AQA

MATHS MADE EASY

GCSE
MATHEMATICS

H

Higher Tier   Paper 2 Calculator

Thursday 8 June 2017   Morning   Time allowed: 1 hour 30 minutes

Materials

For this paper you must have:
- a calculator
- mathematical instruments.

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	

Answer **all** questions in the spaces provided

1 Circle the decimal that is closest in value to $\dfrac{39}{800}$

[1 mark]

0.04   0.048   (0.049)   0.05

$\dfrac{39}{800} = 0.04875$

2 Circle the area that is equal to 36 mm^2

[1 mark]

360 cm^2 3600 cm^2 3.6 cm^2 (0.36 cm^2)

$1 cm^2 = 100 mm^2$

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3   *A* is (2, 12) and *B* is (8, 2)

Circle the midpoint of *AB*.

(3, 5)   (4, 6)   (5, 7)   (6, 10)

$$\frac{2+8}{2} = \frac{10}{2} = 5$$

4   Here is a sequence.

90   82   74   66   58

-8 -8 -8 -8

Circle the expression for the *n*th term of the sequence.

[1 mark]

$n - 8$ $98 - 8n$ $8n + 82$ $8n - 98$

Turn over for the next question

4

Turn over ▶

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5   A code has 4 digits.

Each digit is a number from 0 to 9
Digits may be repeated.

The code starts   5 4 1

5	4	1	

5 (a)   Amy knows the last digit is odd but **not** 7

She chooses a different odd number at random.

What is the probability that she chooses the correct number?

[1 mark]

1, 3, 5, 9

Answer _____ $\frac{1}{4}$ _____

5 (b)   The 4-digit code is changed to an even number.

The first digit is 3

How many possible codes are there?

[2 marks]

FIRST DIGIT IS FIXED, LAST 3 DIGITS COULD BE
000 - 999, SO 1000 OPTIONS. HALF OF THESE ARE
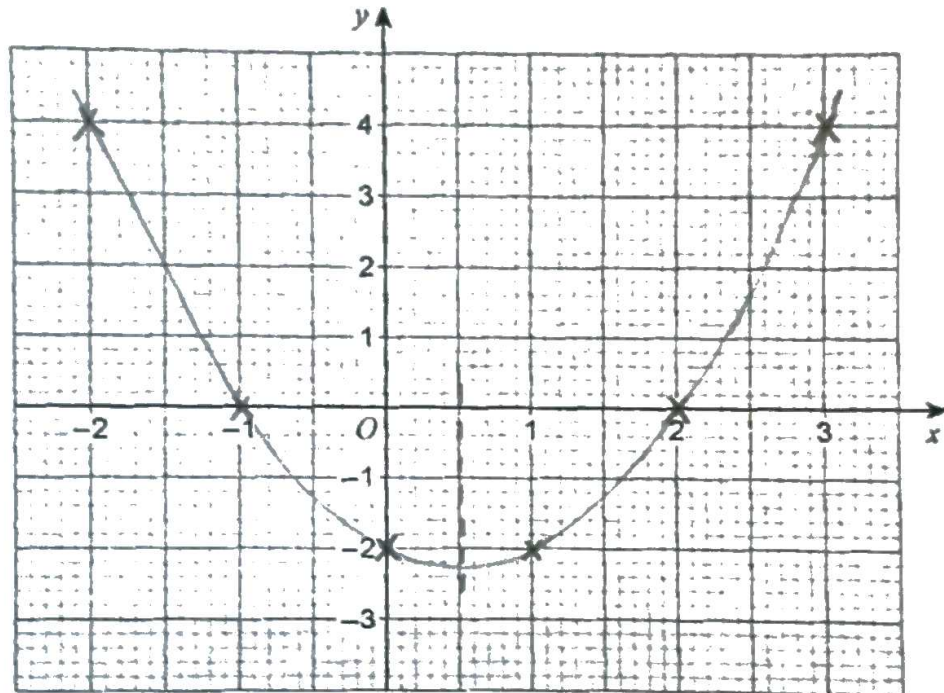EVEN, AND $\frac{1000}{2}$ = 500

Answer _____ 500 _____

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6 (a) Complete the table of values for $y = x^2 - x - 2$

[2 marks]

x	-2	-1	0	1	2	3
y	4	0	-2	-2	0	4

6 (b) Draw the graph of $y = x^2 - x - 2$ for values of x from -2 to 3

[2 marks]

6 (c) Write down the x-coordinate of the turning point of the graph.
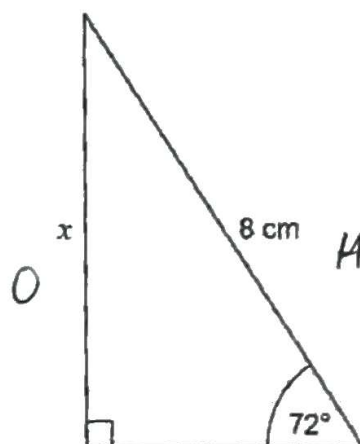
[1 mark]

Answer _____ 0.5 _____

Turn over ▶

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7   Use trigonometry to work out the length x.

Not drawn
accurately

SOHCAHTOA

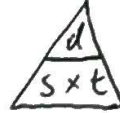x 8 cm   H

O

72°

[2 marks]

$$\sin 72 = \frac{O}{H} = \frac{x}{8}$$

$$\Rightarrow x = 8 \times \sin 72 = 7.61 \text{ cm } (3s.f.)$$
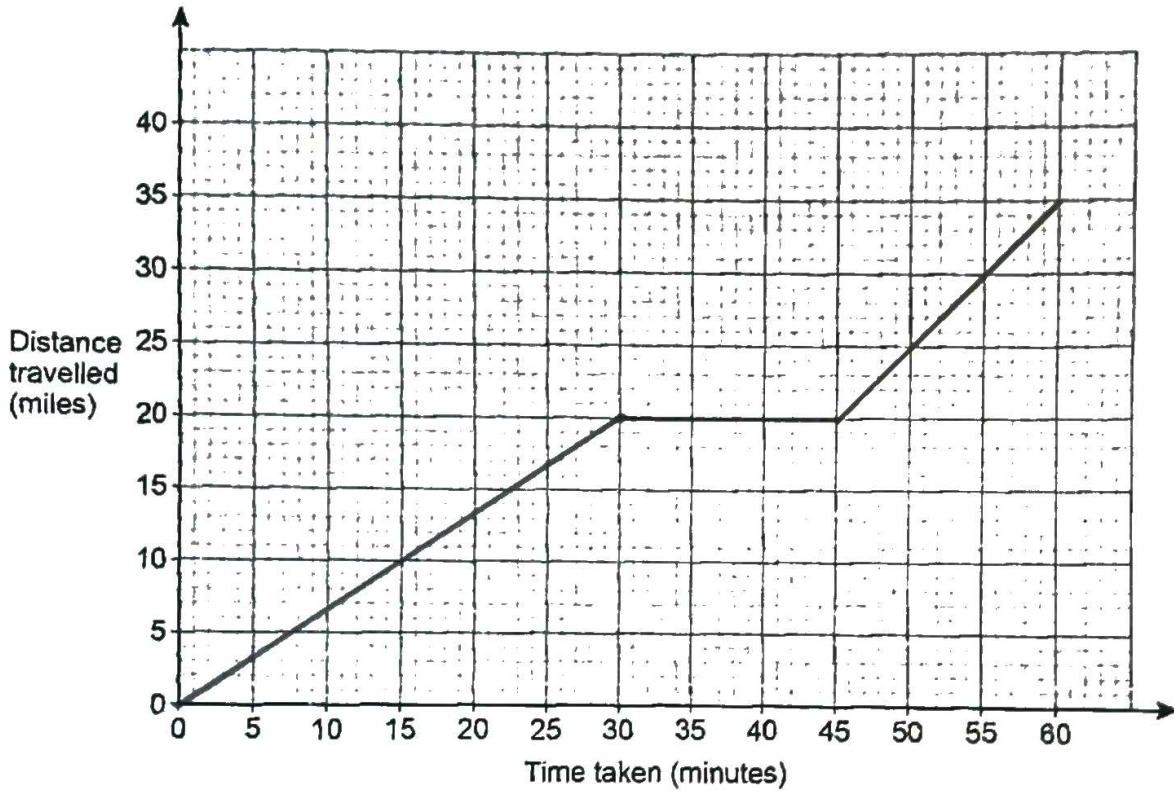
Answer _____ 7.61 _____ cm

8   Lily goes on a car journey. *0.5 HOURS*

      0.5 × 40 = 20 miles

      For the first 30 minutes her average speed is 40 miles per hour.

      She then stops for 15 minutes. *15 MINUTES = 0.25 HOURS*

      60 × 0.25 = 15 miles

      She then completes the journey at an average speed of 60 miles per hour.

      The total journey time is 1 hour.

8 (a)   Draw a distance-time graph for her journey.

d / s × t

[3 marks]

8 (b)   Write down the average speed for the total journey.

[1 mark]

1 HOUR, 35 ÷ 1 = 35 mph

          Answer   *35*   mph

          Turn over for the next question

6

Turn over ▶

9 The table shows information about some CDs.

Type	Rock	Pop	Jazz
Number of CDs	2	x	$2x + 5$

A CD is chosen at random.

The probability it is **rock** is $\frac{1}{20}$

Work out the probability it is jazz.

[4 marks]

$$\frac{1}{20} = \frac{2}{40} \implies \text{THERE ARE } 40 \text{ CDs IN TOTAL.}$$

SO:

$$2 + x + 2x + 5 = 40$$
$$\implies 3x + 7 = 40$$
$$\implies 3x = 33$$
$$\implies x = \frac{33}{3} = 11$$

SO, PROBABILITY OF CHOOSING JAZZ $= \frac{2x+5}{40} = \frac{2(11)+5}{40} = \frac{27}{40}$

Answer $\frac{27}{40}$
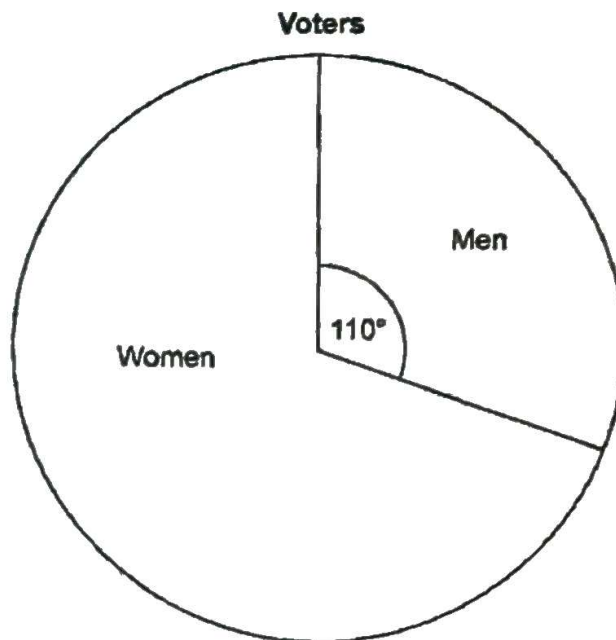
MATHS MADE EASY

10 The pie chart shows information about voters in an election.

Voters

3360 **more** women voted than men.

Work out the total number of voters.

[3 marks]

$360 - 110 = 250°$ FOR WOMEN

DIFFERENCE $= 250 - 110 = 140$

$3360 \div 140 = 24$ PEOPLE PER DEGREE

$24 \times 360 = 8640$ TOTAL PEOPLE

Answer _____ 8640

7

Turn over ▶

MATHS MADE EASY

11   Write these numbers in **descending** order.

$$9563 \qquad 9.56 \times 10^3 \qquad 9.56 \times 3^{10}$$

9563   9560   564508.44   **[2 marks]**

_____

_____

_____

Answer 9.56×3^{10} ,   9563 , 9.56×10^3

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12 A, B, C, D, E and F are points on a circle.
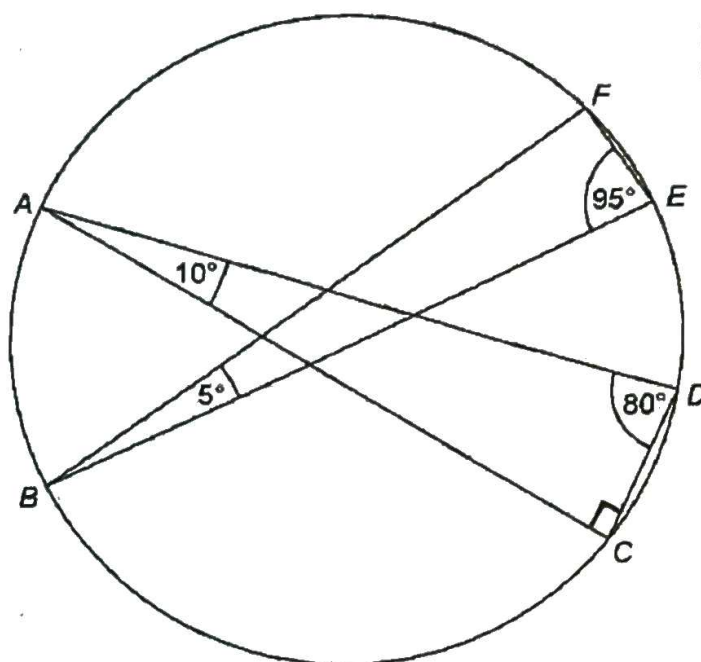
Not drawn accurately

Circle the line that is a diameter of the circle.

[1 mark]

BE   ⬭AD   AC   BF

Turn over for the next question

$10 + 80 = 90 \implies$ ANGLE $ACD = 180 - 90 = 90$

$\implies$ AD IS DIAMETER

(ANGLE IN A SEMI-CIRCLE IS A RIGHT ANGLE)

3

Turn over ▶

MATHS MADE EASY

13 To make one cheese sandwich, Gina uses one bread roll and two cheese slices.

Pack of 15 bread rolls	Pack of 20 cheese slices
£1.88	£2.15

She is going to buy enough packs to
have exactly twice as many cheese slices as bread rolls
make **more than** 100 cheese sandwiches.

Work out the least amount she can spend.

[4 marks]

SHE NEEDS MORE THAN 100 BREAD ROLLS.

TRY: 105 = 15 × 7. THEN, NEED 105 × 2 = 210

CHEESE SLICES, BUT 210 NOT MULTIPLE OF 20. X

TRY: 120 = 15 × 8. THEN, NEED 120 × 2 = 240

CHEESE SLICES. $\frac{240}{20}$ = 12, SO THIS IS POSSIBLE.

COST = (8 × 1.88) + (12 × 2.15)

= 40.84

Answer £ _____ 40.84 _____

14   The graph shows the cost of some taxi journeys.

Cost, £C

Number of miles, n
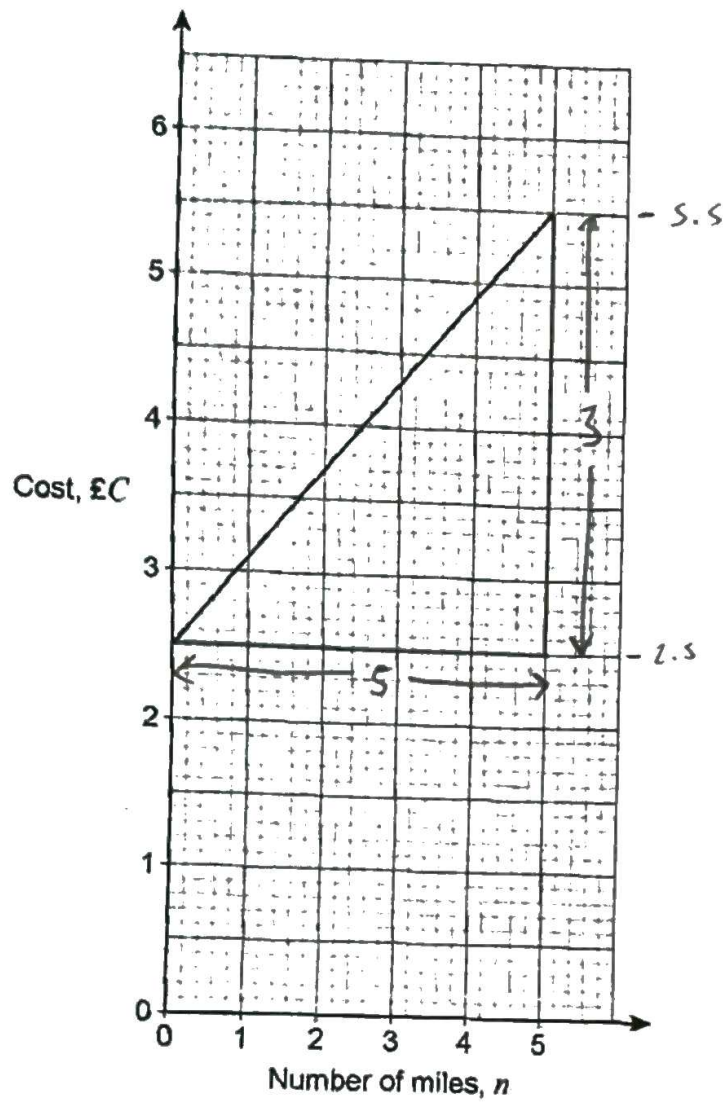
Work out a formula for C in terms of n.

$= \frac{5}{2}$

[3 marks]

INTERCEPT AT $C = 2.5$ (WHEN $n = 0$)

GRADIENT $= \frac{3}{5}$

$\therefore C = \frac{3}{5}n + \frac{5}{2}$

Answer $C = \frac{3}{5}n + \frac{5}{2}$

7

Turn over ▶

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IB/M/Jun17/8300mu

15   Sami is trying to work out the exact value of y using Pythagoras' theorem.

6 cm   2y cm   8 cm
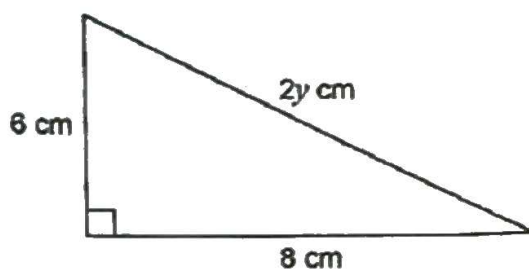
Not drawn accurately

Here is her working.

$$(2y)^2 = 6^2 + 8^2$$
$$2y^2 = 36 + 64$$
$$2y^2 = 100$$
$$y^2 = 100 \div 2$$
$$y^2 = 50$$
$$y = \sqrt{50}$$

15 (a)   What error has she made in her working?

         [1 mark]

ON LINE 2, $(2y)^2 = 4y^2 \neq 2y^2$

MATHS MADE EASY

15 (b)   Kai works out that $y = 5$

Mel says,

"y cannot be 5 because the hypotenuse should be the longest side and the other sides are longer than 5 cm"
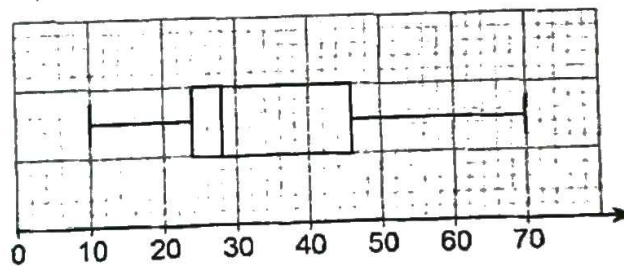
Is Mel correct?

Tick a box.

Yes ☐   No ☑

Give a reason for your answer.

[1 mark]

THE LENGTH OF THE HYPOTENUSE IS NOT y BUT 2y,
WHICH WOULD BE 10cm, WHICH IS LONGER THAN THE OTHER SIDES.

16   Here is a box plot.

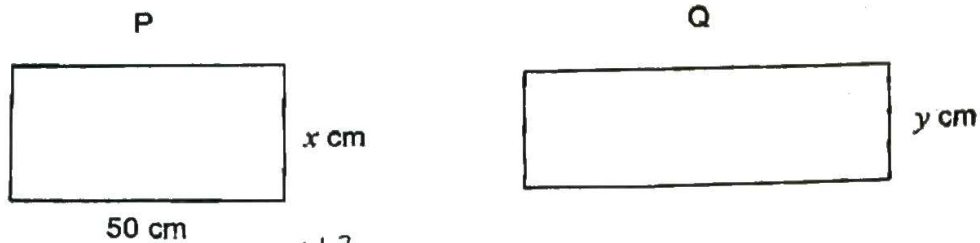Circle the median value.

[1 mark]

(28)   35   24   22

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17   P is a rectangle with length 50 cm and width x cm

Q is a rectangle with width y cm

Not drawn
accurately

P

x cm

50 cm

✓ × 1.2

Q

y cm

The length of Q is 20% **more** than the length of P.

The area of Q is 10% **less** than the area of P.

↖ × 0.9

Work out the ratio $x : y$

Give your answer in its simplest form.

[4 marks]

$$Q = 1.20 \times 50 = 60 \text{ cm}$$

$$\text{AREA OF } P = 50x, \quad \text{AREA OF } Q = 60y$$

$$\text{AREA OF } Q = 0.9 \times (\text{AREA OF } P)$$

$$\Rightarrow \quad 60y = 0.9 \times 50x = 45x$$

$$\Rightarrow \quad \frac{60}{45}y = x \quad \Rightarrow \quad \frac{60}{45} = \frac{x}{5} \quad \Rightarrow \quad x : y = 60 : 45 = 4 : 3$$

Answer _____ 4 _____ : _____ 3 _____

18   A school has 86 teachers.

42 are male and 44 are female.

$\frac{1}{3}$ of the male teachers have blue eyes.

$\frac{1}{4}$ of the female teachers have blue eyes.

$\frac{1}{3} \times 42 = 14 =$ MALE AND BLUE EYES
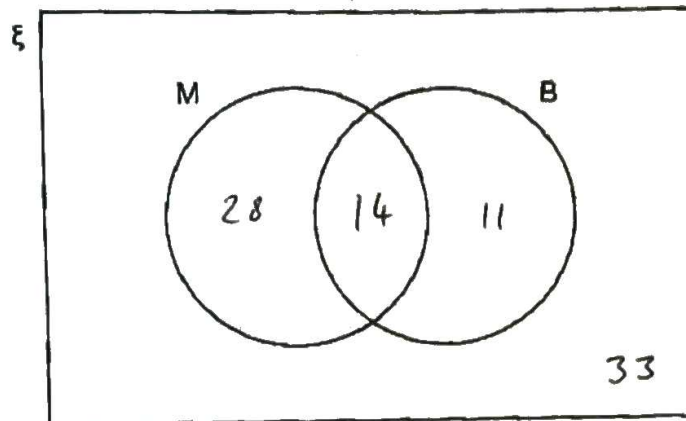
$\frac{1}{4} \times 44 = 11$

18 (a) ξ = teachers in the school

M = male teachers

B = teachers who have blue eyes

Complete the Venn diagram.

[3 marks]

MALE BUT NOT BLUE EYES = $42 - 14 = 28$

BLUE EYES BUT FEMALE = 11

OTHER = $86 - (28 + 14 + 11) = 33$

18 (b)   One teacher who has blue eyes is chosen at random. $\frac{14}{14+11} = \frac{14}{25}$

Work out the probability that the teacher is male.

[1 mark]

Answer $\frac{14}{25}$

Turn over ▶

19 Rana sells 192 cakes in the ratio   small : medium : large = 7 : 6 : 11

The profit for one medium cake is twice the profit for one small cake.

The profit for one large cake is three times the profit for one small cake.

Her total profit is £532.48

Work out the profit for one small cake.

[5 marks]

SIZE :- SMALL : MEDIUM : LARGE : TOTAL

AMOUNT :- 7)×8 : 6)×8 : 11)×8 : 24)×8

56) : 48 : 88 : 192

LET x = PROFIT FOR ONE SMALL CAKE. THEN,

$2x$ = MEDIUM CAKE, $3x$ = LARGE CAKE. FROM THE RATIO:

$(56 \times x) + (48 \times 2x) + (88 \times 3x) = 532.48$

$\Rightarrow 56x + 96x + 264x = 532.48$

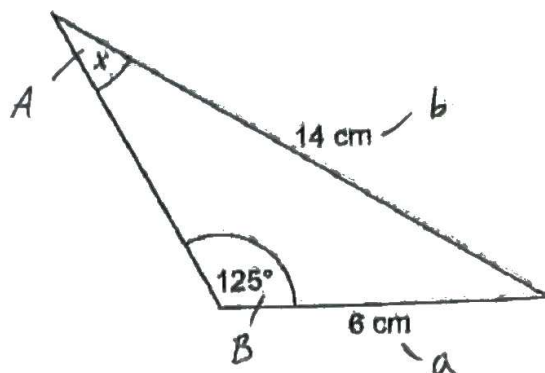$\Rightarrow 416x = 532.48 \Rightarrow x = \dfrac{532.48}{416} = 1.28$

Answer £ _____ 1.28

IB/M/Jun17/8300/2H

20 Work out the size of angle x.

SINE RULE:

$$\frac{\sin A}{a} = \frac{\sin B}{b}$$

14 cm — b

Not drawn
accurately

A

x

125°

B

6 cm — a

[3 marks]

$$\frac{\sin x}{6} = \frac{\sin 125}{14}$$

$$\Rightarrow \sin x = 6 \times \frac{\sin 125}{14} = 0.351065....$$

$$\Rightarrow x = \sin^{-1}(0.35106S...) = 20.6° \\ (3.s.f.)$$

Answer _____ 20.6 _____ degrees

Turn over for the next question

21   Solve $5x^2 = 10x + 4$

Give your answers to 2 decimal places.   **[4 marks]**

$$5x^2 - 10x - 4 = 0$$

$$a = 5, \quad b = -10, \quad c = -4$$

$$x = \frac{-(-10) \pm \sqrt{(-10)^2 - 4(-4) \times 5}}{2 \times 5}$$

$$= \frac{10 \pm \sqrt{180}}{10} = 1 \pm \frac{3}{5}\sqrt{5} = 2.34 \ (2d.p)$$

$$OR - 0.34 \ (2d.p)$$

Answer $x = 2.34, \ x = -0.34$

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22 A ball, dropped vertically, falls *d* metres in *t* seconds.

d is directly proportional to the square of *t*.

The ball drops 45 metres in the first 3 seconds.

How far does the ball drop in the next 7 seconds?

500

1 2 3 4 5 6 7 8 9 10
45

[4 marks]

$$d \propto t^2 \Rightarrow d = kt^2$$

WHEN $d = 45$, $t = 3$, SO $45 = k \times 3^2 = 9k$

$$\Rightarrow k = \frac{45}{9} = 5.$$

SO $d = 5t^2$.
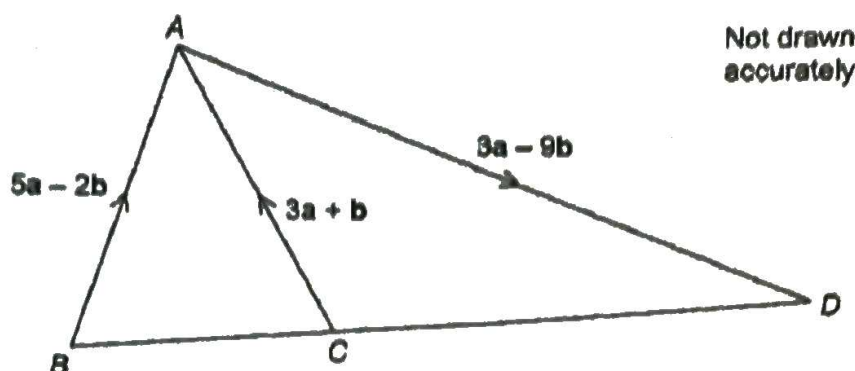
AFTER 10 SECONDS $(3+7)$, $d = 5 \times 10^2 = 500$

$\therefore$ ANSWER $= 500 - 45 = 455\,m$

Answer _____455_____ metres

Turn over for the next question

8

MATHS MADE EASY

IB/M/Jun17/8300/2H

23

Not drawn accurately

Is *BCD* a straight line?

Show working to support your answer.

[3 marks]

$$\vec{BC} = \vec{BA} + \vec{AC} = 5\underline{a} - 2\underline{b} - (3\underline{a} + \underline{b})$$
$$(-\vec{CA}) \qquad = 2\underline{a} - 3\underline{b}$$

$$\vec{CD} = \vec{CA} + \vec{AD} = 3\underline{a} + \underline{b} + 3\underline{a} - 9\underline{b}$$
$$= 6\underline{a} - 8\underline{b}$$

$6\underline{a} - 8\underline{b}$ IS NOT A MULTIPLE OF $2\underline{a} - 3\underline{b}$, THEREFORE $\vec{BC}$ AND $\vec{CD}$ ARE NOT PARALLEL, SO MUST NOT FORM A STRAIGHT LINE

Answer _____NO_____

24 48 students completed some homework.

This histogram shows information about the times taken.
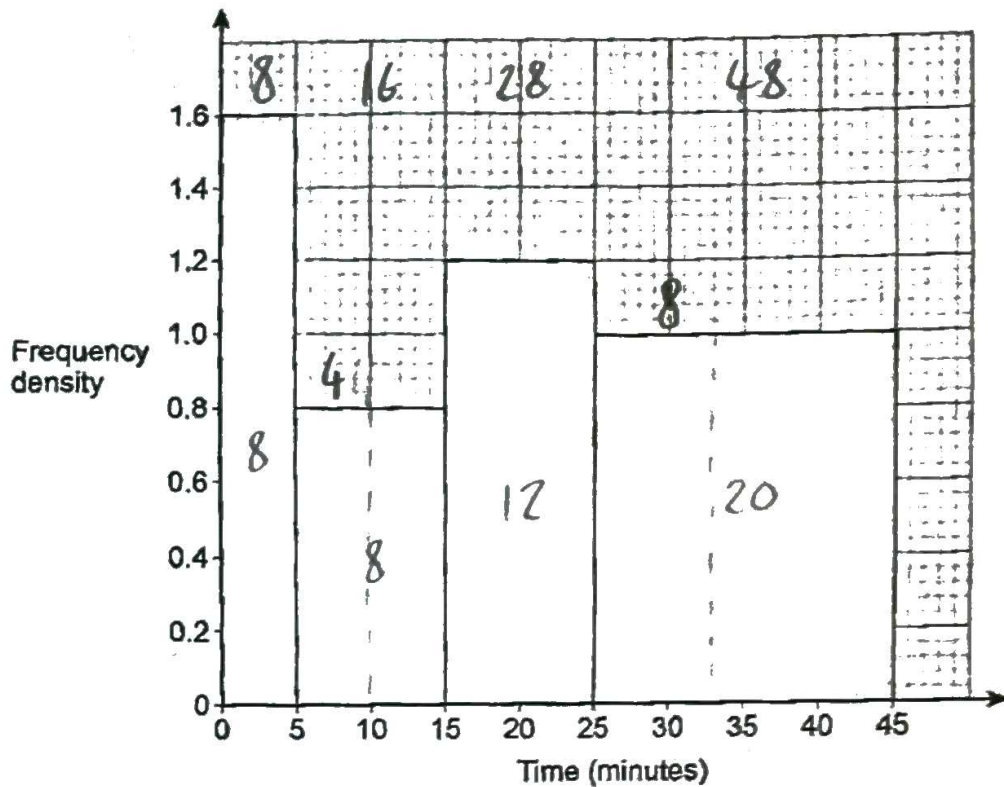
Work out an estimate of the interquartile range.

You **must** show your working.

[4 marks]

LOWER QUARTILE: $\frac{n}{4} = \frac{48}{4} = 12^{th}$ TERM,

$12 - 8 = 4$ PLACES INTO SECOND BAR, SO

$Q_1 = 5 + \left(\frac{4}{8} \times 10\right) = 5 + 5 = 10$

UPPER QUARTILE: $\frac{3n}{4} = \frac{3}{4} \times 48 = 36^{th}$ TERM,

$36 - 28 = 8$ PLACES INTO LAST BAR, SO

$Q_3 = 25 + \left(\frac{8}{20} \times 20\right) = 25 + 8 = 33 \Rightarrow IQR = 33 - 10 = 23$

Answer _____23_____ minutes

Turn over ▶

IB/M/Jun17/8300/2H

Not draw
outside b
box

25 The diagram shows a logo.

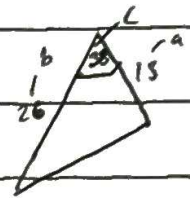   *ABE* and *DCE* are congruent triangles.

   BCE is a sector of a circle, centre *E*.
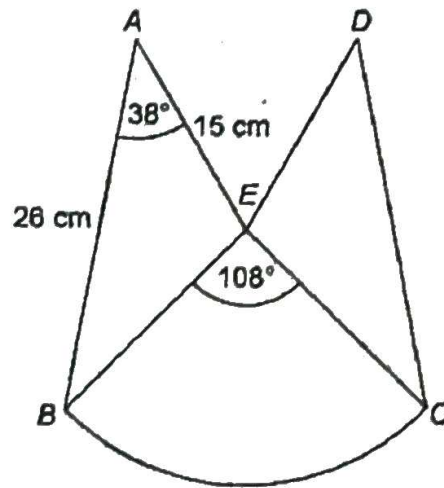
Not drawn
accurately

Show that the area of the logo is 510 cm² to 2 significant figures.

[5 marks]

AREA OF ABE = $\frac{1}{2}ab\sin C$ = $\frac{1}{2} \times 15 \times 26 \times \sin 38$

= 120.0539....

CONGRUENT, SO AREA OF DCE = 120.0539...

AREA OF BCE = $\frac{108}{360} \times \pi r^2$

FOR r, COSINE RULE: $a^2 = b^2 + c^2 - 2bc \cos A$

$\Rightarrow r^2 = 15^2 + 26^2 - 2 \times 15 \times 26 \times \cos 38$
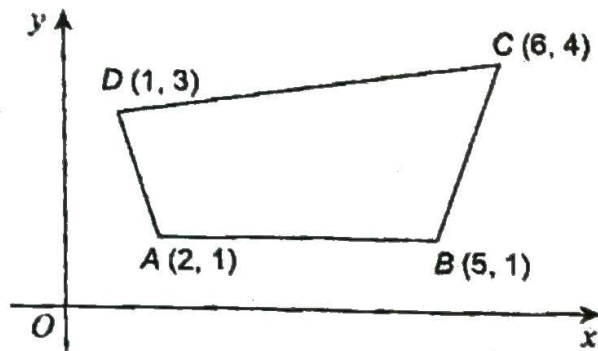
$\Rightarrow r = \sqrt{901 - 780 \cos 38}$ = 16.92...
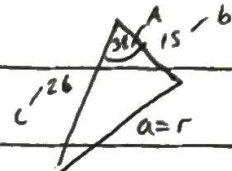
SO AREA OF BCE = $\frac{108}{360} \times \pi \times (16.92...)^2$ = 269.880....

TOTAL = 269.880... + 2(120.0539...) = 509.9... = 510 cm²

(2 s.f.)

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IB/M/Jun17/8300/2H

26 (a) A sketch of a quadrilateral ABCD is shown.

Not drawn accurately
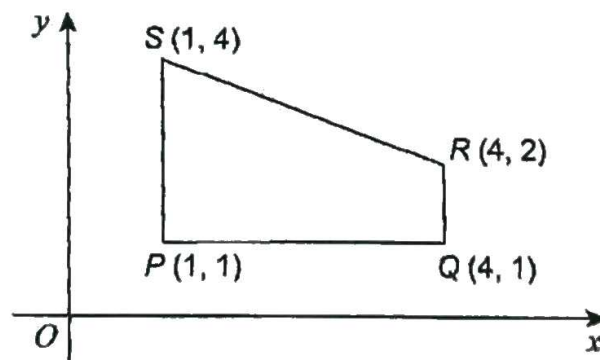
ABCD is enlarged, centre B, scale factor $\frac{1}{3}$

Circle the vertex that is invariant.

[1 mark]

A   (B)   C   D

26 (b) A sketch of a quadrilateral PQRS is shown.

Not drawn accurately

PQRS is reflected in the line $y = x$

Circle the vertex that is invariant.

[1 mark]

(P)   Q   R   S

7

Turn over ▶
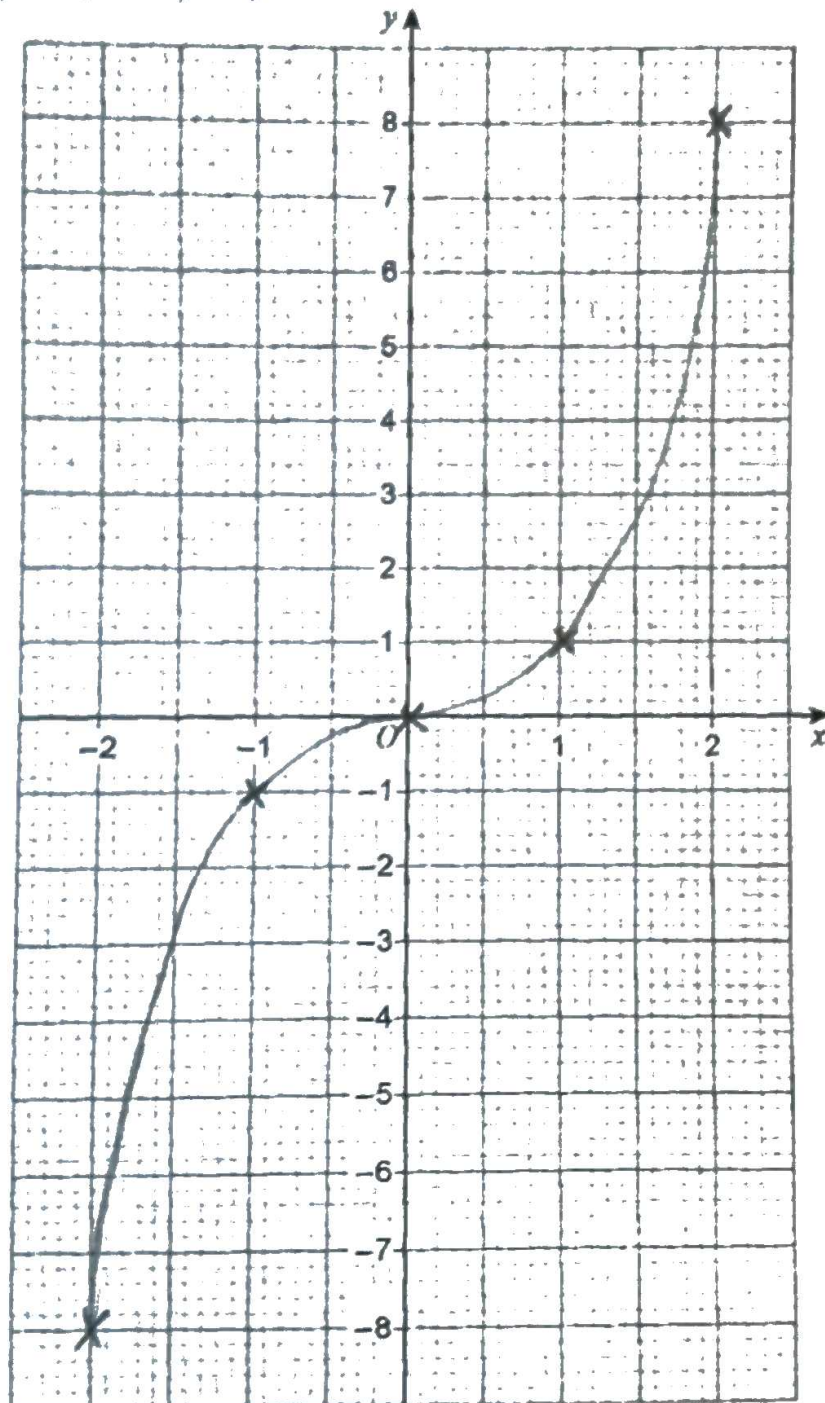
IB/M/Jun17/8300/2H

27 (a) $h(x) = \sqrt[3]{x}$ for all values of x

On the grid, draw the graph of the inverse function $y = h^{-1}(x)$ for $-2 < x < 2$

[2 marks]

$y = \sqrt[3]{x}$, $y^3 = x$, SWITCH x AND y, $y = x^3$

$x : -2, 1, 0, 1, 2$ $\Rightarrow h^{-1}(x) = x^3$

$h^{-1}(x) : -8, -1, 0, 1, 8$

MATHS MADE EASY

27 (b) For all values of x

$f(x) = \sin x$

$g(x) = x + 90$

On the grid, draw the graph of the composite function $y = fg(x)$ for $0° \leqslant x \leqslant 360°$

[2 marks]

$$fg(x) = f(g(x)) = f(x + 90)$$
$$= \sin(x + 90)$$

$\sin x$, TRANSLATED 90 TO THE LEFT

$\sin(0 + 90) = 1$, $\sin(90 + 90) = 0$, $\sin(180 + 90) = -1$,
$\sin(270 + 90) = 0$

END OF QUESTIONS

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4