

# 3H(R)

Pearson Edexcel  
International GCSE

# EDEXCEL

# IGCSE

## MATHEMATICS A

# SOLUTIONS

## JANUARY 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.

In a school, there is a total of 640 children.

The ratio of the number of girls to the number of boys is 7 : 9

How many boys are there in this school?

$$\begin{array}{l} G : B \\ 7 : 9 \end{array} \quad \begin{array}{l} \text{TOTAL} \\ 16 \end{array}$$
$$\frac{640}{16} = 40 \quad \text{---} \rightarrow \quad 40 \times 9 = \underline{\underline{360}} \quad \text{(AI)}$$

(M)

(a) Use your calculator to work out the value of

$$125^2 + \frac{173}{9.3 - 6.8}$$

Give your answer as a decimal.

(A2)

$$\frac{15694.2}{(2)}$$

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

(A1)

$$\frac{15700}{(1)}$$

The table shows information about the numbers of goals scored by some football teams last week.

Number of goals	Number of teams	$x \times f$
0	5	0
1	8	8
2	2	4
3	3	9
4	2	8

(M1)

Work out the total number of goals scored by these football teams last week.

TOTAL  
= 29 (A1)



On the grid, draw the graph of  $y = 3x + 2$  for values of  $x$  from  $-2$  to  $4$

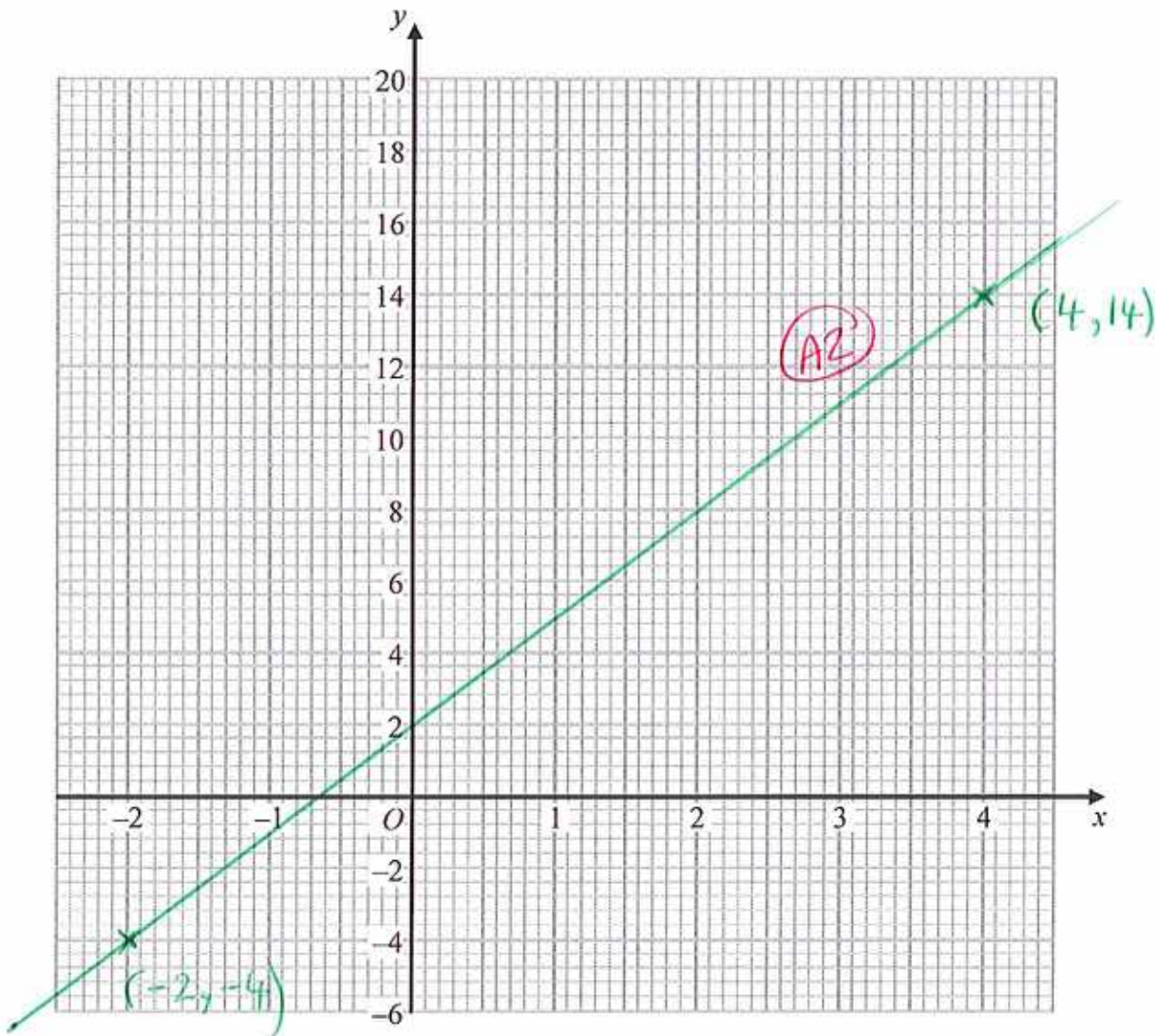
$x$	$-2$	$0$	$4$
$y$	$-4$	$2$	$14$

(m2)

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

↑  
'check'

$$y = 3(4) + 2 = 14$$



$A$  is the point with coordinates  $(4, 1)$

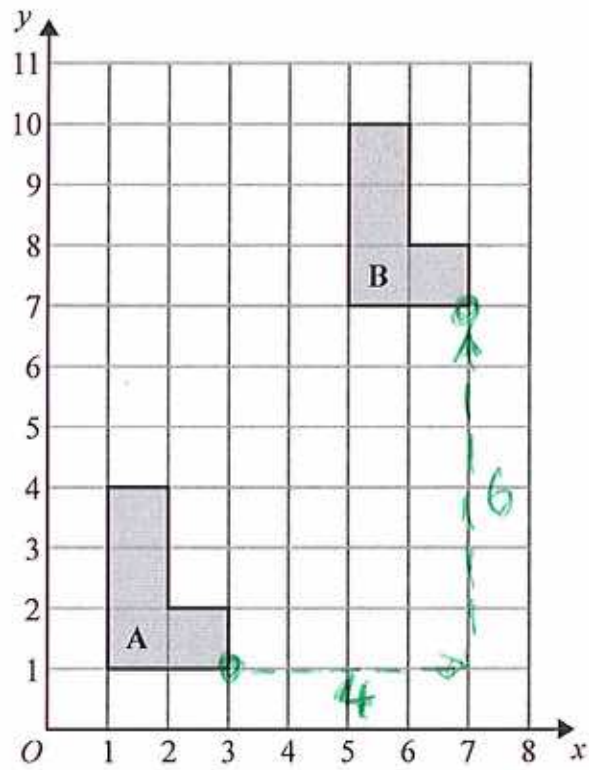
$B$  is the point with coordinates  $(1, 9)$

Find the coordinates of the midpoint of  $AB$ .

$$\left( \frac{4+1}{2}, \frac{1+9}{2} \right)$$

$$\left( \overset{\textcircled{AI}}{2.5}, \overset{\textcircled{AI}}{5} \right)$$





Describe fully the single transformation that maps shape A onto shape B.

TRANSLATION, BY VECTOR

$$\begin{pmatrix} 4 \\ 6 \end{pmatrix}$$

(A1)

(A1)



Lisa sees a dress in a sale.

The normal price of the dress is \$45

The price of the dress is reduced by 12% in the sale.

→ 0.88, 0.12

(a) Work out the price of the dress in the sale.

$$45 \times 0.88 \quad (M1) \quad (A1)$$

REMEMBER THE ZERO!

$$\begin{array}{r} \$ 39.60 \\ (3) \quad (A1) \end{array}$$

Lisa's weekly pay increases from \$525 to \$546

(b) Calculate her percentage pay increase.

$$546 - 525 = 21 \quad (M1)$$

$$(M1) \quad \left| \frac{21}{525} \times 100 = \underline{4} \quad (A1) \right.$$

Show that  $7\frac{1}{2} - 4\frac{2}{3} = 2\frac{5}{6}$

$$\begin{aligned}7\frac{1}{2} - 4\frac{2}{3} &= \frac{15}{2} - \frac{14}{3} \quad (m1) \\ &= \frac{45}{6} - \frac{28}{6} \quad (m1) \\ &= \frac{17}{6} \quad (m1) \\ &= \underline{\underline{2\frac{5}{6}}} \quad \text{QED!}\end{aligned}$$

The diagram shows a solid cylinder.

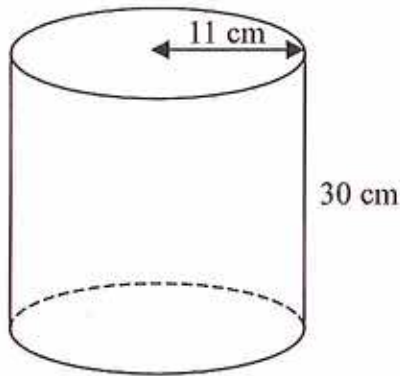


Diagram NOT accurately drawn

The cylinder has a height of 30 cm and a radius 11 cm.

- (a) Work out the **total** surface area of the cylinder.  
Give your answer correct to 2 significant figures.

$$\underline{\text{TOP}} \rightarrow \pi \times 11^2 = 121\pi \quad (\text{mi})$$

$$\therefore \underline{\text{BOTTOM}} = 121\pi$$

$$\underline{\text{SIDE}} \rightarrow \pi D \times 30 = \pi \times 22 \times 30 = 660\pi \quad (\text{mi})$$

$$\text{TOTAL} = 902\pi$$

$$= \underline{\underline{2833.7}}$$

$$\underline{\underline{2800}} \text{ cm}^2 \quad (\text{AI})$$

(4)

- (b) The height of the cylinder is 30 cm, correct to the nearest centimetre.

- (i) Write down the lower bound of the height of the cylinder.

$$30 - 0.5$$

$$\underline{\underline{29.5}} \text{ cm} \quad (\text{AI})$$

- (ii) Write down the upper bound of the height of the cylinder.

$$30 + 0.5$$

$$\underline{\underline{30.5}} \text{ cm} \quad (\text{AI})$$

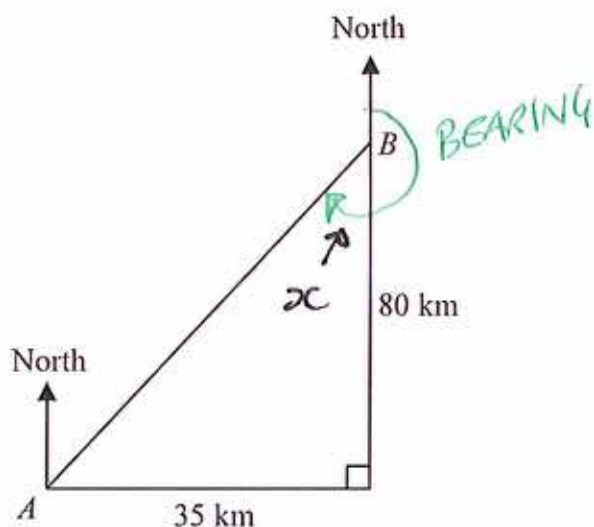


Diagram NOT  
accurately drawn

Town  $B$  is 35 km east and 80 km north of town  $A$ .

Work out the bearing of  $A$  from  $B$ .

Give your answer correct to the nearest degree.

$$\text{TAN } x = \frac{\text{OPP}}{\text{ADJ}}$$

$$\text{TAN } x = \frac{35}{80}$$

$$x = \text{TAN}^{-1}\left(\frac{35}{80}\right)$$

$$= 23.629\dots$$

$$\therefore \text{BEARING} = 180 + 23.629\dots$$

$$= 203.629\dots$$

$$= \underline{\underline{204^\circ}}$$

Here are the marks scored in a test by the girls in class 8C.

2    8     $Q_1$  (10) <sup>3<sup>RD</sup></sup>    12    15    (16)    16    17     $Q_3$  (18) <sup>9<sup>TH</sup></sup>    19    20

(a) Work out the interquartile range of the girls' marks.

11 VALUES  $\Rightarrow$  M

$\therefore Q_1 = \frac{11+1}{4} \rightarrow 3^{RD}$  (M)

$Q_3 = \frac{11+1}{4} \times 3 \rightarrow 9^{TH}$

↑ MARKS ALREADY IN ORDER!

18 - 10

8 (A1)

(2)

The boys in class 8C did the same test.

The boys' marks had a range of 19 and an interquartile range of 11 marks.

Gareth says that the girls' marks are more spread out than the boys' marks.

(b) Is Gareth right?

Tick (✓) the appropriate box.

Yes	No	
<input type="checkbox"/>	<input checked="" type="checkbox"/>	[NO MARK]

Give a reason for your answer.

BECAUSE THE INTERQUARTILE RANGE FOR THE BOYS IS GREATEST. (A1)

(1)

Given that  $A = 2^3 \times 3$  and  $B = 2^2 \times 3^2$

find the Lowest Common Multiple (LCM) of  $A$  and  $B$ .

$$\text{HCF} = 2^2 \times 3$$

$$\therefore \text{LCM} = \frac{2^3 \times 3 \times 2^2 \times 3^2}{2^2 \times 3}$$

(m1) [FOR ANY  
USEFUL  
METHOD]

$$= 2^3 \times 3^2$$

$$= \underline{\underline{72}} \text{ (A1) EITHER}$$

The size of each interior angle of a regular polygon with  $n$  sides is  $140^\circ$

Work out the size of each interior angle of a regular polygon with  $2n$  sides.

$$\text{INTERIOR ANGLE} = 140$$

$$\begin{aligned}\text{EXTERIOR} &= 180 - 140 \\ &= \underline{40} \text{ (m)}\end{aligned}$$

$$\begin{aligned}\text{NUMBER OF SIDES} &= \frac{360}{40} \text{ (m)} \\ &= \underline{9} \text{ (m)}\end{aligned}$$

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$$2n = 18 \text{ SIDES}$$

$$\begin{aligned}\text{EXTERIOR ANGLE} &= \frac{360}{18} \text{ (m)} \\ &= 20\end{aligned}$$

$$\begin{aligned}\therefore \text{INTERIOR ANGLE} &= 180 - 20 \\ &= \underline{160^\circ} \text{ (A)}\end{aligned}$$



Simplify  $\left(2x^{\frac{3}{2}}y\right)^4$

$$2^4 = 16$$

$$x^{\frac{3}{2} \times 4} = x^6$$

$$y^4 = y^4$$

$$\frac{\textcircled{AI}}{16} \frac{\textcircled{AI}}{x^6 y^4}$$

The table shows information about the lengths of time that 120 people spent in a supermarket.

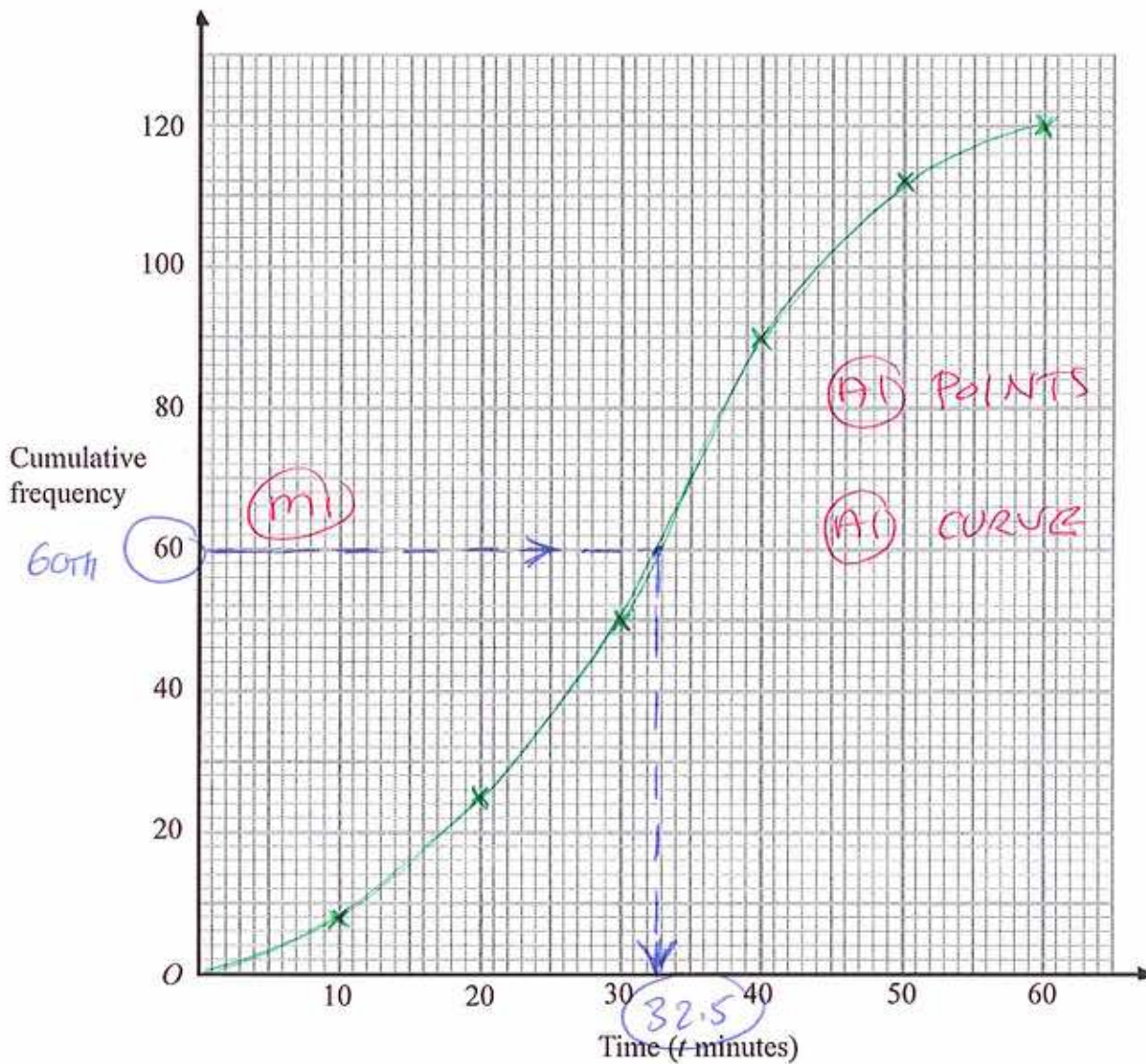
Time ( $t$ minutes)	Frequency
$0 < t \leq 10$	8
$10 < t \leq 20$	17
$20 < t \leq 30$	25
$30 < t \leq 40$	40
$40 < t \leq 50$	22
$50 < t \leq 60$	8

(a) Complete the cumulative frequency table.

Time ( $t$ minutes)	Cumulative frequency	COORDINATES
$0 < t \leq 10$	8	(10, 8)
$0 < t \leq 20$	25	(20, 25)
$0 < t \leq 30$	50	(30, 50)
$0 < t \leq 40$	90	(40, 90)
$0 < t \leq 50$	112	(50, 112)
$0 < t \leq 60$	120	(60, 120)

(1)

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



(2)

(c) Use your graph to find an estimate for the median length of time spent in the supermarket by these people.

$$\begin{aligned} \text{MEDIAN} &= \frac{120}{2} \\ &= 60\text{TH VALUE} \end{aligned}$$

$$\begin{aligned} &32.5 \text{ minutes} \\ &[\pm \frac{1}{2} \text{ SQUARE}] \end{aligned}$$

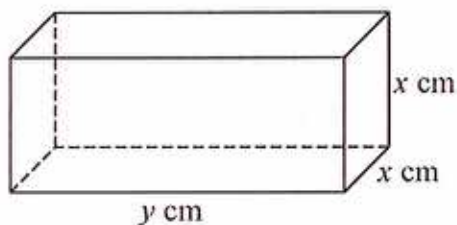


Diagram NOT  
accurately drawn

The diagram shows a cuboid of volume  $V \text{ cm}^3$

The length of the cuboid is  $y \text{ cm}$

The width and height of the cuboid are both  $x \text{ cm}$

The total length of all the edges of the cuboid is 112 cm

(a) Show that  $V = 28x^2 - 2x^3$

8 SHORT SIDED AND 4 LONG SIDES

$$\rightarrow 8x + 4y = 112 \quad (\text{m1})$$

$$\Rightarrow y = \frac{112 - 8x}{4} = \underline{\underline{28 - 2x}} \quad (\text{m1})$$

VOLUME,  $V = y \times x \times x$

$$= (28 - 2x) \times x \times x \quad (\text{m1})$$

$$= 28x^2 - 2x^3 \quad (3)$$

(b) Find  $\frac{dV}{dx}$

$$\frac{dV}{dx} = \underline{\underline{56x - 6x^2}} \quad (\text{A1}) \quad (\text{A1})$$

(2)

(c) Find the maximum value of  $V$   
Give your answer correct to 3 significant figures.

$$56x - 6x^2 = 0 \quad (\text{m1})$$

$$\Rightarrow -6x^2 = -56x$$

$$\Rightarrow x = \underline{\underline{9.3}} \quad (\text{A1})$$

$$V = 28 \times (9.3)^2 - 2 \times (9.3)^3$$

$$= 813.037$$

$$= \underline{\underline{813}} \text{ cm}^3 \quad (\text{A1})$$

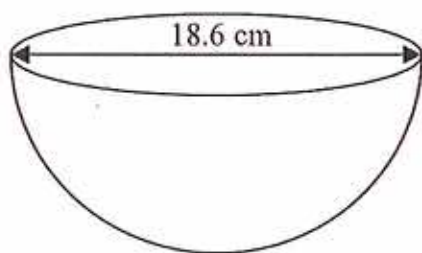


Diagram NOT  
accurately drawn

The diagram shows a hemisphere with a diameter of 18.6 cm.

Work out the volume of the hemisphere.

Give your answer correct to 3 significant figures.

$$V = \frac{4}{3} \pi r^3 \div 2$$

$$= \frac{4}{3} \times \pi \times \underbrace{9.3^2}_{(m)} \div 2 \quad (m)$$

$$= \underline{\underline{1684.64 \dots}}$$

$$\underline{\underline{1680}} \text{ cm}^3 \quad (A1)$$



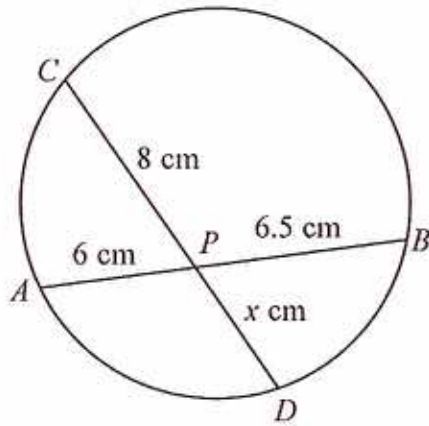


Diagram NOT  
accurately drawn

$APB$  and  $CPD$  are chords of a circle.

$AP = 6$  cm,  $PB = 6.5$  cm,  $CP = 8$  cm,  $PD = x$  cm

Work out the value of  $x$ .

$$8 \times x = 6 \times 6.5 \quad (m)$$

$$x = \frac{6 \times 6.5}{8}$$

$$x = 4.875 \quad (A)$$

$R$  is inversely proportional to the square of  $c$ .

When  $c = 4$ ,  $R = 30$

(a) Find a formula for  $R$  in terms of  $c$ .

$$R = \frac{k}{c^2} \quad (c=4, R=30)$$

$$\Rightarrow 30 = \frac{k}{4^2} \quad \text{(M1) EITHER}$$

$$\Rightarrow k = 30 \times 4^2 = 480 \quad \text{(M1)}$$

$$R = \frac{480}{c^2} \quad \text{(A1)}$$

(3)

(b) Calculate the positive value of  $c$  when  $R = 1920$

$$R = \frac{480}{c^2} \quad (R=1920)$$

$$1920 = \frac{480}{c^2}$$

$$\Rightarrow c^2 = \frac{480}{1920} \quad \text{(M1)}$$

$$\Rightarrow c = \sqrt{\frac{480}{1920}}$$

$$c = 0.5 \quad \text{(A1)}$$

(2)



The functions  $g$  and  $h$  are defined as

$$g(x) = \frac{x}{2x-5}$$

$$h(x) = x + 4$$

(a) Find the value of  $g(1)$

$$g(1) = \frac{1}{2 \times 1 - 5} = \frac{1}{-3}$$

$$\frac{-\frac{1}{3}}{(1)}$$

(b) State which value of  $x$  must be excluded from any domain of  $g$

$$2x - 5 \neq 0, \quad 2x \neq 5 \quad x \neq \frac{5}{2}$$

$$\frac{2.5}{(1)}$$

(c) Find  $gh(x)$

Simplify your answer.

$$gh(x) = \frac{x+4}{2(x+4)-5} \quad (M1)$$

$$= \frac{x+4}{2x+8-5}$$

$$gh(x) = \frac{x+4}{2x+3} \quad (A1)$$

(d) Express the inverse function  $g^{-1}$  in the form  $g^{-1}(x) = \dots$

$$x = \frac{y}{2y-5} \quad (M1)$$

$$\Rightarrow (2y-5)x = y$$

$$\Rightarrow 2xy - 5x = y \quad (M1)$$

$$2xy - y = 5x$$

$$y(2x-1) = 5x$$

$$y = \frac{5x}{2x-1} \quad (A1)$$

$$g^{-1}(x) = \frac{5x}{2x-1} \quad (A1)$$

ANY  
TWO LINES  
OF CORRECT  
WORKING.

Here are 7 cards.  
Each card has a number on it.



Harry takes at random two cards.

IMPLIES NON REPLACEMENT

(a) Calculate the probability that the numbers on the two cards are the same.

$$\begin{aligned}
 P(2,2) &= \frac{2}{7} \times \frac{1}{6} = \frac{2}{42} \\
 P(3,3) &= \frac{3}{7} \times \frac{2}{6} = \frac{6}{42}
 \end{aligned}
 \left. \vphantom{\begin{aligned} P(2,2) \\ P(3,3) \end{aligned}} \right\} \frac{8}{42}$$

$$\frac{4}{21} \quad \text{(AV)}$$


---

(3)

(b) Calculate the probability that the sum of the numbers on the two cards is 5

$$\begin{aligned}
 P(1,4) &= \frac{1}{7} \times \frac{1}{6} = \frac{1}{42} \\
 P(4,1) &= \frac{1}{7} \times \frac{1}{6} = \frac{1}{42} \\
 P(2,3) &= \frac{2}{7} \times \frac{3}{6} = \frac{6}{42} \\
 P(3,2) &= \frac{3}{7} \times \frac{2}{6} = \frac{6}{42}
 \end{aligned}
 \left. \vphantom{\begin{aligned} P(1,4) \\ P(4,1) \\ P(2,3) \\ P(3,2) \end{aligned}} \right\} \text{TOTAL} = \frac{14}{42}$$

$$\frac{1}{3} \quad \text{(AG)}$$


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Here is triangle  $LMN$ , where angle  $LMN$  is an obtuse angle.

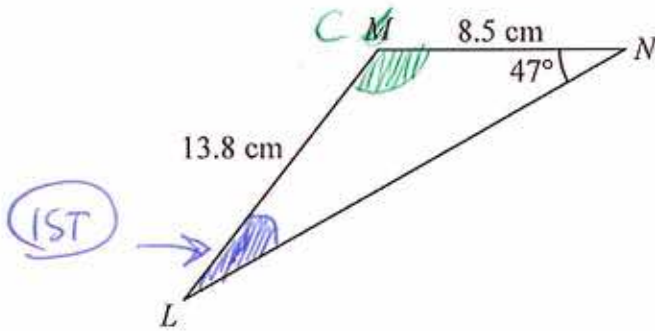


Diagram NOT accurately drawn

$$ML = 13.8 \text{ cm}$$

$$MN = 8.5 \text{ cm}$$

$$\text{Angle } MNL = 47^\circ$$

Work out the area of triangle  $LMN$ .

Give your answer correct to 3 significant figures.

$$A = \frac{1}{2} ab \sin C$$

1ST FIND L:

$$\frac{\sin L}{8.5} = \frac{\sin 47}{13.8}$$

$$\Rightarrow \sin L = \frac{8.5 \times \sin 47}{13.8}$$

$$= 0.45047\dots$$

$$L = \underline{\underline{26.77^\circ}}$$

$$\therefore M = 180 - (26.77 + 47)$$

I've labelled it as 'C'

$$= \underline{\underline{106.23}}$$

$$A = \frac{1}{2} \times 8.5 \times 13.8 \times \sin 106.23$$

$$= 56.312\dots$$

$$= \underline{\underline{56.3 \text{ cm}^2}}$$

Solve the simultaneous equations

$$\begin{aligned} y &= 2x - 3 \\ x^2 + y^2 &= 41 \end{aligned}$$

Show clear algebraic working.

$$x^2 + (2x - 3)^2 = 41 \quad (M1)$$

$$x^2 + (2x - 3)(2x - 3) = 41$$

$$x^2 + 4x^2 - 6x - 6x + 9 = 41$$

$$5x^2 - 12x - 32 = 0 \quad (B1)$$

$$(5x + 8)(x - 4) = 0 \quad (M1) \text{ [OR USE OF FORMULA]}$$

$$x_1 = -\frac{8}{5}$$

$$x_2 = \underline{4}$$

$$= \underline{\underline{-1.6}}$$

(A1) EITHER

$$y_1 = 2x(-1.6) - 3$$

$$y_2 = 2 \times 4 - 3$$

$$= \underline{\underline{-6.2}}$$

$$= \underline{\underline{5}}$$

(A1) BOTH