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3H(R)

Pearson Edexcel
International GCSE

EDEXCEL IGCSE

MATHEMATICS A

SOLUTIONS

MAY 2015 | **4MA0/3HR**

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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.

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The table shows information about the numbers of fish caught by 40 people in one day.

Number of fish	Frequency	$x \times f$
0	2	0
1	12	12
2	15	30
3	8	24
5	2	10
8	1	8
	TOTAL	84

M1

(a) Work out the mean number of fish caught.

$$\text{MEAN} = \frac{\text{TOTAL NO. OF FISH}}{\text{NO. OF PEOPLE}}$$

$$= \frac{84}{40} \quad \text{M1}$$

$$= 2.1$$

A1

2.1

(3)

(b) Work out what percentage of the 40 people caught less than 2 fish.

$$\frac{12+2}{40} \times 100 \quad \text{M1}$$

A1

35 %

(2)

Each exterior angle of a regular polygon is 15°

(a) How many sides has the regular polygon?

EXTERIOR ANGLES ADD TO 360°

M1 $\frac{360}{15} = 24$

24 A1

(2)

The diagram shows 3 identical regular pentagons.

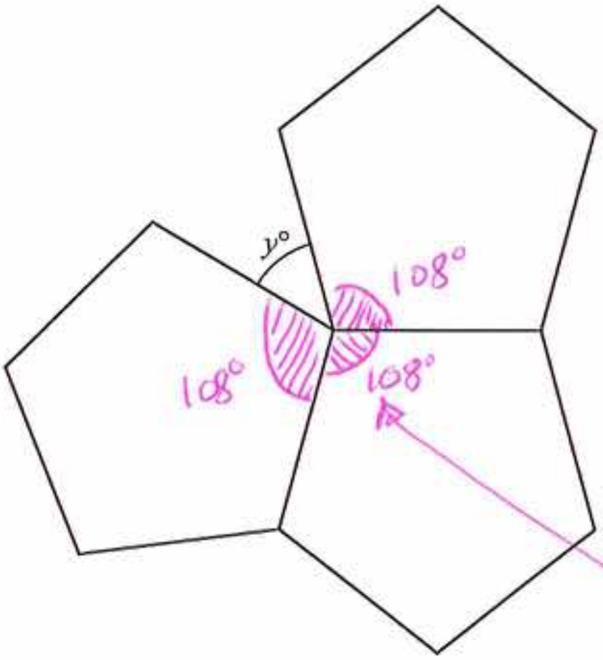


Diagram **NOT** accurately drawn

$\boxed{1ST}$ EXTERIOR ANGLE OF A PENTEGON $= \frac{360}{5} = \underline{\underline{72°}}$

(b) Work out the value of y.

$\boxed{2ND}$ INTERIOR ANGLE OF A PENTAGON $= 180 - 72$
$= \underline{\underline{108°}}$ B1

$\boxed{3RD}$ $y = \underline{360 - 3 \times 108}$ M1

$y =$ 36 A1

(3)

Use your calculator to work out the value of

$$\frac{12.5 \times 4.5}{6.8 + \sqrt{67.24}}$$

$$= \frac{56.25}{15} \quad \text{M1}$$

3.75 A1

(a) Show that $2\frac{4}{9} \div \frac{5}{6} = 2\frac{14}{15}$.

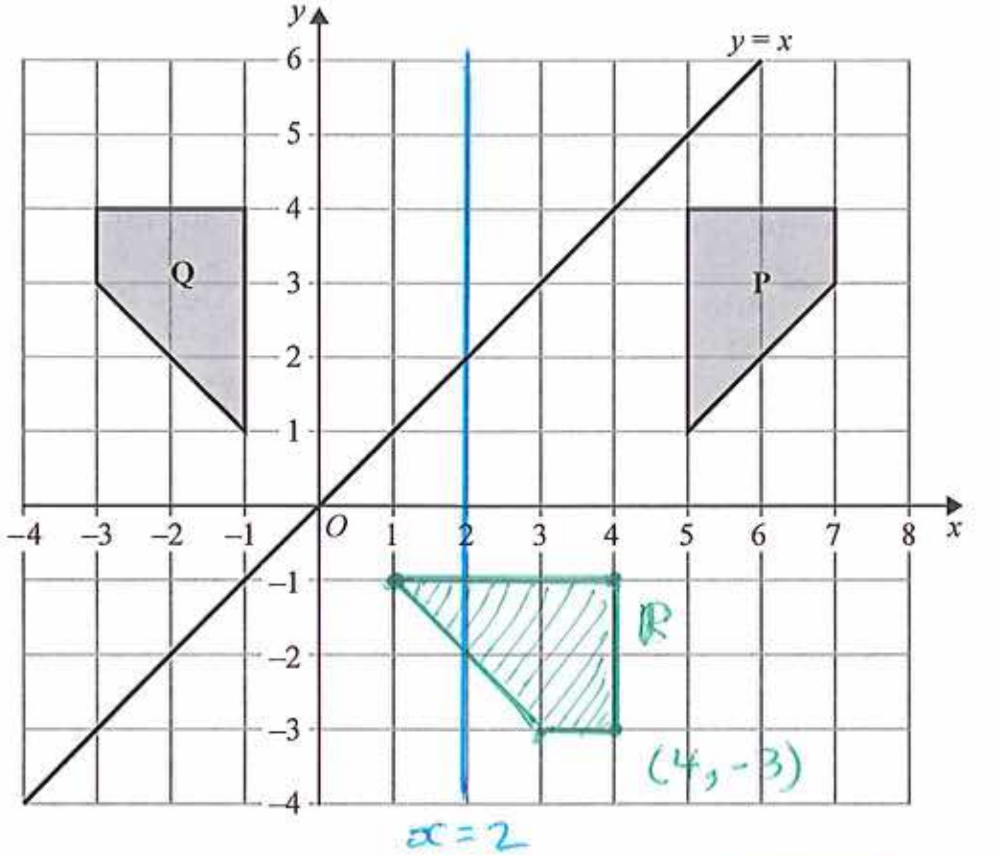
LHS; $2\frac{4}{9} \div \frac{5}{6} = \frac{22}{9} \div \frac{5}{6}$ M1

$= \frac{22}{9} \times \frac{6}{5}$ M1

$= \frac{132}{45}$ M1

$= \frac{44}{5}$

$= 2\frac{14}{15}$ A1



(a) Describe fully the single transformation which maps shape P onto shape Q.

REFLECTION, IN LINE $x = 2$

A1 A1

(2)

(b) Reflect the shape Q in the line $y = x$.
Label the new shape R.

(2)

A1 [ORIENTATION]

A1 [POSITION]

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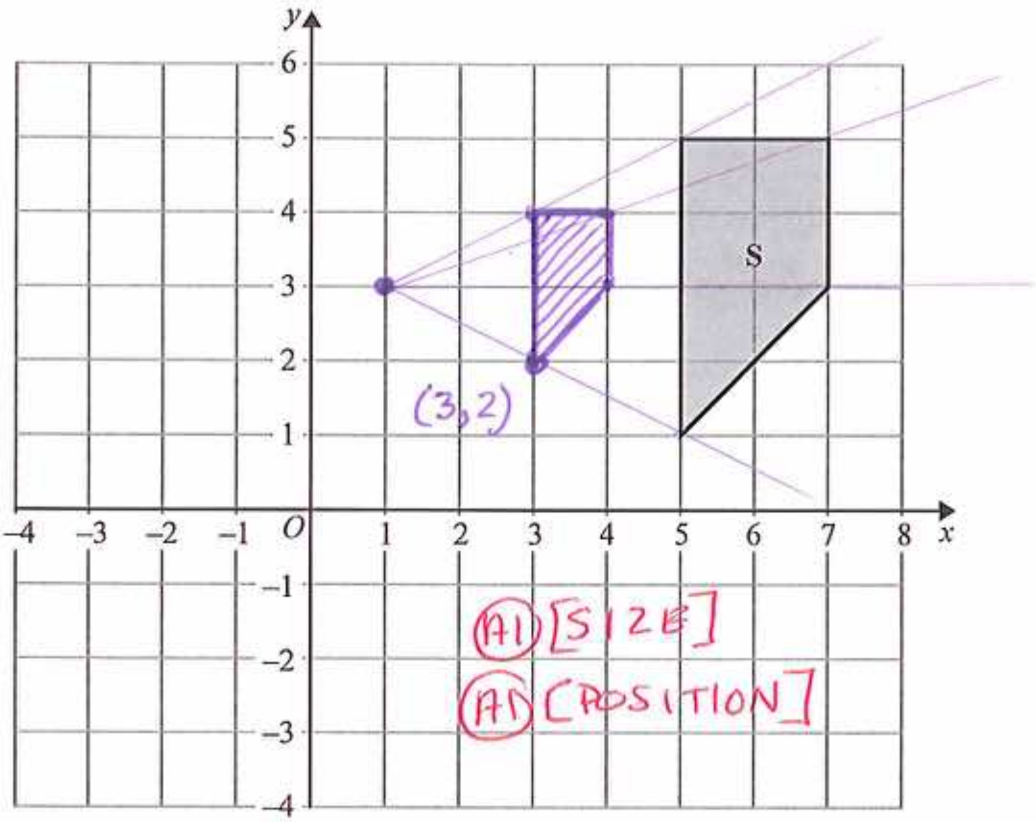


(c) Enlarge shape **S** with scale factor $\frac{1}{2}$ and centre (1, 3)

(2)

The mean height of a group of 6 children is 165 cm.
One child, whose height is 155 cm, leaves the group.

Find the mean height of the remaining 5 children.

TOTAL HEIGHT TO START $= 6 \times 165$

$= \underline{\underline{990}}$ B1

TOTAL HEIGHT AFTER CHILD LEAVES $= 990 - 155$

$= \underline{\underline{835}}$ B1

MEAN HEIGHT OF REMAINING FIVE $= \dfrac{835}{5}$

$= \underline{\underline{167}}$ cm A1

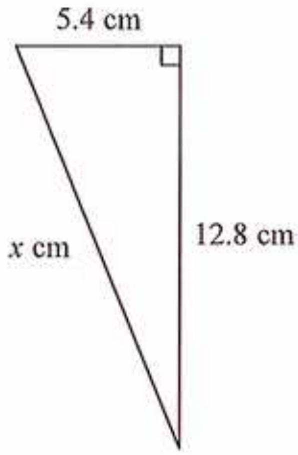


Diagram **NOT** accurately drawn

Work out the value of x.
Give your answer correct to 3 significant figures.

$x^2 = 12.8^2 + 5.4^2$ M1 [ADDING SQUARES]

$= 193$

$x = \sqrt{193}$ M1 [SQUARE ROOTING]

$= 13.8924\ldots$

A1

$x =$ 13.9

(a) Factorise $g^2 + 4g$

A1 A1

$g(g+4)$

(2)

(b) Factorise $e^2 - 2e - 24$

1×24
2×12
3×8
4×6

A1 A1

$(e+4)(e-6)$

(2)

Make r the subject of the formula $A = 4\pi r^2$ where r is positive.

$$4\pi r^2 = A$$

$$r^2 = \frac{A}{4\pi}$$ M1 [DIVIDING]

$$r = \sqrt{\frac{A}{4\pi}}$$ M1 [SQUARE ROOT]

(a) $A = 2^2 \times 3 \times 5^2$

$B = 2^3 \times 5$

(i) Find the Highest Common Factor (HCF) of A and B.

$A = 2^2 \times 3 \times 5^2$

$B = 2^3 \times 5$

COMMON $2^2 \times 5 \rightarrow$ 20 (A1)

(M1) [ANY VALID METHOD]

(ii) Find the Lowest Common Multiple (LCM) of A and B.

WHAT'S LEFT $2^3 \times 3 \times 5^2 \rightarrow$ 600 (A1)

(3)

(b) $\dfrac{8^2 \times 8^3}{8^4} = 2^n$

Find the value of n.

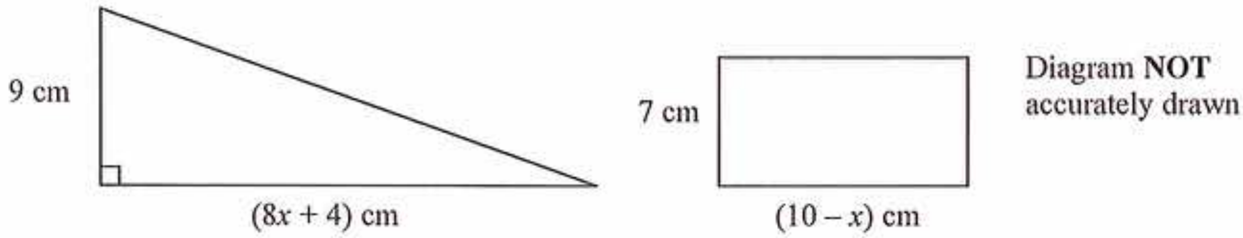
$\Rightarrow \dfrac{8^5}{8^4} = 2^n$

$\Rightarrow 8 = 2^n$

(M1) [EITHER]

$\Rightarrow n = \underline{\underline{3}}$ (A1)

The diagram shows a right-angled triangle and a rectangle.



The area of the triangle is twice the area of the rectangle.

(i) Write down an equation for x.

$$\frac{9 \times (8x+4)}{2} = 2 \times [7 \times (10 - x)] \quad \text{(A1)}$$

$$\Rightarrow 9(8x+4) = 28(10-x) \quad \text{(M1) [SIMPLIFY]}$$

(ii) Find the area of the rectangle.
Show clear algebraic working.

$$72x + 36 = 280 - 28x \quad \text{(M1) [NO BRACKETS]}$$

$$\Rightarrow 72x + 28x = 280 - 36 \quad \text{(M1) [}x\text{ TERMS ON LHS]}$$

$$\Rightarrow 100x = 244$$

$$x = \frac{244}{100}$$

$$= 2.44 \quad \text{(A1)}$$

$\therefore$ AREA OF RECTANGLE

$$= 7 \times (10 - 2.44) \quad \text{(M1)}$$

$$= 52.92 \text{ cm}^2 \quad \text{(A1)}$$

The grouped frequency table gives information about the times recorded for 20 runners in a 1500 metre race.

Time (t seconds)	Frequency
$225 < t \leqslant 230$	1
$230 < t \leqslant 235$	3
$235 < t \leqslant 240$	7
$240 < t \leqslant 245$	6
$245 < t \leqslant 250$	2
$250 < t \leqslant 255$	1

(a) Complete the cumulative frequency table.

Time (t seconds)	Cumulative frequency
$225 < t \leqslant 230$	1
$225 < t \leqslant 235$	4
$225 < t \leqslant 240$	11
$225 < t \leqslant 245$	17
$225 < t \leqslant 250$	19
$225 < t \leqslant 255$	20

A1

(1)

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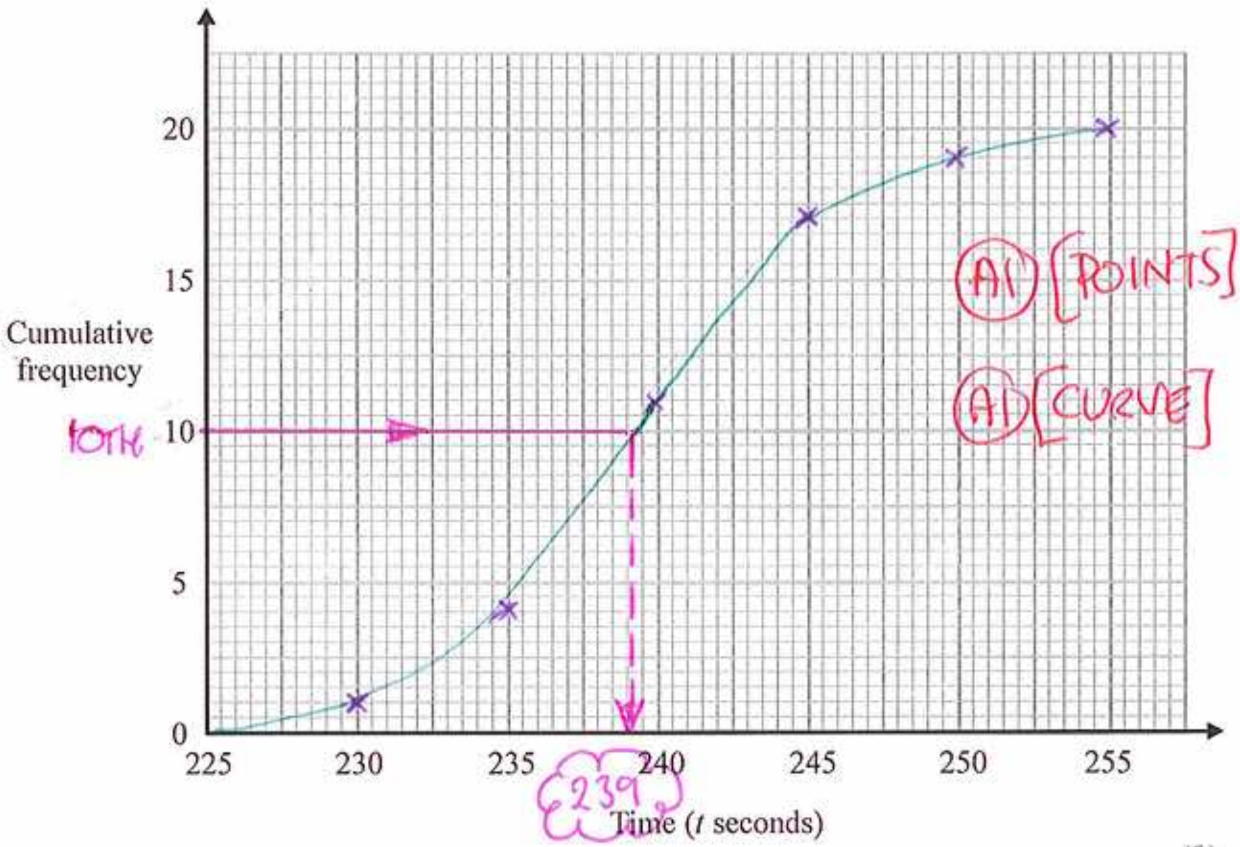
(b) On the grid, draw the cumulative frequency graph for your table.



(2)

(c) Use your graph to find an estimate for the median of the recorded times.

MEDIAN = $\frac{20}{10}$

= 10TH VALUE

M1 [FOR '10' OR CORRECT LINE ON GRAPH]

239 seconds A1

(2)

[±1, FROM THEIR GRAPH]

The table shows information about the oil production, in barrels per day, of five countries during one year.

Country	Oil production (barrels per day)
India	8.97×10^5
Brazil	2.63×10^6
United States	8.4×10^6
Russia	1.09×10^7
Saudi Arabia	9.9×10^6

(a) Which country had the highest oil production?

RUSSIA (A1)

(1)

(b) Calculate the difference between the oil production of Brazil and the oil production of India.
Give your answer in standard form.

$2.63 \times 10^6 - 8.97 \times 10^5$ (M1) [SUBTRACTING]

$= 1\ 733\ 000$

CALCULATOR GAVE THIS

1.73×10^6 (A1) barrels per day

(2)

During the same year, the oil production of California was 6.3×10^5 barrels per day.

(c) Work out the oil production of California as a proportion of the oil production of the United States.

(M1) $\dfrac{6.3 \times 10^5}{8.4 \times 10^6} = \dfrac{3}{40}$ (A1) (0.075)

Solve the simultaneous equations

$$8x - 4y = 7 \longrightarrow ① \times 2$$
$$12x - 8y = 6 \longrightarrow ②$$

Show clear algebraic working.

M1

$$\left.\begin{array}{l} 16x - 8y = 14 \longrightarrow ③ \\ 12x - 8y = 6 \longrightarrow ④ \end{array}\right\} \text{SUBTRACT}$$

$$4x = 8$$
$$x = \frac{8}{4}$$
$$= \underline{\underline{2}} \quad \text{A1}$$

SUBSTITUTE $x = 2$ INTO EQU ①

$$8 \times 2 - 4y = 7$$
$$\Rightarrow 16 - 4y = 7$$
$$\Rightarrow -4y = 7 - 16$$
$$-4y = -9$$
$$y = \frac{-9}{-4}$$
$$= \underline{\underline{2.25}} \quad \text{A1}$$

$x =$ 2

$y =$ 2.25

Use algebra to show that the recurring decimal $0.\dot{4}1\dot{7} = \frac{139}{333}$

B1

$$\left.\begin{aligned} 1000x &= 417.417417\ldots \\ x &= 0.417417\ldots \end{aligned}\right\} \text{SUBTRACT}$$

$$\left.\begin{aligned} 999x &= 417 \\ \Rightarrow \quad x &= \frac{417}{999} \end{aligned}\right\} \text{M1 [EITHER]}$$

$$= \frac{139}{333}$$

ABCD is a kite.

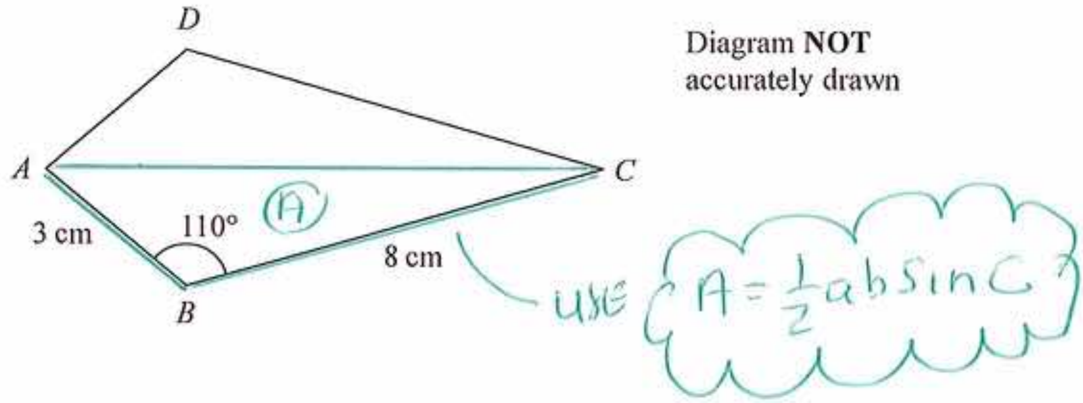


Diagram **NOT** accurately drawn

$AB = 3$ cm
$BC = 8$ cm
Angle $ABC = 110°$

Calculate the area of the kite *ABCD*.
Give your answer correct to 3 significant figures.

AREA OF A $= \frac{1}{2} \times 3 \times 8 \times \sin 110$ (M1)

$= 11.276...$ (A1)

$\therefore$ TOTAL AREA $= 11.276 \times 2$

$= 22.552...$

$= \underline{\underline{22.6 \text{ cm}^2}}$ (A1)

Two bags contain discs.

Bag **A** contains 12 discs.
5 of the discs are red, 6 are blue and 1 is white. $\} P(R) = \frac{5}{12}, P(B) = \frac{6}{12}, P(W) = \frac{1}{12}$

Bag **B** contains 25 discs.
n of the discs are red and the rest are blue. $\} P(R) = \frac{n}{25}, P(B) = \frac{25-n}{25}$

James takes at random a disc from Bag **A**.
Lucy takes at random a disc from Bag **B**.

Given that the probability that James and Lucy both take a red disc is $\frac{2}{15}$

(i) find the value of n, the number of red discs in Bag **B**.

$$P(RR) \quad \frac{5}{12} \times \frac{n}{25} = \frac{2}{15} \quad \text{m1}$$

$$\Rightarrow \frac{5n}{300} = \frac{2}{15} \Rightarrow n = \frac{2}{15} \times \frac{300}{5}$$

$n =$ 8 A1

(ii) Hence calculate the probability that James and Lucy take discs of different colours.

$$P(BB) = \frac{6}{12} \times \frac{(25-8)}{25}$$

$$= \frac{17}{50} \quad \text{m1}$$

$$\therefore P(\text{SAME COLOUR}) = \frac{2}{15} + \frac{17}{50}$$

$$= \frac{71}{150} \quad \text{m1}$$

$$\therefore P(\text{DIFFERENT COLOURS}) = 1 - \frac{71}{150}$$

$$= \frac{79}{150} \quad \text{A1}$$

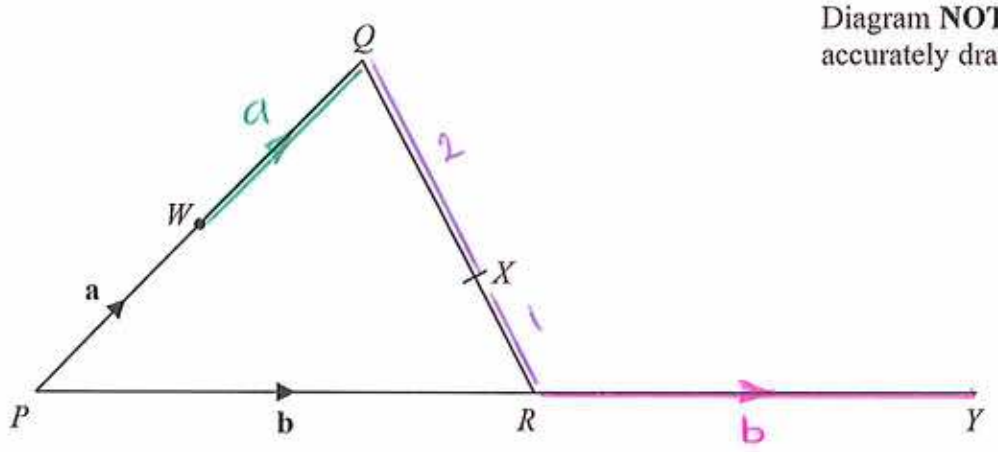


Diagram **NOT** accurately drawn

PQR is a triangle.
The midpoint of PQ is W.
X is the point on QR such that $QX : XR = 2 : 1$
PRY is a straight line.

$\overrightarrow{PW} = \mathbf{a}$ $\overrightarrow{PR} = \mathbf{b}$

(a) Find, in terms of **a** and **b**,

(i) $\overrightarrow{QR}$

$= \overrightarrow{QP} + \overrightarrow{PR} \quad = -2a + b$

$b - 2a$ (A1)

(ii) $\overrightarrow{QX}$

$= \frac{2}{3}\overrightarrow{QR} \quad = \frac{2}{3}(b - 2a)$

$\frac{2}{3}b - \frac{4}{3}a$ (A1)

(iii) $\overrightarrow{WX}$

$= \overrightarrow{WQ} + \overrightarrow{QX} \quad = a + \left[\frac{2}{3}b - \frac{4}{3}a\right]$

$\frac{2}{3}b - \frac{1}{3}a$ (A1)

(3)

R is the midpoint of the straight line PRY.

(b) Use a vector method to show that WXY is a straight line.

$\overrightarrow{XY} = \overrightarrow{XR} + \overrightarrow{RY}$

$= \frac{1}{3}\overrightarrow{QR} + \overrightarrow{RY}$

$= \frac{1}{3} \times [b - 2a] + b$

$= \frac{1}{3}b - \frac{2}{3}a + b$ (B1)

$= \frac{4}{3}b - \frac{2}{3}a \quad = \frac{2}{3}(2b - a)$

NOTE THAT

$\overrightarrow{WX} = \frac{1}{3}(2b - a)$ (B1)

BOTH ARE MULTIPLES OF $(2b - a)$ $\therefore$ SAME DIRECTION

ALSO, THEY BOTH GO THROUGH COMMON POINT X

($\therefore$ STRAIGHT LINE)

The diagram shows a circular pond, of radius r metres, surrounded by a circular path.
The circular path has a constant width of 1.5 metres.

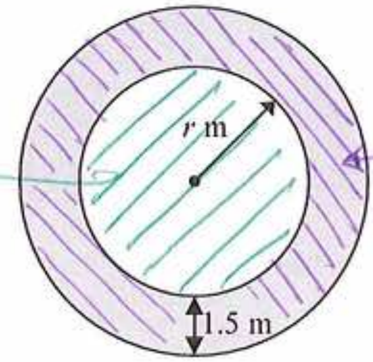


Diagram **NOT** accurately drawn

$A = \pi r^2$

$A = \pi(r+1.5)^2 - \pi r^2$

The area of the path is $\boxed{\frac{1}{10}}$ the area of the pond. → $0.1 \times \ldots$

(a) Show that $2r^2 - 60r - 45 = 0$

$$\pi(r+1.5)^2 - \pi r^2 = 0.1\pi r^2 \quad \text{M1}$$
$$\Rightarrow (r+1.5)^2 - r^2 = 0.1r^2 \quad \text{M1}$$
$$\Rightarrow r^2 + 3r + 2.25 - r^2 = 0.1r^2 \quad \text{M1}$$
$$\Rightarrow 3r + 2.25 = 0.1r^2$$
$$\rightarrow 0.1r^2 - 3r - 2.25 = 0$$
$$\Rightarrow \underline{\underline{2r^2 - 60r - 45 = 0}}$$

(b) Calculate the area of the pond.
Show your working clearly.
Give your answer correct to 3 significant figures.

Use $x = \dfrac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

$$2r^2 - 60r - 45 = 0$$

$a = 2$
$b = -60$
$c = -45$

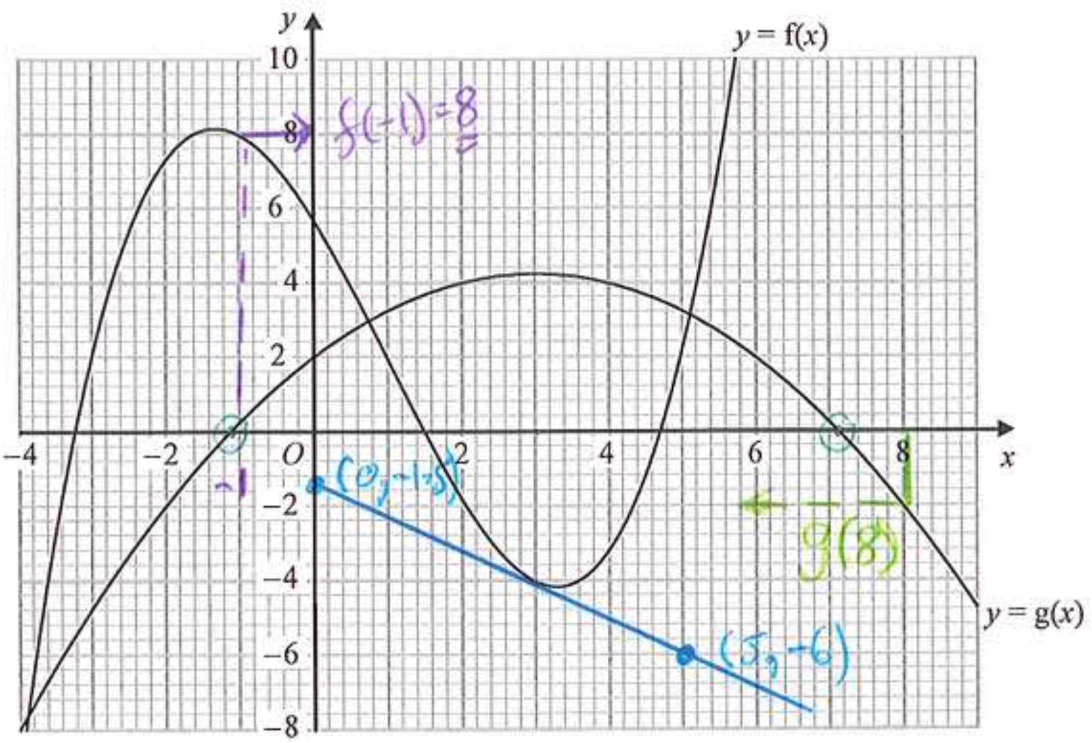
$$x = \frac{-(-60) \pm \sqrt{(-60)^2 - 4(2)(-45)}}{2(2)} \quad \text{M1}$$

$$= \frac{60 \pm \sqrt{3600 + 360}}{4} \quad \text{M1}$$

30.732 A1 $\qquad -0.732$

$$\therefore \text{AREA} = \pi \times (30.732)^2 = 2967.0\ldots$$
M1
$$= \underline{\underline{2970}}\ \text{m}^2 \quad \text{A1}$$

The diagram shows parts of the graphs of $y = \mathrm{f}(x)$ and $y = \mathrm{g}(x)$.



(a) Find g(0)

-1·1 AND 7·1 (A1)

(1)

(b) Find gf(–1)

$= g(8)$ (B1)

$= -2$

-2 (A1)

(2)

(c) Calculate an estimate for the gradient of the curve $y = \mathrm{f}(x)$ at the point on the curve where $x = 3$

(0, -1.5) (5, -6) (B1) [FOR LINE ON GRAPH]

$m = \dfrac{y_1 - y_2}{x_1 - x_2} = \dfrac{-6 - -1.5}{5 - 0}$ (M1)

$= -4.5$ (A1)

Correct to 2 significant figures, $a = 58$, $b = 28$ and $c = 18$

Calculate the upper bound for the value of $\frac{a}{b-c}$

Show your working clearly.

$a = 58 \pm 0.5$

$b = 28 \pm 0.5$

$c = 18 \pm 0.5$

UPPER BOUND OF $\frac{a}{b-c}$ $\frac{[\text{HIGHEST}]}{[\text{LOWEST}]}$

$= \frac{58.5}{27.5 - 18.5}$ (M1) (M1)

$= \frac{58.5}{9}$

$= \underline{\underline{6.5}}$ (A1)

Simplify fully $\dfrac{6x^2 + x - 15}{12x^2 - 27}$

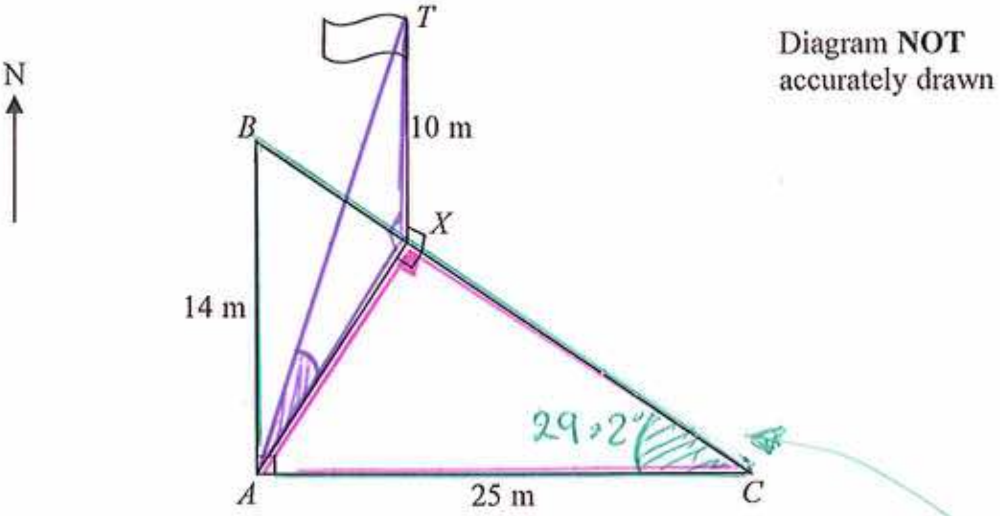
Show clear algebraic working.

1×15
3×5

$$\frac{6x^2+x-15}{12x^2-27} = \frac{(2x-3)(3x+5)}{3(4x^2-9)} \quad \text{M1} \quad \text{M1}$$

$$= \frac{(2x-3)(3x+5)}{3(2x-3)(2x+3)} \quad \text{M1}$$

$$= \underline{\underline{\frac{3x+5}{3(2x+3)}}} \quad \text{A1}$$



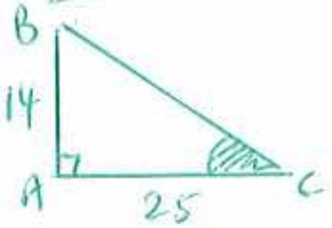
A, *B* and *C* are points on horizontal ground.
B is due North of *A* and *AB* is 14 m.
C is due East of *A* and *AC* is 25 m.

A vertical flagpole, *TX*, has its base at the point *X* on *BC* such that the angle *AXC* is a right angle.

The height of the flagpole, *TX*, is 10 m.

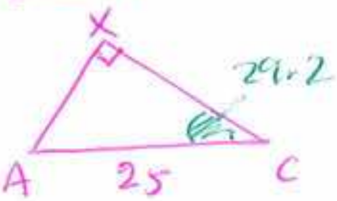
Calculate the size of the angle of elevation of *T* from *A*.
Give your answer correct to 1 decimal place.

1ST



$\text{TAN } C = \frac{14}{25} \Rightarrow C = \text{TAN}^{-1}\left(\frac{14}{25}\right) = 29.249°$ (M1) (A1)

2ND

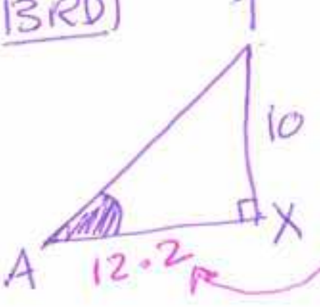


$\text{SIN } 29.249 = \frac{AX}{25}$ (M1)

$\Rightarrow AX = 25 \times \text{SIN } 29.249\ldots$

$= 12.215\ldots$ (A1)

3RD



$\text{TAN } A = \frac{10}{12.2}$

$\Rightarrow A = \text{TAN}^{-1}\left(\frac{10}{12.2}\right) = 39.3058\ldots$ (M1)

$= 39.3°$ (A1)