3H

**Pearson Edexcel
International GCSE**

EDEXCEL
IGCSE

MATHEMATICS A
SOLUTIONS

MAY 2014

4MA0/3H

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Within these solutions We have indicated where marks **might** be awarded for each question. We have used B marks, M marks and A marks in a similar, but **not identical**, way that the exam board uses these marks within their mark schemes. We have done this for simplicity and convenience. We have sometimes interchanged B marks, M marks and A marks and We have sometimes awarded the marks in different ways to the exam board.

B1 – This is an unconditional accuracy mark (the specific number, word or phrase must be seen. This type of mark cannot be given as a result of 'follow through').

M1 – This is a method mark. We have indicated where method marks might be awarded for the method that is shown. If You use a different method, then the same number of method marks would be awarded but We are not able to indicate for what the marks would be awarded for Your particular method. When appropriate, You should seek clarity and download the relevant examiner mark scheme from the exam board's web site

A1 – These are accuracy marks. Accuracy marks are typically awarded after method marks. If the correct answer is obtained, then You should normally (but not always) expect to be awarded all of the method marks (provided that You have shown Your method) and all of the accuracy marks.

(a) Work out the value of $\dfrac{13.8 \times 6.5}{7 + \sqrt{2}}$

Write down all the figures on your calculator display.
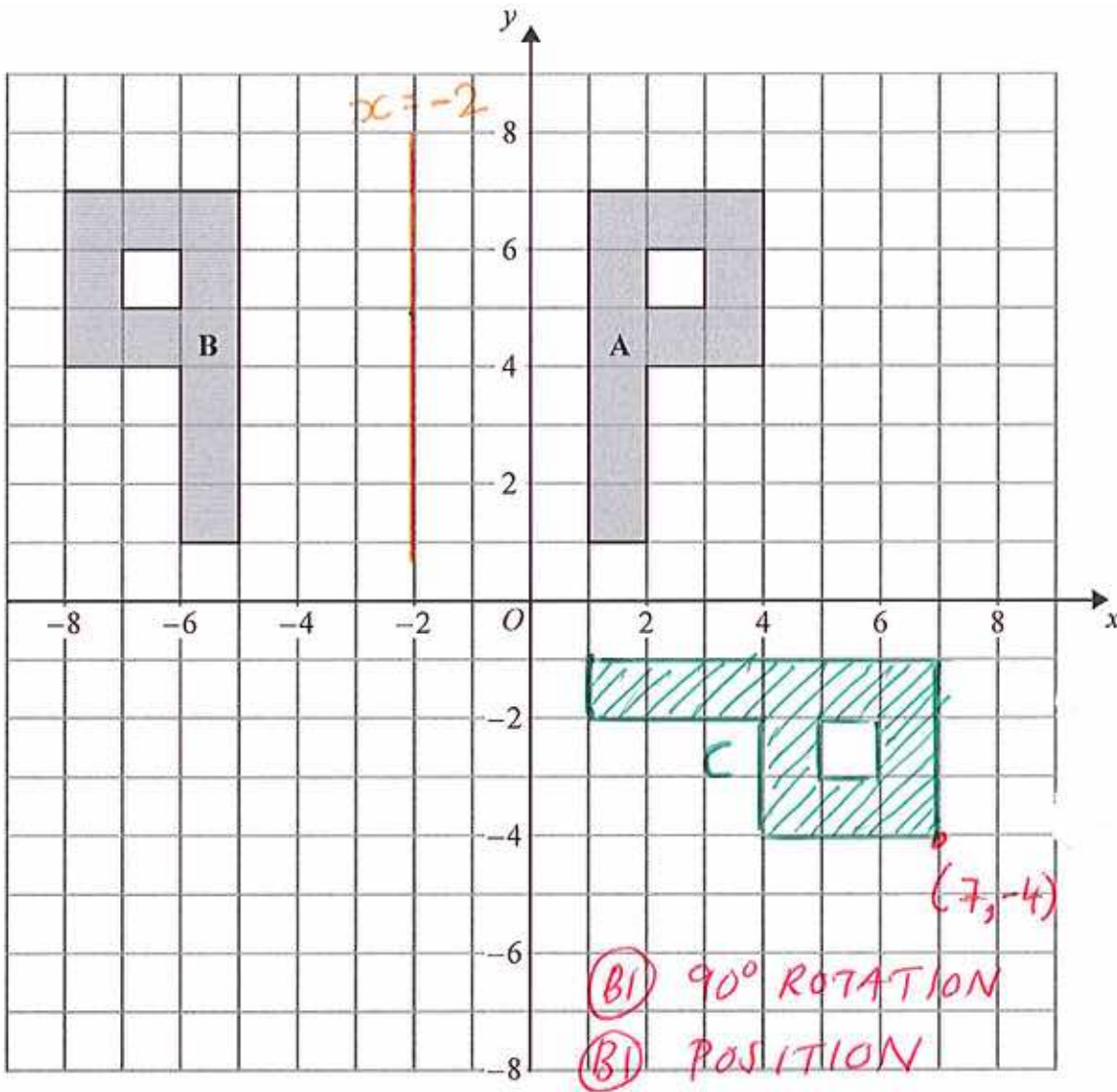
(A2)

10·6605328

(2)

(b) Give your answer to part (a) correct to 3 significant figures.

(A1)

10·7

(1)

Show that $\dfrac{4}{9} \div \dfrac{5}{6} = \dfrac{8}{15}$

$$\dfrac{4}{9} \div \dfrac{5}{6} = \dfrac{4}{9} \times \dfrac{6}{5}$$

(m1)

$$= \dfrac{24}{45}$$

(m1) [OR FOR SHOWING CANCELLING

$$E.G. \quad \dfrac{4}{{}_3\cancel{9}} \times \dfrac{\cancel{6}{}^2}{5} \quad]$$

$$= \dfrac{8}{15}$$

$x = -2$

B

A

C

$(7, -4)$

(B1) 90° ROTATION

(B1) POSITION

(a) Describe fully the single transformation that maps shape **A** onto shape **B**.

REFLECTION (B1) , MIRROR LINE IS $x = -2$ (B1)

(2)

(b) On the grid, rotate shape **A** 90° clockwise about the origin *O*.
Label the new shape **C**.

(2)

(a) Simplify $8d \times 7d$

$$56d^2$$

(1)

(b) Expand $4(3e - 5)$

$12e$

-20

$12e - 20$

(1)

(c) Factorise $f^2 - 2f$

$$f(f - 2)$$

(2)

(d) $H = g^3 + 6g$
Work out the value of H when $g = 2$

$$H = 2^3 + 6 \times 2 \qquad = 8 + 12$$
$$= 20$$

x (OPP)

P   Q

Diagram **NOT** accurately drawn

38°   12.2 cm (HYP)

R
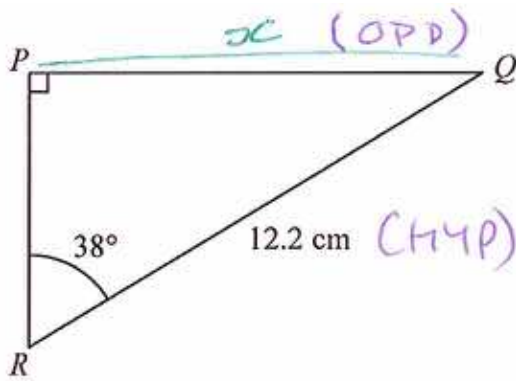
Calculate the length of *PQ*.
Give your answer correct to 3 significant figures.

SOH   CAH   TOA

$$\text{SIN } 38 = \frac{x}{12.2} \quad \text{(M1)}$$

$$x = 12.2 \times \text{SIN } 38 \quad \text{(M1)}$$

$$= 7.511069\ldots$$

$$= 7.51 \text{ cm} \quad \text{(A1)}$$

The diagram shows an accurate scale drawing of part of the boundary of a field.
The complete boundary of the field is in the shape of a quadrilateral ABCD.

AB = 300 metres.
BC = 230 metres.
Point B is due north of point C.
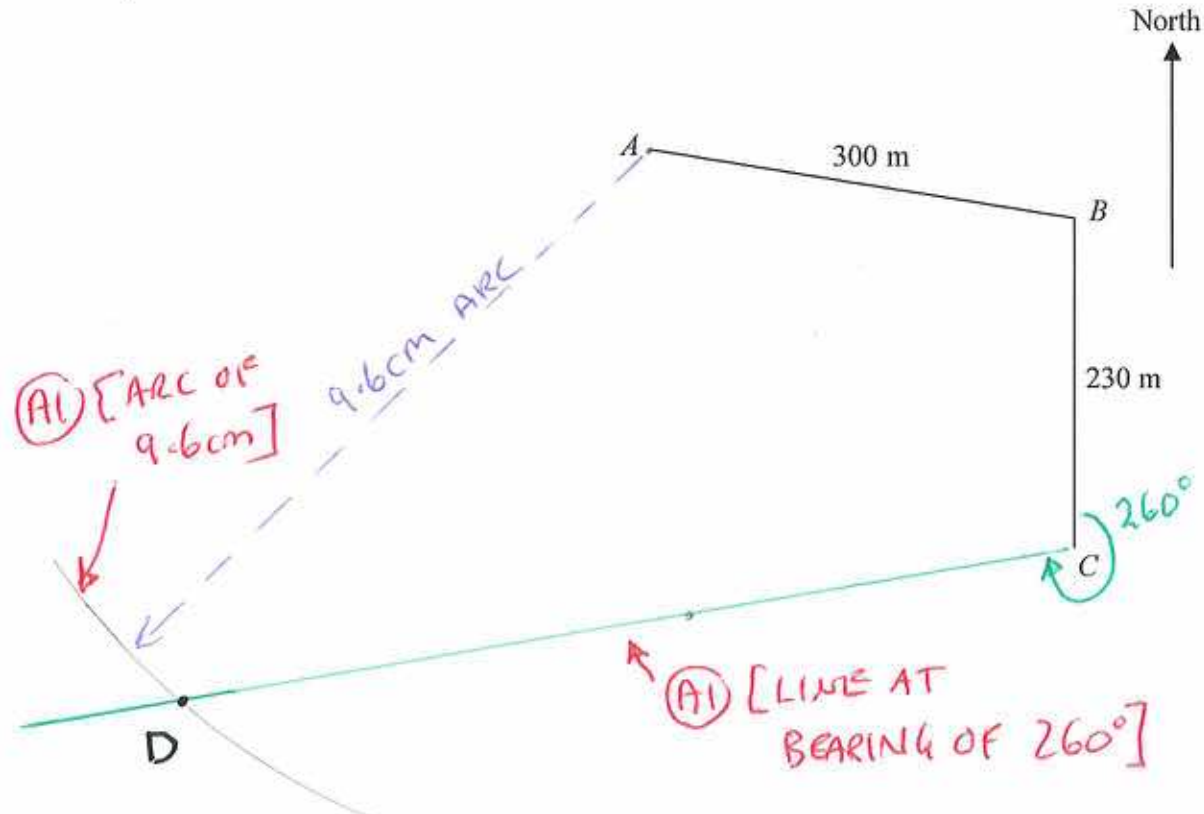
The scale of the diagram is 1 cm to 50 metres.

The bearing of D from C is 260°
AD = 480 metres.

$\frac{480}{50} = 9.6 cm$

Complete the scale drawing of the boundary of the field.
Mark the position of D.

North

A

300 m

B

9.6cm ARC

(A1) [ARC OF 9.6cm]

230 m

260°

C

(A1) [LINE AT BEARING OF 260°]

D

(a) $A = \{p, r, a, g, u, e\}$

$B = \{p, a, r, i, s\}$

$C = \{b, u, d, a, p, e, s, t\}$

List the members of the set

(i) $A \cap B$　　$= \{p, r, a\}$　　　　　　　　　　(A1)

　　　　　　　　　　　　　　　　　　　　$\{a, p, r\}$

(ii) $B \cup C$　　　　　　　ORDER　　　　　　　　(A1)

$\{b, u, d, a, p, e, s, t\}$　　DOESN'T　　　$\{a, b, d, e, i, p, u, r, s, t\}$

$\qquad + \{r, i\}$　　　MATTER　　　　　　　　(2)

(b) $D = \{r, o, m, e\}$

$E = \{l, i, s, b, o, n\}$
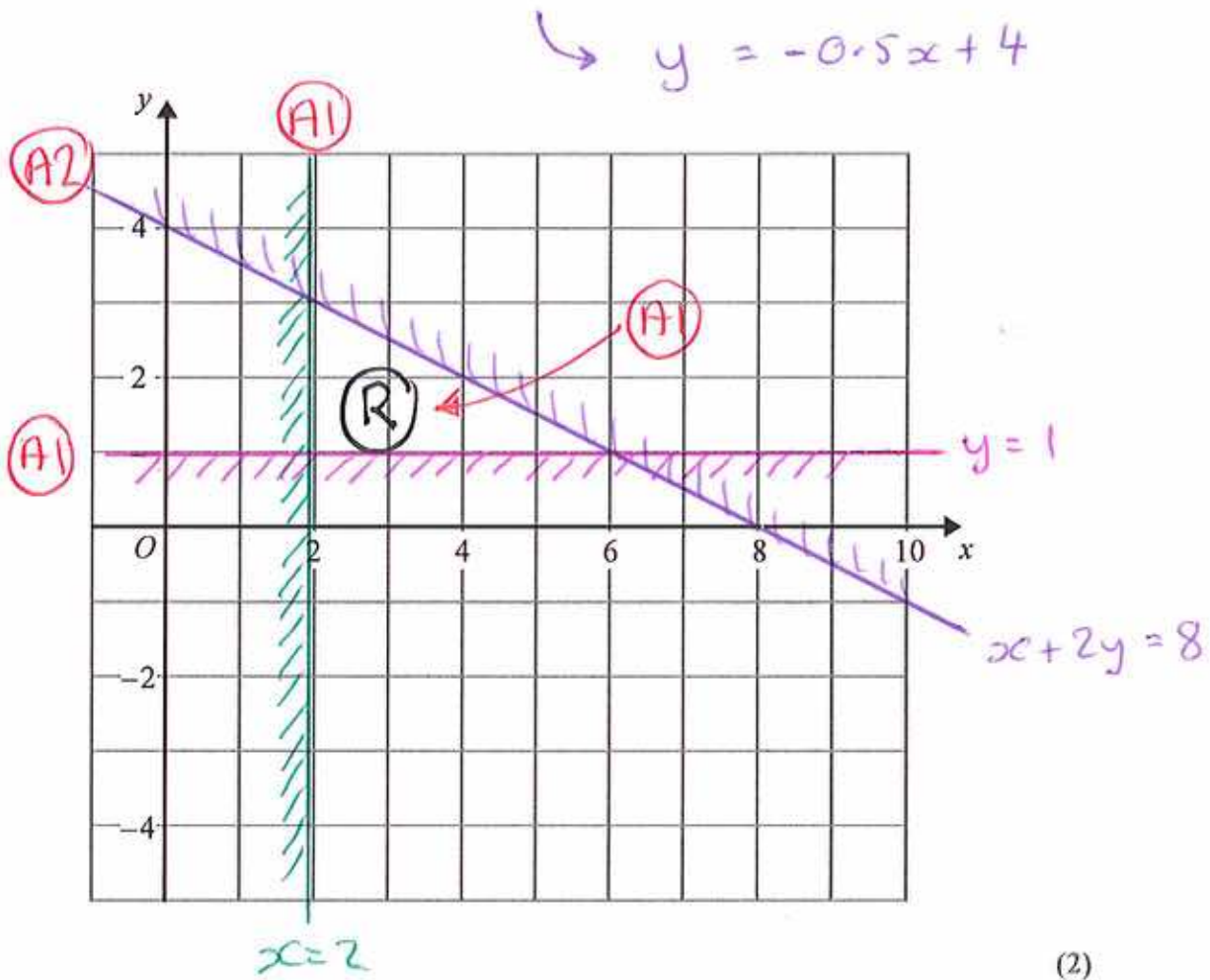
$F = \{b, e, r, l, i, n\}$

Put one of the letters D, E or F in the box below to make the statement correct.

$$A \cap \boxed{E} = \emptyset$$

Explain your answer.

NONE OF THE LETTERS IN "PLAGUE" (SET A)

ARE ALSO IN "LISBON" (SET E)　(A1)　(1)

(a) On the grid, draw the line with equation $x + 2y = 8$ for values of x from 0 to 9

$\rightarrow$ $y = -0.5x + 4$

$x + 2y = 8$

$y = 1$

$x = 2$

(2)

(b) Show, by shading on the grid, the region defined by all three inequalities

$x + 2y \leqslant 8$
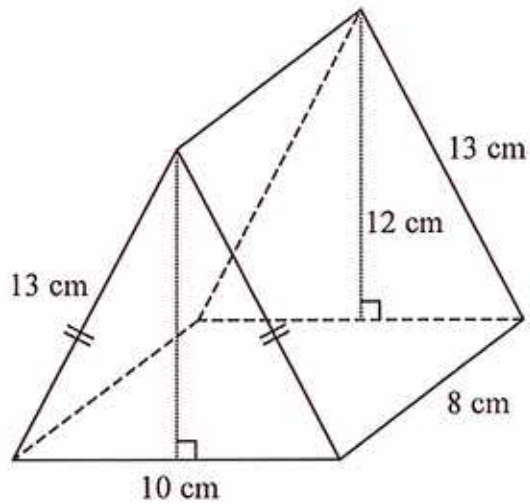
$x \geqslant 2$

$y \geqslant 1$

Label your region **R**.

(3)

Diagram **NOT**
accurately drawn

13 cm

12 cm

13 cm

8 cm

10 cm

The diagram shows a prism.
The cross-section of the prism is an isosceles triangle.
The lengths of the sides of the triangle are 13 cm, 13 cm and 10 cm.
The perpendicular height of the triangle is 12 cm.
The length of the prism is 8 cm.

Work out the total surface area of the prism.

$$FRONT = \frac{10 \times 12}{2} = 60 \quad \text{(m1)}$$

$$BACK = 60$$

$$SIDES: \quad 10 \times 8 = 80$$
$$13 \times 8 = 104 \quad \text{(m1)}$$
$$13 \times 8 = 104$$

$$TOTAL = \underline{408 \ cm^2}$$

(A1)

Zara must take 5 tests.
Each test is out of 100
After 4 tests, her mean score is 64%. → TOTAL = 4×64 = 256 (B1)

What score must Zara get in her 5th test to increase her mean score in all 5 tests to 70%?

TOTAL NEEDS TO BE 5×70 = 350 (B1)

SO SHE NEEDS 350 - 256 = 94 (A1)

(M1)

The table gives information about the speed, in km/h, of 180 vehicles passing a speed checkpoint.

Speed (v km/h)	Frequency
$40 < v \leqslant 50$	4
$50 < v \leqslant 60$	52
$60 < v \leqslant 70$	60
$70 < v \leqslant 80$	34
$80 < v \leqslant 90$	18
$90 < v \leqslant 100$	12

(a) Write down the modal class.

(A1)

$60 < v \leqslant 70$

(1)

(b) Work out an estimate for the probability that the next vehicle passing the speed checkpoint will have a speed of 60 km/h or less.

$\dfrac{4 + 52}{180}$ (m1)

(A1)

$\dfrac{14}{45}$

(2)

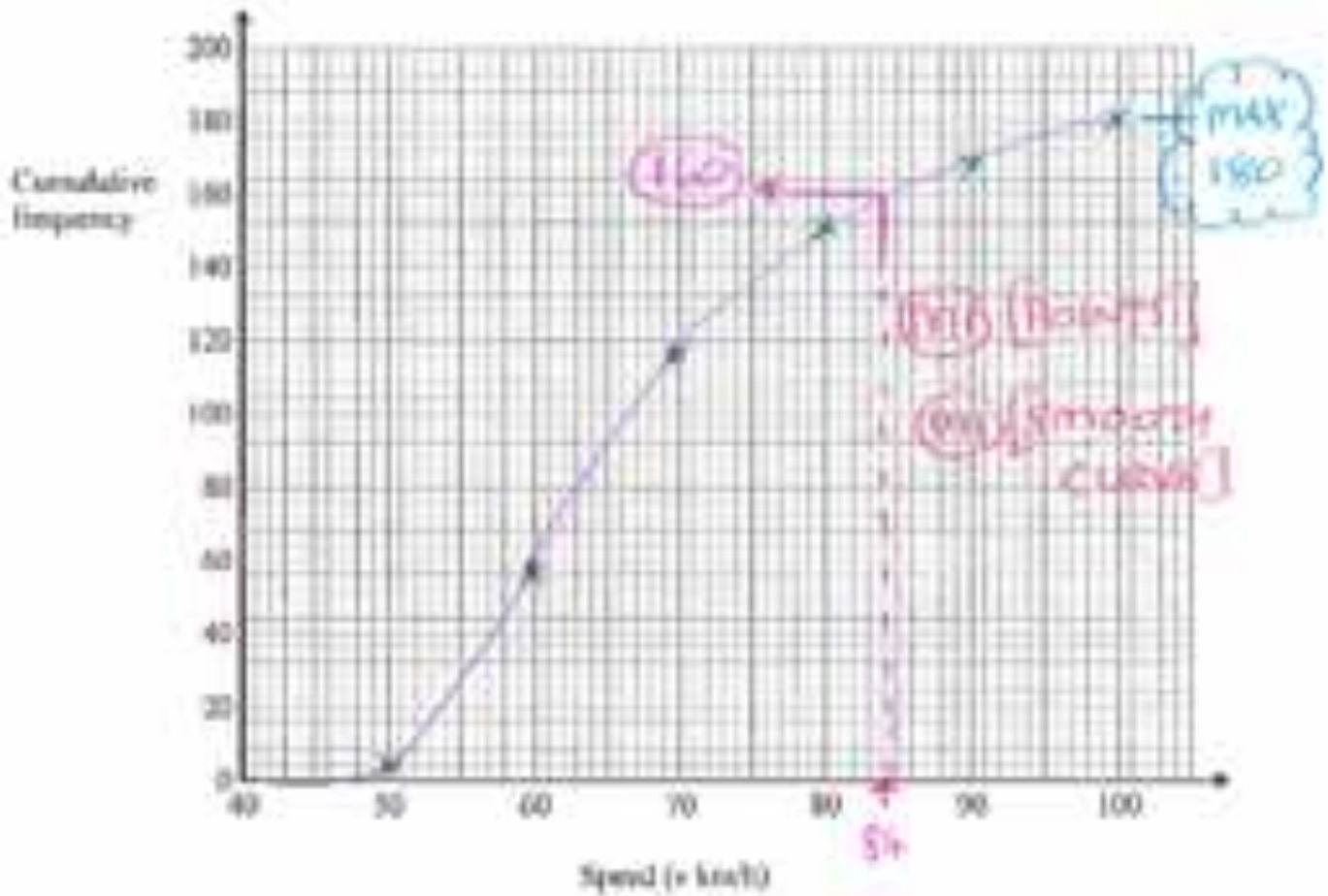(c) Complete the cumulative frequency table.

Speed (v km/h)	Cumulative frequency
$40 < v \leqslant 50$	4
$40 < v \leqslant 60$	56
$40 < v \leqslant 70$	116
$40 < v \leqslant 80$	150
$40 < v \leqslant 90$	168
$40 < v \leqslant 100$	180

(A1)

(d) On the grid, draw a cumulative frequency graph for your table.

Speed (s km/h)

(2)

(e) The police decide to fine the driver of any vehicle passing the speed checkpoint at a speed of more than 84 km/h.
Use your graph to find an estimate for the number of drivers the police decide to fine.
Show your method clearly.

$180 - 160$ (M1)

20 (A1)

(3)

(a) Helen's savings increased from £155 to £167.40   START AMOUNT!

Work out the percentage increase in Helen's savings.

$$INCREASE = 167.40 - 155$$
$$= 12.4 \quad \text{(M1)}$$

$$\% \; INCREASE = \frac{12.4}{155} \times 100 \quad \text{(M1)}$$

         (A1)

    8   %

(3)

(b) Joe's savings increased by 4.5%.   →   0.045   OR   1.045
His savings are now £125.40

     ↑   ↑

What were his savings before the increase?   AMOUNT   FINAL
                                  OF   AMOUNT
                                  INCREASE

$$\frac{125.40}{1.045} = 120$$

    ↑   (M1) DIVIDE

(B1)

                                               (A1)
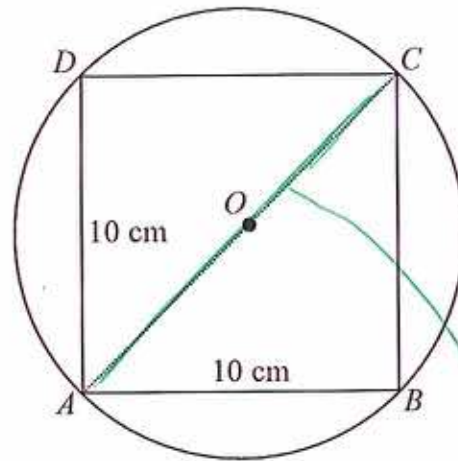
£ 120

(3)

Diagram **NOT** accurately drawn

The diagram shows a square *ABCD* drawn inside a circle, centre *O*.
A, *B*, *C* and *D* are points on the circle.
The lengths of the sides of the square are 10 cm.
AC is a diameter of the circle.

Calculate the circumference of the circle.
Give your answer correct to 3 significant figures.

$$C = \pi \times D$$

$$D^2 = 10^2 + 10^2 \quad \text{(M1)}$$
$$= 200$$
$$D = \sqrt{200} \quad \text{(B1)}$$

$$= \pi \times \sqrt{200} \quad \text{(M1)}$$

$$= 44.4288\ldots$$

$$= 44.4 \text{ cm} \quad \text{(A1)}$$

A farmer has 180 metres of fencing.   *TOTAL = 180*
With the 180 metres of fencing, he makes an enclosure divided into eight equal,
rectangular pens.
The fencing is used for the perimeter of each pen.

→ 10 × y

12 × x
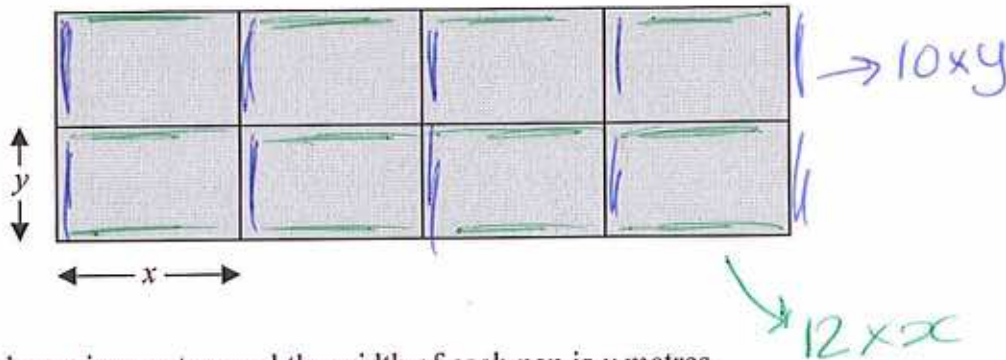
The length of each pen is x metres and the width of each pen is y metres.

(a) (i) Show that $y = 18 - 1.2x$

$$10y + 12x = 180 \quad \text{(m1)}$$
$$\Rightarrow \quad 10y = 180 - 12x \quad \text{(m1)}$$
$$y = 18 - 1.2x$$

The total area of the enclosure is A m².

(ii) Show that $A = 144x - 9.6x^2$

$$A = 4x \times 2y = 8xy \quad \text{(m1)}$$
$$= 8x(18 - 1.2x)$$
$$= 144x - 9.6x^2 \quad \text{(3)}$$

(b) Find $\dfrac{dA}{dx}$

(A1)   (A1)

$$144 - 19.2x$$

(2)

(c) Find the maximum value of A.

$$144 - 19.2x = 0 \quad \text{(m1)}$$
$$\Rightarrow -19.2x = -144$$
$$x = \frac{-144}{-19.2}$$
$$= 7.5 \quad \text{(B1)}$$

$$A = 144 \times 7.5 - 9.6 \times 7.5^2$$
$$= 540 \text{ m}^2 \quad \text{(A1)}$$

HW11

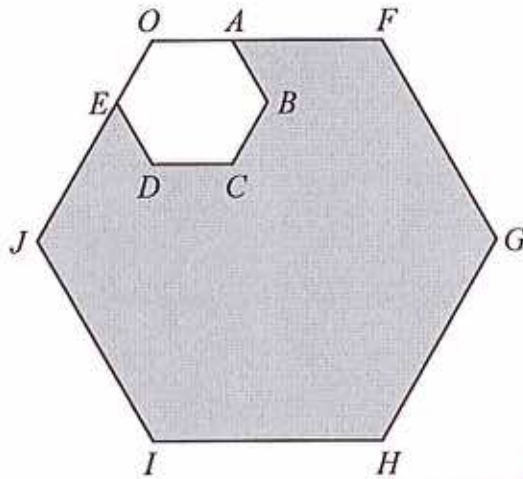The diagram shows two regular hexagons, *OABCDE* and *OFGHIJ*.

Diagram **NOT** accurately drawn

OAF and *OEJ* are straight lines.

OF = 3 *OA*.

The area of *OABCDE* is 4 cm².

Calculate the area of the shaded region.

SCALE FACTOR = 3

SMALL HEXAGON

AREA OF LARGE HEXAGON $= 4 \times 3^2 = \underline{\underline{36}}$ (B1)

(M1)

SHADED AREA = 36 - 4

$= \underline{\underline{32 \ cm^2}}$ (A1)
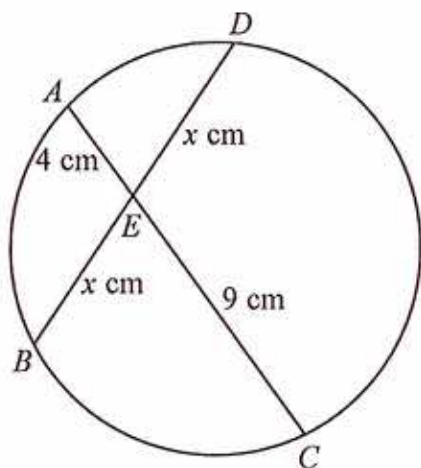
AEC and *DEB* are chords of a circle.

Diagram **NOT** accurately drawn

$AE = 4$ cm.
$CE = 9$ cm.
$DE = BE = x$ cm.

Calculate the value of x.

$BE \times DE = AE \times CE$

$x^2 = 4 \times 9$ (m1)

$x^2 = 36$

$x = \underline{6}$ (A1)

Make x the subject of $y = \sqrt{\dfrac{2x+1}{x-1}}$
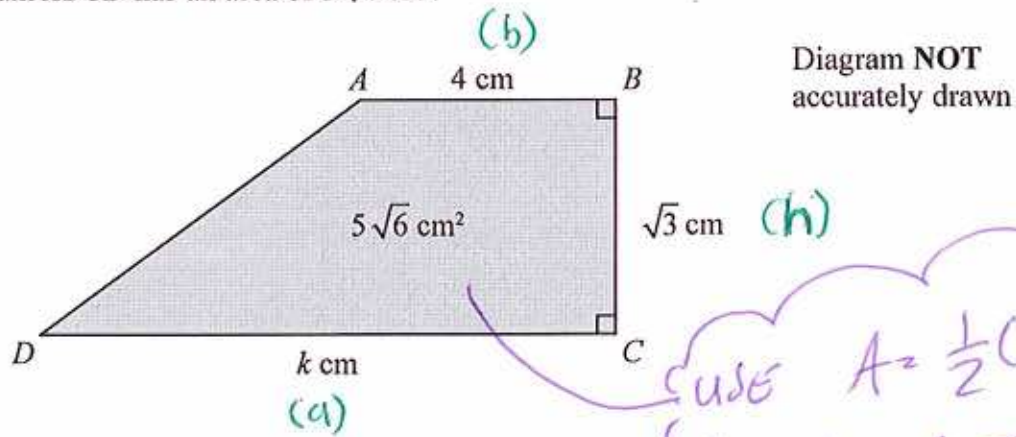
$$y^2 = \frac{2x+1}{x-1}$$ (m1) [SQUARING]

$$y^2x - y^2 = 2x+1$$ (m1) [NO DENOMINATORS]

$$y^2x - 2x = 1+y^2$$
$$x(y^2-2) = 1+y^2$$ (m1) [REARRANGE AND FACTORISE]

$$x = \frac{1+y^2}{y^2-2}$$ (m1) [DIVIDE]

A trapezium *ABCD* has an area of $5\sqrt{6}$ cm².

(b)

Diagram **NOT** accurately drawn

A   4 cm   *B*

$5\sqrt{6}$ cm²

$\sqrt{3}$ cm   (h)

(h)

D   *k* cm   *C*

(a)

USE $A = \frac{1}{2}(a+b)h$

$AB = 4$ cm.
$BC = \sqrt{3}$ cm.
$DC = k$ cm.

Calculate the value of *k*, giving your answer in the form $a\sqrt{b} - c$
where *a*, *b* and *c* are positive integers.
Show each step in your working.

$$\frac{1}{2}(k+4) \times \sqrt{3} = 5\sqrt{6}$$

(M1) [EQUATION]

$$\Rightarrow (k+4) \times \sqrt{3} = 10\sqrt{6}$$

$$\Rightarrow k+4 = \frac{10\sqrt{6}}{\sqrt{3}}$$

$$\Rightarrow k+4 = 10\sqrt{2}$$

$$\Rightarrow k = 10\sqrt{2} - 4$$

(A1) [INTEGER PART]

(A1) [SURD PART]

Rachael walks to school.
The distance to school is 2.8 km, correct to the nearest 0.1 km. ⟶ 2.8 ± 0.05
She walks at a speed of 5 km/h, correct to the nearest km/h. ⟶ 5 ± 0.5

Calculate the upper bound, in minutes, for the time Rachael takes to walk to school.

$$SPEED = \frac{DISTANCE}{TIME}$$

$$\Rightarrow TIME = \frac{DISTANCE}{SPEED}$$

$$= \frac{2.8 + 0.05}{5 - 0.5} \quad \text{(m1) [UPPER BOUND]}$$
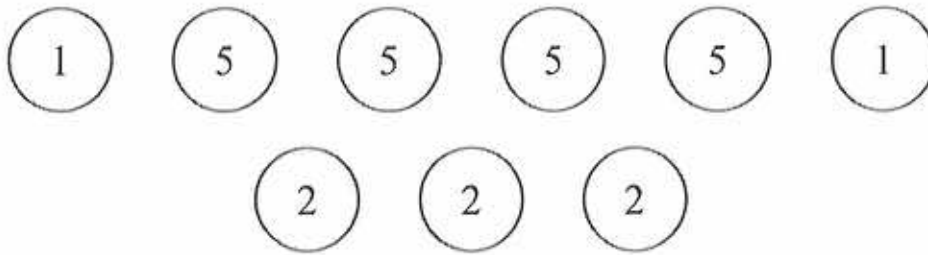$$\text{(m1) [LOWER BOUND]}$$

$$= \frac{2.85}{4.5}$$

$$= 0.6\dot{3} \quad HOURS$$

$$= \underline{38 \; MINUTES}$$
$$\text{(A1)}$$

Here are nine counters.
Each counter has a number on it.

①1 ⑤5 ⑤5 ⑤5 ⑤5 ①1

②2 ②2 ②2

The counters are turned over to hide their numbers and are then mixed up.

Susan takes at random a counter and turns it over to reveal its number.
She takes at random a second counter, from the remaining eight counters, and turns it over
to reveal its number. **NO MENTION OF REPLACEMENT!**

(a) Calculate the probability that the number 5 is on both of the two counters Susan takes.

$$P(5,5) = \frac{4}{9} \times \frac{3}{8} = \frac{12}{72}$$

(m1)

(A1)

$$\frac{1}{6}$$

(2)

(b) Calculate the probability that the sum of the numbers on the two counters Susan
takes is divisible by 3

$$P(1,2) = \frac{2}{9} \times \frac{3}{8} = \frac{6}{72}$$

$$P(2,1) = \frac{3}{9} \times \frac{2}{8} = \frac{6}{72}$$

$$P(1,5) = \frac{2}{9} \times \frac{4}{8} = \frac{8}{72}$$

$$P(5,1) = \frac{4}{9} \times \frac{2}{8} = \frac{8}{72}$$

TOTAL $= \frac{28}{72}$

(m1) [ALL COMBINATIONS]

(m1) [ADDING]

(A1)

$$\frac{7}{18}$$

The function f is defined as $f(x) = \dfrac{3}{4+x}$

(a) Find the value of f(1)

$$\frac{3}{4+1} = \frac{3}{5}$$

(A)

$0 \cdot 6$

(1)

(b) State which value of x must be excluded from any domain of f.

$$4 + x \neq 0 \implies x \neq -4$$

(A)

-4

(1)

The function g is defined as $g(x) = 5 + x$

(c) Given that $g(a) = 7$, find the value of a.

$$5 + a = 7$$
$$a = 7 - 5$$
$$= 2$$

(A1)

$a = \underline{\quad 2 \quad}$

(1)

(d) Calculate fg(1)

$$g(1) = 6 \quad \text{(m1)}$$

$$f(6) = \frac{3}{4+6} = \frac{3}{10}$$

(A1)

$0 \cdot 3$

(2)

(e) Find fg(x)
   Simplify your answer.

$$\frac{3}{4+(5+x)} = \frac{3}{9+x}$$ (A1)

(m1)

The diagram shows a metal plate.

B

30°

8

65°   115°

8 cm   35°
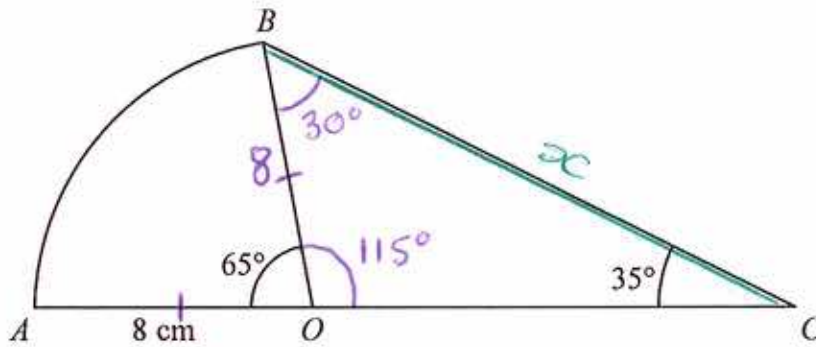
A   O   C

Diagram **NOT**
accurately drawn

The metal plate is made from a sector OAB of a circle, centre O, and a triangle OCB.

Angle $AOB = 65°$ Angle $OCB = 35°$
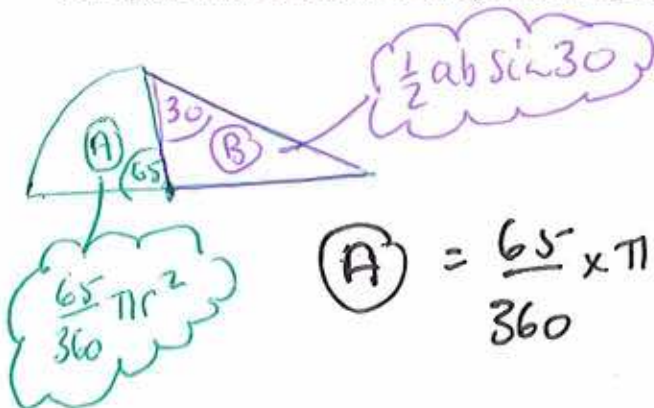$OA = OB = 8$ cm.
AOC is a straight line.

(a) Calculate the length of BC. (x)
   Give your answer correct to 3 significant figures.

$$\frac{OC}{SIN\,115} = \frac{8}{SIN\,35} \quad \text{(m1)}$$

$$\Rightarrow \quad x = \frac{8}{SIN\,35} \times SIN\,115 = 12.6407\ldots \quad = \underline{12.6}\quad \text{cm} \quad \text{(A1)}$$
   (m1)
                                                                                (3)

(b) Calculate the total area of the metal plate.
   Give your answer correct to 3 significant figures.

$\frac{1}{2} ab\, sin\,30$

$\frac{65}{360}\,\pi r^2$

$$\text{(A)} = \frac{65}{360} \times \pi \times 8^2 = 36.302\ldots \quad \text{(m1)}$$

$$\text{(B)} = \frac{1}{2} \times 8 \times 12.6407 \times SIN\,30 = 25.28\ldots \quad \text{(m1)}$$

$$TOTAL = 36.302\ldots + 25.28\ldots = \underline{61.6\ cm^2}$$
                              (m1)   (A1)

Solve the equation $\dfrac{3}{(x+2)} + \dfrac{4}{(x-3)} = 2$

Show clear algebraic working.

MULTIPLY BY BOTH DENOMINATORS!

$3(x-3) + 4(x+2) = 2(x+2)(x-3)$ (m1)

$3x - 9 + 4x + 8 = 2 \times [x^2 - 3x + 2x - 6]$ (m1)

$\qquad\qquad = 2 \times [x^2 - x - 6]$

$7x - 1$

$\qquad\qquad = 2x^2 - 2x - 12$

$\Rightarrow 7x - 1$

REARRANGING:-

$2x^2 - 9x - 11 = 0$ (m1)

$(2x - 11)(x + 1) = 0$ (m1) [FACTORISING]

$x + 1 = 0$

$x = -1$

$2x - 11 = 0$

$2x = 11$

$x = \dfrac{11}{2}$

(A1) [BOTH ANSWERS]