

Surname	Centre Number	Candidate Number
Other Names		0



GCSE

3300U30-1



MATHEMATICS
UNIT 1: NON-CALCULATOR
INTERMEDIATE TIER

FRIDAY, 10 NOVEMBER 2017 – MORNING

1 hour 45 minutes

ADDITIONAL MATERIALS

The use of a calculator is not permitted in this examination.
A ruler, protractor and a pair of compasses may be required.

INSTRUCTIONS TO CANDIDATES

Use black ink or black ball-point pen. Do not use gel pen or correction fluid.

You may use a pencil for graphs and diagrams only.

Write your name, centre number and candidate number in the spaces at the top of this page.

Answer **all** the questions in the spaces provided.

If you run out of space, use the continuation page at the back of the booklet. Question numbers must be given for all work written on the continuation page.

Take π as 3.14.

INFORMATION FOR CANDIDATES

You should give details of your method of solution when appropriate.

Unless stated, diagrams are not drawn to scale.

Scale drawing solutions will not be acceptable where you are asked to calculate.

The number of marks is given in brackets at the end of each question or part-question.

In question 3(a), the assessment will take into account the quality of your linguistic and mathematical organisation, communication and accuracy in writing.

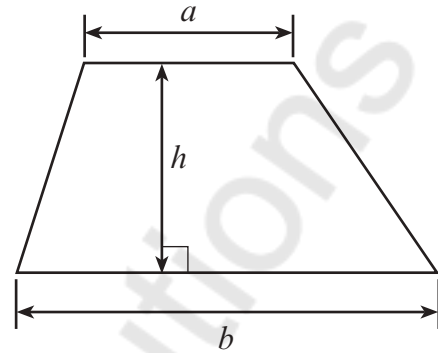
For Examiner's use only		
Question	Maximum Mark	Mark Awarded
1.	7	
2.	3	
3.	7	
4.	3	
5.	6	
6.	9	
7.	5	
8.	3	
9.	5	
10.	4	
11.	5	
12.	3	
13.	4	
14.	5	
15.	3	
16.	4	
17.	4	
Total	80	



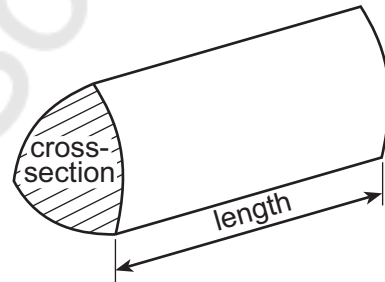
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Formula List – Intermediate Tier

Area of trapezium = $\frac{1}{2}(a + b)h$



Volume of prism = area of cross-section \times length



1. Calculate each of the following.

(a) $3^4 \times 10^3$

$3^4 \times 10^3$

81×1000

81,000

$3^4 \rightarrow (3 \times 3) \times (3 \times 3)$

$9 \times 9 = 81$

[2]

$10^3 = 10 \times 10 \times 10$

$100 \times 10 = 1000$

(b) $\frac{1}{0.5} = 2 //$

$\frac{1}{0.5}$

$0.5 = \frac{5}{10} = \frac{1}{2}$

[1]

$1 \div 0.5 = 1 \div \frac{1}{2} = 1 \times \frac{2}{1} = \frac{2}{1} = \underline{\underline{2}}$

(c) $5.6 - 3.82$

$5.6 - 3.82$

$5.60 - 3.82$

1.78

$$\begin{array}{r} 4 \\ 5.60 \\ - 3.82 \\ \hline 1.78 \end{array}$$

[1]

(d) $\frac{5}{6} - \frac{2}{3}$

$\frac{2}{3} = \frac{4}{6}$

$\frac{5}{6} - \frac{2 \times 2}{3 \times 2} = \frac{5}{6} - \frac{4}{6} = \frac{5-4}{6} = \frac{1}{6}$

$\frac{1}{6}$

[2]

(e) 0.2×0.3

0.2×0.3

$\frac{2}{10} \times \frac{3}{10} = \frac{6}{100} = \underline{\underline{0.06}}$

[1]



2. Circle either TRUE or FALSE for each of the following statements.

[3]

The expression $g \times g \times g$ can be written as $3g$	TRUE	FALSE
The expression $7y - y$ can be written as 7	TRUE	FALSE
$\frac{a}{4} \div a = \frac{1}{4}$	TRUE	FALSE
$\frac{a}{2} + \frac{a}{2} = a$	TRUE	FALSE
When $a = 1, b = 2$ and $c = 3$, $a + b + c = abc$	TRUE	FALSE

$$LHS = RHS$$

Space for working:

$$g \times g \times g = g^3 \quad g = g + g = 3g$$

$$7y - y = 6y \quad 7y - 1y = 6y$$

$$\frac{a}{4} \div a = \frac{a}{4} \div \left(\frac{a}{1}\right) = \frac{a}{4} \times \frac{1}{a} = \frac{1}{4}$$

$$\frac{a}{2} + \frac{a}{2} = \frac{a+a}{2} = \frac{2a}{2} = a$$

$$a + b + c = abc \quad a = 1 \quad b = 2 \quad c = 3$$

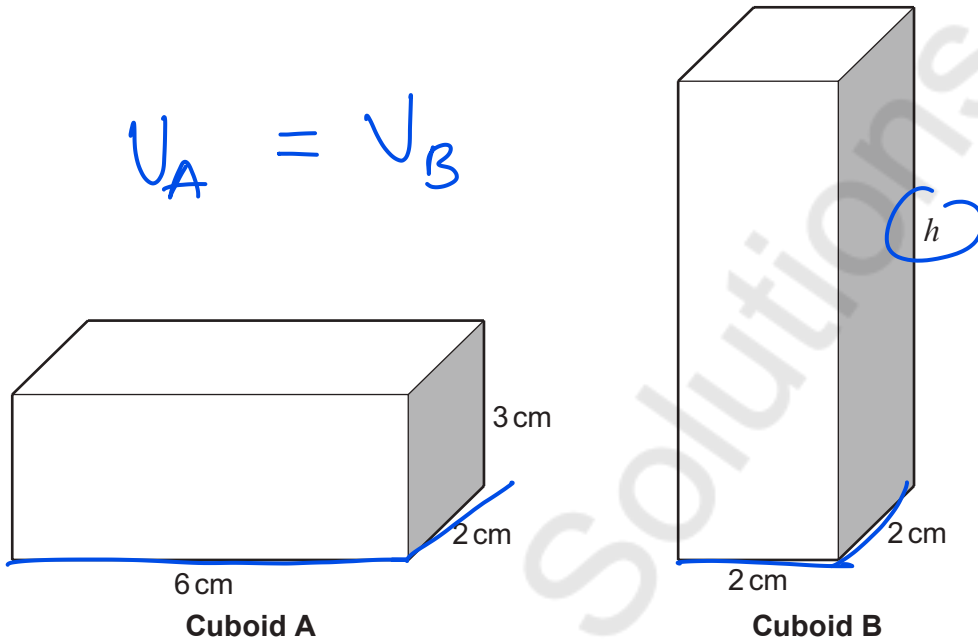
$$1 + 2 + 3 = 1 \times 2 \times 3$$

$$6 = 6$$



3. (a) In this part of the question, you will be assessed on the quality of your organisation, communication and accuracy in writing.

The two cuboids shown below have equal volumes.



Calculate the height h of Cuboid B.
You must show all your working.

Volume of cuboid = Base Area \times Height

[4 + 2 OCW]

$$\text{Volume of Cuboid (A)} = L \times W \times H$$

$$\text{Volume of cuboid (A)} = 6 \times 2 \times 3 = 36 \text{ cm}^3$$

$$\text{Volume of cuboid (B)} = L \times W \times H$$

$$\text{Volume of cuboid (B)} = 2 \times 2 \times h = 4h \text{ cm}^3$$

$$\text{Volume of cuboid (A)} = \text{Volume of cuboid (B)}$$

$$\frac{36}{4} = \frac{4h}{4}$$

$$9 = h \quad h = \underline{\underline{9 \text{ cm}}}$$

- (b) How many cubic centimetres (cm^3) are there in 2.5 litres? [1]

Convert 2.5 litres to cm^3 .

$$1 \text{ litre} = 1000 \text{ cm}^3$$

$$2.5 \text{ litre} = 1000 \times 2.5 \text{ cm}^3 = 2500 \text{ cm}^3$$

$$2.5 \text{ litres} = \underline{\underline{2500}} \text{ cm}^3$$



05

2.5 x 1000

2.5 litres
2500.

4. A fraction is written as $\frac{a}{b}$.

- The fraction is a multiple of 0.2.
- The fraction is greater than $\frac{1}{2}$.
- The fraction is less than 75%.

$$\frac{75}{100} \quad \frac{3}{4}$$

Write down the fraction as $\frac{a}{b}$, where a and b are whole numbers.

[3]

$$\text{fraction} = \frac{a}{b}$$

Fraction is a multiple of $0.2 = \frac{2}{10} = \frac{1}{5}$

The fraction is greater than $\frac{1}{2}$

$$\frac{a}{b} > \frac{1}{2}$$

The fraction is less than 75% = $\frac{3}{4}$

$$\frac{a}{b} < \frac{3}{4}$$

Answer =

$$\frac{a}{b} = \frac{3}{5}$$

$\frac{a}{b}$ is a multiple of 0.2 ($\frac{1}{5}$)

multiple of $\frac{1}{5}$

$$\text{using 1} = \frac{a}{b} = \frac{1}{5} \times 1 = \frac{1}{5}$$

$$\frac{3}{5} \times 100 = 60\%$$

$$\text{using 2} = \frac{a}{b} = \frac{1}{5} \times 2 = \frac{2}{5}$$

$$\text{using 3} = \frac{a}{b} = \frac{1}{5} \times 3 = \frac{3}{5}$$

$$\text{Now, } \left(\frac{3}{5}\right) > \frac{1}{2}$$

$$\frac{3}{5} < \frac{3}{4}$$

$$60\% < 75\%$$

multiple
0.2
 $> \frac{1}{2}$
 $< \frac{3}{4}$



5. (a) Write down the next two numbers in the following sequence. [2]

$$22 \begin{array}{c} -1 \\ -1 \end{array} 21 \begin{array}{c} -3 \\ -3 \end{array} 18 \begin{array}{c} -5 \\ -5 \end{array} 13 \begin{array}{c} -7 \\ -7 \end{array} \underline{6} \begin{array}{c} -9 \\ -9 \end{array} \underline{-3}$$

$$\underline{\underline{6, -3}}$$

- (b) Expand $5(3x - 2)$. [1]

$$5(3x - 2) = 5 \times 3x - 5 \times 2 = \underline{\underline{15x - 10}}$$

- (c) Solve $9x + 3 = 4x + 5$. [3]

$$9x + 3 = 4x + 5$$

Collect like terms

$$9x - 4x = 5 - 3$$

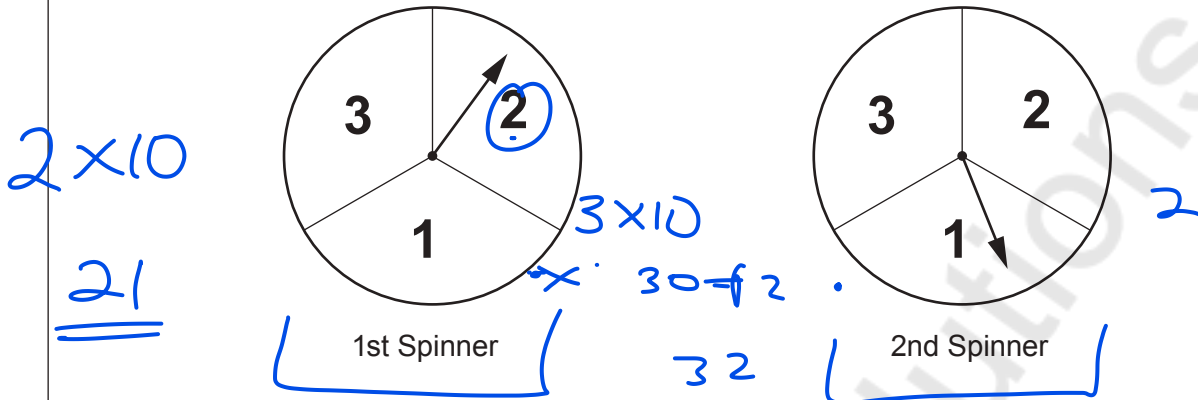
$$5x = 2$$

$$x = \frac{2}{5}$$



6. Sara is in charge of a game at her school's Christmas party.

Two fair spinners are spun as shown in the example below.



People can make a two-digit number using the numbers shown on the spinners using the following rule:

Multiply the number on the first spinner by 10 and then add the number on the second spinner.

One example, as shown above, makes the number 21, because $2 \times 10 + 1 = 21$.

- (a) How many different numbers can be made playing this game? [1]

$\frac{11}{\checkmark}$ $\frac{12}{\times}$ $\frac{13}{\checkmark}$ $\frac{21}{\times}$ $\frac{22}{\times}$ $\frac{23}{\checkmark}$ $\frac{31}{\checkmark}$ $\frac{32}{\times}$ $\frac{33}{\times}$

9

- (b) Write down all the prime numbers that can be made playing this game. [2]

11, 13, 23, 31

Prime number are numbers that has only two factors which is 1 and it self

- (c) What is the probability that a person makes a prime number when playing the game once? [2]

Probability of prime number = $\frac{\text{no of time prime number can be made}}{\text{Total sample space}}$

Probability of prime number = $\frac{4}{9}$



- (d) Sara charges each person £1 to play the game once.
Each player who makes a prime number from their spins wins £2.
How much profit would the school expect to make when 180 people play the game? [4]

Charge to play game \rightarrow £1

Winning is £2 for prime number

Total income of 180 people

$$\text{Total income} = 180 \times 1 = \text{£}180$$

$$\text{Pr}(\text{prime number}) = \frac{4}{9}$$

So, total number of people that will make prime number

$$\frac{4}{9} \times 180 = 80 \text{ people will win}$$

Each winning is £2

$$\text{Total winning payout} = \text{£}2 \times 80 = \text{£}160$$

$$\text{Profit} = \text{£}180 - \text{£}160$$

$$\text{Profit} = \text{£}20$$



7. $ABCD$ is a quadrilateral.
 $\hat{A}BC = 93^\circ$, $\hat{B}CD = 122^\circ$ and $\hat{A}DC = 85^\circ$.
 Points P and Q lie on the quadrilateral as shown, such that $AP = AQ$.

Prove that triangle APQ is an equilateral triangle.
 You must show all your working.

[5]

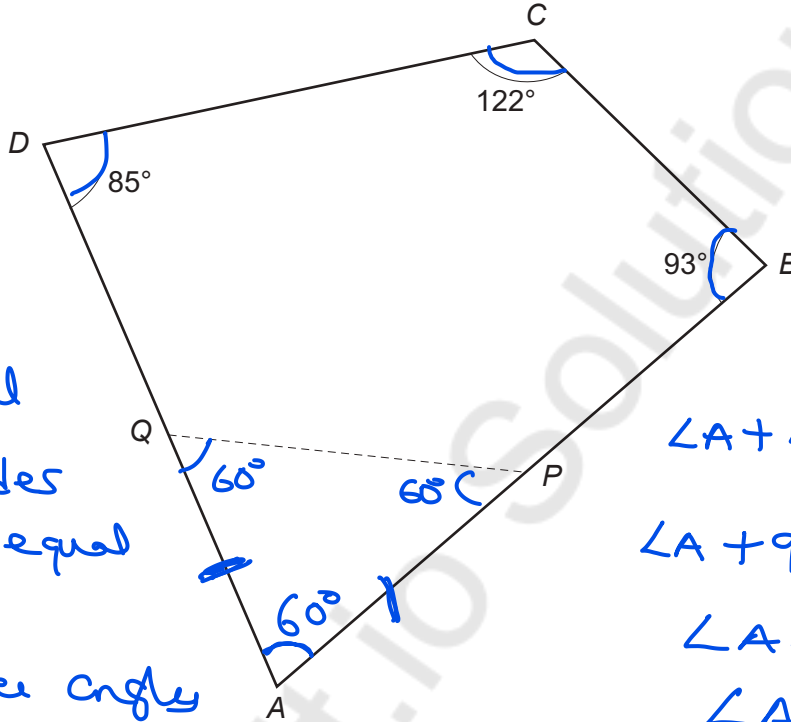


Diagram not drawn to scale

122
 93

 215
 85

 300

For $\triangle APQ$ to be equilateral

(i) All three sides have to be equal

OR

(ii) All the three angles have to be equal

$$\angle A + \angle B + \angle C + \angle D = 360$$

$$\angle A + 93 + 122 + 85 = 360$$

$$\angle A + 300 = 360$$

$$\angle A = 360 - 300$$

$$\angle A = 60^\circ$$

$\triangle APQ$ is isosceles $\angle P = \angle Q$

$$\angle A + \angle P + \angle Q = 180 \quad [\text{sum of angle in a triangle}]$$

$$60 + \angle P + \angle Q = 180$$

$$\angle P + \angle Q = 180 - 60$$

$$\angle P + \angle Q = 120$$

$$60 + 60 = 120$$

$$\angle P = 60^\circ \quad \angle Q = 60^\circ$$

Since all three angles in $\triangle APQ$ is 60° . Then, $\triangle APQ$ is an equilateral triangle

proof



8. Look at the following descriptions of special quadrilateral shapes. Circle the correct name for each one.

[Plane shapes with 4 sides]

(a) Its diagonals intersect at 90° .
Only one diagonal is a line of symmetry.

[1]

- Kite
- Rhombus
- Square
- Trapezium
- Rectangle

(b) Only one pair of sides are parallel.

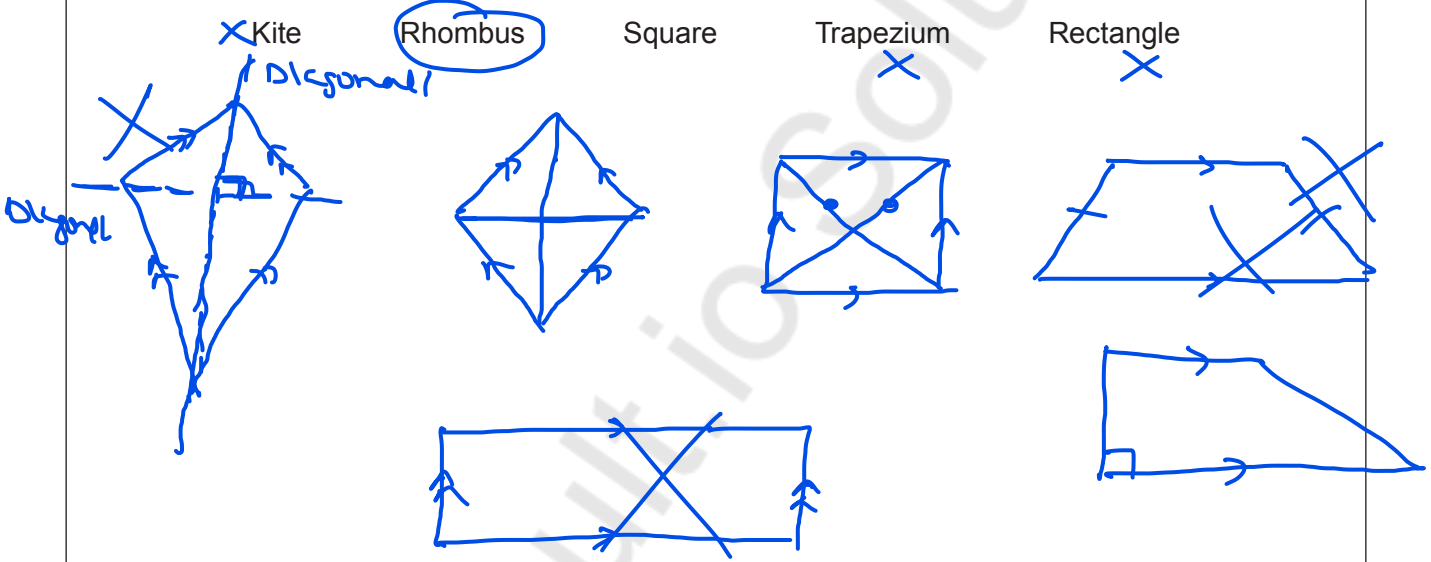
[1]

- Kite
- Rhombus
- Square
- Trapezium
- Rectangle

(c) All four sides are equal.
Its diagonals are not equal in length.

[1]

- ~~Kite~~
- Rhombus
- Square
- Trapezium
- Rectangle



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9. (a) Complete the table below.
 Draw the graph of $y = 2x^2 - 5$ for values of x between -2 and 3 .
 Use the graph paper below.
 Choose a suitable scale for the y -axis.

$(-1)^2 = -1 \times -1 = +1 = 1$

$4 \ 5$
 $\frac{13}{4} = 3$

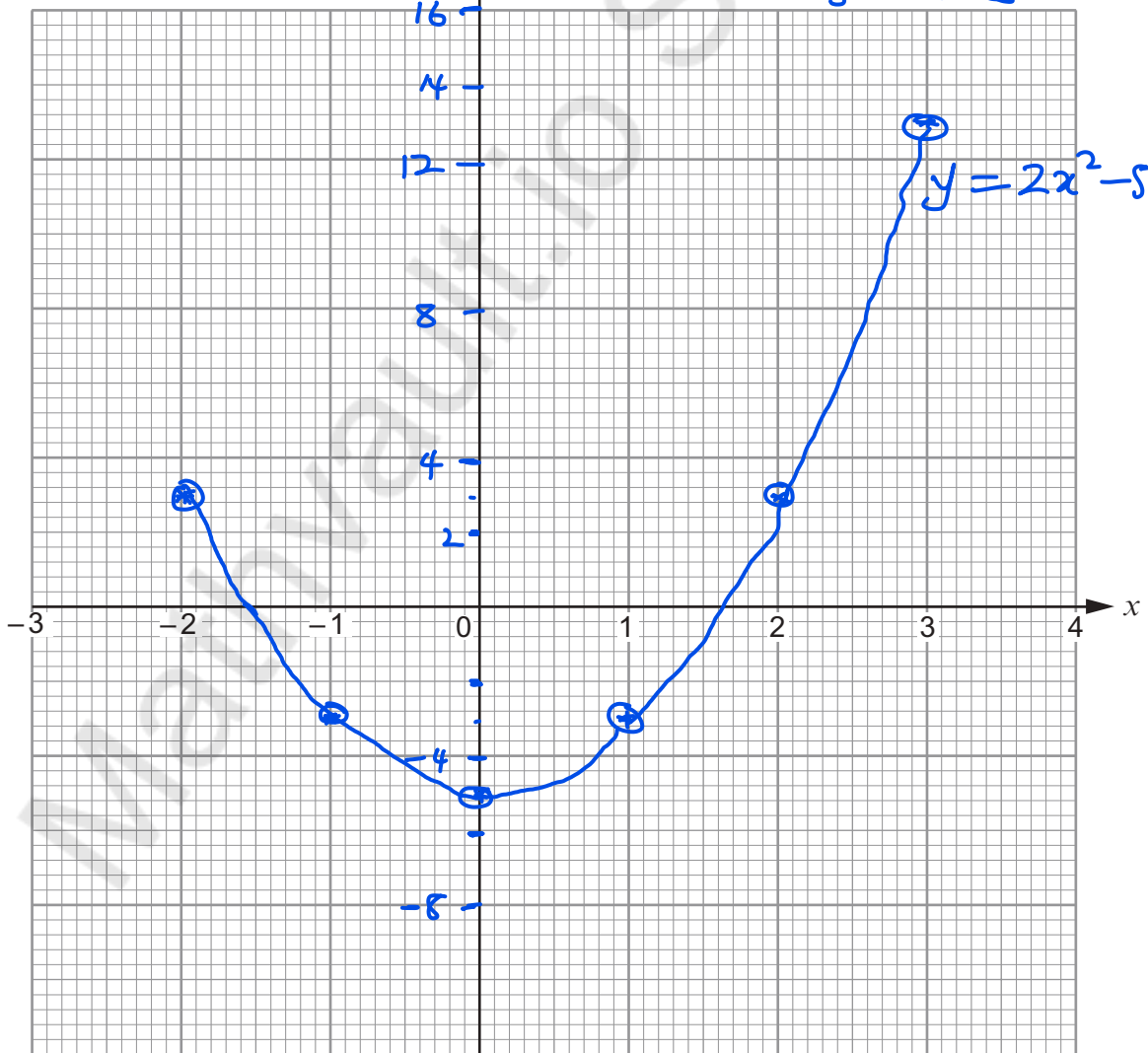
x	-2	-1	0	1	2	3
$y = 2x^2 - 5$	3	-3	-5	-3	3	13

$y = 2x^2 - 5$ when $x = -1$

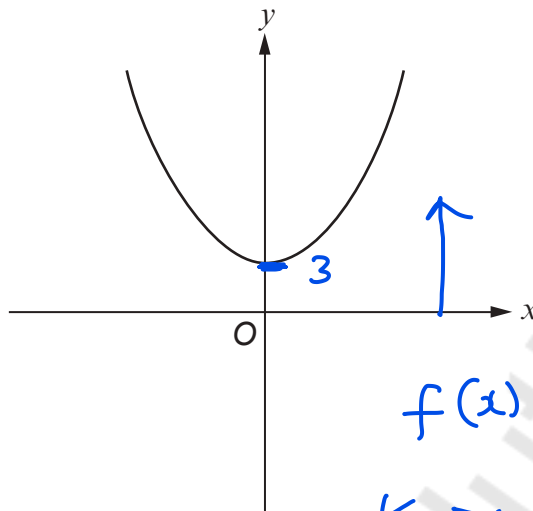
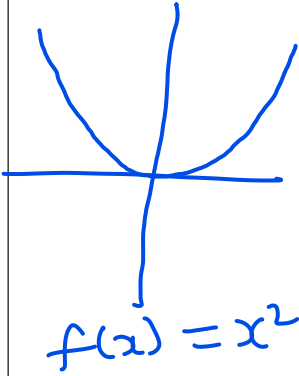
$y = 2 \times (-1)^2 - 5 = 2 \times 1 - 5 = 2 - 5$

$y = -3$

Scale: 2cm to represent 4 units on y -axis



(b)



$$f(x) = a f(bx-h) + k$$

$k > 0$ shifted up

$k < 0$ shifted down

The sketch above can represent only one of the equations given below.
Circle this equation.

[1]

$y = x^2$

$y = x^2 - 3$

$y = -x^2$

$y = x^2 + 3$

$y = 3x$

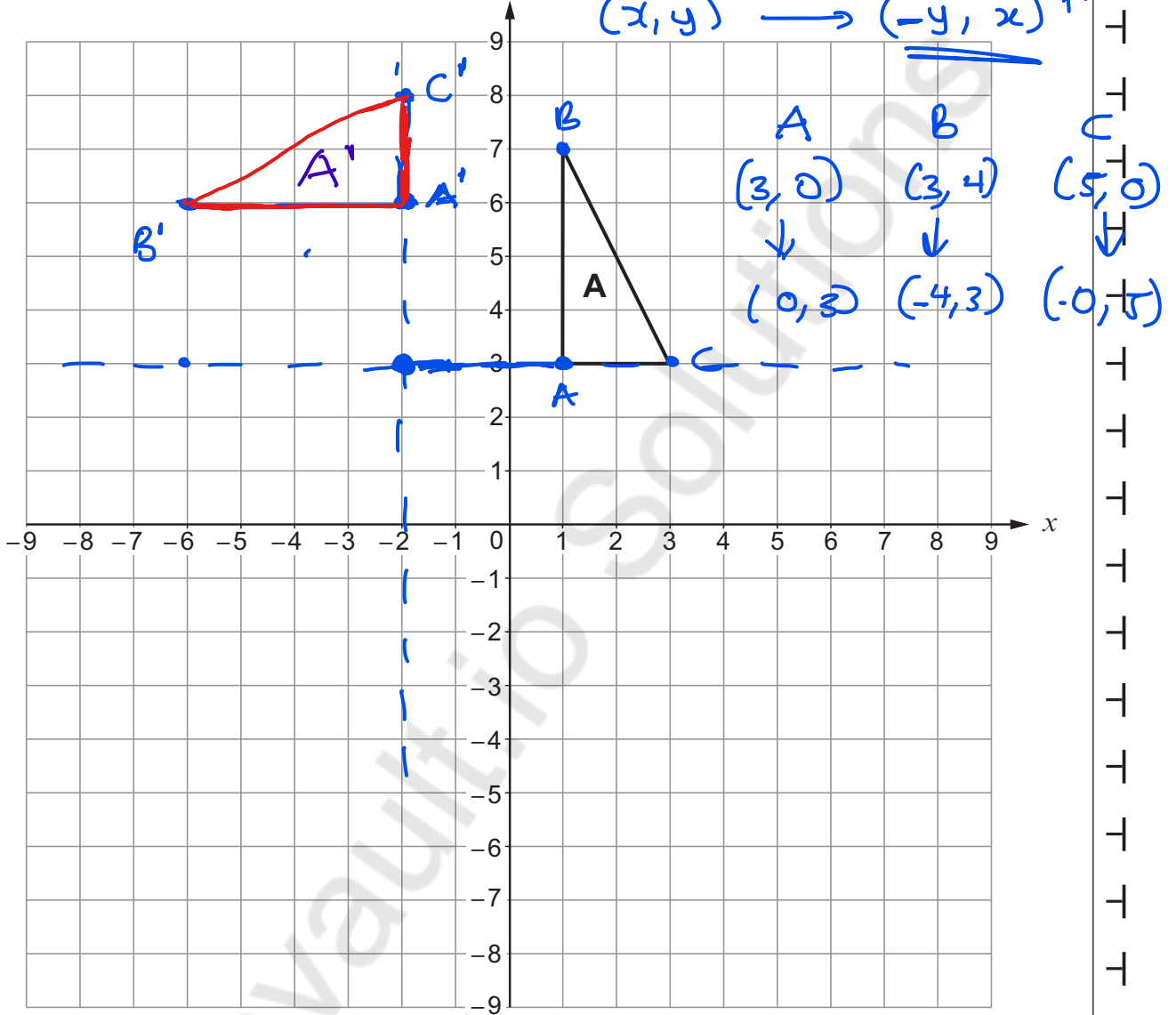
$$f(x) = x^2 + k$$

$$f(x) = x^2 + \underline{\underline{3}}$$

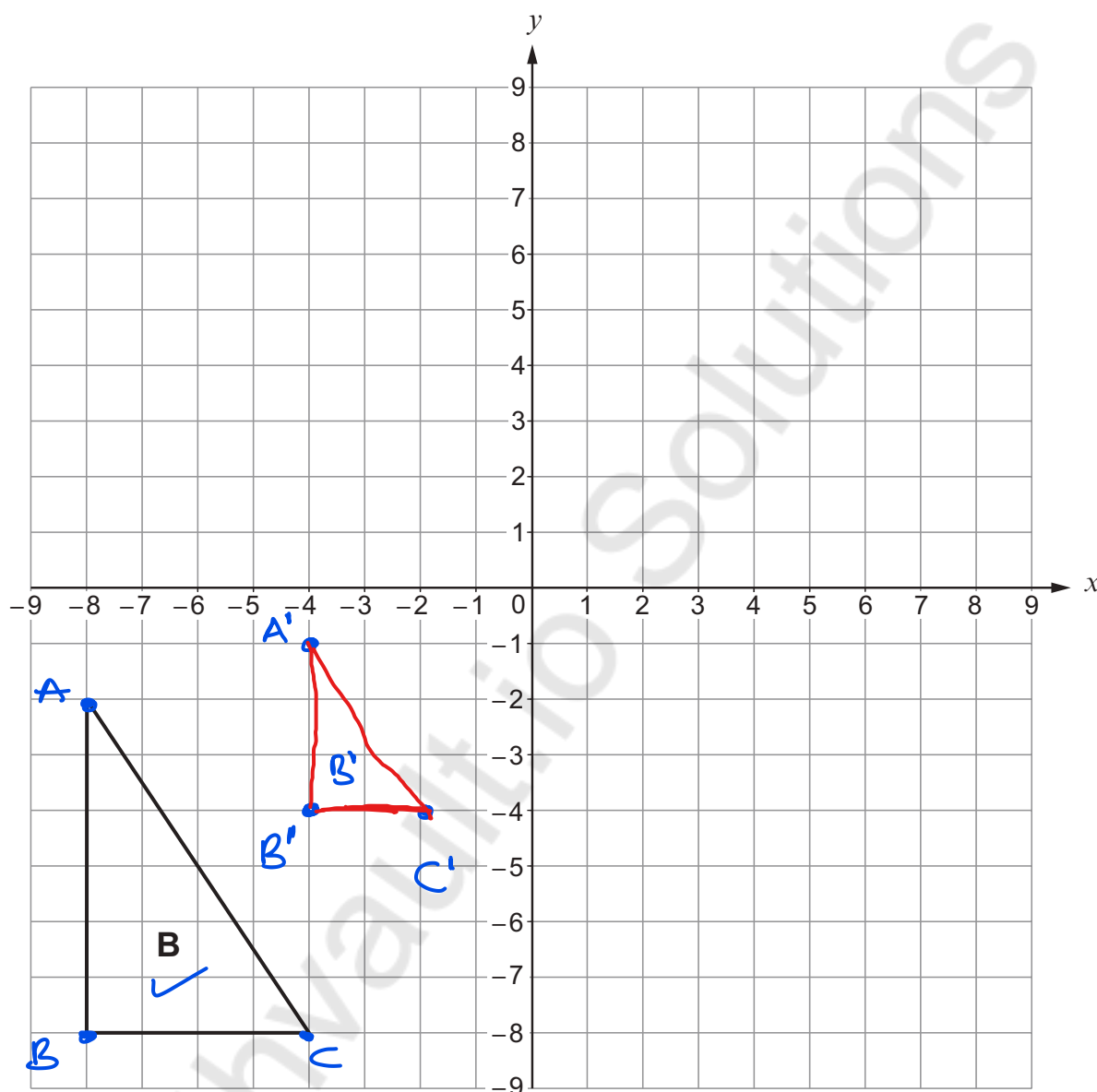


10. (a) Rotate triangle A through 90° anticlockwise, about the point $(-2, 3)$. [2]

Rotating 90° anticlockwise: Transformation is $(x, y) \rightarrow (-y, x)$ *



- (b) Enlarge triangle B by a scale factor of $\frac{1}{2}$, using (0, 0) as the centre of enlargement. [2]



Scale factor $\frac{1}{2}$

$$A(-8, -2) \quad A' = \frac{1}{2} \times (-8, -2) = (-4, -1)$$

$$B(-8, -8) \quad B' = \frac{1}{2} \times (-8, -8) = (-4, -4)$$

$$C(-4, -8) \quad C' = \frac{1}{2} \times (-4, -8) = (-2, -4)$$



11. PQ and PR are tangents to a circle with centre O .
 $\hat{RPQ} = 30^\circ$.

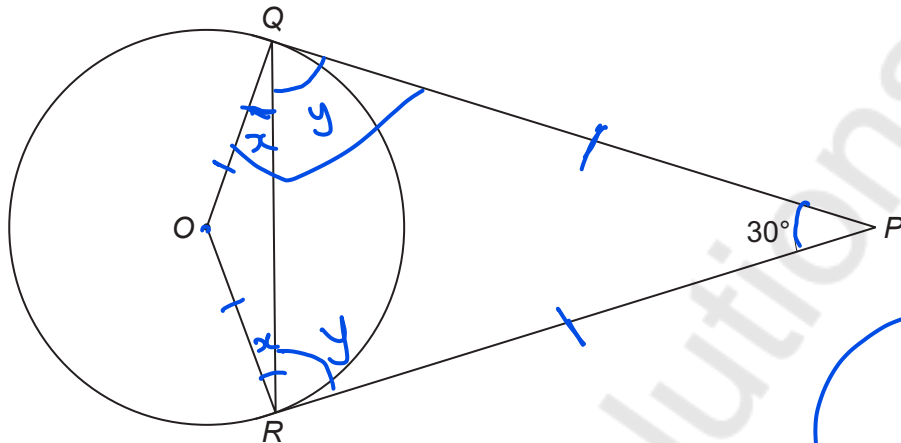
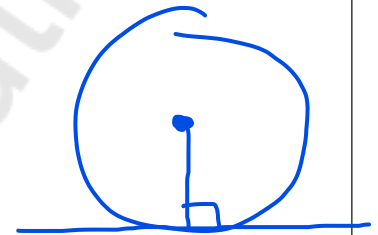


Diagram not drawn to scale



Find the size of \hat{OQR} .

You must indicate any angles you calculate.
 You must give a reason for each stage of your working.

[5]

$$OQ = OR \quad [\text{radii of the circle}]$$

Then $\triangle OQR$ is isosceles triangle.

$$\angle OQR = \angle ORP = 90^\circ \quad [\text{Tangent of a circle}]$$

$$RP = PQ \quad [\text{equidistant from the circumference of the circle}].$$

$$y + y + 30 = 180 \quad [\text{sum of angles in a triangle}]$$

$$2y + 30 = 180$$

$$2y = 180 - 30$$

$$2y = 150$$

$$y = \frac{150}{2} = 75^\circ$$

$$x + y = 90^\circ$$

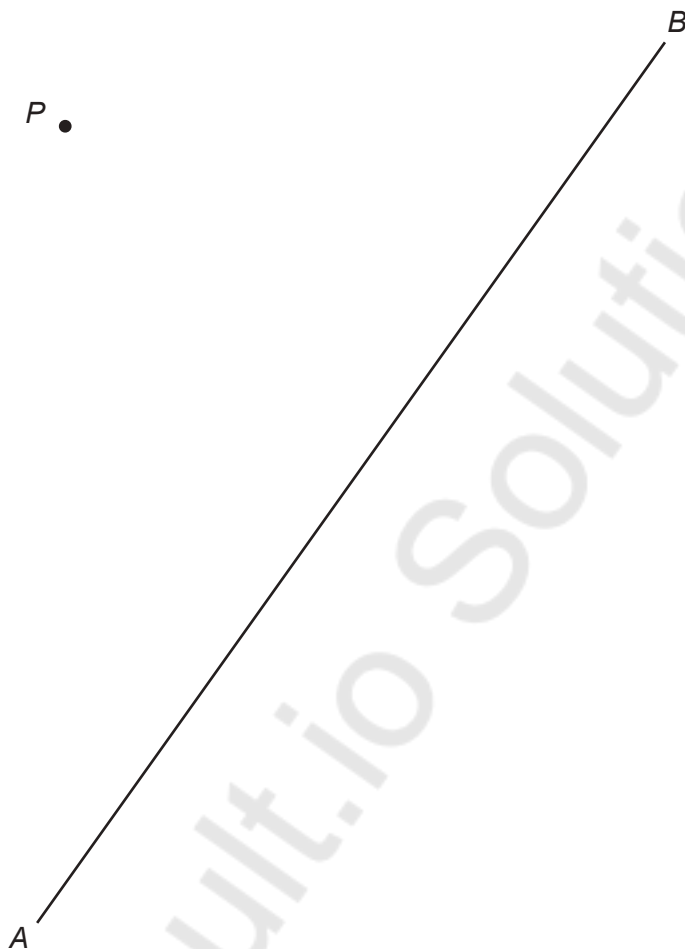
$$x + 75 = 90^\circ$$

$$x = 90 - 75 = 15^\circ$$

$$\hat{OQR} = \underline{\underline{15^\circ}}$$



12. Using only a ruler and a pair of compasses, construct a perpendicular line from the point P to the line AB . [3]



18
 $1 = 10^0 \rightarrow A \times 10^n \rightarrow \text{Integer}$

13. (a) Express 0.00042 in standard form. [1]

0.00042
 $n = -4$
 4.2×10^{-4}

(b) Calculate the value of $\frac{7.2 \times 10^6}{2 \times 10^{-2}}$. [1]

$\frac{a^m}{a^n} = a^{m-n}$

Give your answer in standard form.

$\frac{7.2 \times 10^6}{2 \times 10^{-2}} = 3.6 \times 10^{6-(-2)} = 3.6 \times 10^8$

(c) Calculate the value of $(4.7 \times 10^5) - (6.2 \times 10^4)$. [2]
 Give your answer in standard form.

$(4.7 \times 10^5) - (6.2 \times 10^4)$
 $6.2 = 0.62 \times 10^1$

$(4.7 \times 10^5) - (0.62 \times 10^1 \times 10^4)$

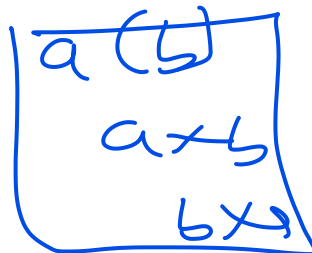
$(4.7 \times 10^5) - (0.62 \times 10^5)$

$ax - bx = x(a-b)$

$10^5 (4.7 - 0.62)$

$10^5 (4.08)$

4.08×10^5



$2 \overline{) 7.2}$
 $\underline{6}$
 1.2
 $\underline{1.2}$
 0

4.7
 $\underline{-0.62}$
 4.08



14. A group of pupils from a school took part in The Urdd National Eisteddfod. All of them competed in at least one of the following competitions: Singing, Dancing or Reciting.

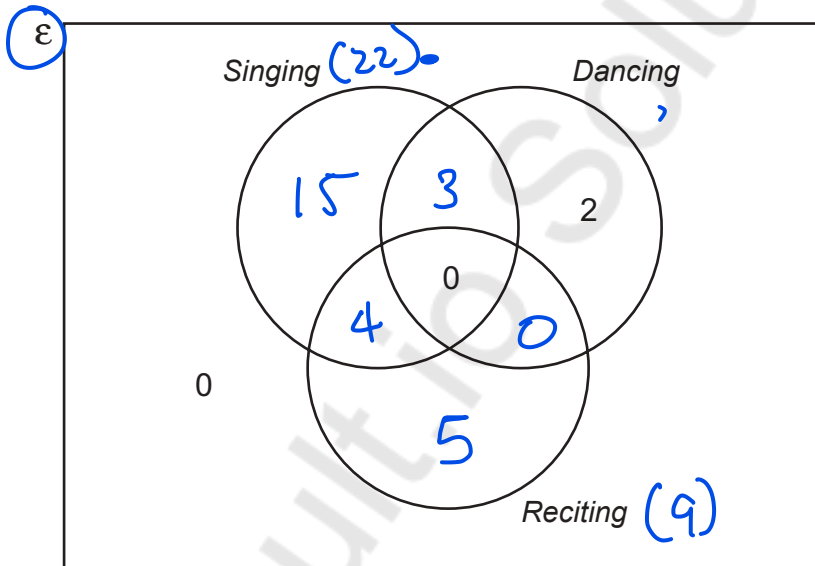
- 2 of them only took part in a Dancing competition.
- 5 only took part in a Reciting competition.
- No one took part in both a Reciting and a Dancing competition.
- 3 took part in both a Singing and a Dancing competition.
- 9 took part in a Reciting competition.
- 22 took part in a Singing competition.

The Venn diagram below shows some of the above information. The universal set, \mathcal{E} , contains all of the pupils in the group.

One of the pupils in the group is chosen at random. What is the probability that this person **only** took part in a Singing competition? [5]

22
- 7

15



$$\mathcal{E} = 15 + 3 + 4 + 2 + 5$$

$$\mathcal{E} = 29$$

$$\Pr(\text{only singing}) = \frac{\text{Number of people that sing only (15)}}{\text{Total number of people (29)}}$$

$$\Pr(\text{only singing}) = \frac{15}{29}$$



15. Factorise $x^2 - 7x - 18$, and hence solve $x^2 - 7x - 18 = 0$.

[3]

$$\begin{array}{l}
 1x^2 - 7x - 18 \\
 \hline
 1x - 18 = -18
 \end{array}
 \quad
 \begin{array}{l}
 x^2 - 9x + 2x - 18 \\
 \hline
 x(x-9) + 2(x-9) \\
 \hline
 (x-9)(x+2)
 \end{array}$$

Factors of -18	Add the factors
$-6 \times 3 = -18$	$-6 + 3 = -3$
$6 \times -3 = -18$	$6 + (-3) = 3$
$9 \times -2 = -18$	$9 + (-2) = 7$
$-9 \times 2 = -18$	$-9 + 2 = -7$

$$x^2 - 7x - 18 = (x-9)(x+2)$$

$$x^2 - 7x - 18 = 0$$

$$a \times b = 0$$

$$a = 0 \text{ OR } b = 0$$

$$\text{Since } x^2 - 7x - 18 = (x-9)(x+2)$$

$$(x-9)(x+2) = 0$$

$$x-9 = 0 \quad \text{OR} \quad x+2 = 0$$

$$x = 0 + 9 \quad \text{OR} \quad x = 0 - 2$$

$$x = 9 \quad \text{OR} \quad -2$$



16. Solve the following simultaneous equations using an algebraic (not graphical) method. [4]

$$4x - 3y = 2$$

$$6x - 5y = 1$$

Using elimination method

$$4x - 3y = 2 \quad \text{--- (i)} \quad \times 3$$

$$6x - 5y = 1 \quad \text{--- (ii)} \quad \times 2$$

4 and 6

$$\text{LCM} = 12$$

$$12x - 9y = 6$$

$$\Rightarrow 12x - 10y = 2$$

$$-9y \quad \text{---} \quad -10y$$

$$0 + y = 4$$

$$\underline{\underline{y = 4}}$$

From equation (i)

$$4x - 3y = 2$$

Since $y = 4$

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

$$4x - 12 = 2$$

$$+12 \quad +12$$

$$4x = 14$$

$$x = \frac{14}{4} = \frac{7}{2} = 3.5$$

$$\underline{\underline{x = \frac{7}{2}, \quad y = 4}}$$



17. A cylinder just fits inside a hollow cube with sides of length m cm.

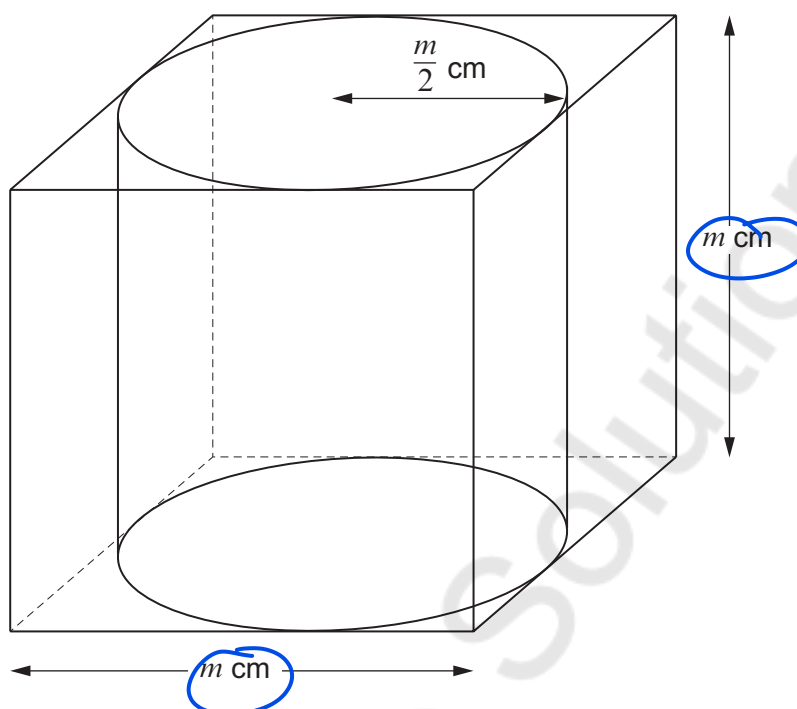


Diagram not drawn to scale

The radius of the cylinder is $\frac{m}{2}$ cm.

The height of the cylinder is m cm.

The ratio of the volume of the cube to the volume of the cylinder is given by

volume of cube : volume of cylinder

$$= k : \pi,$$

where k is a number.

$$S = m$$

Find the value of k .

You must show all your working.

[4]

$$V_{\text{cube}} = \text{Base Area} \times \text{Height}$$

$$V_{\text{cube}} = S^2 \times S$$

$$V_{\text{cube}} = S^3$$

$$V_{\text{cube}} = m^3 \text{ cm}^3$$

$$\text{Volume cylinder} = \text{Base Area} \times \text{Height}$$

$$V_{\text{cylinder}} = \pi r^2 \times h$$



$$r = \frac{m}{2} \quad h = m$$

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only

$$V_{\text{cylinder}} = \pi r^2 h$$

$$V_{\text{cylinder}} = \pi \times \left(\frac{m}{2}\right)^2 \times m = \pi \times \frac{m^2}{4} \times m$$

$$V_{\text{cylinder}} = \frac{\pi m^3}{4} \text{ cm}^3$$

$$\text{Volume of cube} : \text{Volume of cylinder} = k : \pi$$

$$V_{\text{cube}} : V_{\text{cylinder}} = \frac{V_{\text{cube}}}{V_{\text{cylinder}}} = m^3 \div \frac{\pi m^3}{4}$$

$$V_{\text{cube}} : V_{\text{cylinder}} = \cancel{m^3} \times \frac{4}{\pi \cancel{m^3}} = \frac{4}{\pi}$$

END OF PAPER

$$V_{\text{cube}} : V_{\text{cylinder}} = \frac{4}{\pi} = 4 \div \pi$$

$$V_{\text{cube}} : V_{\text{cylinder}} = \textcircled{k} : \pi = \textcircled{4} : \pi$$

$$\underline{\underline{k = 4}}$$



Question number	Additional page, if required. Write the question number(s) in the left-hand margin.
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