

3H

Pearson Edexcel
International GCSE

EDEXCEL

IGCSE

MATHEMATICS A

SOLUTIONS

MAY 2016

4MA0/3H

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The methods used in these solutions, where relevant, are methods which have been successfully used with students. The method shown for a particular question is not always the only method and We do not claim that the method we have used is necessarily the most efficient or ‘best’ method. We will, from time to time, update a solution to show a different method if We feel that it is a good idea to do so.

Sometimes a method used in these solutions might be unfamiliar to You. If You are able to use a different method to obtain the correct answer then We would usually recommend that You keep using your existing method and not change to the method that We have used here. However, the choice of method is always up to You and We believe that it is often useful if You know more than one method to solve a particular type of problem.

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.

Here are the ingredients needed to make 12 muffins.

Ingredients to make 12 muffins
300g flour
150g sugar
250ml milk
100g butter
2 eggs

Sarah makes 60 muffins. $\rightarrow 12 \times 5!$

(a) Work out how much sugar she uses.

$$\begin{array}{r} 5 \times 150 \\ \hline \text{(ml)} \end{array}$$

$$\begin{array}{r} 750 \text{ g} \\ \hline \text{(2)} \end{array} \quad \text{(AI)}$$

James makes some muffins.
He uses 625 ml of milk.

(b) How many muffins did he make?

$$\text{(ml)} \left[\frac{625}{250} = 2.5 \text{ BATCHES} \right]$$

$$= 2.5 \times 12 \longrightarrow \begin{array}{r} 30 \\ \hline \text{(2)} \end{array} \quad \text{(AI)}$$

$$a = -5$$
$$c = -2$$

(a) Work out the value of $2a^2 + 6c$

$$2(-5)^2 + 6(-2) \quad \text{(M1)}$$

$$\begin{array}{r} \text{(A1)} \\ 38 \\ \hline (2) \end{array}$$

There are 4 pens in a small box of pens.
There are 10 pens in a large box of pens.

Ami buys x small boxes of pens and y large boxes of pens.
She buys a total of T pens.

(b) Write down a formula for T in terms of x and y .

$$\begin{array}{r} \text{(A1)} \quad \text{(A1)} \quad \text{(A1)} \\ [T = 4x + 10y] \\ \hline (3) \end{array}$$

The table shows information about the number of visits each of 40 adults made to the gym last week.

Number of visits to the gym	Frequency
0	4
1	3
2	12
3	5
4	8
5	5
6	2
7	1

$$0 \times 4 = 0$$

$$1 \times 3 = 3$$

$$2 \times 12 = 24$$

$$\rightarrow 15$$

$$\rightarrow 32$$

$$\rightarrow 25$$

$$\rightarrow 12$$

$$\rightarrow 7$$

Work out the mean of the number of visits to the gym.

$$\rightarrow \text{TOTAL} = 118 \text{ (ml)}$$

$$\Rightarrow \text{MEAN} = \frac{118}{40} \text{ (ml)} \rightarrow 2.95 \text{ (Al)}$$

$$A = \{2, 4, 6, 8, 10, 12, 14\}$$

$$B = \{1, 3, 5, 7, 9, 11, 13\}$$

$$C = \{3, 6, 9, 12\}$$

(a) List the members of the set

(i) $A \cap C$

$$\{6, 12\} \quad \text{(BI)}$$

(ii) $A \cup C$

$$\{2, 4, 6, 8, 10, 12, 14, 3, 9\} \quad \text{(2) (BI)}$$

(b) Explain why $A \cap B = \emptyset$

A AND B HAVE NO MEMBERS IN COMMON

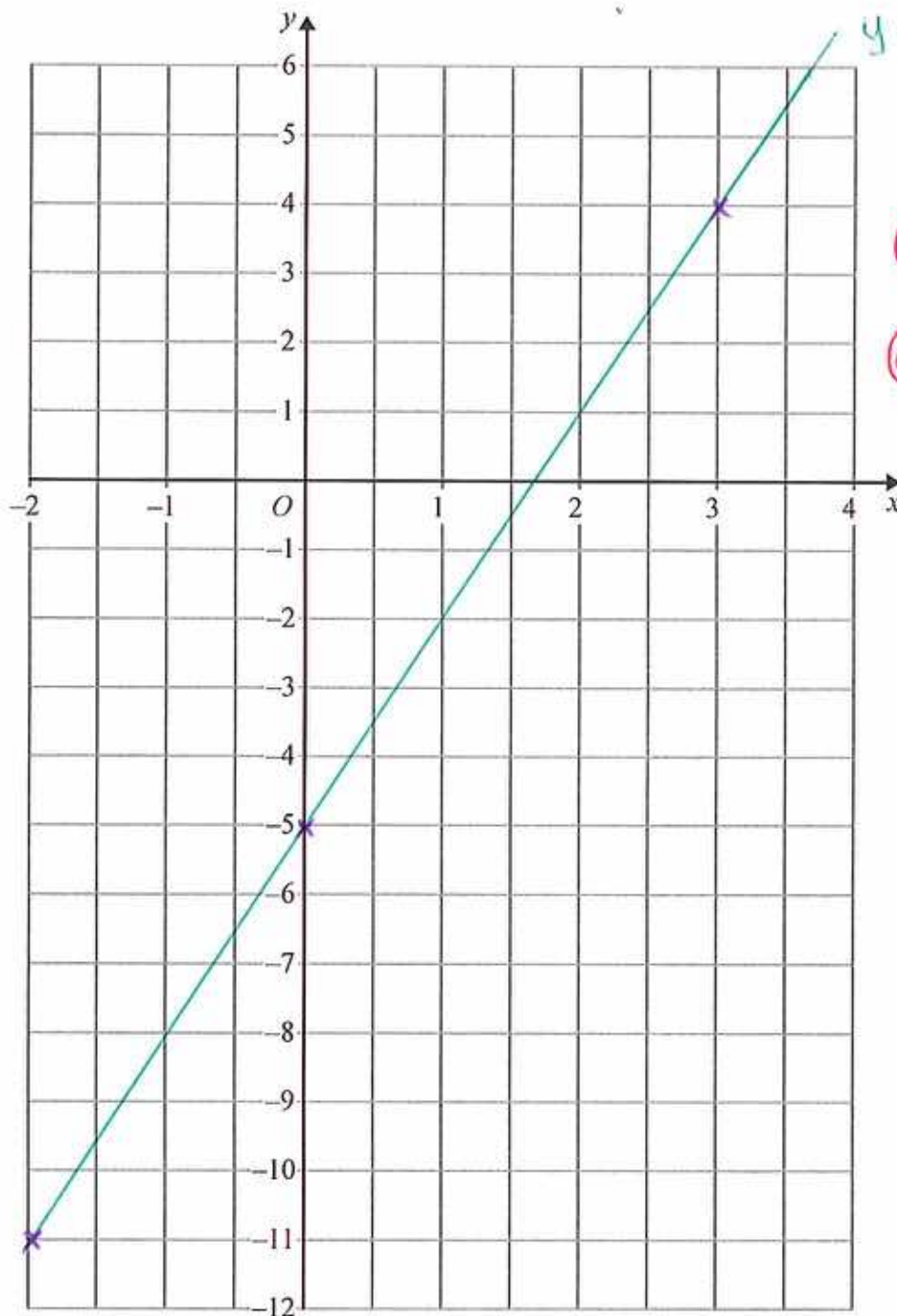
(BI) (1)

[OR EQUIVALENT]

On the grid, draw the graph of $y = 3x - 5$ for values of x from -2 to 3

x	-2	0	3
y	-11	-5	4

$$y = 3(-2) - 5$$
$$= -11$$



(A1) [POINTS]

(A1) [LINE]

(a) Show that $\frac{3}{10} + \frac{2}{15} = \frac{13}{30}$

$$\begin{aligned} \frac{3}{10} + \frac{2}{15} &= \frac{9}{30} + \frac{4}{30} \\ &= \frac{13}{30} \\ &= \underline{\underline{\frac{13}{30}}} \end{aligned}$$

(M1) [COMMON DENOMINATORS]

(M1) [FRACTIONS CORRECT]

(2)

(b) Show that $2\frac{5}{8} \div 1\frac{1}{6} = 2\frac{1}{4}$

$$2\frac{5}{8} \div 1\frac{1}{6} = \frac{21}{8} \div \frac{7}{6}$$

(M1) [IMPROPER FRACTIONS]

$$= \frac{21}{8} \times \frac{6}{7}$$

(M1) [MULTIPLY AND FLIP]

$$= \frac{126}{56}$$

(M1) [EITHER]

$$= \frac{9}{4}$$

$$= \underline{\underline{2\frac{1}{4}}}$$

(3)

(a) Factorise $3y^2 + 2y$

$$\underline{y(3y+2)} \quad \text{(1)} \quad \text{(BI)}$$

(b) Expand and simplify $(x-9)(x+2)$

$$\begin{array}{cccc} F & O & I & L \\ x^2 & +2x & -9x & -18 \end{array}$$

(M) [ANY THREE CORRECT]

$$\underline{x^2 - 7x - 18} \quad \text{(2)} \quad \text{(AI)}$$

(c) (i) Solve $6k + 5 < 20$

$$6k < 15$$

$$k < \frac{15}{6} \quad \text{(M)}$$

$$\underline{k < 2.5} \quad \text{(AI)}$$

(ii) n is an integer and $6n + 5 < 20$ Write down the largest possible value of n

SAME AS PART (i)

$$n < 2.5$$

$$\underline{2} \quad \text{(AI)}$$

(3)

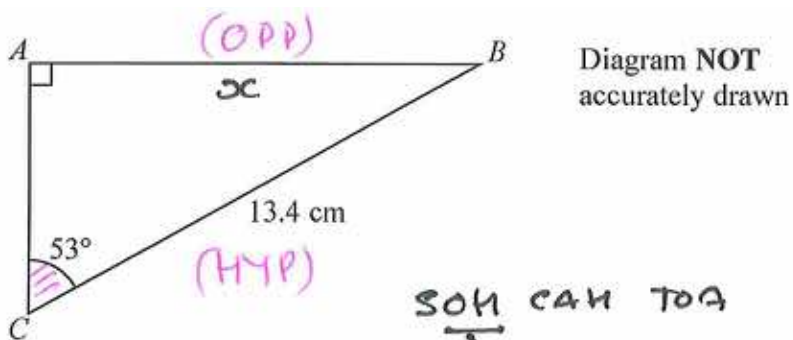
(d) Simplify fully $\frac{28x^5y^3}{4xy^2}$

$$\frac{28}{4} \times \frac{x^5}{x} \times \frac{y^3}{y^2} = 7 \times x^4 \times y$$

$$\text{(AI)} \downarrow \text{(AI)}$$

$$\underline{7x^4y}$$

(2)



Work out the length of AB .
Give your answer correct to 1 decimal place.

SOH CAH TOA

$$\sin 53 = \frac{\text{OPP}}{\text{HYP}}$$

$$\sin 53 = \frac{x}{13.4} \quad (m)$$

$$x = 13.4 \times \sin 53 \quad (m)$$

$$= 10.7017\dots$$

$$\underline{10.7} \quad (A) \text{ cm}$$

Bhavin, Max and Imran share 6000 rupees in the ratios 2 : 3 : 7

Imran then gives $\frac{3}{5}$ of his share of the money to Bhavin.

What percentage of the 6000 rupees does Bhavin now have?

Give your answer correct to the nearest whole number.

1ST	B	M	I	TOTAL
	2	3	7	12

$$\frac{6000}{12} = 500 \quad (B1)$$

∴ SHARES ARE

$$B : M : I$$

$$1000 : 1500 : 3500$$

2ND

$$\frac{3}{5} \times 3500 = 2100 \quad (M1)$$

BHAVIN NOW HAS

$$2100 + 1000 = 3100 \quad (M1)$$

$$\text{PERCENTAGE IS } \frac{3100}{6000} \times 100$$

$$\rightarrow 52 \quad (A1) \%$$

The diagram shows a circle inside a rectangle.

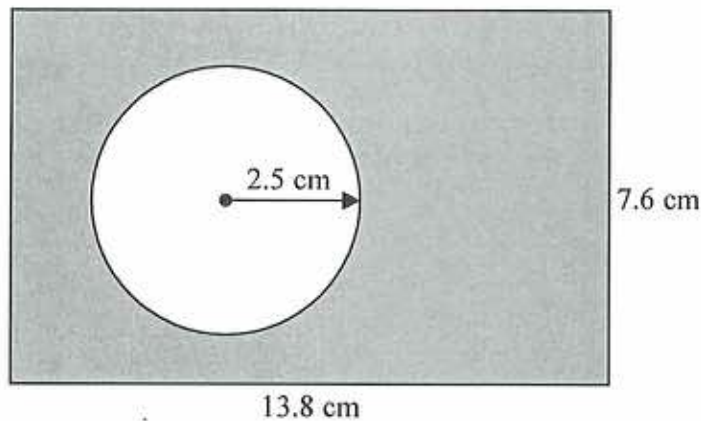


Diagram NOT
accurately drawn

Work out the area of the shaded region.
Give your answer correct to 3 significant figures.

RECTANGLE

$$13.8 \times 7.6 = 104.88$$

CIRCLE

$$\pi \times 2.5^2 = 19.6349\dots$$

(m1) [EITHER]

SHADED REGION

$$104.88 - 19.6349\dots$$

(m1)

$$\underline{\underline{85.2}} \text{ cm}^2$$

(A1)

The frequency table shows information about the weights of 80 adults.

Weight (w kg)	Frequency
$40 < w \leq 50$	4
$50 < w \leq 60$	7
$60 < w \leq 70$	21
$70 < w \leq 80$	21
$80 < w \leq 90$	18
$90 < w \leq 100$	7
$100 < w \leq 110$	2

(a) Complete the cumulative frequency table.

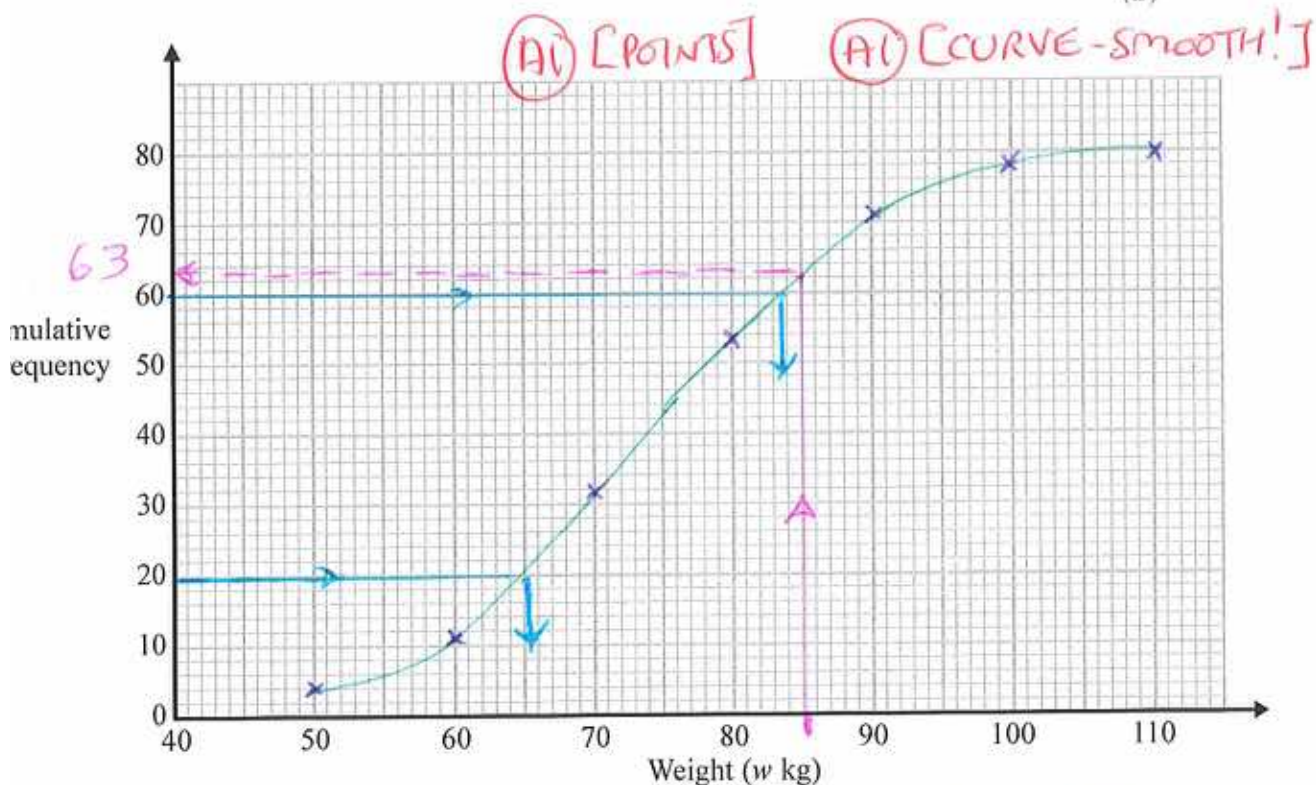
Weight (w kg)	Cumulative frequency
$40 < w \leq 50$	4
$40 < w \leq 60$	11
$40 < w \leq 70$	32
$40 < w \leq 80$	53
$40 < w \leq 90$	71
$40 < w \leq 100$	78
$40 < w \leq 110$	80

(B1)

(1)

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

(2)



(c) Use your graph to find an estimate for the number of adults with weight more than 85 kg.

80 - 63 (M) [IF LINE IS SHOWN ON GRAPH]

17 (AI)

(2)

(d) Use your graph to find an estimate for the interquartile range of the weights of the adults.

[ACCEPT 16-20]

$$Q_1 = \frac{80}{4} = 20\text{TH VALUE} \rightarrow$$

$$Q_3 = \frac{80}{4} \times 3 = 60\text{TH VALUE} \rightarrow$$

$$IQR = Q_3 - Q_1$$

$$= 84 - 65$$

(M) [NEEDS METHOD OR LINES ON GRAPH]

19 (AI)

[ACCEPT 18-22]

Solve the simultaneous equations

$$4x + 5y = 13$$

$$3x - 2y = 27$$

Show clear algebraic working.

$$4x + 5y = 13 \quad \text{--- (1) } \times 2 \quad \text{(m)} \text{ [MULTIPLYING]}$$

$$3x - 2y = 27 \quad \text{--- (2) } \times 5$$

$$8x + 10y = 26 \quad \text{--- (3)}$$

$$15x - 10y = 135 \quad \text{--- (4)}$$

} ADD

$$23x = 161$$

$$x = \frac{161}{23}$$

$$= \underline{\underline{7}} \quad \text{(A1)}$$

SUBSTITUTE INTO (1)

$$4(7) + 5y = 13$$

(m) [SUBSTITUTING]

$$5y = 13 - 4(7)$$

$$y = \frac{13 - 4(7)}{5}$$

$$= \underline{\underline{-3}} \quad \text{(A1)}$$

$$x = \underline{\underline{7}}$$

$$y = \underline{\underline{-3}}$$

The straight line L passes through the points $(-2, 3)$ and $(6, 9)$

Find an equation of the line that is parallel to L and passes through the point $(5, -1)$

Give your answer in the form $ax + by = c$ where a , b and c are integers.

$$\begin{aligned} \text{GRADIENT OF } L &= \frac{9-3}{6-(-2)} \quad (\text{M1}) \\ &= \frac{6}{8} \\ &= \frac{3}{4} \quad (\text{A1}) \end{aligned}$$

$$m = \frac{y_1 - y_2}{x_1 - x_2}$$

EQUATION OF PARALLEL LINE

$$y - y_1 = m(x - x_1)$$

$$y - (-1) = \frac{3}{4}(x - 5) \quad (\text{M1})$$

$$y + 1 = \frac{3}{4}x - \frac{15}{4}$$

$$y = \frac{3}{4}x - \frac{19}{4} \quad (\text{M1})$$

[CORRECT EQUATION]

$$\Rightarrow 4y = 3x - 19$$

$$\underline{3x - 4y = 19} \quad (\text{A1})$$

[INTEGER FORM]

A particle is moving along a straight line.

The fixed point O lies on this line.

The displacement of the particle from O at time t seconds is s metres where

$$s = 2t^3 - 12t^2 + 7t$$

(a) Find an expression for the velocity, v m/s, of the particle at time t seconds.

$$v = \frac{ds}{dt}$$

$$v = \frac{6t^2 - 24t + 7}{(2)}$$

(b) Find the time at which the acceleration of the particle is instantaneously zero.

$$a = 12t - 24$$

WHEN $a = 0$, THEN

$$12t - 24 = 0 \quad (M1)$$

$$12t = 24$$

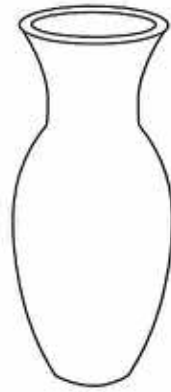
$$t = \underline{2} \quad (A1)$$

$$a = \frac{dv}{dt}$$

The diagram shows two mathematically similar vases, A and B.



A



B

Diagram NOT
accurately drawn

Vase A has a surface area of 120 cm^2
Vase B has a surface area of 750 cm^2 and a volume of 1600 cm^3

Work out the volume of vase A.

$$V_A = \frac{1600}{2.5^3} \quad (\text{m})$$

$$= \underline{\underline{102.4 \text{ cm}^3}} \quad (\text{A})$$

SCALE
FACTOR = $\sqrt{\frac{750}{120}}$

= $\boxed{2.5}$

(B)

ABCDEFGH is a cuboid.

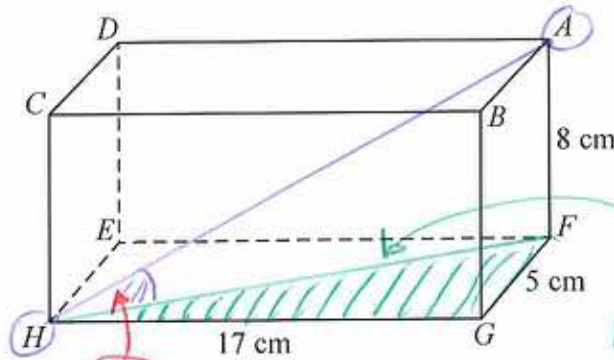


Diagram NOT accurately drawn

The cuboid has

length 17 cm
width 5 cm
height 8 cm

(M) [CORRECT ANGLE IDENTIFIED - ANYWHERE!]

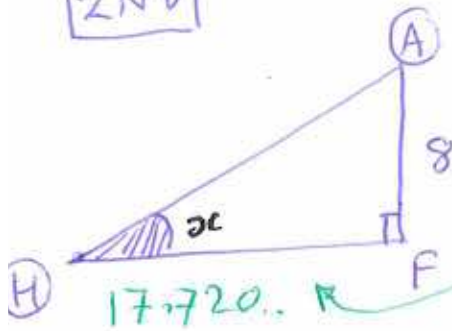
1ST

$$FH = \sqrt{17^2 + 5^2} = 17.7200 \dots$$

(BI)

Work out the size of the angle that AH makes with the plane EFGH.
Give your answer correct to 1 decimal place.

2ND



$$\tan \alpha = \frac{\text{OPP}}{\text{ADJ}}$$

$$\tan \alpha = \frac{8}{17.7200 \dots}$$

(M)

$$\alpha = \tan^{-1} \left(\frac{8}{17.7200 \dots} \right)$$

$$= 24.297 \dots$$

$$= \underline{\underline{24.3^\circ}}$$

(AI)

The diagram shows a trapezium.

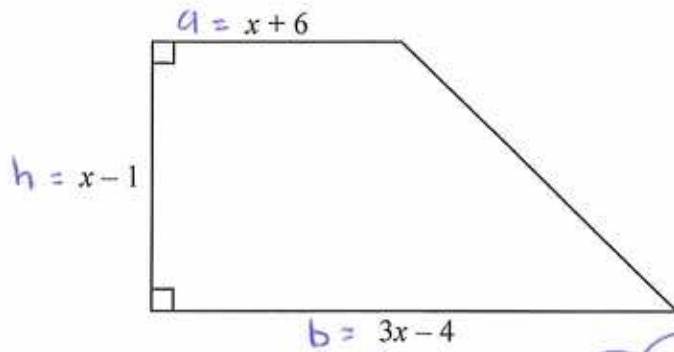


Diagram NOT
accurately drawn

All measurements on the diagram are in centimetres.

The area of the trapezium is 119 cm^2

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

(i) Show that $2x^2 - x - 120 = 0$

$$\frac{1}{2}(x+6 + 3x-4)(x-1) = 119 \quad (m1)$$

$$\Rightarrow (4x+2)(x-1) = 238$$

$$\Rightarrow 4x^2 - 4x + 2x - 2 = 238$$

$$\Rightarrow 4x^2 - 2x - 240 = 0$$

$$\Rightarrow 2x^2 - x - 120 = 0 \quad \text{QED!}$$

(m2) [ANY TWO STEPS
OF WORKING]

(ii) Find the value of x .

Show your working clearly.

$$2x^2 - x - 120 = 0$$

$$(2x+15)(x-8) = 0 \quad (m1)$$

$$\downarrow$$

$$x = -\frac{15}{2}$$

$$\downarrow$$

$$x = 8 \quad (m1) \quad \text{[TWO ANSWERS]}$$

[NEGATIVE x IS NOT

POSSIBLE SO...

$$\longrightarrow x = 8$$

(A1) [DISCOUNTS
NEGATIVE]

Make t the subject of the formula $m = \frac{t+1}{t-3}$

$$m = \frac{t+1}{t-3}$$

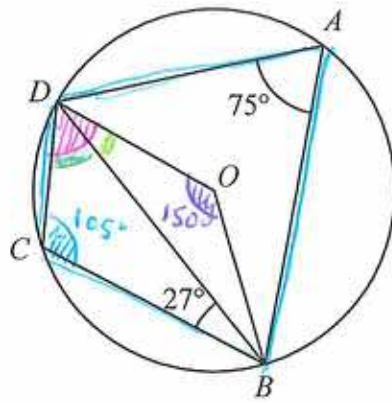
$$m t - 3m = t + 1 \quad \text{(M1) [MULTIPLY BY DENOMINATOR]}$$

$$m t - t = 1 + 3m \quad \text{[t-TERMS ON THE SAME SIDE]}$$

$$\text{(M2)} \quad t(m-1) = 1 + 3m \quad \text{[FACTORISE TO GET SINGLE t]}$$

$$\text{(M3)} \quad t = \frac{1+3m}{m-1} \quad \text{(A1) [DIVIDE BY BRACKET]}$$

Diagram NOT accurately drawn



[2ND]

$DCO = 105^\circ$ (B1)

[CYCLIC QUADRILATERAL]

[1ST]

$BOD = 150^\circ$ [ANGLE AT CENTRE] (B1)

A, B, C and D are points on a circle, centre O.

Angle DAB = 75°

Angle DBC = 27°

Work out the size of angle ODC.

[3RD]

$$BDC = 180 - (105 + 27)$$

$$= 48^\circ$$

(M1) [EITHER]

[5TH]

$$ODC = 48 + 15$$

$$= 63^\circ$$

[4TH]

$$BOD = \frac{180 - 150}{2}$$

$$= 15^\circ$$

63 (A1)

A metal cube has sides of length 4.5 cm, correct to the nearest 0.5 cm.

± 0.25

The cube is melted down and the metal is used to make small spheres. Each sphere has a radius of 3 mm, correct to the nearest millimetre.

$$V_{\text{SPHERE}} = \frac{4}{3} \pi r^3$$

Work out the greatest number of spheres that could be made from the metal.

Show your working clearly.

GREATEST VOLUME FOR CUBE
SMALLEST VOLUME FOR SPHERES

GREATEST VOLUME FOR CUBE

$$4.75^3 = 107.171875$$

(B1)

SMALLEST VOLUME OF SPHERES

$$\frac{4}{3} \pi \times 0.25^3 = 0.0654498\dots$$

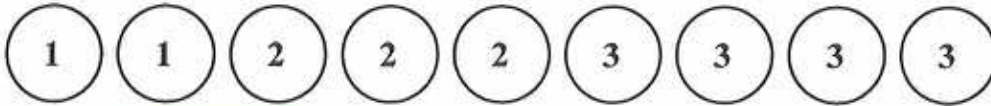
CHANGED TO
cm! (M1)

$$\text{GREATEST NUMBER OF SPHERES} = \frac{107.17875}{0.0654498\dots} \quad (M1)$$

$$= 1637.466\dots$$

$$= \underline{\underline{1637}} \quad (A1)$$

There are 9 counters in a bag.
There is a number on each counter.



Kal takes at random 3 counters from the bag.

He adds together the numbers on the 3 counters to get his Total.

Work out the probability that his Total is 6

$$P(2,2,2) = \frac{3}{9} \times \frac{2}{8} \times \frac{1}{7} = \frac{6}{504} \quad (B1) \text{ [oe]}$$

$$P(1,2,3) = \frac{2}{9} \times \frac{3}{8} \times \frac{4}{7} = \frac{24}{504}$$

$$P(1,3,2) = \frac{2}{9} \times \frac{4}{8} \times \frac{3}{7} = \frac{24}{504}$$

$$P(2,1,3)$$

$$P(2,3,1)$$

$$P(3,1,2)$$

$$P(3,2,1) = \frac{4}{9} \times \frac{3}{8} \times \frac{2}{7} = \frac{24}{504}$$

(M1) [FOR ONE OF THESE]

ALL THE SAME

+ (M1) [FOR ALL SIX]

$$\text{TOTAL} = \frac{6}{504} + 6 \times \frac{24}{504} \quad (M1)$$

$$\frac{25}{84} \quad (A1)$$

The diagram shows a pentagon.

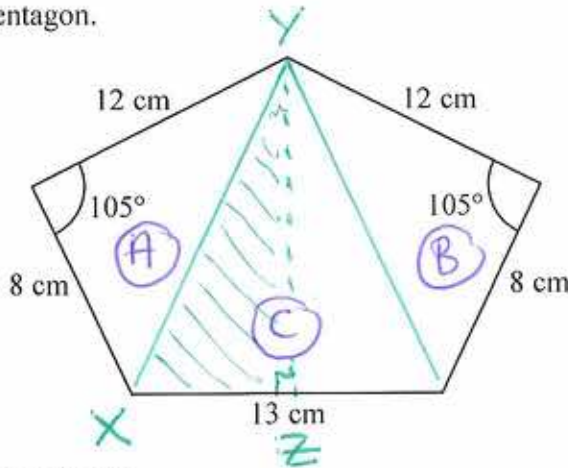


Diagram NOT
accurately drawn

Work out the area of the pentagon.

Give your answer correct to 3 significant figures.

1ST

$$A = \frac{1}{2} \times 12 \times 8 \times \sin 105 = 46.364 \dots \text{ (A)}$$

$$\Rightarrow B = 46.364 \dots$$

2ND

$$XY^2 = 12^2 + 8^2 - 2 \times 12 \times 8 \times \cos 105 \text{ (m)}$$

$$= 257.69 \dots \text{ (A)}$$

$$\Rightarrow XY = \underline{16.0528 \dots}$$

3RD

$$YZ = \sqrt{16.0528^2 - 6.5^2}$$

$$= \underline{14.6779 \dots \text{ (m)}}$$

4TH

$$C = \frac{1}{2} \times 13 \times 14.6779 \dots = 95.406 \dots \text{ (A)}$$

5TH

TOTAL

$$46.364 + 46.364$$

$$+ 95.406$$

$$= 188.134$$

$$= \underline{188} \text{ (A)}$$