AQA

.CG Maths.
Hints

Please write clearly in block capitals.

Centre number | | | | | | Candidate number | | | | |

Surname _____

Forename(s) _____

Candidate signature _____

GCSE MATHEMATICS

H

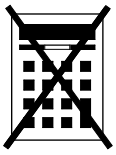
Higher Tier Paper 1 Non-Calculator

Thursday 2 November 2017 Morning Time allowed: 1 hour 30 minutes

Materials

For this paper you must have:
- mathematical instruments

You must **not** use a calculator.



Instructions

- Use black ink or black ball-point pen. Draw diagrams in pencil.
- Answer **all** questions.
- You must answer the questions in the spaces provided. Do not write outside the box around each page or on blank pages.
- Do all rough work in this book. Cross through any work you do not want to be marked.

Information

- The marks for questions are shown in brackets.
- The maximum mark for this paper is 80.
- You may ask for more answer paper, graph paper and tracing paper. These must be tagged securely to this answer book.

Advice

- In all calculations, show clearly how you work out your answer.

For Examiner's Use	
Pages	Mark
2–3	
4–5	
6–7	
8–9	
10–11	
12–13	
14–15	
16–17	
18–19	
20–21	
22–23	
24–25	
26–27	
TOTAL	

Please note that these worked solutions have neither been provided nor approved by AQA 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

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Answer **all** questions in the spaces provided

1 Work out $\sqrt{2^6 + 6^2}$

Circle your answer.

[1 mark]

10 14 50 100

$2^6 = 2 \times 2 \times 2 \times 2 \times 2 \times 2$. Keep doubling to work this out. $6^2 = 6 \times 6$. Add together the results. One of the answers above will square to get the result

2 What is 800 million in standard form?

Circle your answer.

[1 mark]

800×10^6 8×10^8 8×10^9 0.8×10^{10}

$800 = 8 \times 10^2$. A million = 10^6. Standard form is $a \times 10^n$, where $1 \leq a < 10$ and n is an integer

3 Circle the expression that is equivalent to $\left(4a^5\right)^2$

[1 mark]

$16a^{10}$ $16a^7$ $8a^{10}$ $8a^7$

Both parts can be raised to the power of 2 separately so it becomes $4^2 \times (a^5)^2$. $(b^x)^y = b^{xy}$

4 $y = \frac{10}{x}$

If the value of x doubles, what happens to the value of y?

Circle your answer.

[1 mark]

÷ 2 × 2 ÷ 5 × 5

Doubling the denominator means dividing by twice the amount

5 (a) Factorise $x^2 - 100$

[1 mark]

Factorise using difference of two squares. $A^2 - B^2 = (A + B)(A - B)$

Answer _____

5 (b) Solve $7x + 6 > 1 + 2x$

[2 marks]

This solves in a similar way to an equation. Collect the x terms on the side with the most and get rid of everything else. Do the opposite operations to rearrange to get x on its own

Answer _____

7

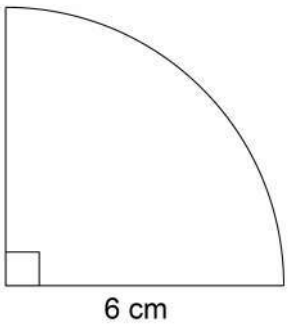
6 Work out the value of $\left(\sqrt{3}\right)^2 \times \left(\sqrt{2}\right)^2$

[2 marks]

The square and the square root cancel out as they are opposites

Answer _____

7 Here is a quarter circle of radius 6 cm



Not drawn accurately

Work out the area of the quarter circle.

Give your answer in terms of π.

[2 marks]

Area of circle = π x radius^2. Do a quarter of this as it is a quarter circle

Answer _____ cm^2

8 Three **whole** numbers are each rounded to the nearest 10

The sum of the rounded numbers is 70

Work out the **maximum** possible sum for the original three numbers.

[2 marks]

Whole numbers include 0, 1, 2, 3, 4, 5... not negative numbers, decimals or fractions. Start by considering which three multiples of 10 can be added together to give 70. Then consider the highest each of these could be and still round down to the multiple of 10. Add the maximum they could have been together to get the maximum possible sum for the original three numbers

Answer _____

9 Circle the expression for the range of n consecutive integers.

[1 mark]

$\frac{n+1}{2}$ $\quad n-1 \quad$ n $\quad n+1$

Take for example the consecutive integers 4, 5, 6, 7. There are 4 of them so n is 4. The range is largest - smallest = ... Only one of the expressions will work

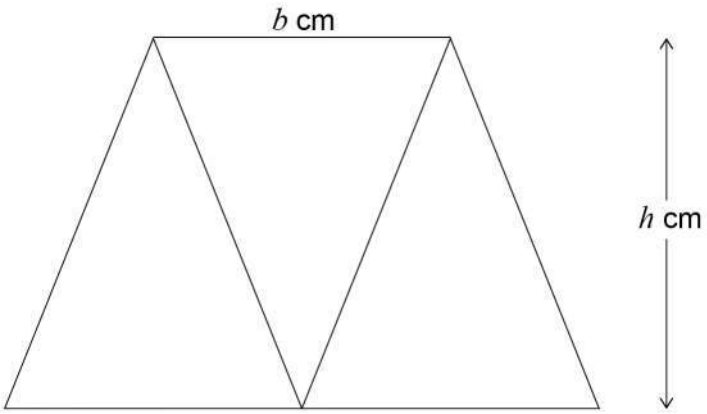
Turn over for the next question

7

10 Three identical isosceles triangles are joined to make this trapezium.

Each triangle has base b cm and perpendicular height h cm

Not drawn accurately



10 (a) Work out an expression, in terms of b and h, for the area of the trapezium.

Give your answer in its simplest form.

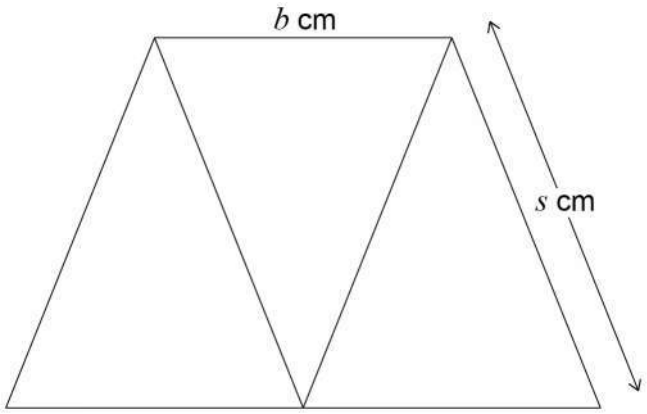
[2 marks]

Area of triangle = 1/2 x base x height. b is the base and h is the height. Multiplying the area of one of the triangles by 3 expresses the area of the trapezium as it is made of 3 identical triangles

Answer _____ cm^2

10 (b) This diagram shows the same trapezium.

Not drawn accurately



$b : s = 2 : 3$

Work out an expression, in terms of b, for the perimeter of the trapezium.

[2 marks]

s is 3/2 x b as 3 is 3/2 x 2. Adding all of the outside edges together expresses the perimeter. There is no need to simplify the expression

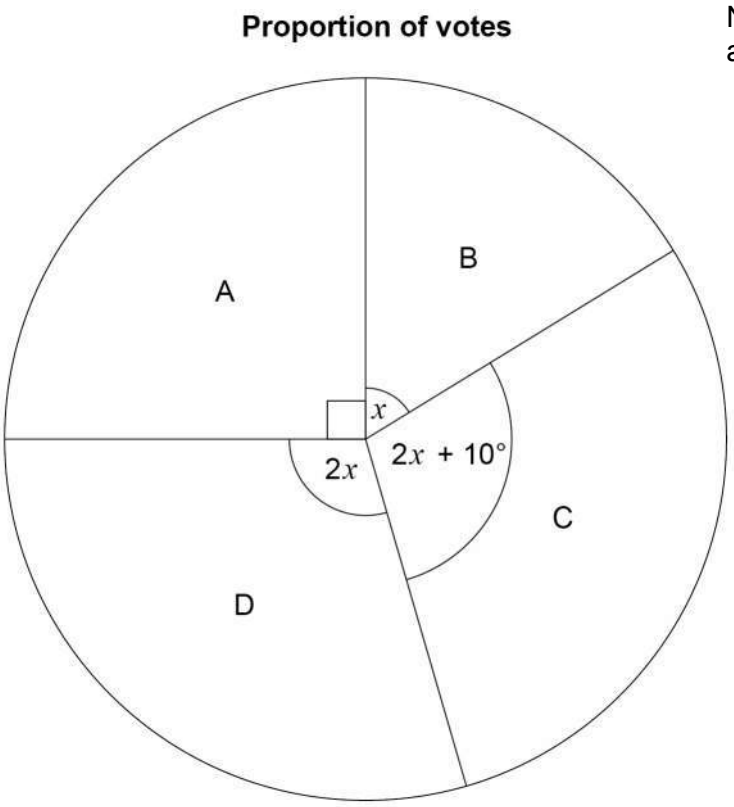
Answer _____ cm

Turn over for the next question

4

11 The four candidates in an election were A, B, C and D.

The pie chart shows the proportion of votes for each candidate.



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Work out the probability that a person who voted, chosen at random, voted for C.

[4 marks]

Adding all of the angles must give 360. Create an equation using this fact then collect like terms to simplify. Rearrange to find x. Then work out how many degrees represent C. Express the number of degrees representing C as a fraction of the 360 degrees in total

Answer _____

12 Use approximations to 1 significant figure to estimate the value of

$$\frac{0.526 \times 39.6^2}{\sqrt{97.65}}$$

You **must** show your working.

[3 marks]

To round to 1 significant figure, if the second figure is a 0, 1, 2, 3, 4, 5 the first figure stays the same and if it is a 5, 6, 7, 8, 9 the first figure rounds up. Everything after the first figure is set to 0 and all decimal places after it are ignored. Follow the order of operations, BIDMAS, when doing the calculation

Answer _____

Turn over for the next question

7

13 $x : y = 7 : 4$

$x + y = 88$

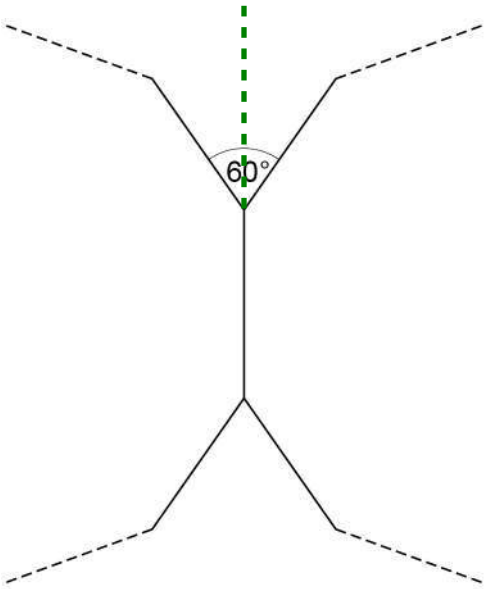
Work out the value of $x - y$

[3 marks]

Work out how many parts there are in total in the ratio. These represent a total of 88. Work out what 1 part represents then multiply it by 7 and 4 to work out what x and y are. Then subtract y from x

Answer _____

14 Two congruent regular polygons are joined together.



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Work out the number of sides on each polygon.

[3 marks]

The line drawn above divides the angle into 2 and creates exterior angles of both of the polygons. The sum of the exterior angles of a polygon is 360°. As they are regular, all of the exterior angles are the same. Work out how many exterior angles each polygon has. There are as many sides as there are exterior angles

Answer _____

Turn over for the next question

6

15

Meal Deal

Choose one sandwich, one drink and one snack

There are

7 different sandwiches

5 different drinks

and

3 different snacks.

15 (a) How many different Meal Deal combinations are there?

[2 marks]

The product rule for counting can be used. Multiplying the number of possible outcomes of each individual event works out the total number of possible outcomes

Answer _____

15 (b) Two of the sandwiches have cheese in them.

Three of the drinks are fizzy.

Eva picks a Meal Deal at random.

Work out the probability that the sandwich has cheese in it **and** the drink is fizzy.

Give your answer as a fraction.

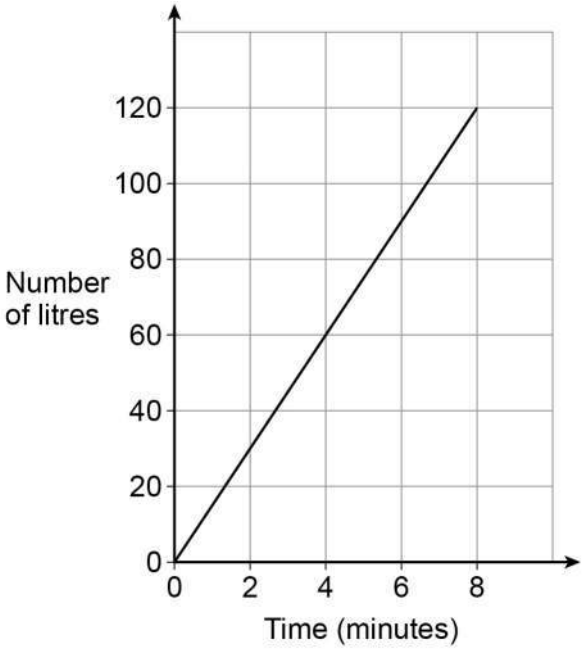
[2 marks]

The product rule for counting can be used again to work out how many combinations there are where the sandwich has cheese in it and the drink is fizzy. There are also still 3 different snacks. Express the number of combinations which the sandwich has cheese in it and the drink is fizzy as a fraction of the total number of combinations worked out in part (a)

Answer _____

16 Water is poured into a tank.

The graph shows the number of litres of water in the tank.



How much water is poured into the tank each minute?

Circle your answer.

[1 mark]

1.5 litres 15 litres 30 litres 120 litres

Read up from 1 minute to the line then across

Turn over for the next question

5

17 A and B are **similar** solids.

Solid	length (cm)
A	l
B	$2l$

Alex says,

"The volume of B is double the volume of A because the length of B is double the length of A."

Is he correct?

Tick a box.

Yes ☐ No ☑

Give a reason for your answer.

[1 mark]

Consider what happens to the volume of a cube if the side lengths are doubled

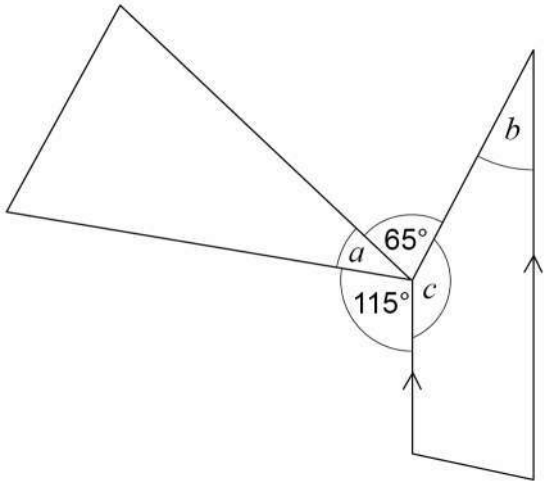
18 Circle the **two** roots of $(2x + 3)(5x - 2) = 0$

[1 mark]

$-\frac{3}{2}$ $-\frac{2}{5}$ $\frac{2}{5}$ $\frac{3}{2}$

Either 2x + 3 = 0 or 5x - 2 = 0. Rearrange the equations to find x

19 The diagram shows a triangle and a trapezium.



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Prove that $a = b$

[3 marks]

Co-interior angles add up to 180. b and c are co-interior angles. Angles around a point add up to 360. Use these facts to create an equation linking a and b then rearrange the equation until a = b

Turn over for the next question

5

20 In one month, the number of hours of exercise taken by 10 people are

4 7 2 8 6 5 1 82 3 9

Which is the appropriate average to use in this situation?

Tick a box.

Mean is total/number. Median is the middle value when they are all put in order. Mode is the most frequent result

☐ Mean ☑ Median ☐ Mode

Give one reason for each of the other two averages as to why they are **not** appropriate.

[2 marks]

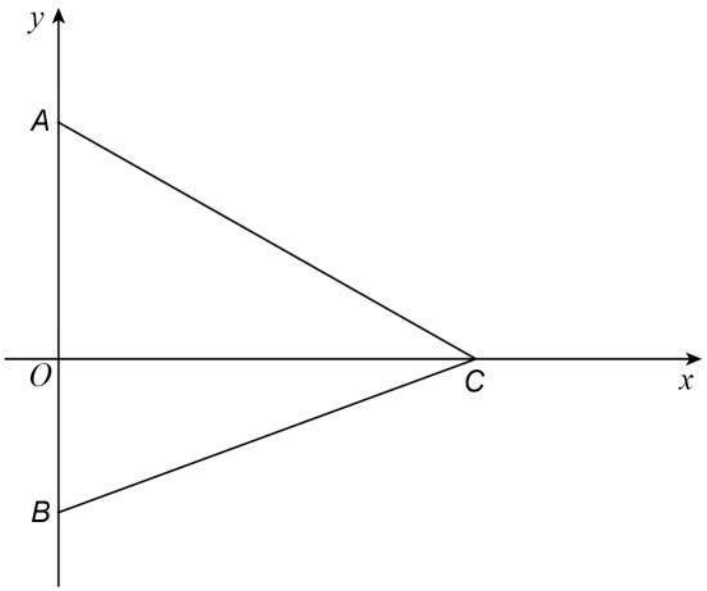
Reason 1 _____

_____

Reason 2 _____

_____

21 *A*, *B* and *C* are points on the axes as shown.



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The area of triangle *ABC* is 28 square units.

Work out possible coordinates for *A*, *B* and *C*.

[2 marks]

$\frac{1}{2}bh = 28$ ← Area of triangle = 1/2 x base x height

Work out possible values for the base and height. The base is length AB and the height is length OC. The x coordinate of A and B must be 0 as they are on the y axis. The y coordinate of A must be positive and the y coordinate of B must be negative. The y coordinate of C must be 0 as it is on the x axis and the x coordinate must be positive

A (0 , _____) *B* (0 , _____) *C* (_____ , 0)

Turn over for the next question

4

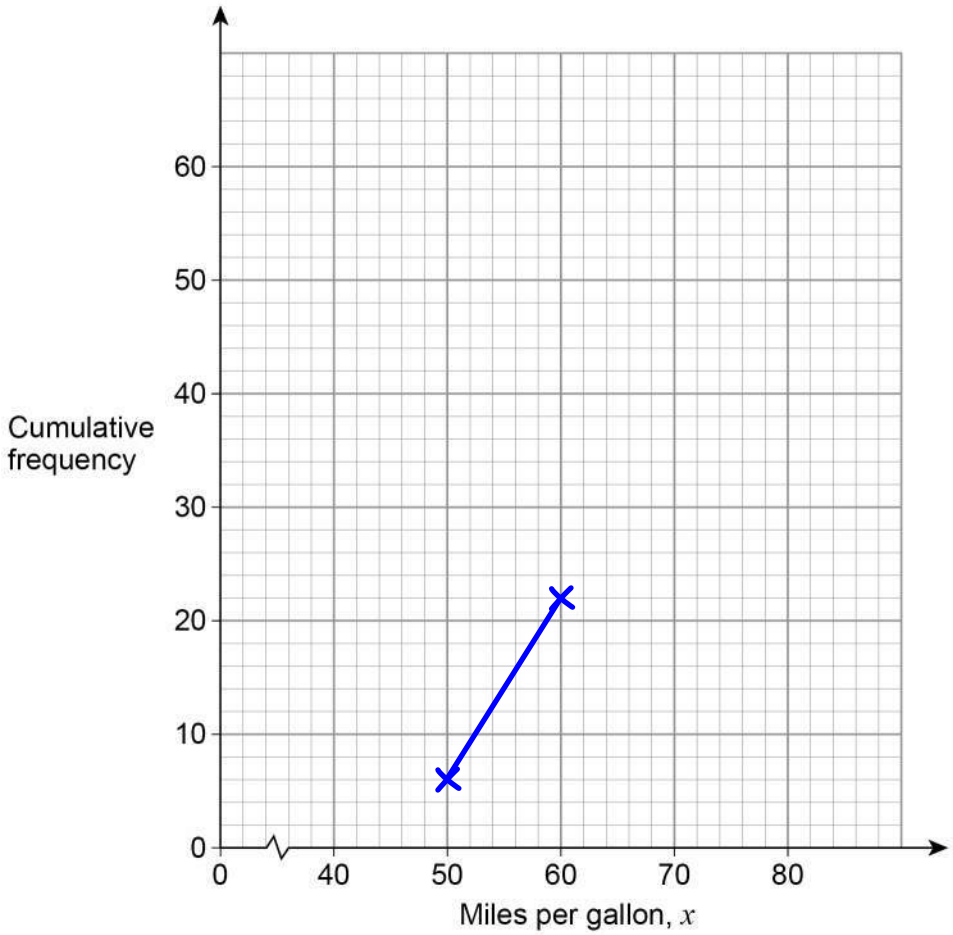
22 Here is some information about the miles per gallon of 60 cars.

Miles per gallon, x	Frequency	Cumulative frequency
$40 < x \leqslant 50$	6	6
$50 < x \leqslant 60$	16	22
$60 < x \leqslant 70$	28	
$70 < x \leqslant 80$	10	

Adding the frequency up as they go works out the cumulative frequency

22 (a) Draw a cumulative frequency graph.

[3 marks]



The cumulative frequencies are plotted at the end point of each category as it is reached by the end of the category. Joining up the points with a series of straight lines (a curve may be used but it is harder) completes the graph

22 (b) Use the graph to work out the interquartile range.

[2 marks]

Interquartile range = upper quartile - lower quartile. The lower quartile is 1/4 of the way through the data and this is roughly the 15th frequency as 60/4 = 15. Reading across from 15 to the line then down works out an estimate of the lower quartile. The upper quartile is 3/4 of the way through the data

Answer _____ miles per gallon

23 The equation of a curve is $y = (x + 3)^2 + 5$

Circle the coordinates of the turning point.

[1 mark]

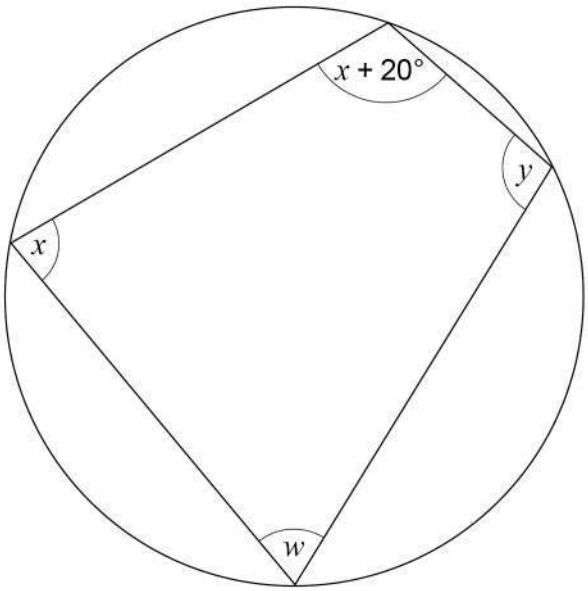
(5, 3) (5, –3) (3, 5) (–3, 5)

The turning point occurs when x + 3 = 0 as 0^2 is the minimum a squared number can be

Turn over for the next question

6

24 Here is a cyclic quadrilateral.



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$x : y = 5 : 7$

Work out the size of angle w.

[4 marks]

Opposite angles in a cyclic quadrilateral add up to 180. Work out x using the ratio and the fact that the total of x and y is 180 then work out the value of x + 20. w is opposite to this angle

Answer _____ degrees

25 15 machines work at the same rate.

Together, the 15 machines can complete an order in 8 hours.

3 of the machines break down after working for 6 hours.

The other machines carry on working until the order is complete.

In total, how many hours does **each** of the other machines work?

[3 marks]

15 × 8

This works out the number of hours worth of work the 15 machines do in 8 hours. Subtracting the number of hours worth done by 15 machines in 6 hours works out how many more hours worth of work needs to be done once the 3 machines have broken down. Dividing this by the number of other machines works out how many extra hours it will take

Answer _____ hours

Turn over for the next question

7

26 (a) $0.\dot{7} = \frac{7}{9}$

Use this fact to show that $0.0\dot{7} = \frac{7}{90}$

[1 mark]

$0.\dot{7} \div 10 = 0.0\dot{7}$ ← Dividing by 10 moves the decimal point once to the left

26 (b) Using part (a) or otherwise, convert $0.2\dot{7}$ to a fraction.

Give your answer in its simplest form.

[3 marks]

Adding 0.2 to $0.0\dot{7}$ gives $0.2\dot{7}$. Express 0.2 as a fraction and add it to 7/90. To add fractions the denominators need to be the same. Multiply the numerators and denominators by the same amount until they are the same. Then add the numerators and the denominators stay the same. Simplify the fraction by dividing the numerator and denominator by the same amount to get smaller whole numbers

Answer _____

27 There are 11 pens in a box.

8 are black and 3 are red.

Two pens are taken out at random **without** replacement.

Work out the probability that the two pens are the **same** colour.

[4 marks]

Black AND black OR red AND red. AND means to multiply and OR means to add. There is 1 fewer pen in total after the first is picked. There is 1 fewer black pen once the first black is picked. There is 1 fewer red pen once the first red is picked. Fractions can be multiplied by multiplying the numerators and denominators together. The denominators should be the same so the numerators can then be added

Answer _____

8

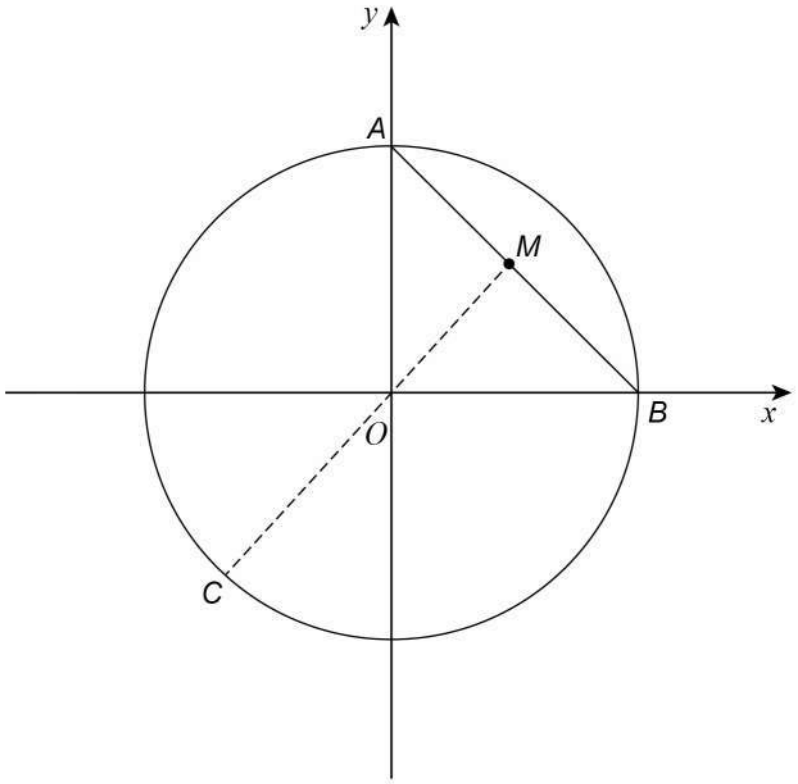
28 *A*, *B* and *C* are points on the circle $x^2 + y^2 = 36$ as shown.

A is on the y-axis.

B is on the x-axis.

M is the midpoint of *AB*.

COM is a straight line.



28 (a) Show that the coordinates of *A* are (0, 6)

[1 mark]

Substituting the x and y coordinate of point A into the equation of the circle to show that the coordinates satisfy the equation shows that A is on the circle and the x coordinate is 0 so it is on the y axis

28 (b) Work out the coordinates of *B*.

[1 mark]

The y coordinate must be 0 as it is on the x axis. Substituting 0 for y in the equation gives $x^2 + 0^2 = 36$. Solve the equation to find the x coordinate. The x coordinate of B must be positive

Answer (_____ , 0)

28 (c) Show that the equation of the straight line passing through *C*, *O* and *M* is $y = x$

[2 marks]

The general equation of a straight line is y = mx + c, where m is the gradient and c is the y intercept. Find the coordinates of point M by doing the mean of the x and y coordinates of A and B, as M is the midpoint. The coordinates of point O are (0 , 0). Gradient = (change in y)/(change in x)

28 (d) Work out the coordinates of *C*.

Give your answers in surd form.

[3 marks]

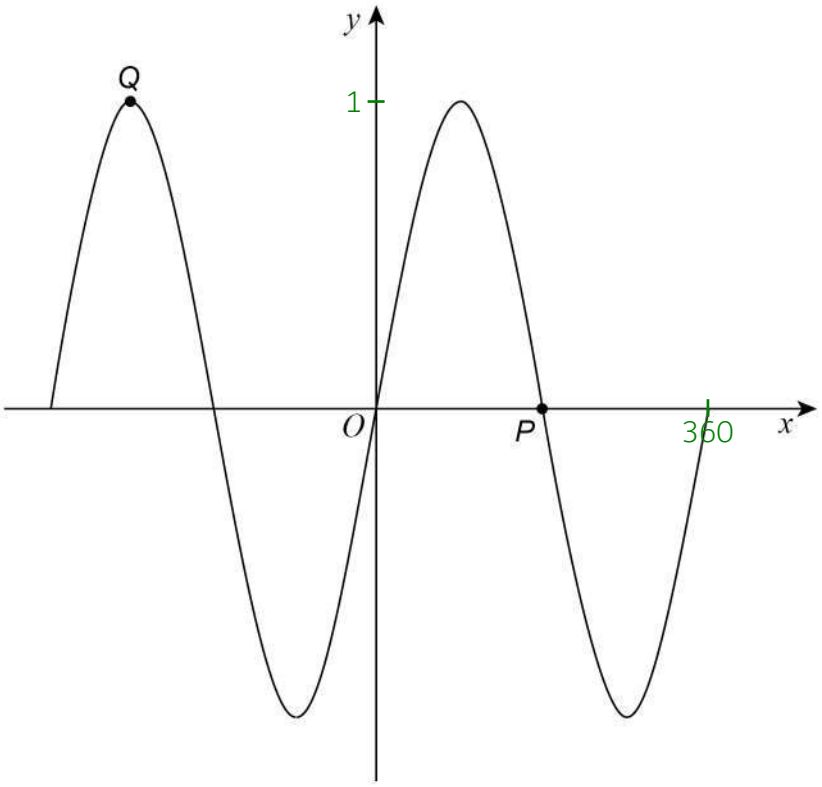
The lines $x^2 + y^2 = 36$ and y = x meet at point C. So doing simultaneous equations works out the coordinates of the intersection at C. Substitute x for y in $x^2 + y^2 = 36$ to get an equation just in terms of x which can be rearranged and solved. The x coordinate must be negative as it is on the left of the y axis. As y = x, the y coordinate is the same as the x coordinate

Answer (_____ , _____)

Turn over for the next question

7

29 Here is a sketch of $y = \sin x°$ for $-360 \leqslant x \leqslant 360$



29 (a) Write down the coordinates of *P*.

[1 mark]

Answer (_____ , _____)

29 (b) Write down the coordinates of *Q*.

[1 mark]

Answer (_____ , _____)

30 (a) Work out the value of $81^{-\frac{1}{4}}$

[2 marks]

The power of 1/4 means to do the positive fourth root, which is the square root of the square root. Then the negative power means to do the reciprocal

Answer _____

30 (b) Write 16×8^{2x} as a power of 2 in terms of x.

[3 marks]

Write both 16 and 8 as powers of 2 (this means 2 to the power of something). $(a^x)^y = a^{xy}$. $a^x \times a^y = a^{x+y}$

Answer _____

END OF QUESTIONS

7