Surname	Centre Number	Candidate Number
Other Names		0

GCSE

3300U30-1

A17-3300U30-1

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	7
2.	3	10
3.	7	17
4.	3	20
5.	6	26
6.	9	35
7.	5	40
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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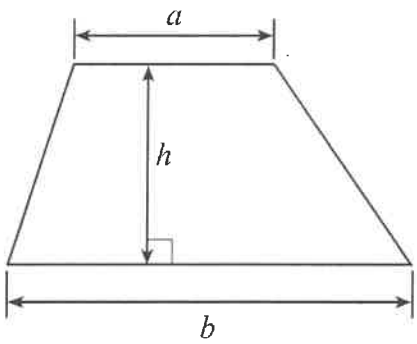
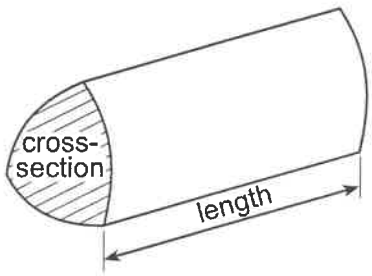
Formula List – Intermediate Tier

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



Volume of prism = area of cross-section × length



Examiner only

1. Calculate each of the following.

(a) $3^4 \times 10^3$ [2]

$3 \times 3 \times 3 \times 3 = 81$ $\quad 27 \times 3 = 81$

$10 \times 10 \times 10 = 1000$ $\quad £1 \times 1000 = £1000$

(b) $\frac{1}{0{\cdot}5}$ [1]

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

(c) $5{\cdot}6 - 3{\cdot}82$ [1]

$5.60 - 3.82 = 1.78$

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

$\frac{5}{6} - \frac{4}{6} = \frac{1}{6}$

(e) $0{\cdot}2 \times 0{\cdot}3$ [1]

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

3300U301
03

Examiner only

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

Space for working:

$\frac{a}{4} \div \frac{a}{1} \Rightarrow \frac{a}{4} \times \frac{1}{a} = \frac{1}{4}$ ✓

$a = 1 \quad \frac{1}{4} \div 1$ ✓

$a = 2 \quad \frac{2}{4} \div 2 \quad \frac{1}{2} \div 2 = \frac{1}{4}$ ✓

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

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

$6 = 6$ ✓

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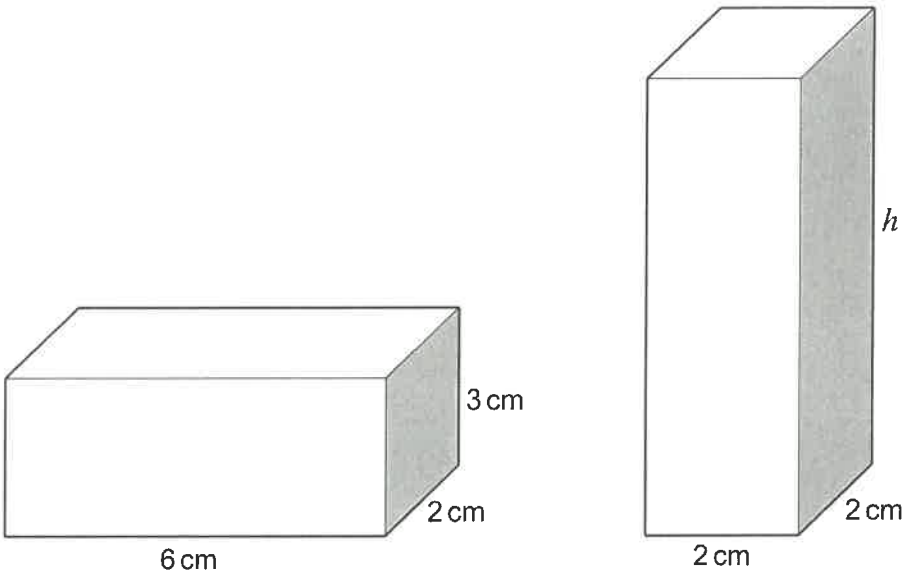
3. *(a)* *In this part of the question, you will be assessed on the quality of your organisation, communication and accuracy in writing.*

The two cuboids shown below have equal volumes.



Cuboid A **Cuboid B**

Diagrams not drawn to scale

Calculate the height h of Cuboid B.
You must show all your working. [4 + 2 OCW]

Volume of A: $6 \times 2 \times 3 = 36$ cm^3

Volume of B: $2 \times 2 \times h = 4h$ cm^3

Now Volume of A = Volume of B

$36 = 4h$

$h = 9$

So the height of cuboid B is 9 cm

(b) How many cubic centimetres (cm^3) are there in 2·5 litres? [1]

1 Litre = 1000 cm^3

2.5 L = 2500 (×2.5)

2·5 litres = 2500 cm^3

3300U301
05

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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%.

Write down the fraction as $\frac{a}{b}$, where a and b are whole numbers. [3]

0.2 0.4 | 0.6 | 0.8

0.5

75%

$\frac{6}{10}$

Answer = $\frac{3}{5}$

Examiner only

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

22 21 18 13 ..... 6 ..... -3

-1 -3 -5 -7 -9

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

$15x - 10$

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

$-4x \quad -4x$

$5x + 3 = 5$

$-3 \quad -3$

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

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

3300U301
07

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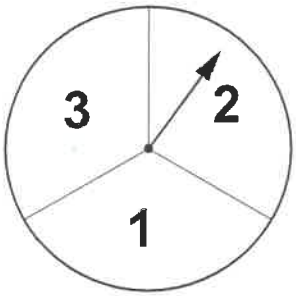
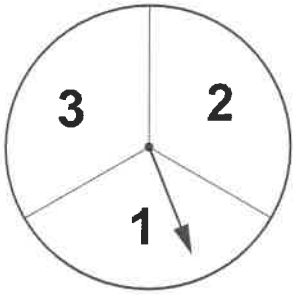
6. Sara is in charge of a game at her school's Christmas party.

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



1st Spinner



2nd Spinner

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]

11 ~~21~~ 31
~~12~~ ~~22~~ ~~32~~ 9 different n°'s
13 23 ~~33~~

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

11, 13, 23, 31

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

$\frac{4}{9}$

Examiner only

(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]

Game earns $180 \times £1 = £180$

No of winners $= \frac{4}{9} \times 180$

$= 4 \times 20 = 80$ winners.

Game pays $= 80 \times £2 = £160$

So profit $= 180 - 160 = £20$

3300U301
09

4 sides, interior angles add to 360°

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7. $ABCD$ is a quadrilateral.
$A\hat{B}C = 93°$, $B\hat{C}D = 122°$ and $A\hat{D}C = 85°$.
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]

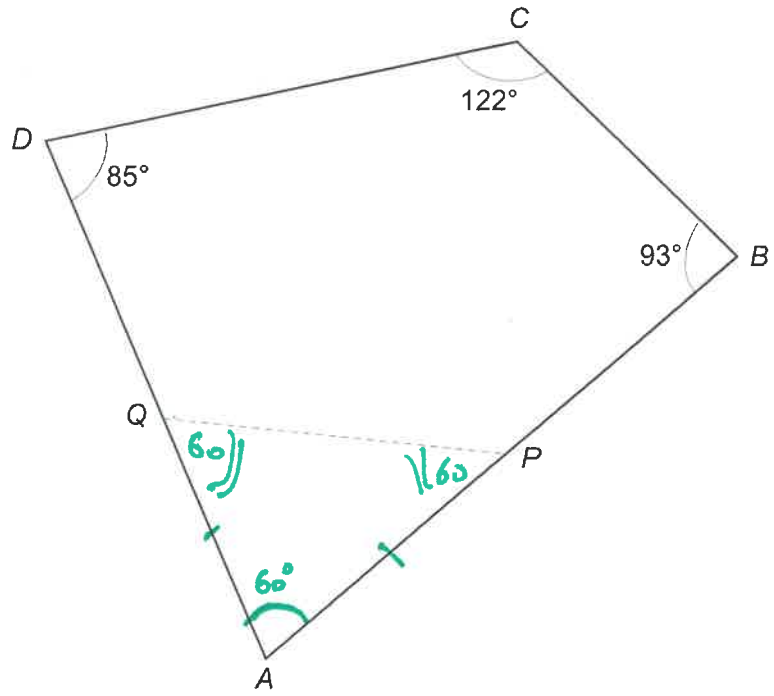


Diagram not drawn to scale

122
85
+ 93
300
2 1

$\hat{DAB} = 360° - 300 = 60°$

because $AQ = AP$, $\triangle APQ$ is isosceles

$A\hat{Q}P = A\hat{P}Q$

$180 - 60 = 120 \div 2 = 60°$

∴ all angles in $\triangle APQ$ are 60° so it is equilateral

Examiner only

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

(a) Its diagonals intersect at 90°.
Only one diagonal is a line of symmetry. [1]

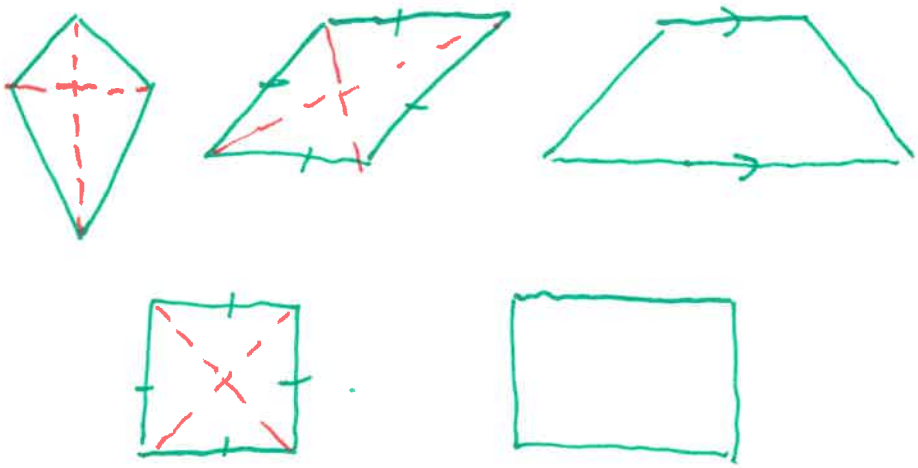
Kite Rhombus Square Trapezium Rectangle

(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

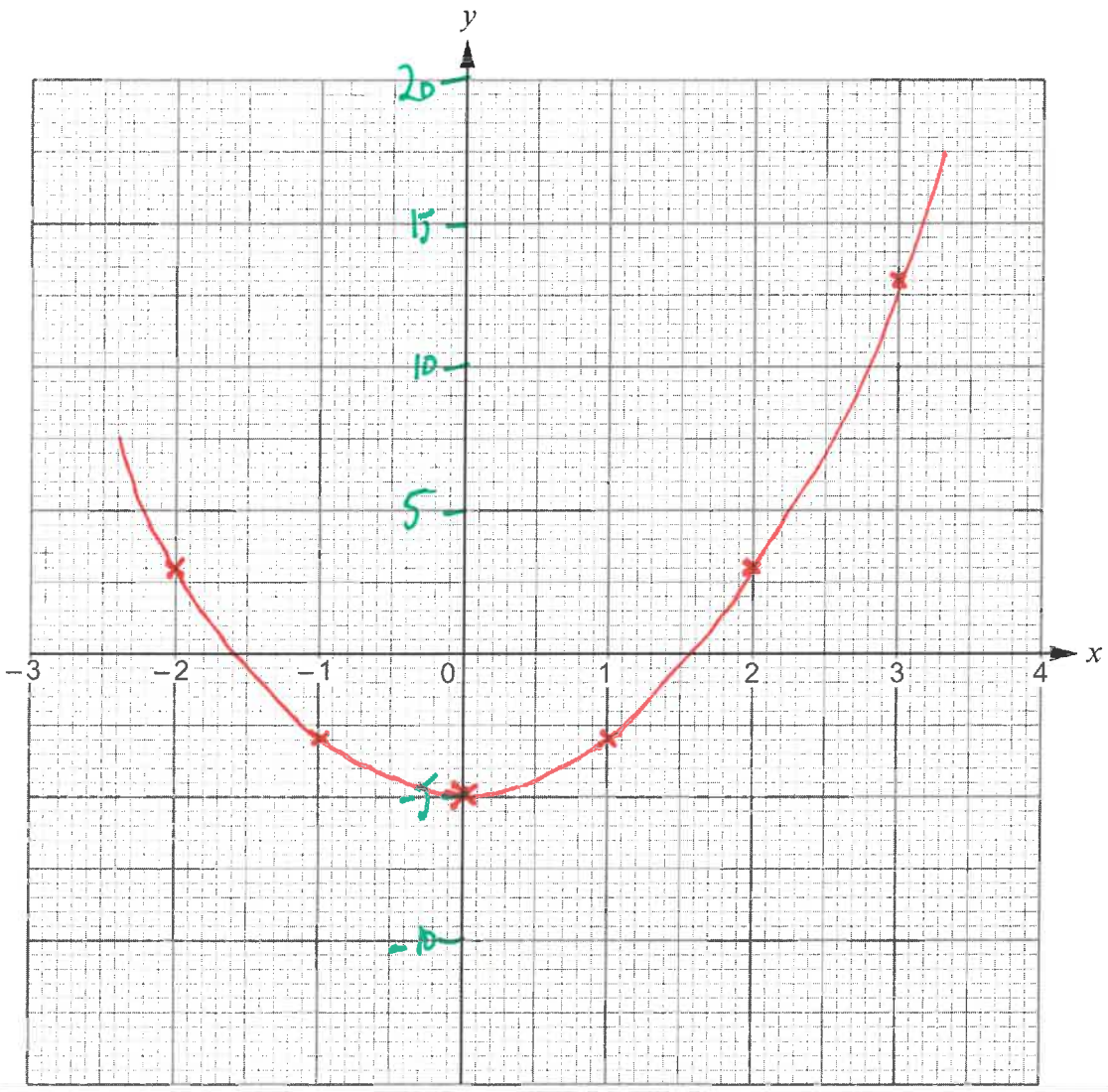


Examiner only

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. [4]

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

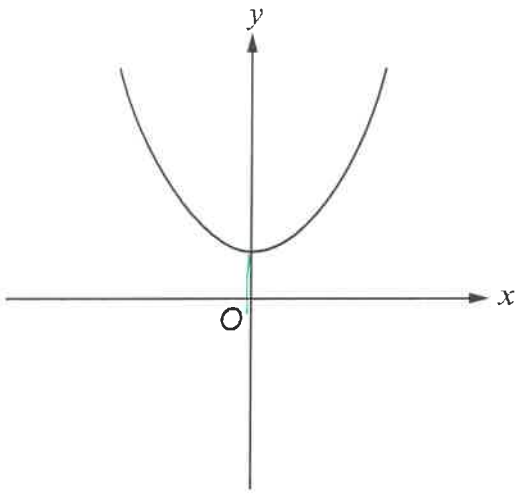
$y = 2(-1)^2 - 5$
$= 2 \times 1 - 5$
$= 2 - 5 = -3$



0.5 9

Examiner only

(b)



The sketch above can represent only one of the equations given below.
Circle this equation. [1]

$y = x^2$ $\quad y = x^2 - 3$ $\quad y = -x^2$ $\quad y = x^2 + 3$ $\quad y = 3x$

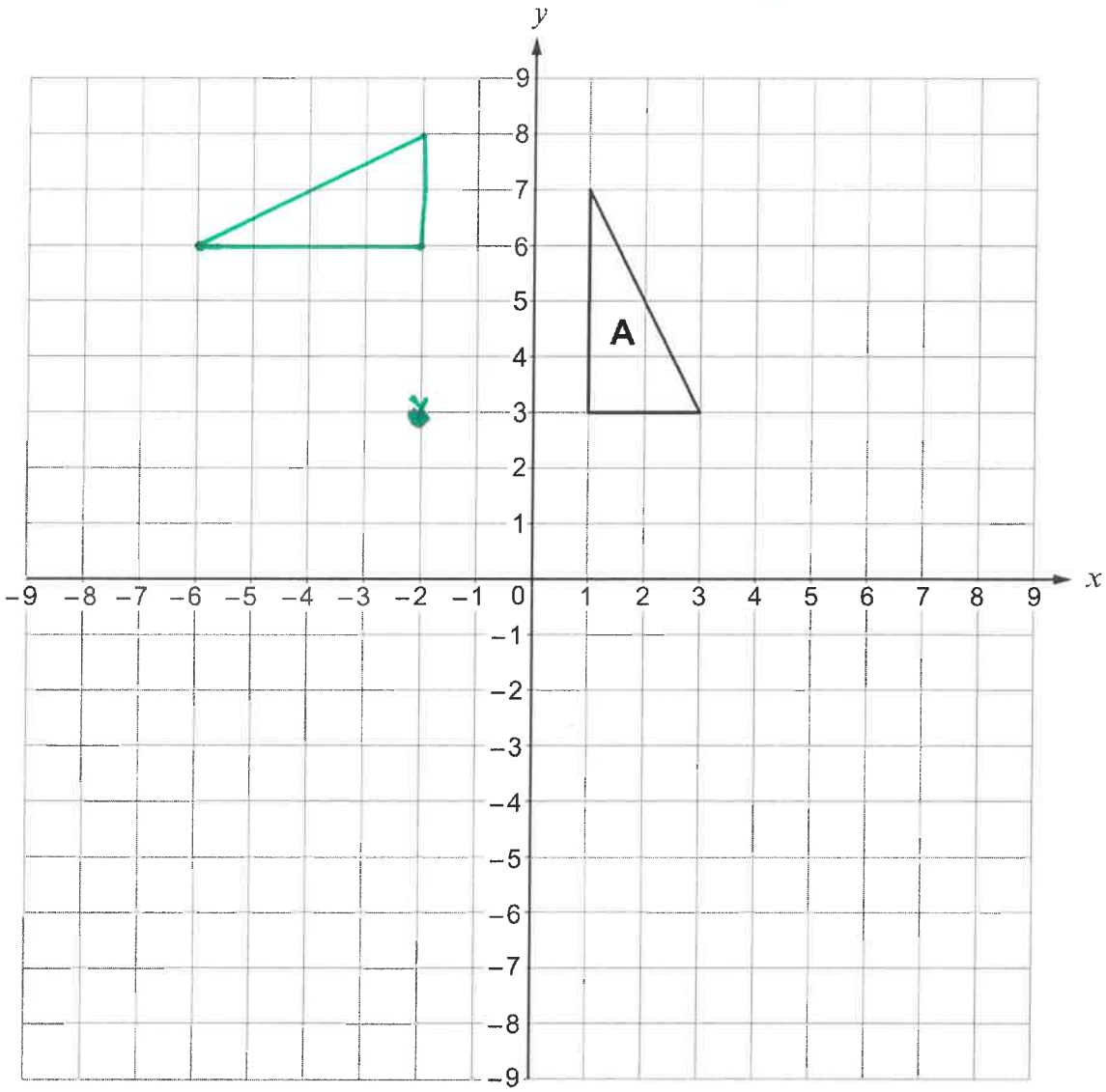
$x = 0$

$y = 0^2$ $\quad y = 0^2 - 3$ $\quad y = -0^2$ $\quad y = 0^2 + 3$ $\quad y = 3 \times 0$

$= 0$ $\quad y = -3$ $\quad = 0$ $\quad y = +3$ $\quad = 0$

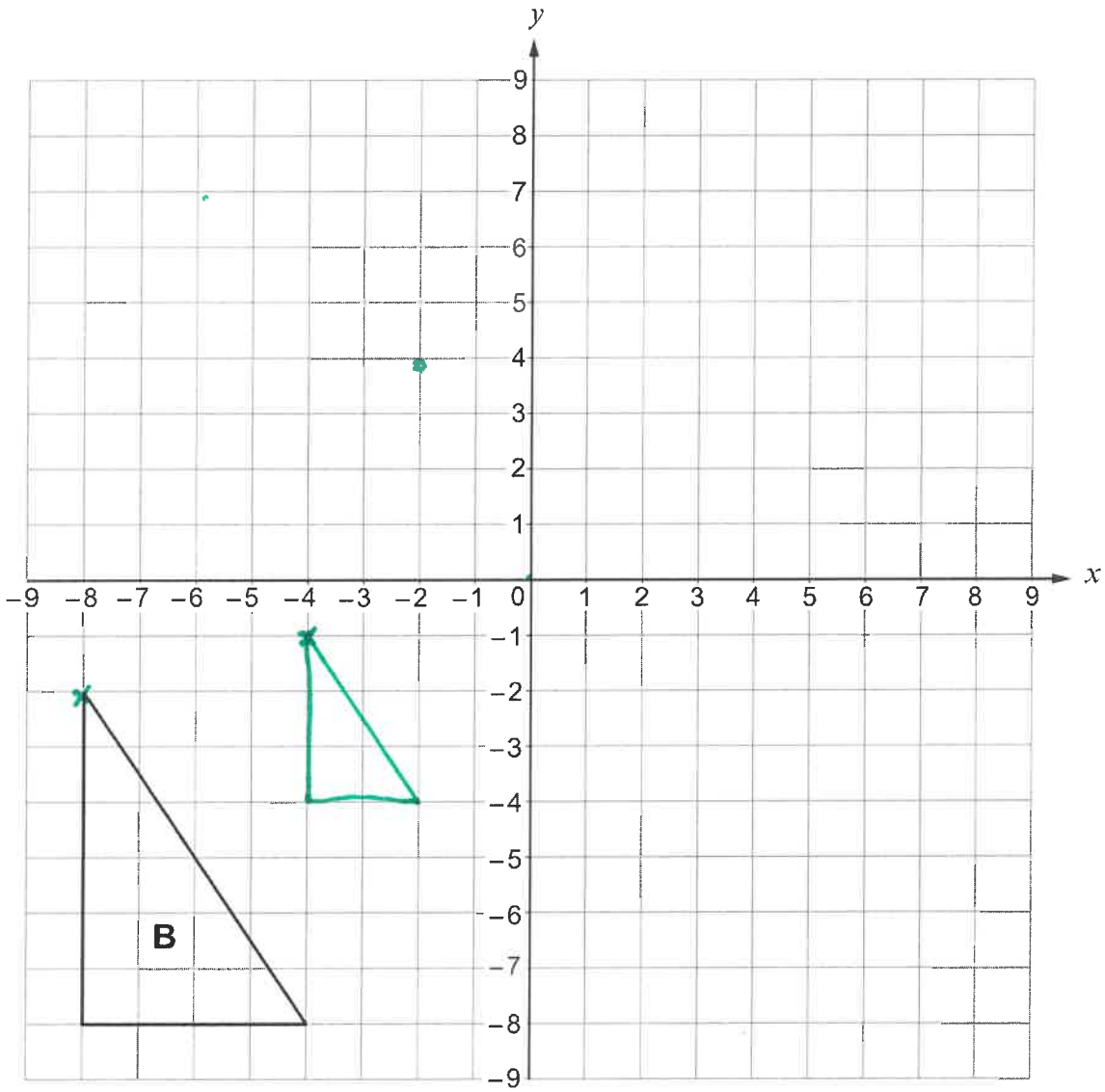
Examiner only

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



Examiner only

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



Examiner only

11. PQ and PR are tangents to a circle with centre O.
$R\hat{P}Q = 30°$.

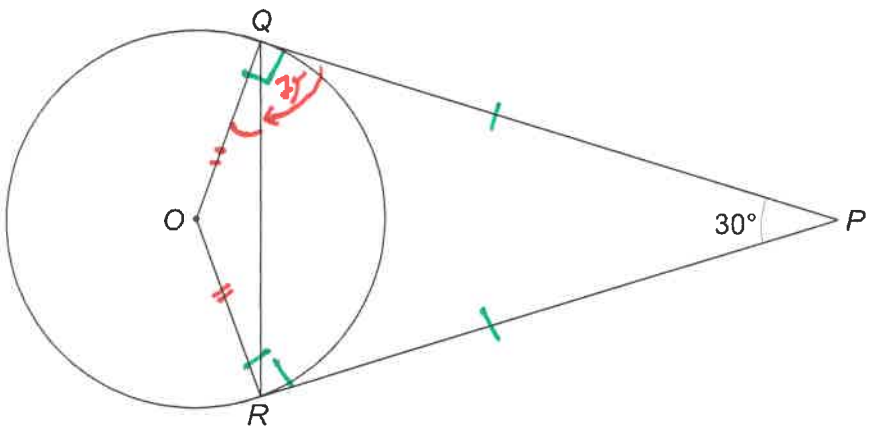


Diagram not drawn to scale

Find the size of $O\hat{Q}R$.

You must indicate any angles you calculate.
You must give a reason for each stage of your working. [5]

$\hat{PQO} = 90°$ (angle between tangent + radius is 90° angle)

$\triangle PQR$ is isosceles (lines between a point & tangent to circle are the same length)

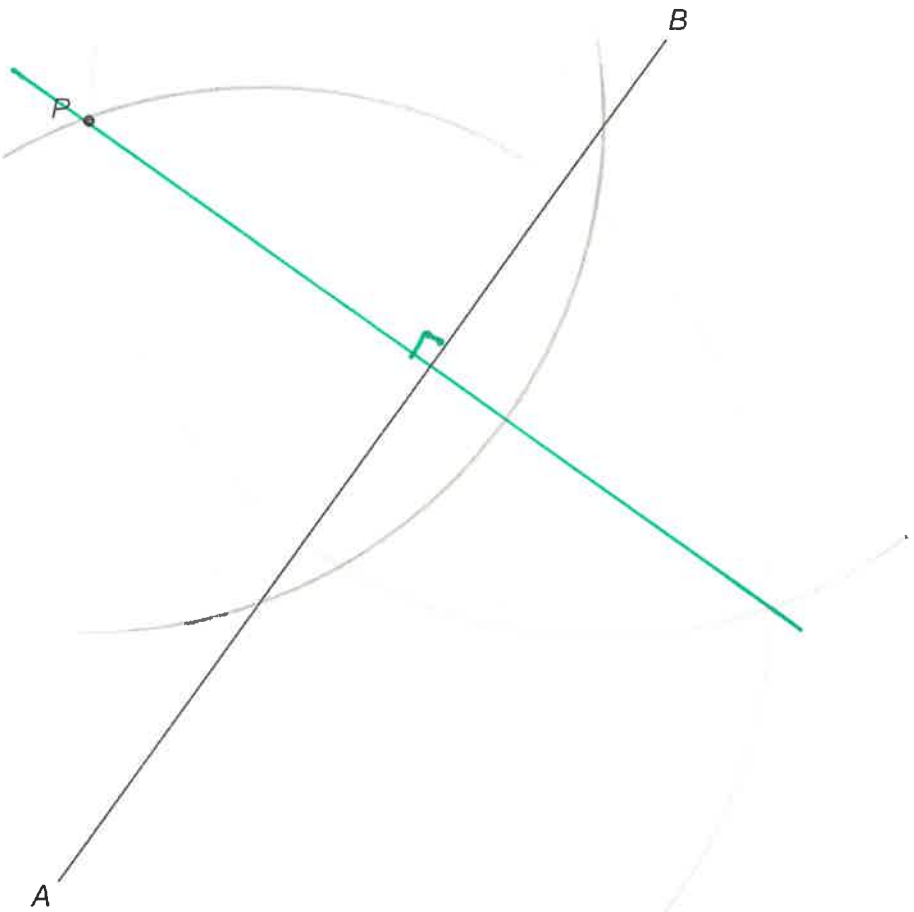
So $\hat{PQR} = 180 - 30 = 150 \div 2 = 75°$

So $\hat{OQR} = 90 - 75 = 15°$

$O\hat{Q}R =$ ..... °

Examiner only

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



Examiner only

13. *(a)* Express 0·00042 in standard form. [1]

4.2×10^{-4}

(b) Calculate the value of $\dfrac{7{\cdot}2 \times 10^{6}}{2 \times 10^{-2}}$.

Give your answer in standard form. [1]

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

(c) Calculate the value of $(4{\cdot}7 \times 10^{5}) - (6{\cdot}2 \times 10^{4})$.
Give your answer in standard form. [2]

4.08×10^{5}

H T U

10^{6} 10^{5} 10^{4} 10^{3} 10^{2} 10^{1} 10^{0} . 10^{-1} 10^{-2} 10^{-3} 10^{-4} 10^{-5}

0 . 0 0 0 4 2

4 $\overset{6}{\cancel{7}}$ 0 0 0 0 .

− 6 2 0 0 0 .

4 0 8 0 0 0

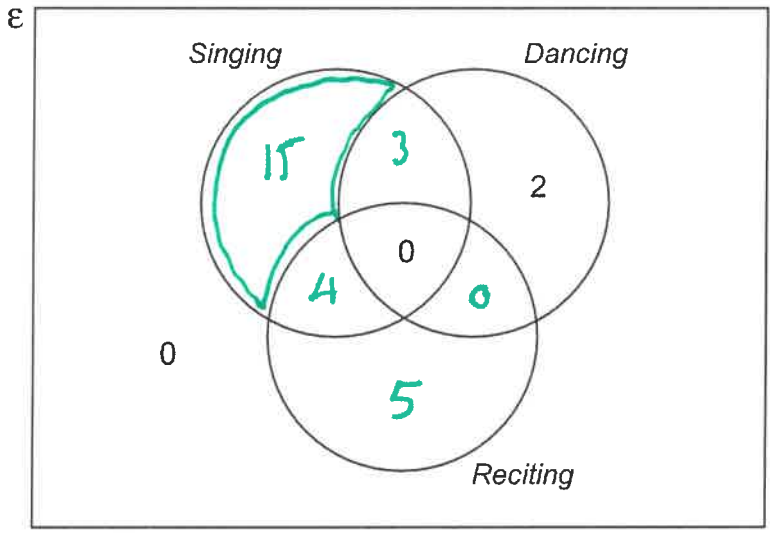
Examiner only

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, ε, 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]



$\frac{15}{29}$

Turn over.

Examiner only

15. Factorise $x^2 - 7x - 18$, and hence solve $x^2 - 7x - 18 = 0$. [3]

1 18 x
+2 −9
3 6

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

either $x=-2$
or $x=9$

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

Examiner only

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

$4x - 3y = 2$ — (1)
$6x - 5y = 1$ — (2).

(1) × 3 $12x - 9y = 6$ — (3)

(2) × 2 $12x - 10y = 2$ — (4)

(3) − (4) $-9y + 10y = 4$

$y = 4$

Substitute y in (1)

$4x - 3(4) = 2$

$4x - 12 = 2$

$+12 \quad +12$

$4x = 14$

$x = \frac{14}{4} = \frac{7}{2} = 3\frac{1}{2} = 3.5$

Examiner only

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

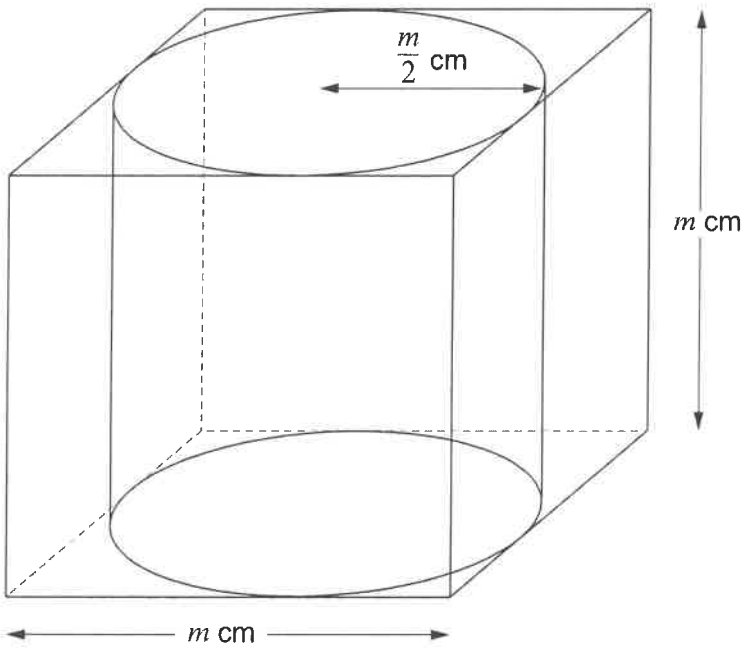


Diagram not drawn to scale

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.

Find the value of k.
You must show all your working. [4]

Volume of cube $= m \times m \times m = m^3$

Volume of cylinder $= \pi \times \left(\frac{m}{2}\right)^2 \times m = \pi \times \frac{m^2}{4} \times m = \frac{\pi m^3}{4}$

Ratio $m^3 : \frac{\pi}{4} m^3$

$\div m^3$ ↓ $1 : \frac{\pi}{4}$ ↓ $\times 4$

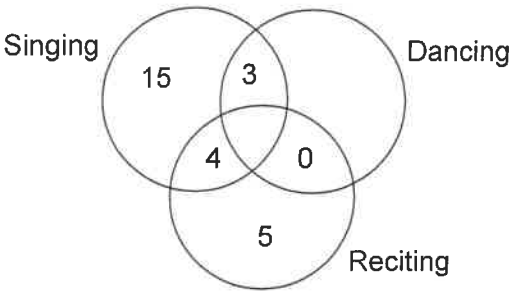
$\times 4$ ↓ $4 : \pi$

So $k = 4$

GCSE Mathematics Unit 1: Intermediate Tier Autumn 2017 Final Mark Scheme	Mark	Comments
1.(a) 81 000	B2	B1 for sight of either 81 or 1000.
1.(b) 2	B1	Allow 2/1. Mark final answer.
1.(c) 1·78	B1	Mark final answer.
1.(d) Correctly using a common denominator. 1/6 or equivalent	M1 A1	Mark final answer.
1.(e) 0.06	B1	Mark final answer.
2. FALSE FALSE TRUE TRUE TRUE	B3	For all 5 correct. B2 for 4 correct. B1 for 3 correct.
3.(a) (Volume of cuboid A =) $6 \times 3 \times 2$ (= $36cm^3$) OR (Volume of cuboid B =) $2 \times 2 \times h$	M1	M1 for sight of 36 OR 4h.
$6 \times 3 \times 2 = 2 \times 2 \times h$ OR $6 \times 3 = 2 \times h$	M1	This implies M1M1.
$\frac{6 \times 3 \times 2}{2 \times 2} = h$ OR $36 = 4h$	m1	Award M1M1m1 for $6 \times 3 \times 2 = 2 \times 2 \times 9$ (but not the A1) Allow correct FT value of 9 if 'their $6 \times 3 \times 2' \neq 36$
(h =) 9(cm)	A1	C.A.O. May be seen on diagram.
Organisation and Communication.	OC1	For OC1, candidates will be expected to: • present their response in a structured way • explain to the reader what they are doing at each step of their response • lay out their explanation and working in a way that is clear and logical
Accuracy of writing.	W1	For W1, candidates will be expected to: • show all their working • make few, if any, errors in spelling, punctuation and grammar • use correct mathematical form in their working • use appropriate terminology, units, etc
3.(b) 2500	B1	Answer space takes precedence.
4. $\frac{3}{5}$ or equivalent fraction (a/b)	B3	B2 for two of the conditions met. B1 for one condition met. Penalise −1 if the answer is given as a decimal or a percentage or a fraction containing a decimal.
5.(a) 6 and −3	B2	B1 for each. Allow F.T. for 2nd number if '9 less than previous number' AND negative.
5.(b) 15x – 10	B1	Must be an expression. Mark final answer.
5.(c) $9x - 4x = 5 - 3$ $5x = 2$ OR $-2 = -5x$ $x = \frac{2}{5}$ or equivalent.	B1 B1 B1	F.T. until 2nd error. Mark final answer. Do not allow $x = -2/-5$. A final answer of '2 ÷ 5' is B1B1B0.

6.(a)	9	B1	Allow a list of all 9 numbers (no repeats or extras).
6.(b)	11, 13, 23, 31.	B2	All correct with no incorrect numbers. B1 for all correct with at most 2 incorrect. B1 for three correct and at most 1 incorrect. B1 for two correct and 0 incorrect.
6.(c)	4/9 ISW	B2	Correct answer OR F.T. 'their number of primes' / 'their (a)', provided the resulting fraction is between 0 and 1. B1 4/x with x>4 OR y/9 with y<9 or equivalent for FT. Penalise -1 if incorrect notation used e.g '4 out of 9'
6.(d)	(Number of winners =) $\frac{4}{9} \times 180$ $= 80$	M1 A1	F.T. 'their 4/9' if less than 1. M0 for '4/9 of 180' unless correct evaluation shown. A0 if incorrect reduction in (c) is used.
	(Expected profit =) (£)180 – 80 × (£)2 = (£)20	M1 A1	F.T. 'their stated 80'. If the FT results in a loss then 'Loss' must be stated or the answer left as a negative.
7.	(BÂD =) 360 – (85 + 122 + 93) = 60(°)	M1 A1	*This is a 'proof' question so the work for the M1 mark must be seen before the A1 mark can be awarded.* F.T. 'their 60' only if previous M1 awarded.
	(APQ = AQP =) $\frac{180-60}{2}$ = 60(°)	M1 A1	Allow reference to isosceles triangle.
	A convincing statement AND the three angles shown as, or stated to be 60(°)	E1	Independent of previous marks. Must refer to three (all) angles being equal. Three angles of 60° must be shown or stated as part of a convincing statement. Reference to equal sides alone is E0.
8.(a)	Kite	B1	
8.(b)	Trapezium	B1	
8.(c)	Rhombus	B1	
9.(a)	−3	B1	
	Scale on y-axis '2cm square ≡ 5 units'. OR '2cm square ≡ 4 units'.	B1	B0 for '2cm square ≡ 10 units'.
	At least 5 correct plots and no incorrect plot.	P1	F.T. 'their (−1,−3)' AND 'their uniform scale' if possible. Allow ±'½ a small square'.
	A smooth curve drawn through their plots.	C1	F.T. 'their 6 plots' OR a curve through the 5 given plots and (−1,−3). Allow for the intention to pass through their plots. (± 1 small square horizontal OR vertical).
9.(b)	$y = x^2 + 3$	B1	
10.(a)	Correct rotation.	B2	Allow B1 for two correct vertices. B1 for a 90° clockwise rotation about (−2,3) OR B1 for a 90° anticlockwise rotation about (3,−2).
10.(b)	Correct enlargement.	B2	Allow B1 for two correct vertices. B1 for an enlargement of scale factor ½ but not centred at (0,0). Must be in the correct orientation. SC1 for a correct enlargement using a scale factor of −1/2 centred at (0,0).

11.		*Note : Both E1 marks are awarded for a suitable/valid attempt at statement (not an implied reason from a calculation).* *Both E marks are dependent on attempt at related work.* *Look for angles seen on the diagram.* *For this question allow angles shown in diagram to take precedence over answer space.*
(RQP or QRP =) $\frac{180-30}{2}$	M1	
$= 75(°)$	A1	
Tangents (from external point) are equal (in length) OR a geometric consequence based on this fact (e.g. 'QPR is isosceles' or ' PQOR is a kite'.	E1	Accept any suitable attempt at a valid statement. Allow PQ = PR. Also allow unambiguous indication on the diagram. 'Angles in a triangle' not sufficient.
(OQR = 90 – 75 =) 15(°)	B1	F.T. 'their derived 75' provided acute.
Tangent and radius (at any point) are perpendicular	E1	Accept any suitable attempt at a valid statement. Also allow unambiguous indication on the diagram.
		Alternative method 1 *(ROQ = 360−90−90−30 =) 150(°) B1* *Tangent and radius (at any point) are perpendicular. E1* *OQR = $\frac{180-150}{2}$ FT 'their derived 150' M1* *= 15(°) A1* *Radii form an isosceles triangle. E1* *Alternative method 2 (with line OP drawn)* *(POQ or RQP=) 180 −90 – 15 M1* *= 75(°) A1* *Tangents (from external point) are equal (in length) OR a geometric consequence based on this fact (e.g. 'QPR is isosceles' or ' PQOR is a kite'. E1* *(OQR = 90 – 75 =) 15(°) B1* *F.T. 'their derived 75' provided acute.* *Tangent and radius (at any point) are perpendicular. E1* *[Note: Do not 'mix and match' marks from alternative methods.]*
12. Arc, centre P, intersecting AB at two points. (B may be one of the points with no arc seen at point B)	M1	[Note to markers: These arcs may be identified by the fact that they will 'cross the line AB at an acute angle'. Arcs 'crossing the line at 90°' is evidence of an inappropriate method.]
Intersecting arcs (equal radii) using the above two points as centres.	m1	
Line drawn	A1	M1 and m1 must be gained before A1 is awarded. *Alternative method.* *Using the properties of a kite.* *Intersecting arcs whose centres are any two points on the line AB and respective radii equal in length to the distance from the points to the point P.* M2 *[Note to markers: The arcs will always intersect at a point that is a 'reflection of point P' in the line AB.]* *Line drawn A1*

13.(a)	$4{\cdot}2 \times 10^{-4}$	B1	
13.(b)	$3{\cdot}6 \times 10^{8}$	B1	
13.(c)	$4{\cdot}08 \times 10^{5}$	B2	B1 for sight of any correct value but not in standard form. e.g. $40{\cdot}8 \times 10^{4}$ or 408000.
14 			
	5 AND 3 AND 0 in correct position. Total of 9 for 'Reciting'. Total of 22 for 'Singing'.	 B1 B1 B1	Allow empty space to imply 0. C.A.O.
	(Probability only took part in '*Singing*') = $\frac{15}{29}$ ISW	B2	15/29 gains all 5 marks. Otherwise, strict F.T. from 'their diagram'. B1 for a correct numerator in a fraction <1. B1 for a correct denominator in a fraction <1. Penalise -1 if incorrect notation used for probability e.g. '15 out of 29'.
15.	$(x - 9)(x + 2)$ $(x =) 9$ AND $(x =) -2$	B2 B1	B1 for $(x \ldots 9)(x \ldots 2)$. Strict F.T. from their brackets. Penalise change of letter −1. If no factorising shown, allow the following. B2 for $x - 9 (=0)$ AND $x + 2 (=0)$ (B1) $(x =) 9$ AND $(x =) -2$ (B1) B1 for $x + 9 (=0)$ AND $x - 2 (=0)$ (B0) $(x =) -9$ AND $(x =) 2$ (B1) FT B1 if only $(x =) 9$ AND $(x =) -2$ seen. (B1)
16.			*No marks for trial and improvement.*
	Method to eliminate variable e.g. equal coefficients with appropriate addition or subtraction.	M1	Allow 1 error in one term, not the term with equal coefficients.
	First variable found, $x = 3\frac{1}{2}$ or $y = 4$.	A1	C.A.O.
	Substitute to find the 2nd variable.	m1	F.T. their '1st variable'.
	Second variable found	A1	

17. (Volume of cube =) m^3 OR $m \times m \times m$ OR $m^2 \times m$	B1	For sight of m^3 or equivalent.
(Volume of cylinder =) $= \frac{\pi m^3}{4}$ OR $\frac{\pi \times m \times m \times m}{4}$ OR $\frac{\pi \times m^2 \times m}{4}$	B2	For sight of $\pi m^3/4$ or equivalent. B1 for $\pi \times \left(\frac{m}{2}\right)^2 \times m$. Also allow this B1 if brackets are missing. $m^3 : \frac{\pi m^3}{4}$ OR $4m^3 : \pi m^3$ OR $1 : \frac{\pi}{4}$ all imply B1B2.
$k = 4$	B1	Allow B1 if left as $4 : \pi$. F.T only for $\pi m^3 / 2$ (giving $k = 2$ or $2 : \pi$) Note : If a value is used for m then mark as above and penalise −1 from total mark gained.