

Please write clearly in block capitals.

Centre number

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Candidate number

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Surname

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Forename(s)

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Candidate signature

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# GCSE MATHEMATICS

# H

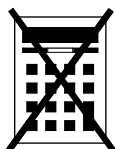
Higher Tier      Paper 1 Non-Calculator

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.

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	
<b>TOTAL</b>	

## Advice

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



Answer **all** questions in the spaces provided

- 1 Work out  $\sqrt{2^6 + 6^2}$   
Circle your answer.

[1 mark]

10

14

50

100

$$\sqrt{64 + 36} = \sqrt{100} = 10$$

- 2 What is 800 million in standard form?  
Circle your answer.

[1 mark]

 $800 \times 10^6$  $8 \times 10^8$  $8 \times 10^9$  $0.8 \times 10^{10}$ 

800 000 000

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

[1 mark]

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

$$4^2 a^{10} = 16a^{10}$$



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

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

Circle your answer.

[1 mark]

$\div 2$                        $\times 2$                        $\div 5$                        $\times 5$

$$y = \frac{10}{2x} = \frac{1}{2} \times \frac{10}{x}$$

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

[1 mark]

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

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

[2 marks]

$$7x + 6 > 1 + 2x$$

$$5x > -5 \quad (-6, -2x)$$

$$x > -1 \quad (\div 5)$$

Answer  $x > -1$



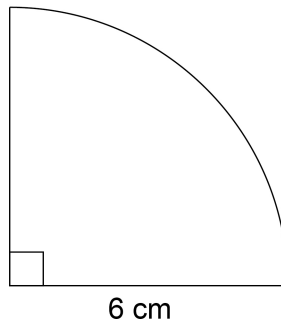
6 Work out the value of  $(\sqrt{3})^2 \times (\sqrt{2})^2$

[2 marks]

$$3 \times 2 = 6$$

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  $\pi$ .

[2 marks]

$$\begin{aligned} \text{Area of circle} &= \pi r^2 = \pi \times 6^2 = 36\pi \\ \text{quarter} &= \frac{1}{4} (36\pi) = 9\pi \end{aligned}$$

Answer 9π cm<sup>2</sup>



- 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]

For max sum - each no has units digit  
4

$$34 + 34 + 14 = 82 \quad \checkmark$$

$$\text{rounds: } 30 + 30 + 10 = 70$$

Answer 82

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

[1 mark]

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

$$n-1$$

$$n$$

$$n+1$$

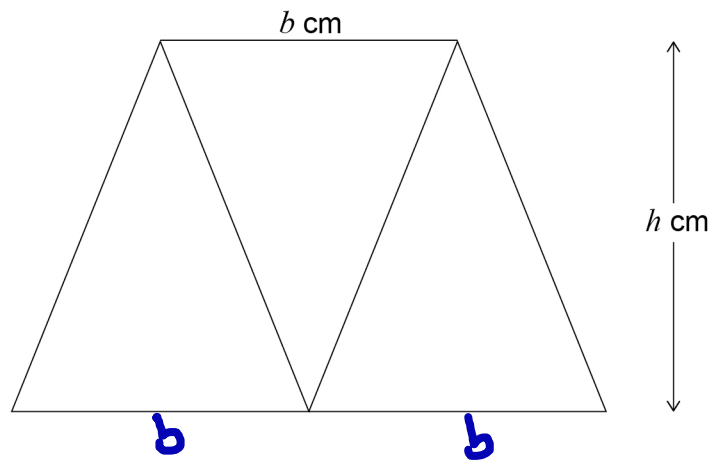
$$n=4, \text{ range} = 4-1 = 3$$

$$n=10, \text{ " } = 10-1 = 9$$

Turn over for the next question



- 10 Three identical isosceles triangles are joined to make this trapezium.  
Each triangle has base  $b$  cm and perpendicular height  $h$  cm



- 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]

$$\text{base} = 2b$$

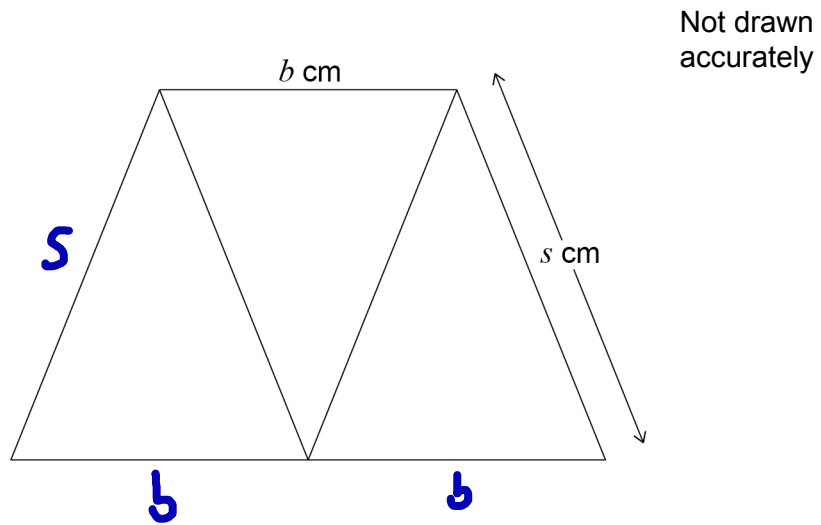
$$\text{Area} = \frac{1}{2}(b + 2b)h$$

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

Answer  $\frac{3}{2}bh$  cm<sup>2</sup>



10 (b) This diagram shows the same trapezium.



$$b : s = 2 : 3$$

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

[2 marks]

$$b : s$$

$$2 : 3$$

$$\text{so } 3b = 2s$$

$$2s + 3b = 3b + 3b \\ = 6b$$

Answer 6b cm

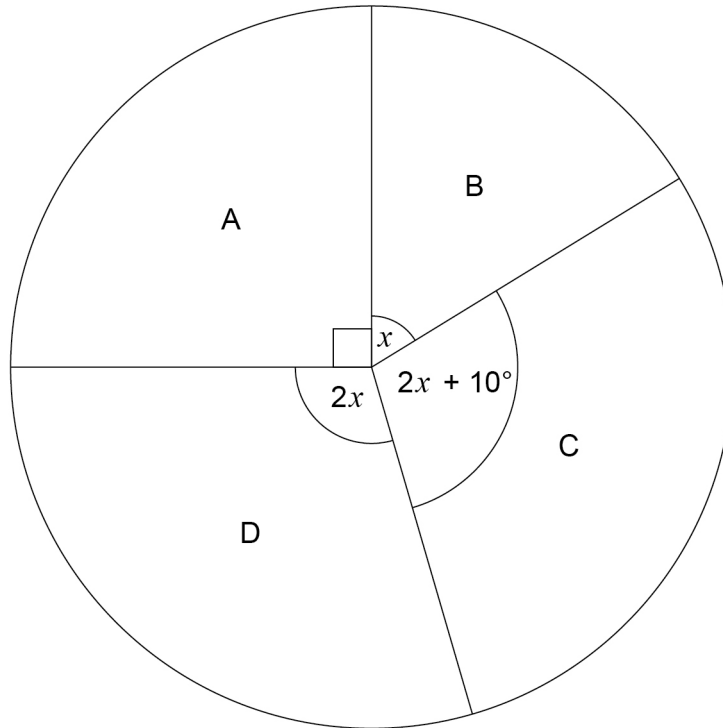
Turn over for the next question



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

Not drawn  
accurately

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

[4 marks]

$$\text{Total angle: } 90 + x + 2x + 10 + 2x = 360$$

$$100 + 5x = 360$$

$$5x = 260 \quad (-100)$$

$$x = 52 \quad (\div 5)$$

$$C: 2(52) + 10 = 114$$

$$P(C) = \frac{114}{360} \equiv \frac{19}{60} \approx 32\%$$

Answer

$$\frac{19}{60}$$





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]

$$\approx \frac{0.5 \times 40^2}{\sqrt{100}} = \frac{0.5 \times 1600}{10}$$

$$= \frac{800}{10} = 80$$

Answer 80

Turn over for the next question

Turn over ►



13

$$x : y = 7 : 4$$

$$x + y = 88$$

Work out the value of  $x - y$

[3 marks]

	$x$	:	$y$		total
ratio	7	:	4		11
actual	56	:	32		88

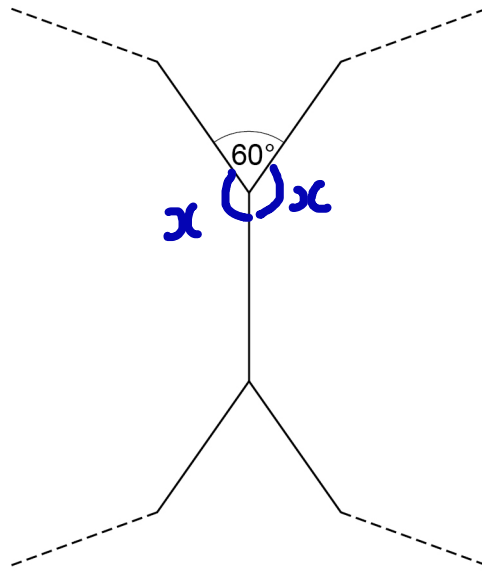
$$x - y = 56 - 32 = 24$$

Answer 24



14

Two congruent regular polygons are joined together.

Not drawn  
accurately

Work out the number of sides on each polygon.

[3 marks]

$$\text{Total angle: } 2x + 60 = 360$$

$$2x = 300 \quad (-100)$$

$$x = 150 \quad (\div 2)$$

$$180(n-2) = 150n \quad 30n = 360 \quad (-150n, +360)$$

$$n = 12 \quad (\div 30)$$

Answer \_\_\_\_\_

Turn over for the next question

Turn over ►



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]

$$7 \times 5 \times 3 = 105$$

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]

$$P(\text{cheese}) = \frac{2}{7}$$

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

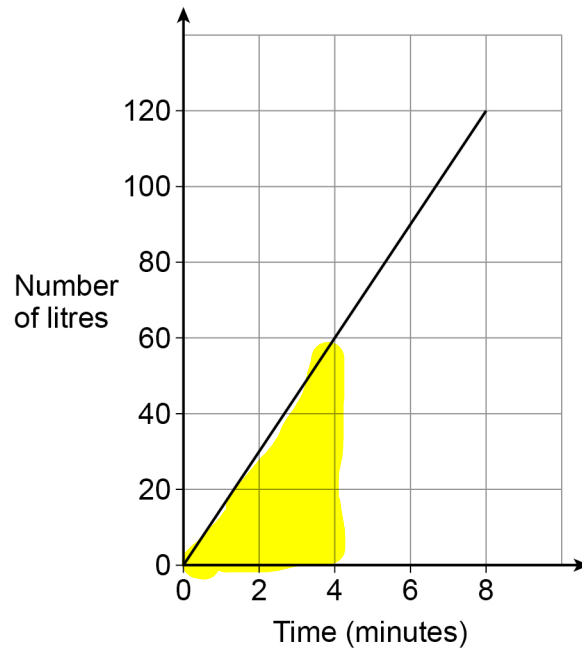
Answer  $\frac{6}{35}$



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

60L in 4 min

15L in 1 min

Turn over for the next question

Turn over ►



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]

Volume scale factor is  $2^3 = 8$

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

[1 mark]

$$\left(-\frac{3}{2}\right)$$

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

$$\left(\frac{2}{5}\right)$$

$$\frac{3}{2}$$

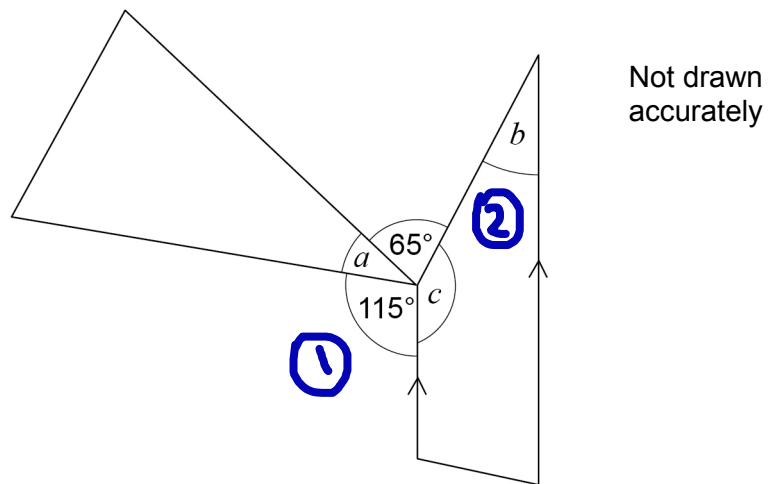
$$2x + 3 = 0 \Rightarrow x = -\frac{3}{2}$$

$$5x - 2 = 0 \Rightarrow x = \frac{2}{5}$$



19

The diagram shows a triangle and a trapezium.

Prove that  $a = b$ 

[3 marks]

$$\text{Total at } \textcircled{1}: a + 65 + c + 115 = 360$$

$$a + c = 180 \quad (-65, -115)$$

$$\text{Interior angle } \textcircled{2}: b + c = 180$$

$$\text{so } a + c = b + c$$

$$a = b \quad (-c)$$

Turn over for the next question

Turn over ►



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

There is no mode for this data

Reason 2

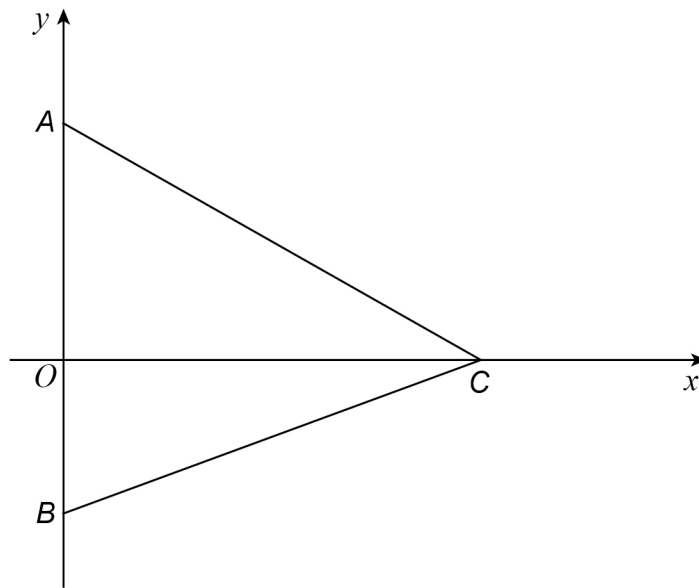
82 will affect mean disproportionately





21

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

Not drawn  
accurately

The area of triangle ABC is 28 square units.

Work out possible coordinates for A, B and C.

[2 marks]

$$AB \times OC \times \frac{1}{2} = 28$$

$$\text{eg: } AB = 14, OC = 4 \quad \neq$$

$$\text{or: } AB = 28, OC = 2$$

$$A ( \underline{0}, \underline{10} ) \quad B ( \underline{0}, \underline{-4} ) \quad C ( \underline{4}, \underline{0} )$$

Turn over for the next question

Turn over ►

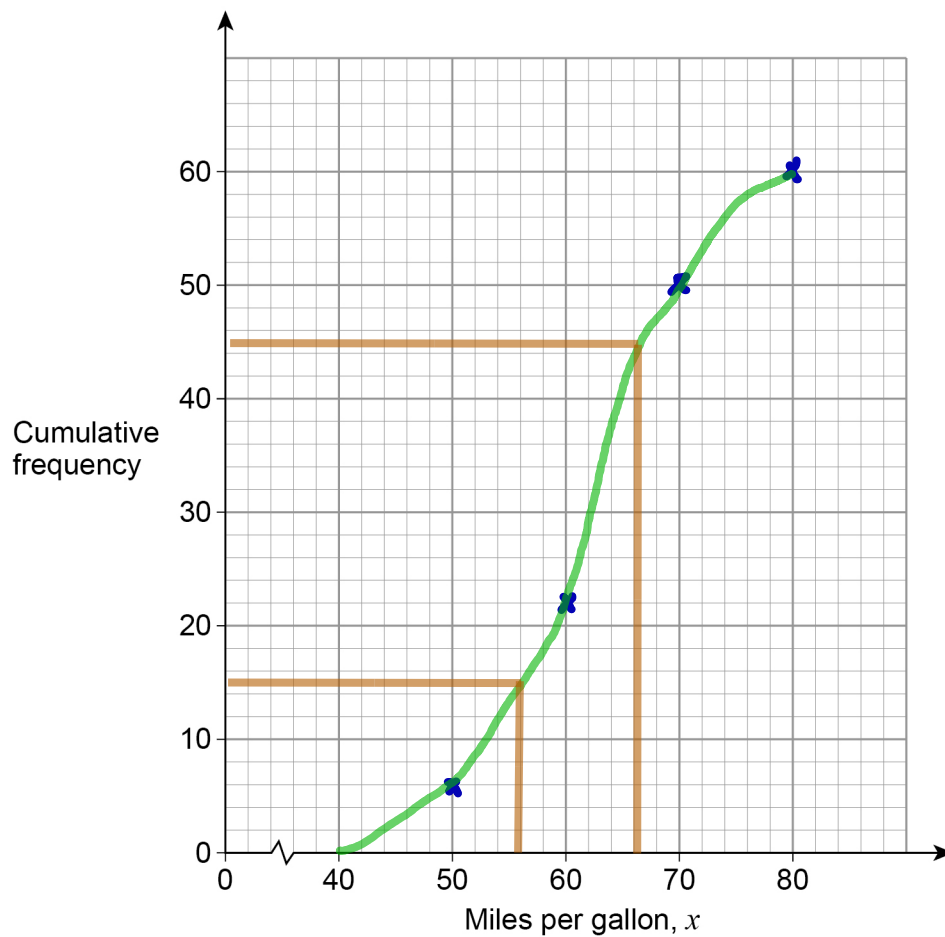


22 Here is some information about the miles per gallon of 60 cars.

Miles per gallon, $x$	Frequency	<i>cf.</i>	<i>upper <math>x</math></i>
$40 < x \leq 50$	6	6	50
$50 < x \leq 60$	16	22	60
$60 < x \leq 70$	28	50	70
$70 < x \leq 80$	10	60	80

22 (a) Draw a cumulative frequency graph.

[3 marks]



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

[2 marks]

$$66 - 56 = 10$$

Answer 10 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)

$$y_{\min} = (-3 + 3)^2 + 5 = 5$$

$$x = -3.$$

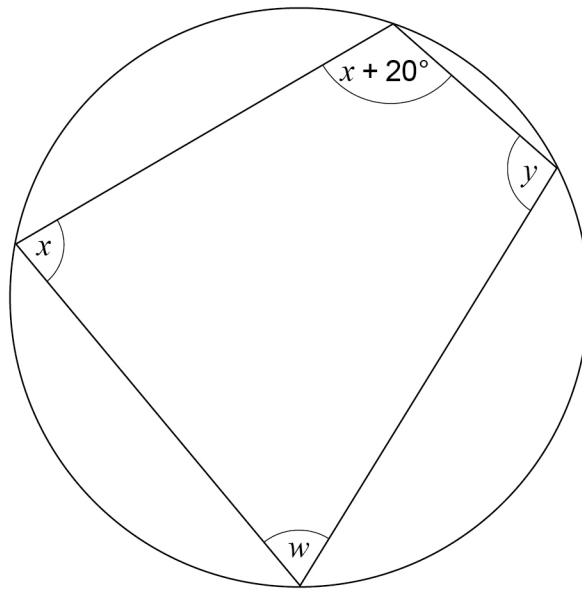
Turn over for the next question

Turn over ►



24

Here is a cyclic quadrilateral.

Not drawn  
accurately

$$x : y = 5 : 7$$

Work out the size of angle  $w$ .

[4 marks]

$$\begin{array}{r}
 x : y \quad \text{total} \\
 5 : 7 \quad 12 \\
 \times 5 \downarrow \quad \times 5 \downarrow \quad \times 5 \downarrow \\
 75 : 105 \quad 180 \quad (\text{cyclic quad})
 \end{array}$$

$$x + 20 + w = 180$$

$$75 + 20 + w = 180$$

$$w = 85 \quad (-75, -20)$$

Answer 85 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]

$$\text{Total hours req} = 15 \times 8 = 120$$

$$120 - (3 \times 6) = 102 \quad (\text{hours worked by other 12})$$

$$102 \div 12 = 8.5$$

Answer 8.5 hours

Turn over for the next question



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

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

[1 mark]

$$0.\dot{7} \div 10 = 0.0\dot{7} \qquad \frac{7}{9} \div 10 = \frac{7}{9} \times \frac{1}{10} = \frac{7}{90}$$

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

$$\frac{5}{18}$$



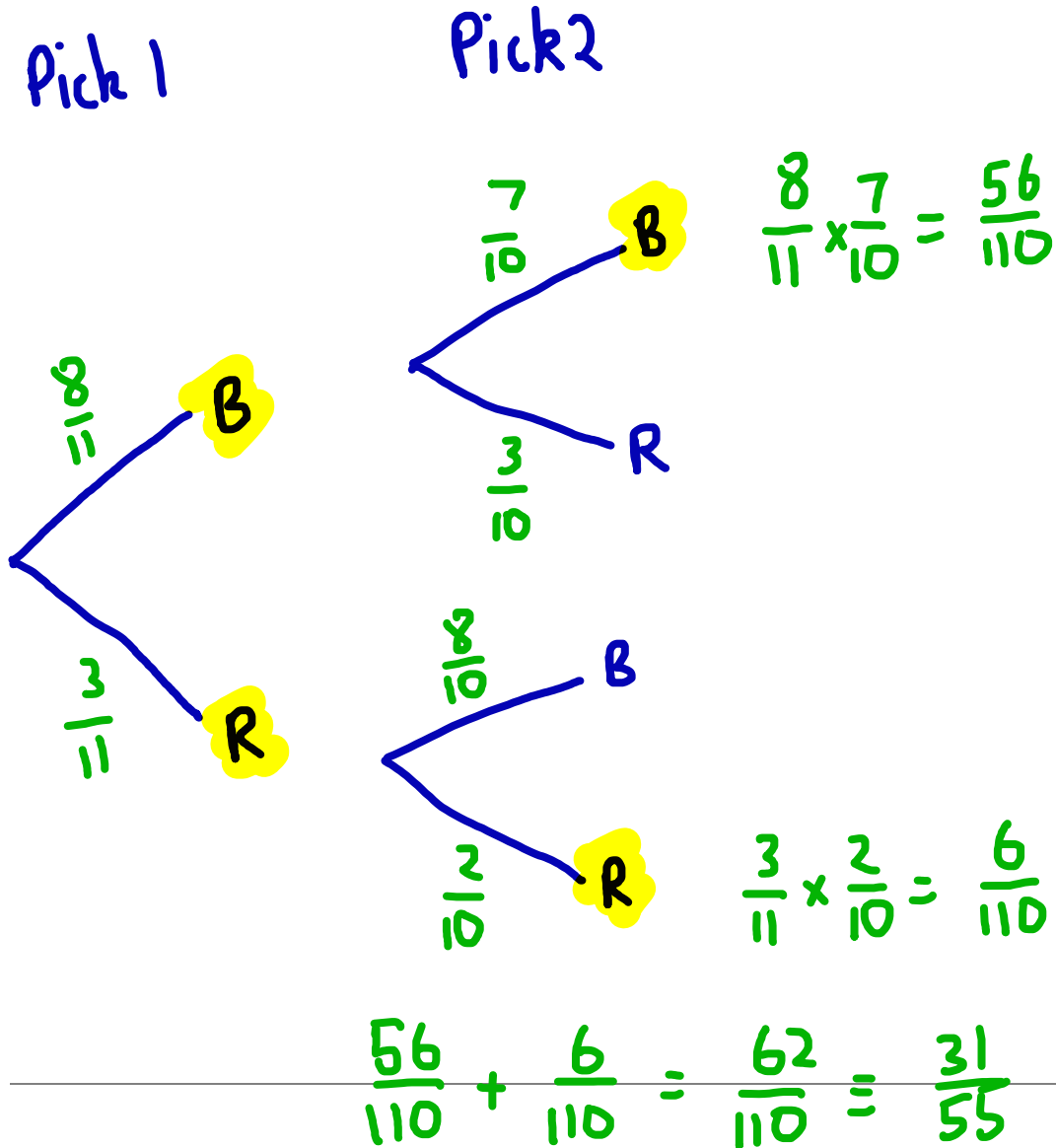
27

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]



Answer

 $\frac{31}{55}$ 

8

Turn over ►



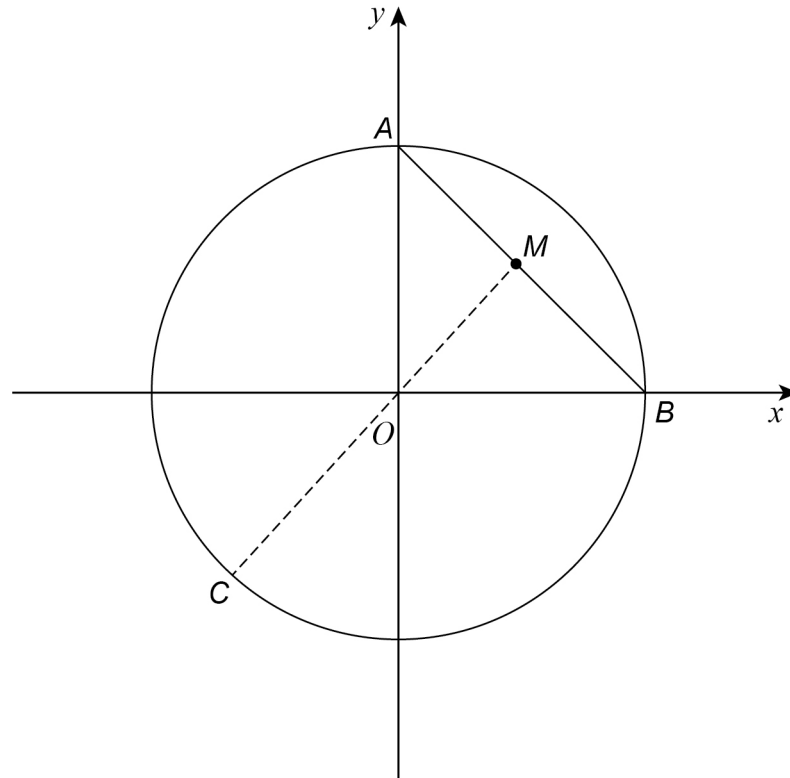
28  $A, B$  and  $C$  are points on the circle  $x^2 + y^2 = 36$  as shown.

$A$  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]

$$\begin{aligned} \text{y-axis: } x=0 &\rightarrow 0^2 + y^2 = 36 \\ y^2 = 36 &\Rightarrow y = \pm 6 \\ &\text{so } A(0, 6) \end{aligned}$$

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

[1 mark]

$$\begin{aligned} y=0 &\Rightarrow x^2 = 36 \\ x &= \pm 6 \quad B \text{ at } +6 \end{aligned}$$

Answer ( 6 , 0 )





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

[2 marks]

$$\begin{array}{l} A(0,6) \\ B(6,0) \end{array} \quad \frac{\Delta y}{\Delta x} = \frac{-6}{6} = -1 \quad m_{AB}$$

$$m_{OM} \times m_{AB} = -1 \text{ so } m_{OM} = 1 \\ \Rightarrow y = x$$

- 28 (d) Work out the coordinates of C.  
Give your answers in surd form.

[3 marks]

$$x^2 + y^2 = 36 \quad y = x$$

$$2x^2 = 36$$

$$x^2 = 18 \Rightarrow x = \pm\sqrt{18}$$

$$x = -\sqrt{18} \text{ at } C = y$$

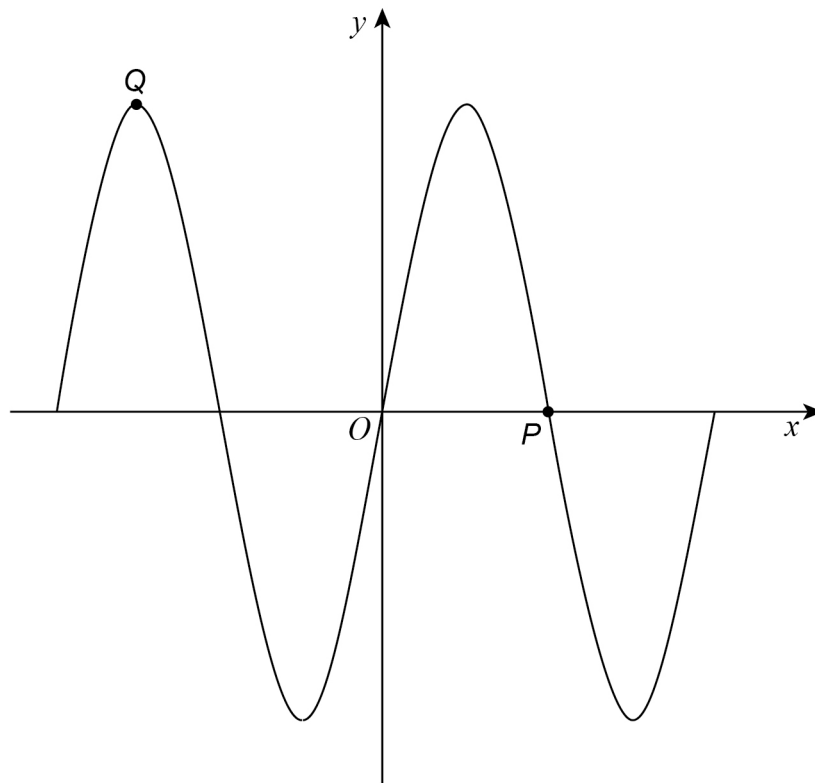
Answer (  $-\sqrt{18}$  ,  $-\sqrt{18}$  )

Turn over for the next question

Turn over ►



29 Here is a sketch of  $y = \sin x^\circ$  for  $-360 \leq x \leq 360$



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 )



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

[2 marks]

$$\sqrt[4]{81} = \frac{1}{3}$$

Answer  $\frac{1}{3}$

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

[3 marks]

$$2^4 \times (2^3)^{2x}$$

$$2^4 \times 2^{6x} = 2^{6x+4}$$

Answer  $2^{6x+4}$

END OF QUESTIONS



**There are no questions printed on this page**

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