3 is 3 marks)

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4 Sean has drawn a time series graph to show the numbers, in thousands, of visitors to a fun park.
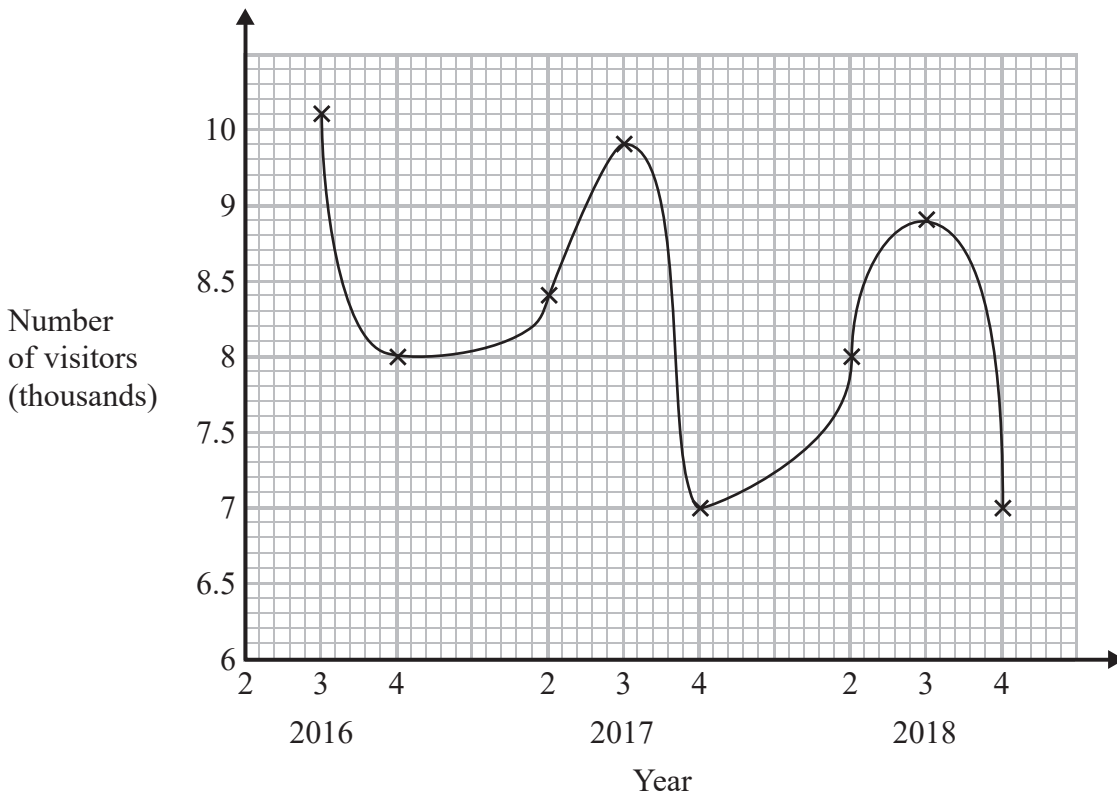
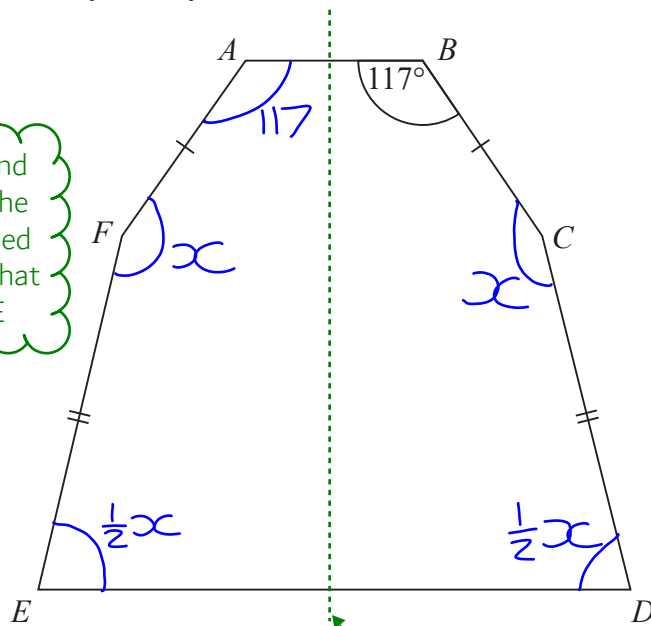Write down two things that are wrong or could be misleading with this graph.

1 ....

> It must be something to do with the axes or the curve as we have no data for what the plotted points should be.

....

2 ....

....

....

(Total for Question 4 is 2 marks)

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

$FA = BC$
$EF = CD$
Angle $ABC = 117°$

Angle $BCD = 2 \times$ angle CDE

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

.... °

(Total for Question 5 is 4 marks)

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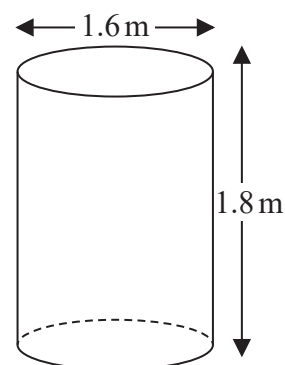**6** Jeremy has to cover 3 tanks completely with paint.

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 m²

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

Calculate how much area 7 tins of paint will cover.

π x diameter gives the circumference. Multiplying this be the height gives the curved surface area.

2 lots of πr^2 as there are 2 circular surfaces per tank. The radius is half of the diameter.

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

Compare the amount of paint needed to the paint he has.

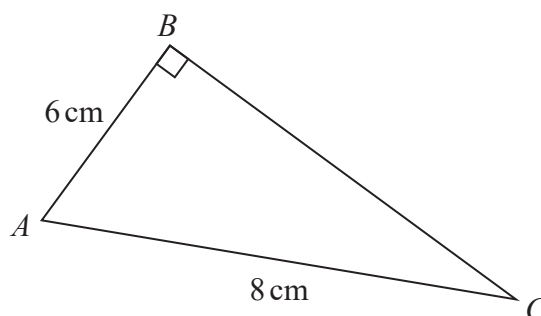**(Total for Question 6 is 5 marks)**

7 Work out

$$\sqrt{\frac{2.5 \times \sin 43°}{8.2^2 - 50.5}}$$

Give your answer correct to 3 significant figures.

Put the whole expression into the calculator. Give the first 3 digits after the first non-zero digit and decide whether to round up or down by checking the 4th.

....

(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*.

$BC^2 = AB^2 + AC^2$ ← *There is a mistake on the first line.*
$ = 6^2 + 8^2$
$ = 100$
$BC = 10$

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

....

....

....

(1)

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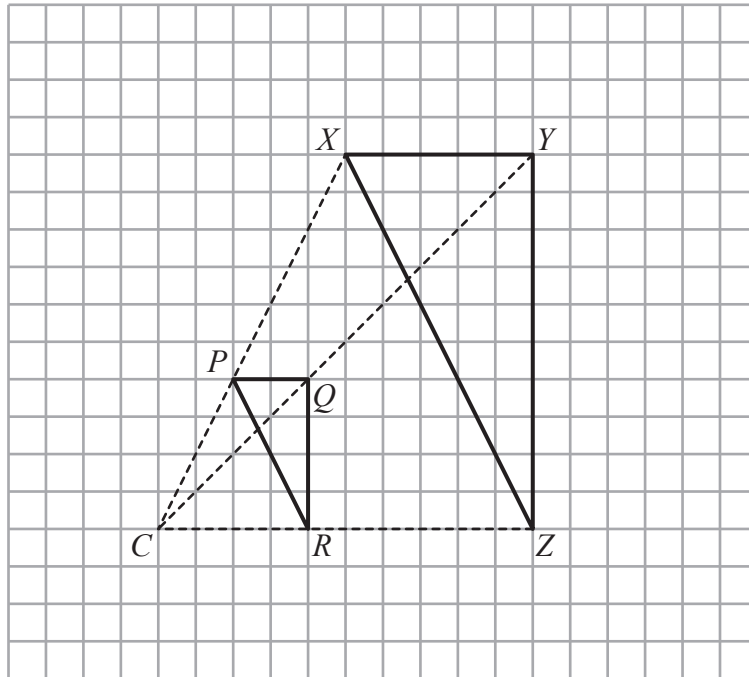
Roy is going to enlarge triangle PQR with centre C and scale factor $1\frac{1}{2}$

He draws triangle XYZ.

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

....

He has enlarged correctly from the right point but the scale factor...

....

....

(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
Number of machines working	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. 1 machine working for a full day is 1 machine day.

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

....

(Total for Question 9 is 3 marks)

.CG Maths.

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.

> Interest x 0.2 = tax
> 0.2 is equivalent to 20%
> Interest = ?
>
> Once the interest has been calculated, express
> the interest as a fraction of the original amount
> invested and convert it into a percentage.

.... %

(Total for Question 10 is 3 marks)

11 In May 2019, the distance between Earth and Mars was 3.9×10^7 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 3×10^5 km per second,

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

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

From the formula triangle, time = distance/speed

.... seconds

(2)

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

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

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

....

....

....

(1)

(Total for Question 11 is 3 marks)

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

Patrick says,

"$\dfrac{1}{4}$ of 64 is 16 so $64^{\frac{1}{4}} = 16$"

Explain what is wrong with what Patrick says.

Power of 1/2 means square root, power of 1/3 means cube root, power of 1/4 means...

....

....

....

(Total for Question 12 is 1 mark)

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13 The density of ethanol is $1.09\,\text{g/cm}^3$
The density of propylene is $0.97\,\text{g/cm}^3$

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.

$\dfrac{M}{D \mid V}$

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

Work out the mass of the ethanol. Work out the mass of the propylene. Add these together to give the total mass of the antifreeze. Dividing this by the volume gives the density.

.... g/cm^3

(Total for Question 13 is 4 marks)

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

A   *B*

30°   30°

24 cm   24 cm
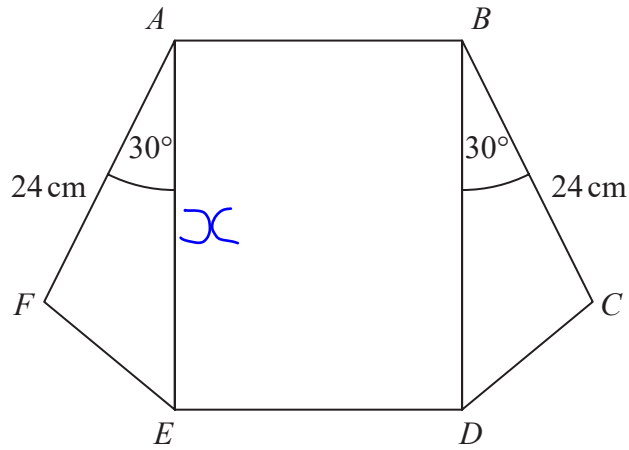
Label AE as x as this is what we are trying to find. Use the ratio to express AB in terms of x

F   *C*

E   *D*

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

$$AB : AE = 1 : 3$$

Work out the length of *AE*.

Area of rectangle = length x width
Area of triangle = 1/2 x a x b x sinA

.... cm

(Total for Question 14 is 4 marks)

.CG Maths.

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. The -3 translates the graph downwards by 3

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

(Total for Question 15 is 2 marks)

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

$$-1 \quad 5 \quad 15 \quad 29 \quad 47 \quad 69$$
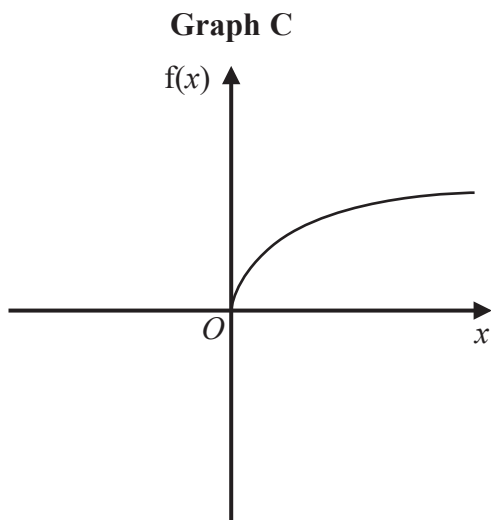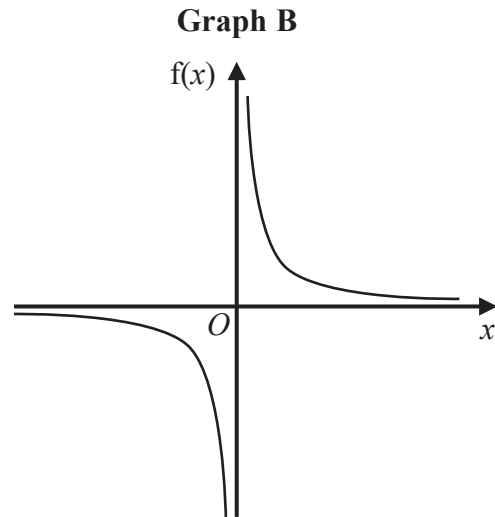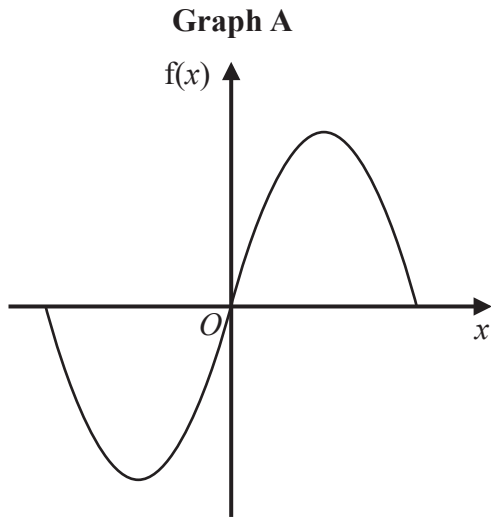
Find an expression, in terms of n, for the nth term of this sequence.

Quadratic sequences are in the form $an^2 + bn + c$
a is half of the second difference.
List the sequence of an^2 then work out the linear sequence which needs to be added to this to get the quadratic sequence.
Add both of the sequences.

....

(Total for Question 16 is 3 marks)

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17 Here are four graphs.

Graph A

Graph B
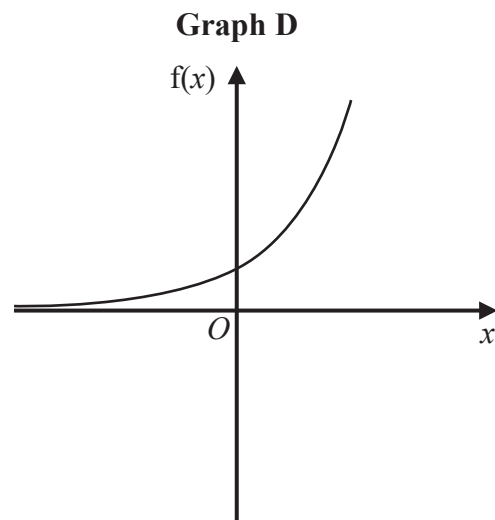
Graph C

Graph D

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

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

$f(x) = 1/x$

$f(x) = 2^x$

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

A trigonometrical function could be sin, cos or tan

(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.

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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.

> Expand and simplify the first two brackets then expand the result with the third bracket

(3)

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

> First solve as an equation. Follow BIDMAS backwards to make x the subject. Remember that the square root of a value has both positive and negative values so there will be two solutions to the equation. Then consider the shape of the graph of $(1 - x)^2$ to determine the solutions to the inequality. For example, if the graph is u-shaped, the solutions of the inequality will be between the solutions of the equation

....

(3)

(Total for Question 18 is 6 marks)

19 $D = \dfrac{u^2}{2a}$

$u = 26.2$ 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.

> The upper bound for D is the highest possible value. Consider whether the upper bound or lower bound for u and a are needed for this to happen and substitute these values into the equation to find D. To find the bounds of a number, add and subtract half of the degree it has been rounded to (both of these have been rounded to the nearest 0.1)

....

(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.

> Find a value of D which both the upper and lower bound round to. Choose a degree of accuracy which does this

....

....
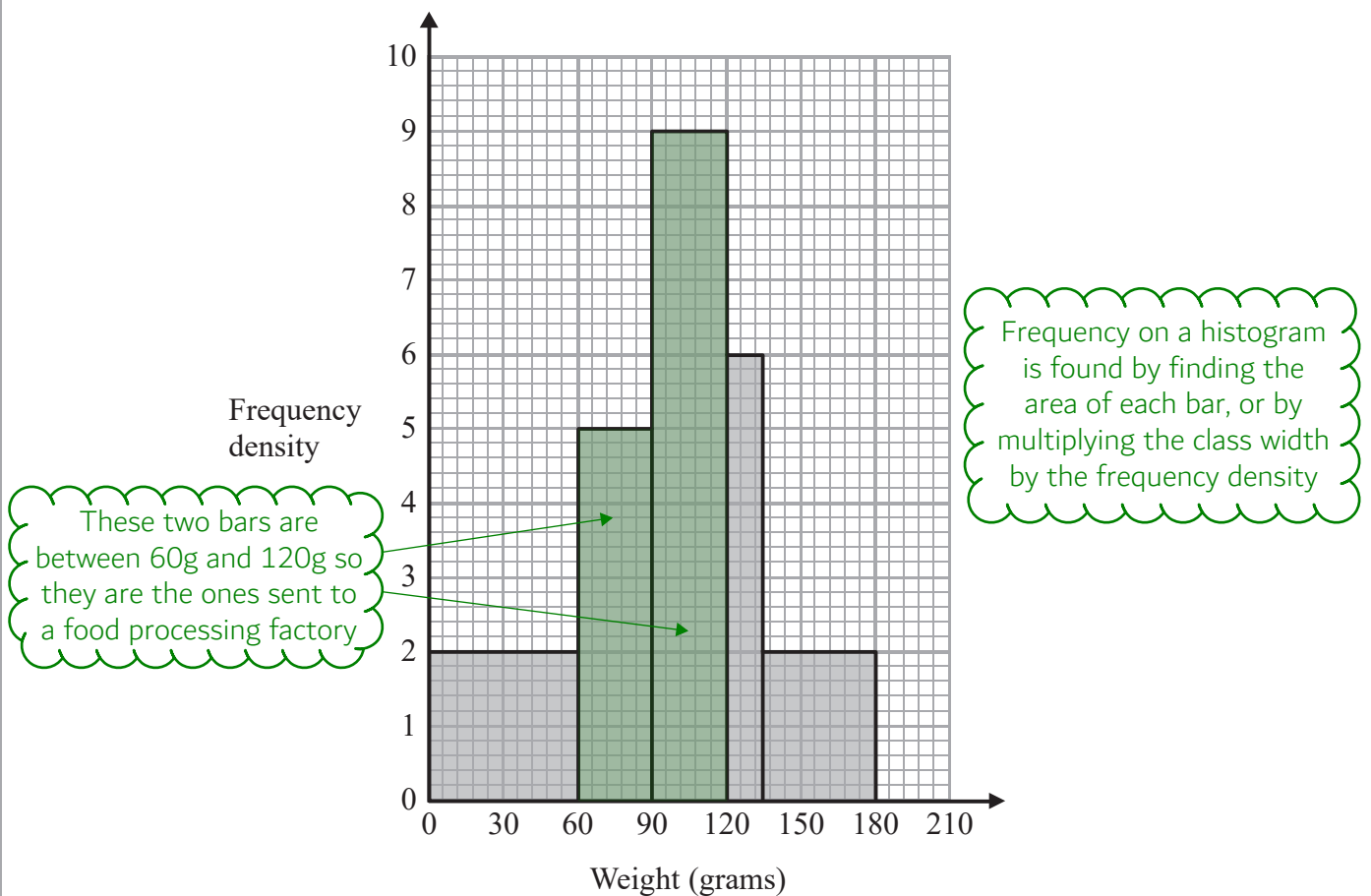
(2)

(Total for Question 19 is 5 marks)

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20 Solve algebraically the simultaneous equations

$$x^2 - 4y^2 = 9$$
$$3x + 4y = 7$$

Rearrange the second equation to make x the subject. Substitute the result for x in the first equation so that it is now only in terms of y. Expand the square bracket using 'square the first term, double the product, square the last term' for the numerator. Eliminate the denominator by multiplying everything by it. Rearrange and simplify into the form $ay^2 + by + c = 0$ then use the quadratic formula. Finally substitute the values of y into the original rearranged linear equation to find the values of x

....

(Total for Question 20 is 5 marks)

.CG Maths.

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

Frequency density

These two bars are between 60g and 120g so they are the ones sent to a food processing factory

Frequency on a histogram is found by finding the area of each bar, or by multiplying the class width by the frequency density

Weight (grams)

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.

.CG Maths.

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

used for pickling

sold at the market

$x°$

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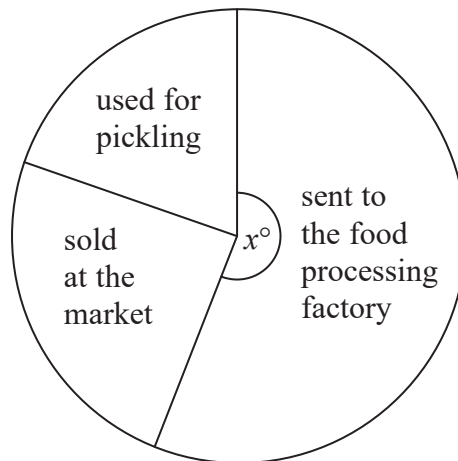
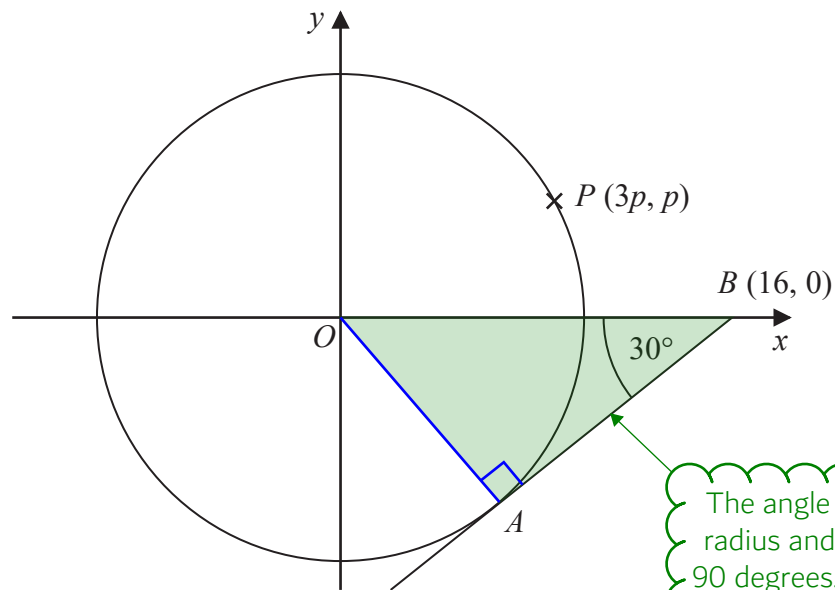The angle of the sector for the onions sent to the food processing factory is $x°$.

Work out the value of x.

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

$x =$ ....

(Total for Question 21 is 4 marks)

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

AB is the tangent to the circle at the point *A*.
Angle *OBA* = 30°

Point *B* has coordinates (16, 0)
Point *P* has coordinates (3*p*, *p*)

Find the value of *p*.
Give your answer correct to 1 decimal place.
You must show all your working.

Use SOH CAH TOA to find the radius OA. Then substitute the length of the radius and the x and y coordinates of point P into the equation of a circle, $x^2 + y^2 = r^2$. Simplify then rearrange to find p

p = ...

(Total for Question 22 is 4 marks)

.CG Maths.

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

Co-interior angles add up to 180 degrees

Angles around a point add up to 360 degrees

This is the bearing we are trying to find
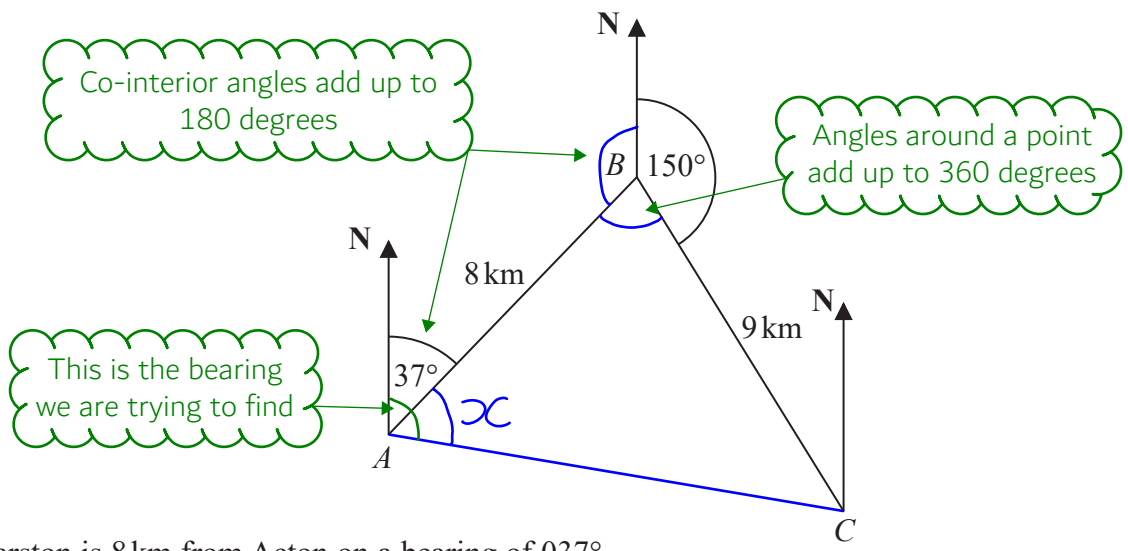
Barston is 8 km from Acton on a bearing of 037°
Chorlton is 9 km from Barston on a bearing of 150°

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

.... °

(Total for Question 23 is 5 marks)

TOTAL FOR PAPER IS 80 MARKS

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