Please write clearly in block capitals.

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

Surname StemUp Model Solution

Forename(s)

Candidate signature

GCSE MATHEMATICS

H

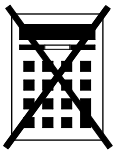
Higher Tier Paper 1 Non-Calculator

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	

Do not write outside the box

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 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}

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

[1 mark]

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

Do not write outside the box

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

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

[1 mark]

Answer $(x - 10)(x + 10)$

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

[2 marks]

$7x - 2x > 1 - 6$

$5x > -5$

$x > -1$

Answer $x > -1$

7

Turn over ►

Do not write outside the box

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

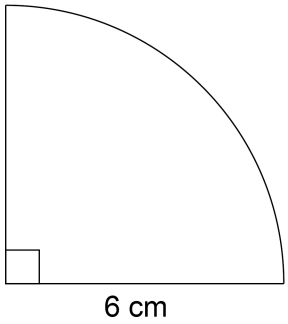
[2 marks]

$(\sqrt{3})^2 = 3$ and $(\sqrt{2})^2 = 2$

$3 \times 2 = 6$

Answer 6

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 $= \frac{1}{4} \times \pi \times r^2 = \frac{1}{4} \times \pi \times 6^2$

$= \frac{1}{4} \times 36\pi = 9\pi$

Answer 9π cm^2

Do not write outside the box

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]

Each whole number can be at most 4 more than its rounded value

(e.g. 34 rounds down to 30, but 35 would round up to 40)

so each number must have units digit 4

e.g. 44 + 24 + 14 → 40 + 20 + 10 = 70

44 + 24 + 14 = 82

Maximum = 70 + 3 × 4 = 82

Answer 82

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

[1 mark]

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

Turn over for the next question

7

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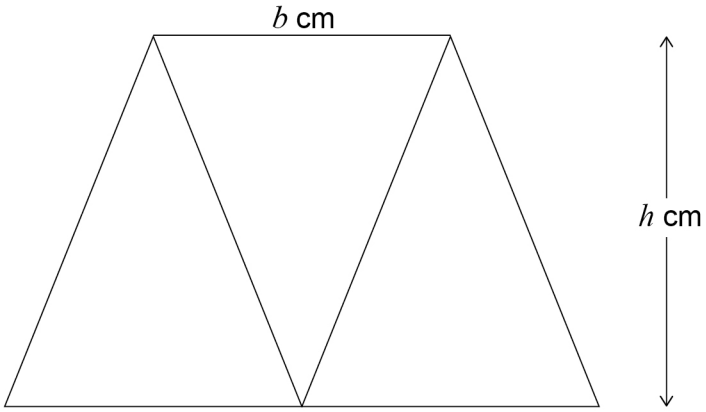
10 Three identical isosceles triangles are joined to make this trapezium.

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 one triangle = ½ × b × h

Trapezium = 3 triangles = 3 × ½ × b × h

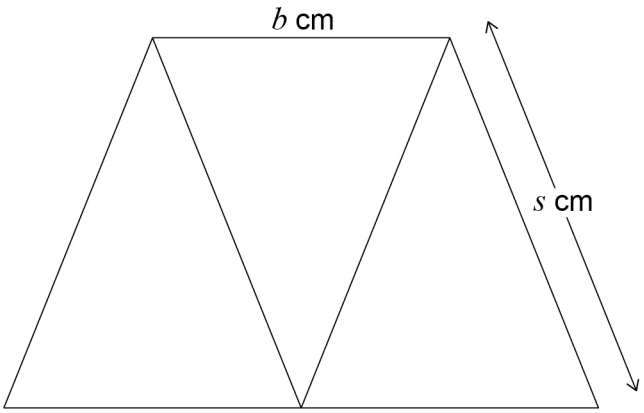
$= \frac{3bh}{2}$

Answer $\frac{3bh}{2}$ cm^2

Do not write outside the box

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]

$b : s = 2 : 3$ so $s = 3b \div 2 = 1.5b$

Perimeter $= b + 2b + s + s = 3b + 2s$

$= 3b + 2 \times 1.5b = 3b + 3b$

$= 6b$

Answer $6b$ cm

Turn over for the next question

4

Do not write outside the box

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

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

Proportion of votes

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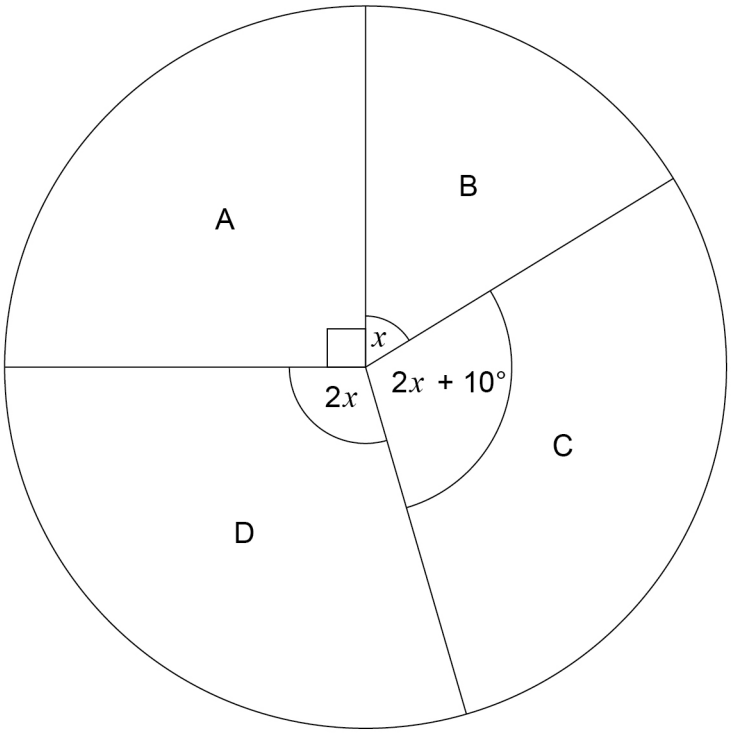

Work out the probability that a person who voted, chosen at random, voted for C.

[4 marks]

Angles at centre: $90 + x + 2x + (2x + 10) = 360$

$5x + 100 = 360$

$5x = 260$

$x = 52$

Angle for C $= 2 \times 52 + 10 = 114°$

$P(C) = \frac{114}{360}$

$= \frac{57}{180} = \frac{19}{60}$

Answer $\frac{19}{60}$

Do not write outside the box

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]

$0.526 \approx 0.5$ $39.6 \approx 40$ $97.65 \approx 100$

$\approx 0.5 \times 40^2 \div \sqrt{100}$

$= 0.5 \times 1600 \div 10$

$= 800 \div 10$

$= 80$

Answer 80

Turn over for the next question

7

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13 $x : y = 7 : 4$

$x + y = 88$

Work out the value of $x - y$

[3 marks]

7 + 4 = 11 parts

88 ÷ 11 = 8 per part

x = 7 × 8 = 56 y = 4 × 8 = 32

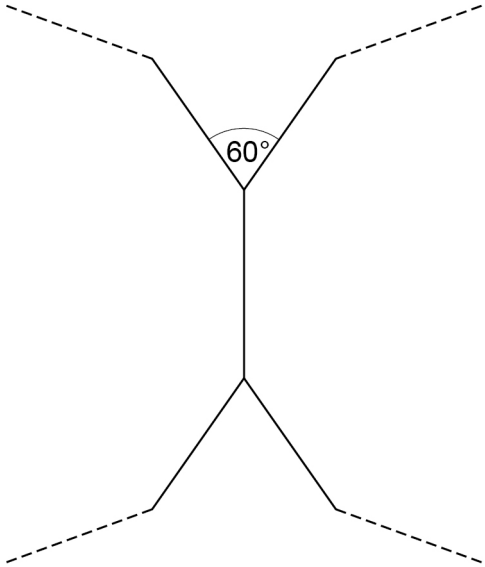
check: 56 + 32 = 88

x − y = 56 − 32 = 24

Answer 24

Do not write outside the box

14 Two congruent regular polygons are joined together.



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Work out the number of sides on each polygon.

[3 marks]

Angles at a point: 60 + 2 × interior = 360

interior angle = (360 − 60) ÷ 2 = 150°

exterior angle = 180 − 150 = 30°

number of sides = 360 ÷ 30 = 12

Answer 12

Turn over for the next question

6

Do not write outside the box

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]

$7 \times 5 \times 3 = 35 \times 3$

$= 105$

Answer 105

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 sandwich and drink are chosen independently, so multiply

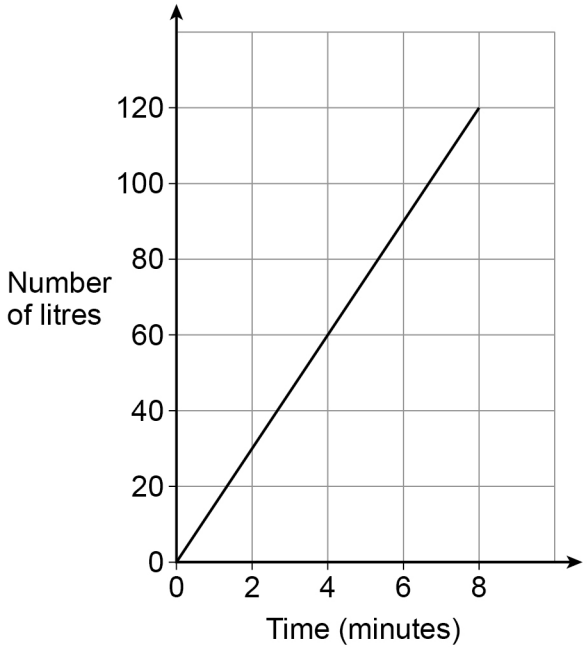
$P(\text{cheese and fizzy}) = \frac{2}{7} \times \frac{3}{5} = \frac{6}{35}$

Answer $\frac{6}{35}$

Do not write outside the box

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

120 litres in 8 minutes: 120 ÷ 8 = 15

Turn over for the next question

5

Do not write outside the box

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]

No. Volume scale factor = $2^3 = 8$, so the volume of B is 8 times the volume of A ($8l^3$ compared with l^3).

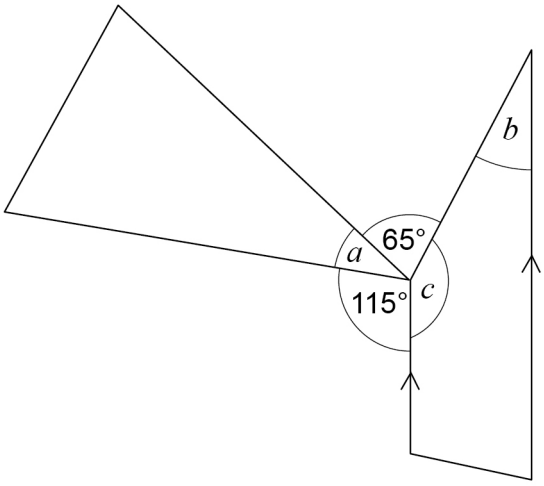
18 Circle the **two** roots of $(2x + 3)(5x - 2) = 0$

[1 mark]

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

Do not write outside the box

19 The diagram shows a triangle and a trapezium.



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Prove that $a = b$

[3 marks]

a + 65 + 115 + c = 360 (angles at a point add up to 360°)

a + c = 360 − 180 = 180, so a = 180 − c

b + c = 180 (co-interior angles between parallel lines

add up to 180°)

so b = 180 − c

Therefore a = b

Turn over for the next question

5

Do not write outside the box

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 ☑ Median ☐ Mode

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

[2 marks]

Reason 1 *Mode: there is no mode, every value appears only once.*

Reason 2 *Mean: the 82 is an extreme value (outlier) and would make the mean far too high.*

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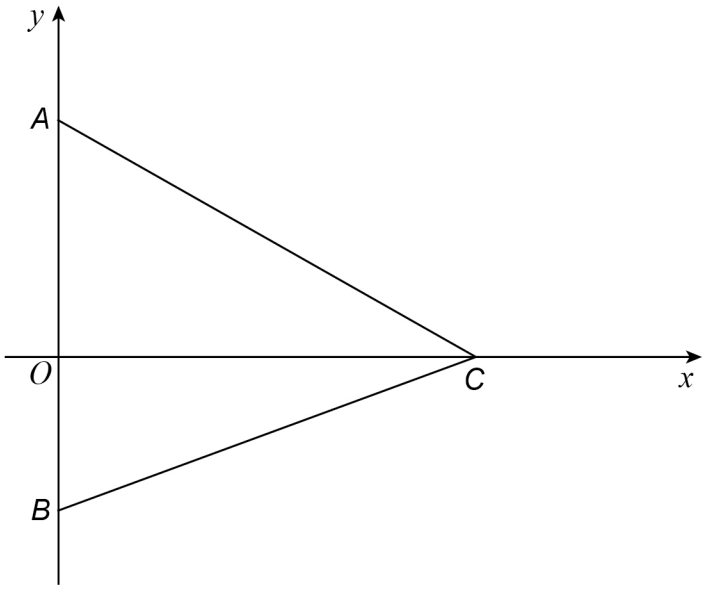
21 *A*, *B* and *C* are points on the axes as shown.



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

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

[2 marks]

Area = ½ × base × height, with base AB and height OC

Choose AB = 14 and OC = 4: ½ × 14 × 4 = 28 ✓

A is on positive y-axis, B on negative y-axis: A(0, 10), B(0, −4)

C is on positive x-axis: C(4, 0)

A (0 , 10) *B* (0 , −4) *C* (4 , 0)

Turn over for the next question

4

Do not write outside the box

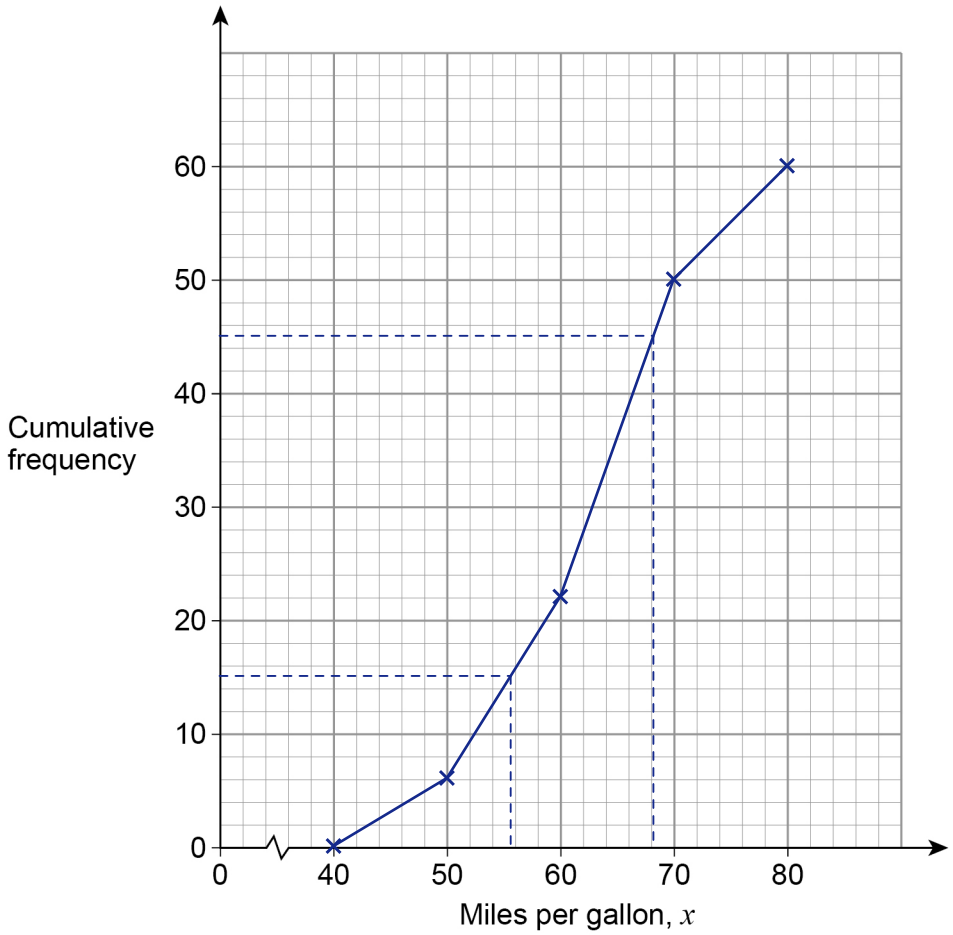
22 Here is some information about the miles per gallon of 60 cars.

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

Miles per gallon	Cumulative frequency
$40 < x \leq 50$	6
$40 < x \leq 60$	22
$40 < x \leq 70$	50
$40 < x \leq 80$	60

22 (a) Draw a cumulative frequency graph.

[3 marks]



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

[2 marks]

LQ: ¼ × 60 = 15th car → 55.6 mpg

UQ: ¾ × 60 = 45th car → 68.2 mpg

IQR = 68.2 − 55.6 = 12.6

Answer 12.6 miles per gallon

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

Circle the coordinates of the turning point.

[1 mark]

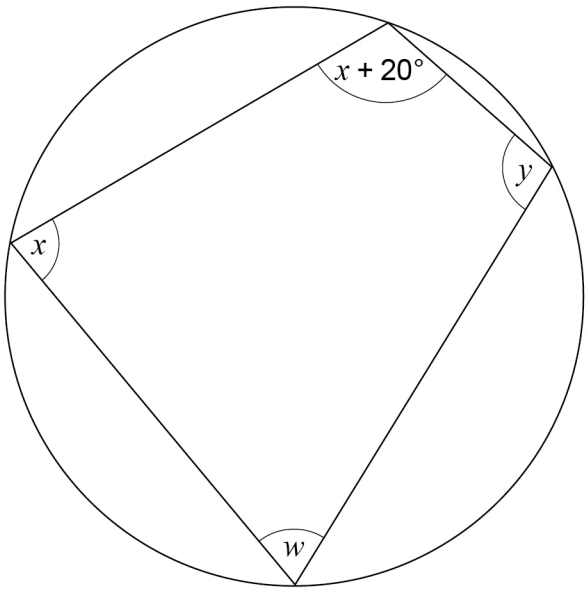
(5, 3) (5, –3) (3, 5) (–3, 5)

Turn over for the next question

6

Do not write outside the box

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 of a cyclic quadrilateral add up to 180°

x + y = 180, x : y = 5 : 7, so 12 parts = 180

180 ÷ 12 = 15

x = 5 × 15 = 75° y = 7 × 15 = 105°

Angle opposite w = x + 20 = 75 + 20 = 95°

w + 95 = 180 (opposite angles of a cyclic quadrilateral)

w = 180 − 95 = 85°

Answer 85 degrees

Do not write outside the box

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]

Total work = 15 × 8 = 120 machine-hours

Broken machines did 3 × 6 = 18 machine-hours

Work left for the other 12 machines = 120 − 18 = 102

Each of the 12 machines works 102 ÷ 12 = 8.5 hours

Answer 8.5 hours

Turn over for the next question

7

Do not write outside the box

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

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

[1 mark]

$0.\dot{7} \div 10 = 0.0\dot{7}$

and $\frac{7}{9} \div 10 = \frac{7}{9 \times 10} = \frac{7}{90}$

so $0.0\dot{7} = \frac{7}{90}$

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

Give your answer in its simplest form.

[3 marks]

$0.2\dot{7} = 0.2 + 0.0\dot{7}$

$= \frac{2}{10} + \frac{7}{90}$

$= \frac{18}{90} + \frac{7}{90}$

$= \frac{25}{90}$

$= \frac{5}{18}$

Answer $\frac{5}{18}$

Do not write outside the box

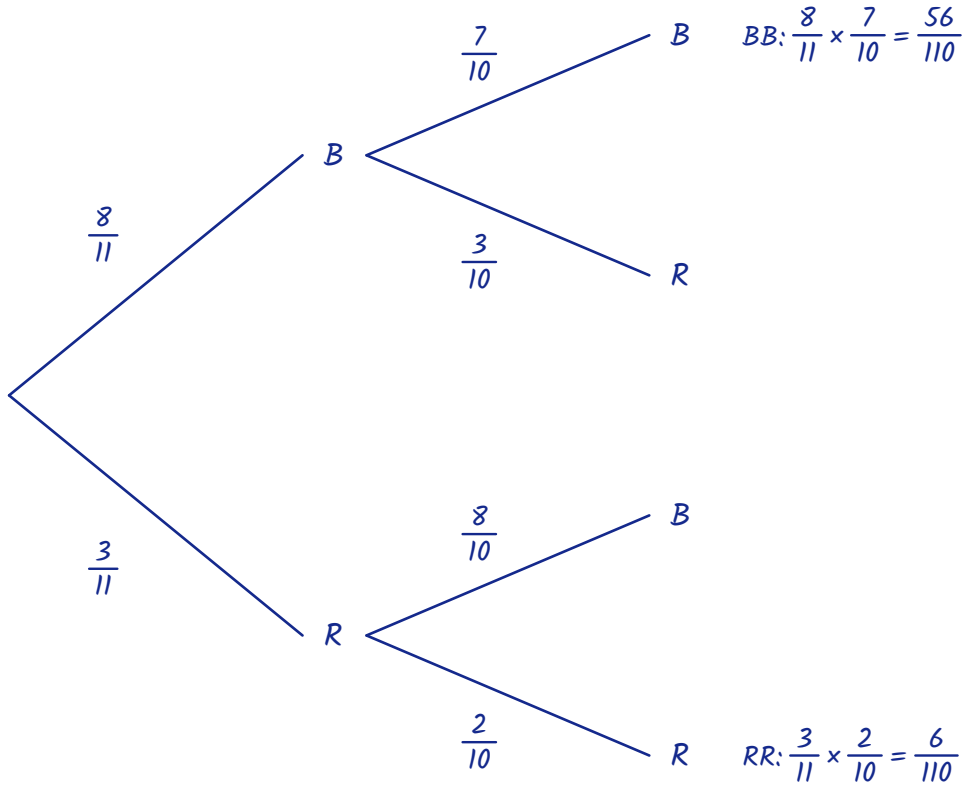
27 There are 11 pens in a box.

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]



$P(\text{same colour}) = P(BB) + P(RR)$

$= \frac{8}{11} \times \frac{7}{10} + \frac{3}{11} \times \frac{2}{10}$

$= \frac{56}{110} + \frac{6}{110}$

$= \frac{62}{110} = \frac{31}{55}$

Answer $\frac{31}{55}$

8

Turn over ►

Do not write outside the box

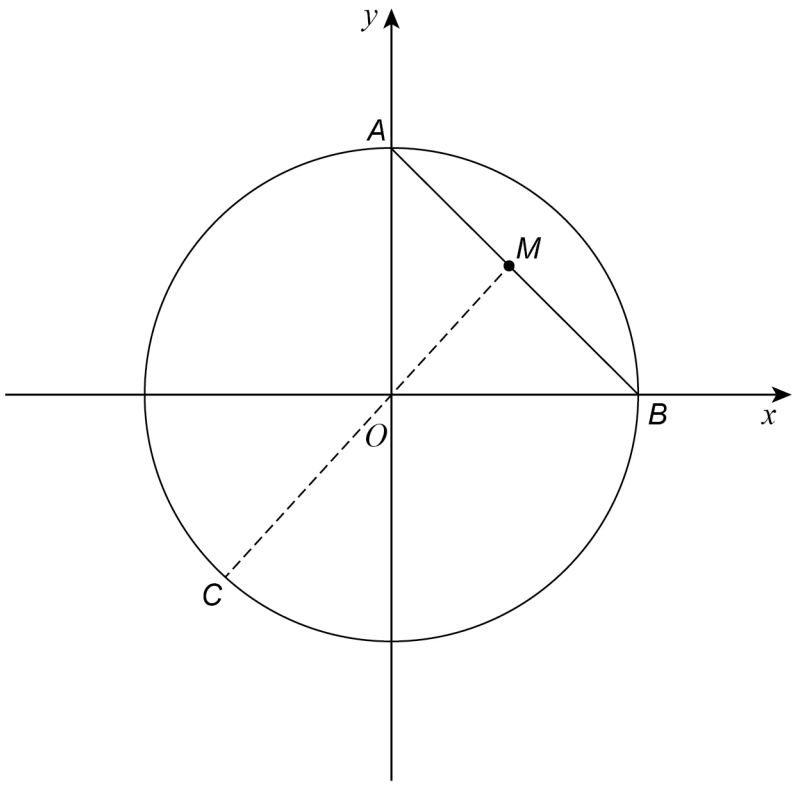
28 *A*, *B* and *C* are points on the circle $x^2 + y^2 = 36$ as shown.

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]

A is on the y-axis so x = 0: $0^2 + y^2 = 36$

$y^2 = 36$, $y = \sqrt{36} = 6$ (positive y-axis), so A is (0, 6)

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

[1 mark]

B is on the x-axis so y = 0: $x^2 + 0^2 = 36$

$x^2 = 36$, $x = 6$ (positive x-axis)

Answer (6 , 0)

Do not write outside the box

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

[2 marks]

$M = ((0 + 6) \div 2, (6 + 0) \div 2) = (3, 3)$

gradient $OM = (3 - 0) \div (3 - 0) = 1$

line passes through $O(0, 0)$, so y-intercept $= 0$

$y = 1x + 0$, so the line is $y = x$

28 (d) Work out the coordinates of C.

Give your answers in surd form.

[3 marks]

C is on $y = x$ and on $x^2 + y^2 = 36$

$x^2 + x^2 = 36$, $2x^2 = 36$, $x^2 = 18$

$x = -\sqrt{18} = -\sqrt{9} \times \sqrt{2} = -3\sqrt{2}$ (C is in the third quadrant)

$y = x = -3\sqrt{2}$

Answer ($-3\sqrt{2}$, $-3\sqrt{2}$)

Turn over for the next question

7

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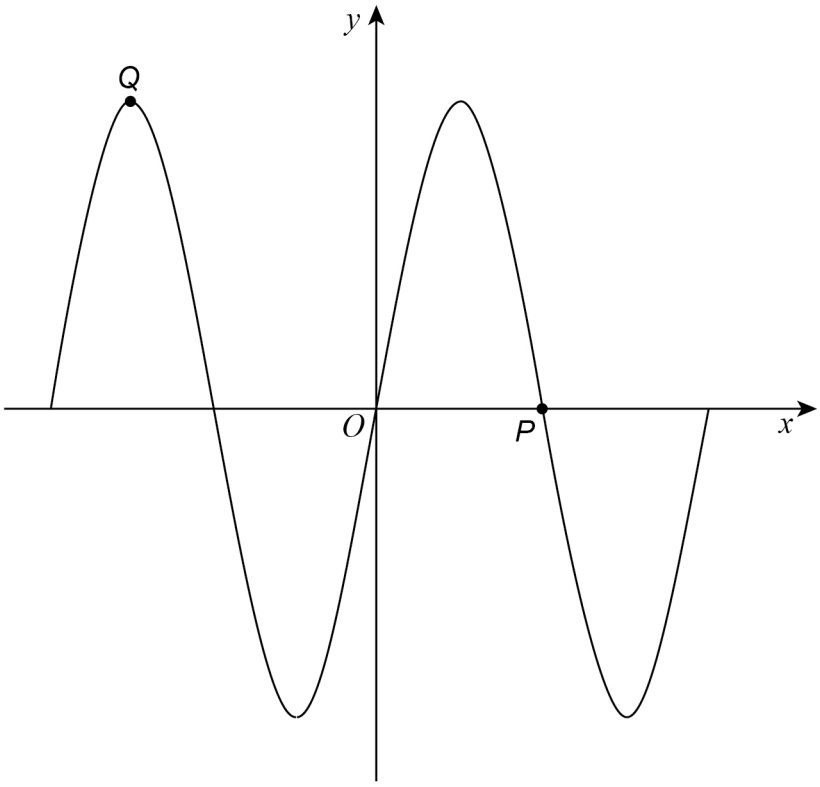
29 Here is a sketch of $y = \sin x°$ for $-360 \leqslant x \leqslant 360$



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

[1 mark]

Answer (180 , 0)

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

[1 mark]

Answer (−270 , 1)

Do not write outside the box

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

[2 marks]

$81^{1/4} = \sqrt[4]{81} = 3$ (since $3^4 = 81$)

$81^{-1/4} = \frac{1}{81^{1/4}} = \frac{1}{3}$

Answer $\frac{1}{3}$

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

[3 marks]

$16 = 2^4$

$8^{2x} = (2^3)^{2x} = 2^{6x}$

$16 \times 8^{2x} = 2^4 \times 2^{6x}$

$= 2^{4+6x}$

Answer 2^{4+6x}

END OF QUESTIONS

7

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