

Write your name here

Surname

Other names

Centre Number

Candidate Number

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

Mathematics

Paper 2 (Calculator)

Higher Tier

Monday 6 November 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 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 ►

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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

Answer ALL questions.

Write your answers in the spaces provided.

You must write down all the stages in your working.

1 Solve $5x - 6 = 3(x - 1)$

Expand the brackets on the right side. Bring all the x terms to the same side. Eliminate all of the other terms on the side with the x terms. Divide by the number before x to get x on its own

$x = \dots\dots\dots$

(Total for Question 1 is 3 marks)

2 Emily buys a pack of 12 bottles of water.
The pack costs £5.64

Emily sells all 12 bottles for 50p each.

Work out Emily's percentage profit.
Give your answer correct to 1 decimal place.

Percentage profit = percentage change
= (new - original)/original x 100. The
new amount is what she sells them for in
total and the original is £5.64

$\dots\dots\dots\%$

(Total for Question 2 is 3 marks)

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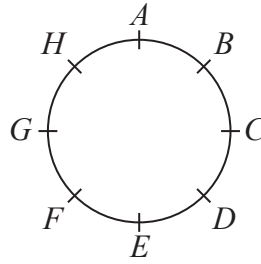
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3 Hasmeet walks once round a circle with diameter 80 metres.



There are 8 points equally spaced on the circumference of the circle.

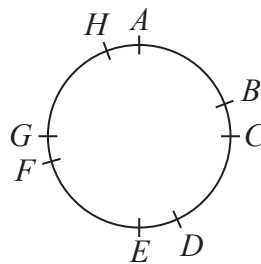
(a) Find the distance Hasmeet walks between one point and the next point.

$$\text{Circumference} = \pi \times \text{diameter}$$

.....m

(2)

Four of the points are moved, as shown in the diagram below.



Hasmeet walks once round the circle again.

(b) Has the mean distance that Hasmeet walks between one point and the next point changed? You must give a reason for your answer.

$$\text{Mean} = \text{total} / \text{number} \text{ where total is the total distance and the number is the number of points}$$

(1)

(Total for Question 3 is 3 marks)

4 There are only blue cubes, yellow cubes and green cubes in a bag.

There are

twice as many blue cubes as yellow cubes
and four times as many green cubes as blue cubes.

Hannah takes at random a cube from the bag.

Work out the probability that Hannah takes a yellow cube.

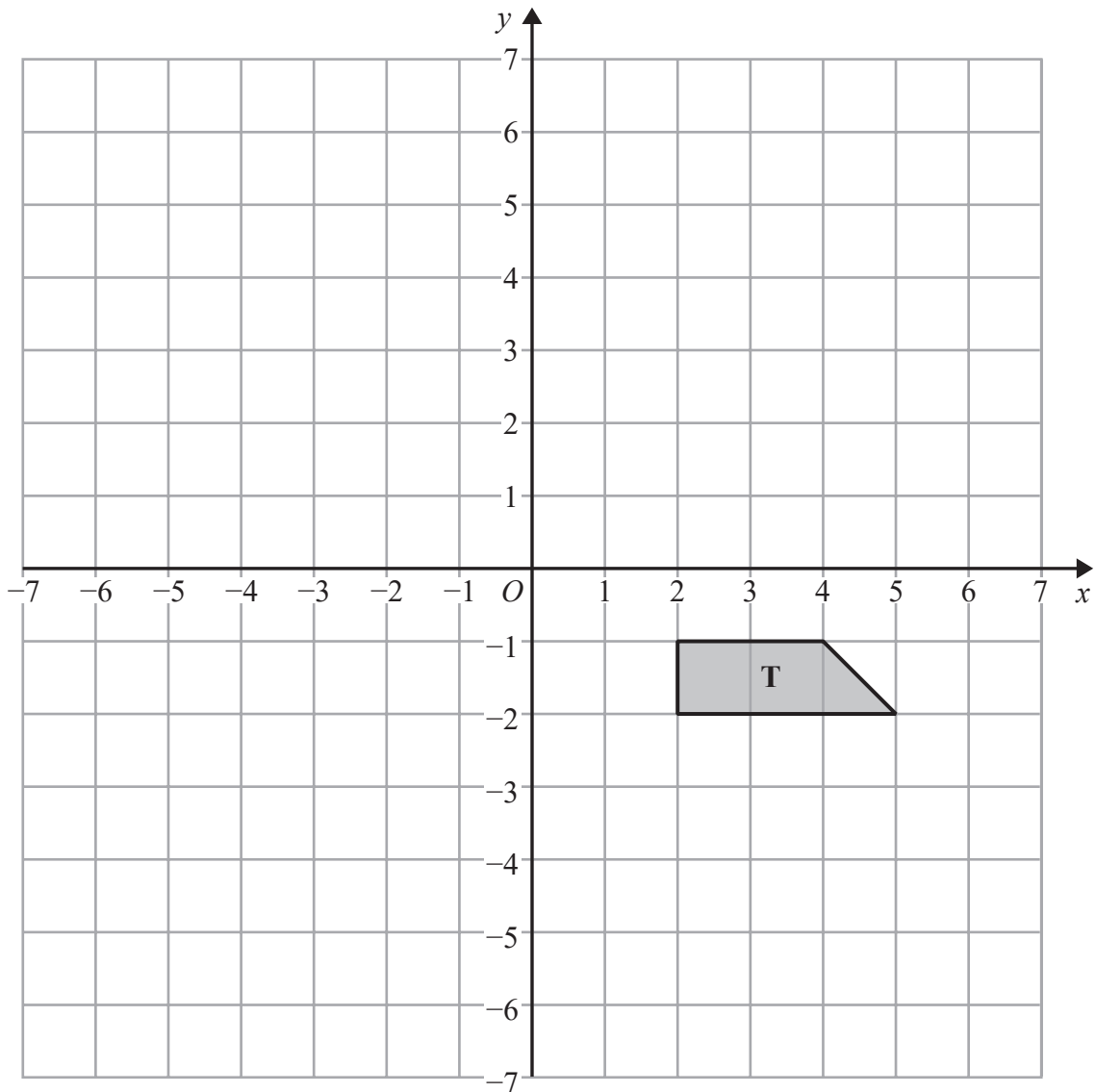
Write the ratio of yellow : blue : green. Let there be 1 part for yellow.
There are twice as many blue so there are ? parts for blue. There are
four times as many green so there are ? parts for green. Then express
the number of parts for yellow as a fraction of the total number of parts

(Total for Question 4 is 3 marks)

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- (a) Rotate trapezium **T** 180° about the origin.
Label the new trapezium **A**.

Use tracing paper to sketch around **T** then rotate the paper 180° about the origin $(0, 0)$

(1)

- (b) Translate trapezium **T** by the vector $\begin{pmatrix} -1 \\ -3 \end{pmatrix}$
Label the new trapezium **B**.

-1 in the x direction and
-3 in the y direction

(1)

(Total for Question 5 is 2 marks)

$$6 \quad p^3 \times p^x = p^9$$

(a) Find the value of x .

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

$$x = \dots\dots\dots (1)$$

$$(7^2)^y = 7^{10}$$

(b) Find the value of y .

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

$$y = \dots\dots\dots (1)$$

$100^a \times 1000^b$ can be written in the form 10^w

(c) Show that $w = 2a + 3b$

Start by expressing 100 and 1000 as powers of 10 in the form 10^n and setting the expression equal to 10^w . The equation can be simplified using $(a^x)^y = a^{xy}$ and $a^x \times a^y = a^{x+y}$. Once 10^w is on one side and 10^2 is on the other, the powers can be set equal to each other

(2)

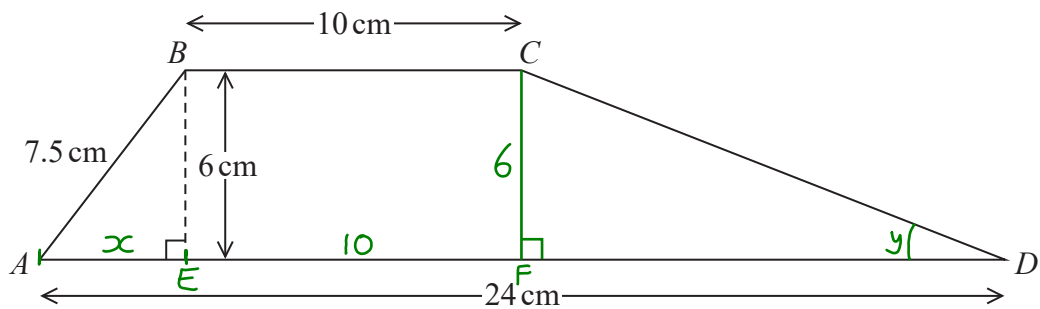
(Total for Question 6 is 4 marks)

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7 $ABCD$ is a trapezium.



Work out the size of angle CDA .
 Give your answer correct to 1 decimal place.

Pythagoras' Theorem can be used to find x as we have two sides of the right-angled triangle ABE . $a^2 + b^2 = c^2$. We can then work out side FE by subtracting x and EF from 24.

Triangle CFD is right-angled so SOH CAH TOA can be used to find the angle CDA

(Total for Question 7 is 5 marks)

8 Use your calculator to work out $\sqrt{\frac{\sin 25^\circ + \sin 40^\circ}{\cos 25^\circ - \cos 40^\circ}}$

(a) Write down all the figures on your calculator display.

Type into the calculator

2.7...

(2)

(b) Write your answer to part (a) correct to 2 decimal places.

Use the third decimal place to round the second decimal place. Then ignore all the decimal places after the second

(1)

(Total for Question 8 is 3 marks)

9 Yesterday it took 5 cleaners $4\frac{1}{2}$ hours to clean all the rooms in a hotel.

There are only 3 cleaners to clean all the rooms in the hotel today.

Each cleaner is paid £8.20 for each hour or part of an hour they work.

How much will each cleaner be paid today?

First work out how many hours worth of work are done yesterday.
For example if 2 cleaners worked 3 hours, $2 \times 3 = 6$ so 6 hours worth of work have been done. Then divide the amount of work by the cleaners today and round up to the nearest whole number of hours. Finally multiply this number of hours by the hourly rate

£

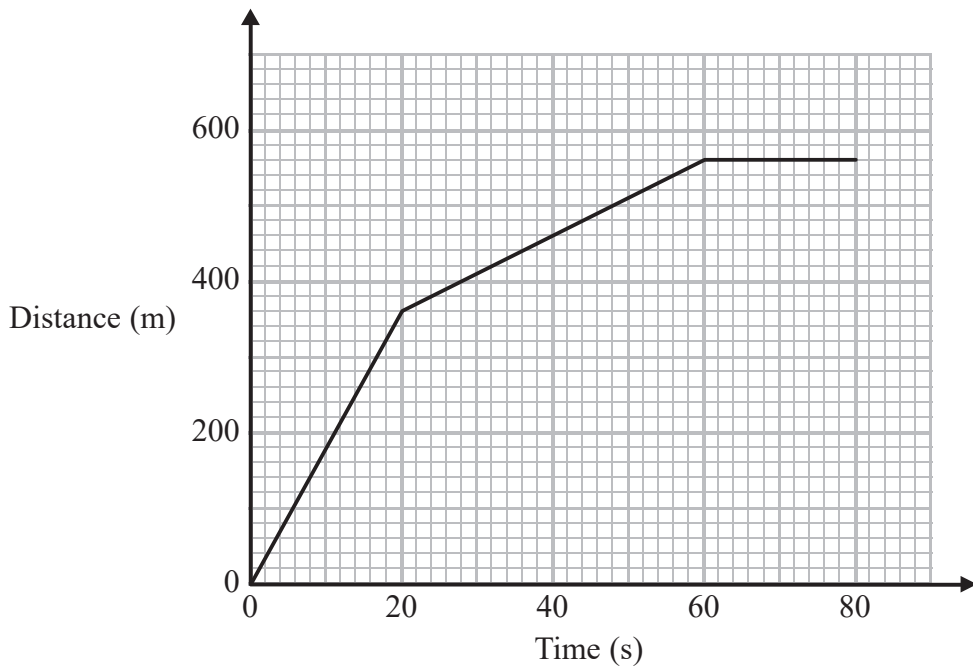
(Total for Question 9 is 3 marks)

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10 Here is part of a distance-time graph for a car's journey.



- (a) Between which two times does the car travel at its greatest speed?
Give a reason for your answer.

Speed on a distance-time graph is the gradient

(2)

- (b) Work out this greatest speed.

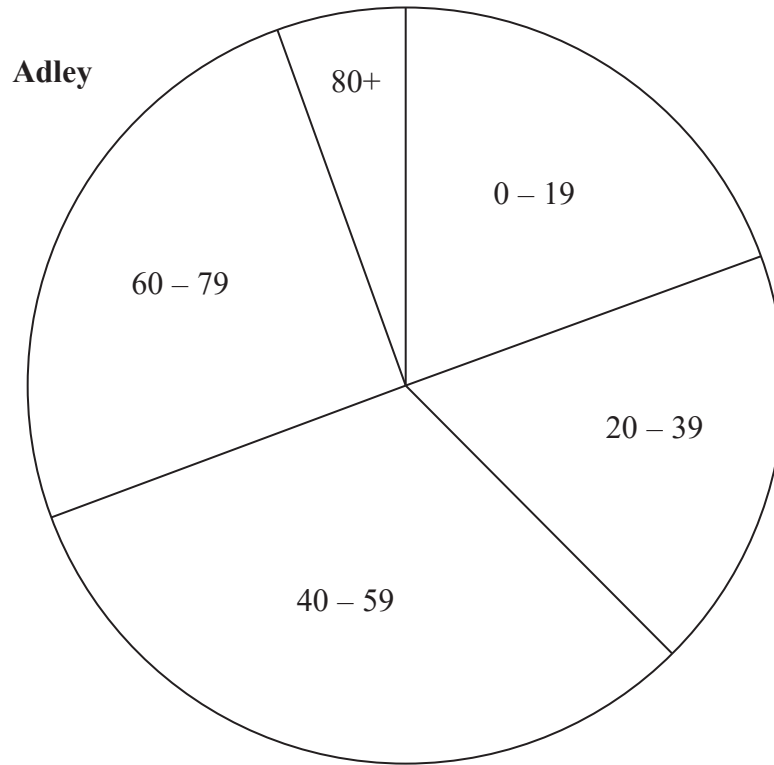
Speed = gradient = (change in y)/(change in x)

..... m/s

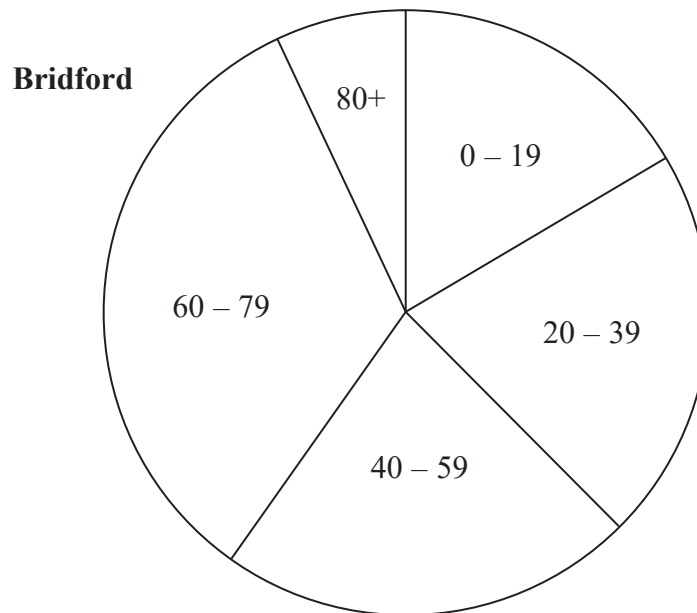
(1)

(Total for Question 10 is 3 marks)

- 11 The pie charts give information about the ages, in years, of people living in two towns, Adley and Bridford.



Diagrams
accurately
drawn



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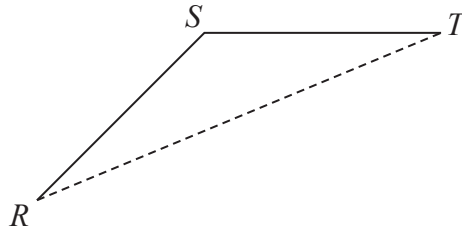
The ratio of the number of people living in Adley to the number of people living in Bridford is given by the ratio of the areas of the pie charts.

What proportion of the total number of people living in these two towns live in Adley **and** are aged 0 – 19?

Give your answer correct to 3 significant figures.

Express the area of the sector representing living in Adley and are aged 0 – 19 as a fraction of the total area of both circles. This is the proportion.
Convert it into a decimal and round it to 3 significant figures by ignoring all the figures after the first 3 after rounding. Area of circle = $\pi \times \text{radius}^2$

.....
(Total for Question 11 is 3 marks)



RS and ST are 2 sides of a regular 12-sided polygon.
 RT is a diagonal of the polygon.

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

Exterior angle = $360 / (\text{number of sides})$. As there are 180 degrees around a point on a straight line, the interior angle RST can be worked out. Triangle TRS is isosceles as two of the sides are equal (it is a regular polygon) so the base angles are equal. There are 180 degrees in total in a triangle

(Total for Question 12 is 3 marks)

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13 At the beginning of 2009, Mr Veale bought a company.
The value of the company was £50 000

Each year the value of the company increased by 2%.

- (a) Calculate the value of the company at the beginning of 2017
Give your answer correct to the nearest £100

100% + 2% = 102%, which needs to be converted into a decimal. Multiply £50000 by this decimal to the power of the number of years between 2009 and 2017

£.....
(2)

At the beginning of 2009 the value of a different company was £250 000
In 6 years the value of this company increased to £325 000

This is equivalent to an increase of $x\%$ each year.

- (b) Find the value of x .
Give your answer correct to 2 significant figures.

$100 + x$ expresses the percentage it increases to each year. Dividing by 100 changes this into a decimal multiplier. £250000 is increased by the percentage 6 times so the multiplier is raised to the power of 6. It is then equal to £325000. Make an equation out of this then rearrange to find x

.....
(3)

(Total for Question 13 is 5 marks)

14 On the grid, shade the region that satisfies all these inequalities.

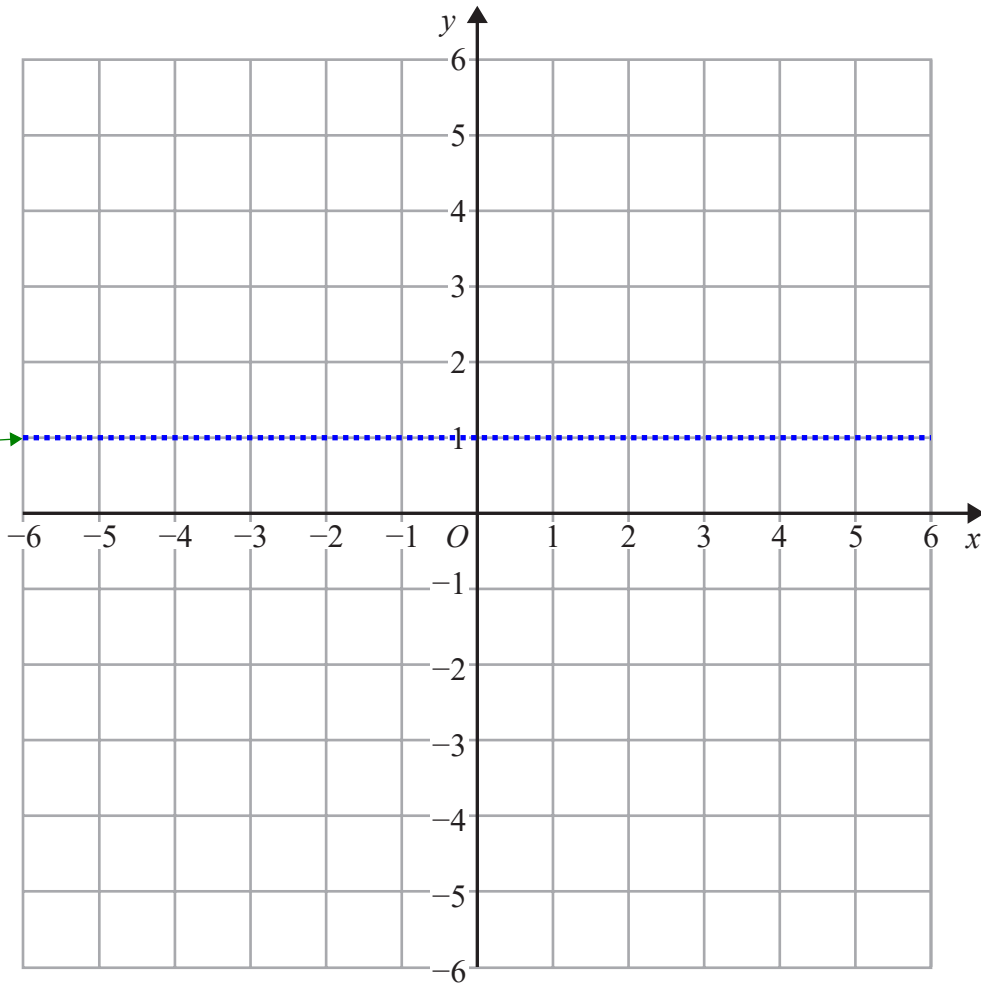
$$y > 1$$

$$x + y < 5$$

$$y > 2x$$

Label the region **R**.

$$y < 5 - x$$



$y = 1$. The region is above this line

Sketch the inequalities as equations. Then determine if the region is above or below each line

(Total for Question 14 is 3 marks)

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- 15 Tracey is going to choose a main course and a dessert in a cafe. She can choose from 8 main courses and 7 desserts.

Tracey says that to work out the number of different ways of choosing a main course and a dessert you add 8 and 7

- (a) Is Tracey correct?

You must give a reason for your answer.

The product rule of counting should be used

(1)

12 teams play in a competition. Each team plays each other team exactly once.

- (b) Work out the total number of games played.

The product rule of counting should be used. Remember that each game gets counted twice as a game is played by two of the teams

(2)

(Total for Question 15 is 3 marks)

- 16 Solve $(x - 2)^2 = 3$

Give your solutions correct to 3 significant figures.

Rearrange to make x the subject. There are two solutions as the square root of a number can be positive or negative

(Total for Question 16 is 2 marks)

Frequency = class width \times frequency density
 Frequency density = frequency / class width

17 The table gives information about the heights of 150 students.

Class width is 10
 as $150 - 140 = 10$

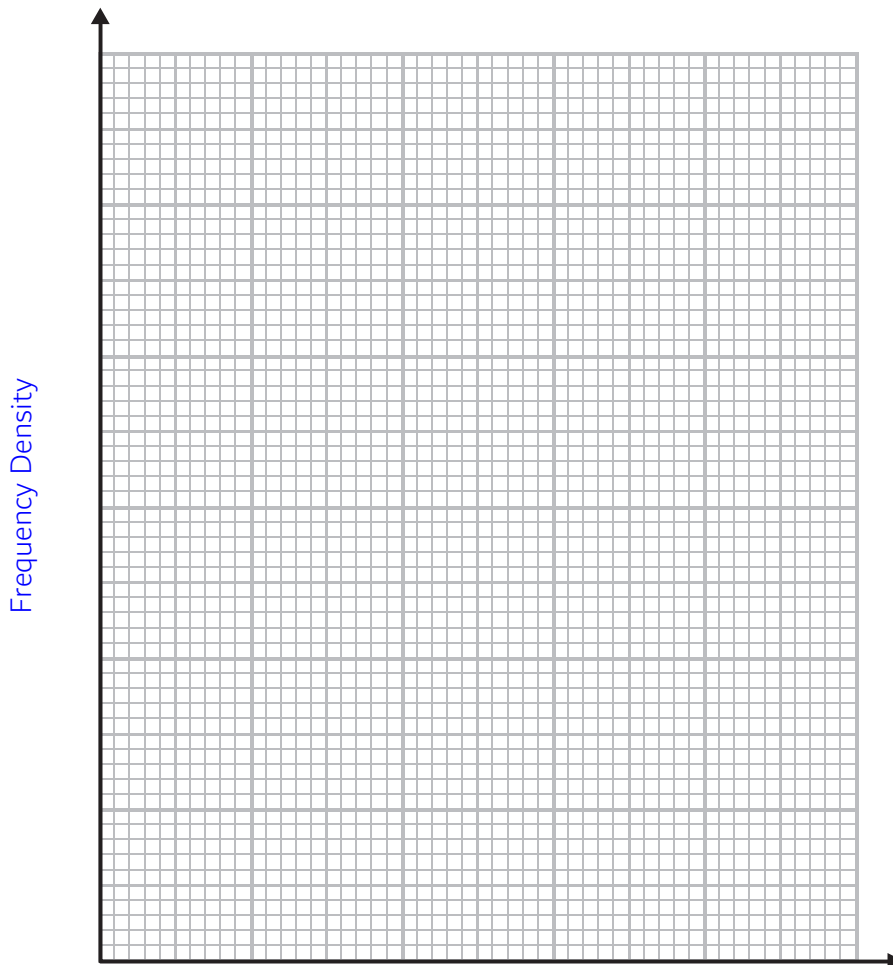
Height (h cm)	Frequency
$140 < h \leq 150$	15
$150 < h \leq 155$	30
$155 < h \leq 160$	51
$160 < h \leq 165$	36
$165 < h \leq 180$	18

f.d.

1.5

15/10

(a) On the grid, draw a histogram for this information.



Height

(3)

(b) Work out an estimate for the fraction of the students who have a height between 150 cm and 170 cm.

Add together the frequencies which are for categories between 150 and 170 and work out an estimate for the frequency between 165 and 170. Frequency = class width \times frequency density. Put the total frequency as a fraction of the 150 students

(2)

(Total for Question 17 is 5 marks)

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18 At time $t = 0$ hours a tank is full of water.

Water leaks from the tank.

At the end of every hour there is 2% less water in the tank than at the start of the hour.

The volume of water, in litres, in the tank at time t hours is V_t

Given that

$$\begin{aligned} V_0 &= 2000 \\ V_{t+1} &= kV_t \end{aligned}$$

write down the value of k .

The notation basically means that we multiply the volume by k to get the volume in the next hour. What can we multiply by to reduce it by 2%?

$k = \dots\dots\dots$

(Total for Question 18 is 1 mark)

19 A triangle has vertices P , Q and R .

The coordinates of P are $(-3, -6)$

The coordinates of Q are $(1, 4)$

The coordinates of R are $(5, -2)$

M is the midpoint of PQ .

N is the midpoint of QR .

Prove that MN is parallel to PR .

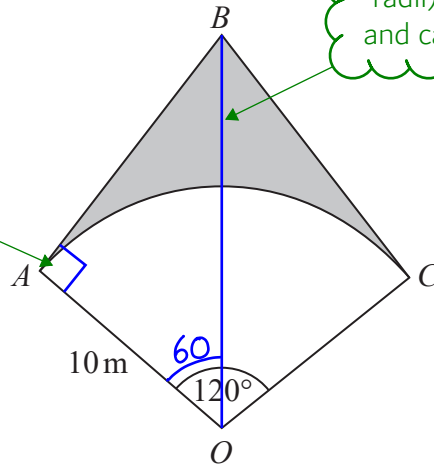
You must show each stage of your working.

If they are parallel, they have the same gradient. Gradient = (change in y)/(change in x).

Change can be found by subtracting the coordinates of one point from the other. The coordinates of the midpoints can be found by taking the mean of the coordinates they are in the middle of (e.g. the x coordinate of M is the mean of the x coordinates of P and Q)

(Total for Question 19 is 4 marks)

The angle between a radius and tangent is 90 degrees



The shape is a kite as $AB = BC$ (the tangents of a circle from same point are equal in length) and $AO = OC$ (they are both radii). Therefore the shape is symmetrical and can be split into two identical triangles

OAC is a sector of a circle, centre O , radius 10 m.

BA is the tangent to the circle at point A .
 BC is the tangent to the circle at point C .

Angle $AOC = 120^\circ$

Calculate the area of the shaded region.
 Give your answer correct to 3 significant figures.

Shaded area = area of kite - area of sector
 Area of kite = 2 x area of triangle AOB
 Area of triangle = $\frac{1}{2} \times \text{base} \times \text{height}$
 Area of sector = $\frac{x}{360} \times \pi \times \text{radius}^2$, where x is the number of degrees out of the full circle.
 To find the height of the triangle AB , use SOH CAH TOA

.....m²

(Total for Question 20 is 5 marks)

- 21 There are 12 counters in a bag.
There is an equal number of red counters, blue counters and yellow counters in the bag.
There are no other counters in the bag.

3 counters are taken at random from the bag.

- (a) Work out the probability of taking 3 red counters.

Red AND red AND red. AND means to multiply together the probabilities.
Express the probabilities of each event by expressing the number of red counters as a fraction of the total number of counters. Remember that each time a red is taken there is one fewer red and one fewer in total

.....
(2)

The 3 counters are put back into the bag.

Some more counters are now put into the bag.

There is still an equal number of red counters, blue counters and yellow counters in the bag.
There are no counters of any other colour in the bag.

3 counters are taken at random from the bag.

- (b) Is it now less likely or equally likely or more likely that the 3 counters will be red?
You must show how you get your answer.

There could now be 5 of each colour. Use a similar method to part (a) to work out the probability and compare this to the previous probability

(2)

(Total for Question 21 is 4 marks)

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22 The functions f and g are such that

$$f(x) = 5x + 3 \quad g(x) = ax + b \quad \text{where } a \text{ and } b \text{ are constants.}$$

$$g(3) = 20 \quad \text{and} \quad f^{-1}(33) = g(1)$$

Find the value of a and the value of b .

To find the inverse function $f^{-1}(x)$, replace $f(x)$ with x and x with y in $f(x)$. Rearrange it to make y the subject then replace y back with $f^{-1}(x)$. Substitute x for 33 in $f^{-1}(x)$ to find the value of $f^{-1}(33)$. Substituting x for 1 and 3 in $g(x)$ finds $g(1)$ and $g(3)$.

Using the equations given, there should now be two equations in terms of a and b , which can be solved simultaneously

$$a = \dots\dots\dots$$

$$b = \dots\dots\dots$$

(Total for Question 22 is 5 marks)

23 S is a geometric sequence.

- (a) Given that $(\sqrt{x} - 1)$, 1 and $(\sqrt{x} + 1)$ are the first three terms of S, find the value of x .
You must show all your working.

It is a geometric sequence so each term is multiplied by a certain factor (lets call this r) to get the next term. 1st term $\times r =$ 2nd term. 2nd term $\times r =$ 3rd term. Rearranging these gives 2nd term/1st term $= r$ and also 3rd term/2nd term $= r$. As both are equal to r , 2nd term/1st term $=$ 3rd term/2nd term. This makes an equation which can be solved to find x

.....
(3)

- (b) Show that the 5th term of S is $7 + 5\sqrt{2}$

x was solved in the previous question. We should now know what the 3rd term is. Consider what the 2nd term, 1, needs to be multiplied by to get the 3rd term. All the terms need to be multiplied by this to get the next term

(2)

(Total for Question 23 is 5 marks)

TOTAL FOR PAPER IS 80 MARKS