Surname	Centre Number	Candidate Number
Other Names		0

GCSE

3300U50-1

A19-3300U50-1

MONDAY, 11 NOVEMBER 2019 – AFTERNOON

MATHEMATICS
UNIT 1: NON-CALCULATOR
HIGHER TIER

1 hour 45 minutes

ADDITIONAL MATERIALS

The use of a calculator is not permitted in this examination.

A ruler, a 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 additional page at the back of the booklet. Question numbers must be given for all work written on the additional 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 **10**, 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.	**4**	
2.	**5**	
3.	**4**	
4.	**3**	
5.	**4**	
6.	**6**	
7.	**3**	
8.	**7**	
9.	**3**	
10.	**9**	
11.	**4**	
12.	**4**	
13.	**4**	
14.	**3**	
15.	**5**	
16.	**4**	
17.	**4**	
18.	**4**	
Total	**80**	

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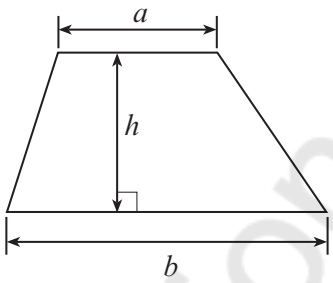
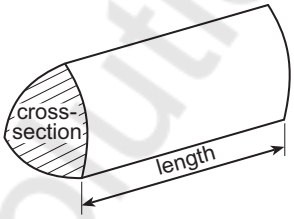
Formula List - Higher Tier

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



Volume of prism = area of cross-section × length

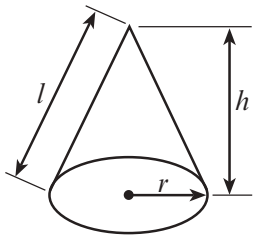


Volume of sphere = $\frac{4}{3}\pi r^3$

Surface area of sphere = $4\pi r^2$

Volume of cone = $\frac{1}{3}\pi r^2 h$

Curved surface area of cone = $\pi r l$

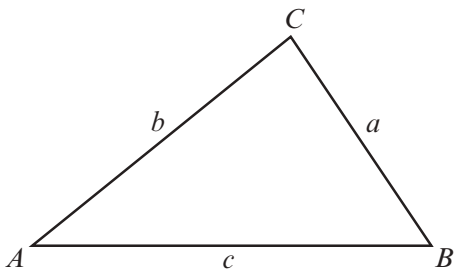


In any triangle ABC

Sine rule $\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$

Cosine rule $a^2 = b^2 + c^2 - 2bc\cos A$

Area of triangle = $\frac{1}{2}ab\sin C$



The Quadratic Equation

The solutions of $ax^2 + bx + c = 0$ where $a \neq 0$ are given by $x = \frac{-b \pm \sqrt{(b^2 - 4ac)}}{2a}$

Annual Equivalent Rate (AER)

AER, as a decimal, is calculated using the formula $\left(1+\frac{i}{n}\right)^n - 1$, where i is the nominal interest rate per annum as a decimal and n is the number of compounding periods per annum.

Examiner only

1. The exterior angle of a regular polygon is 36°.

(a) How many sides does the polygon have? [2]

$n = \frac{360}{36}$

$n = 10$

(b) Calculate the sum of all the interior angles of this regular polygon. [2]

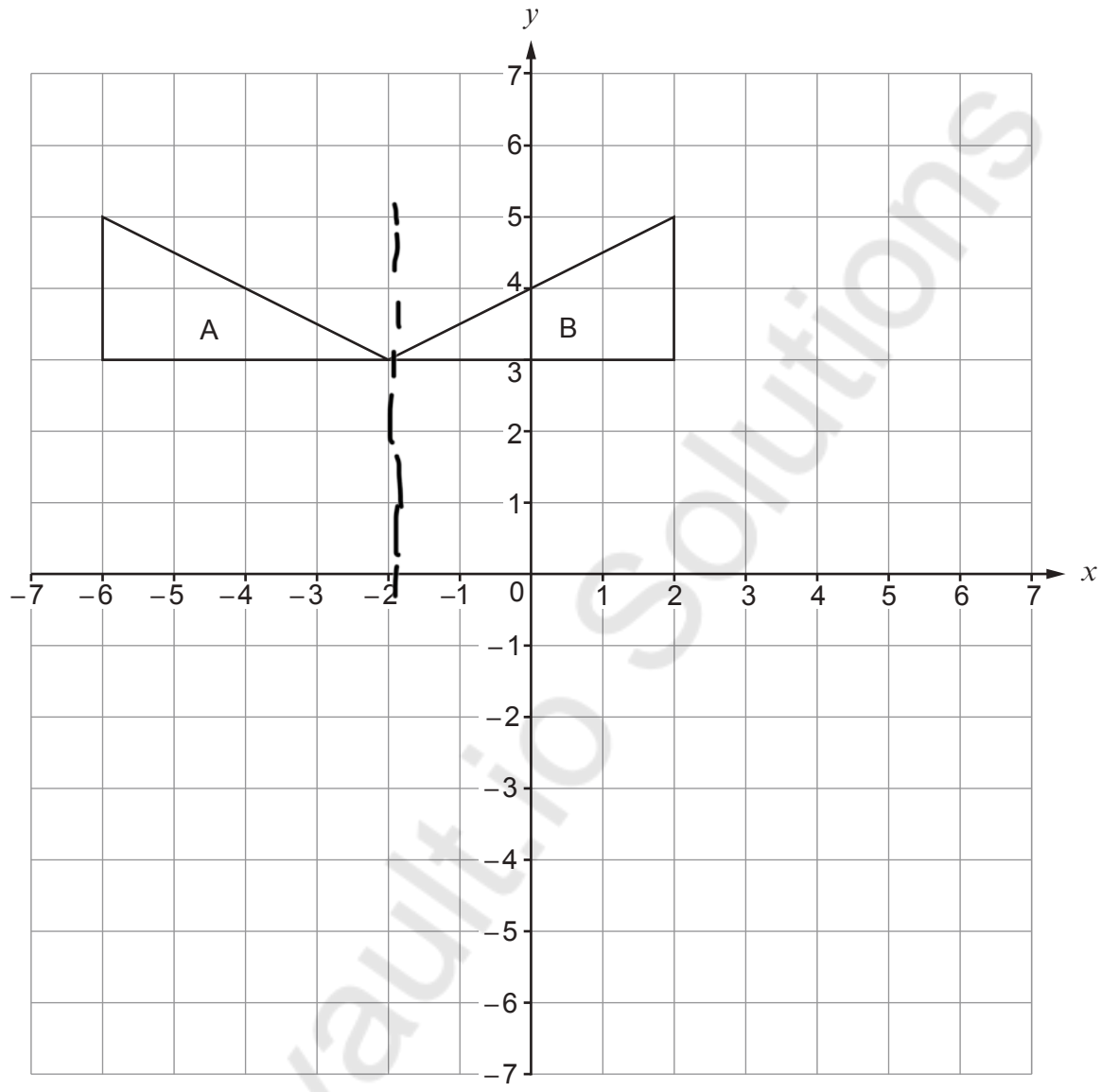
$180(10-2)$

180×8

$= 1440°$

Examiner only

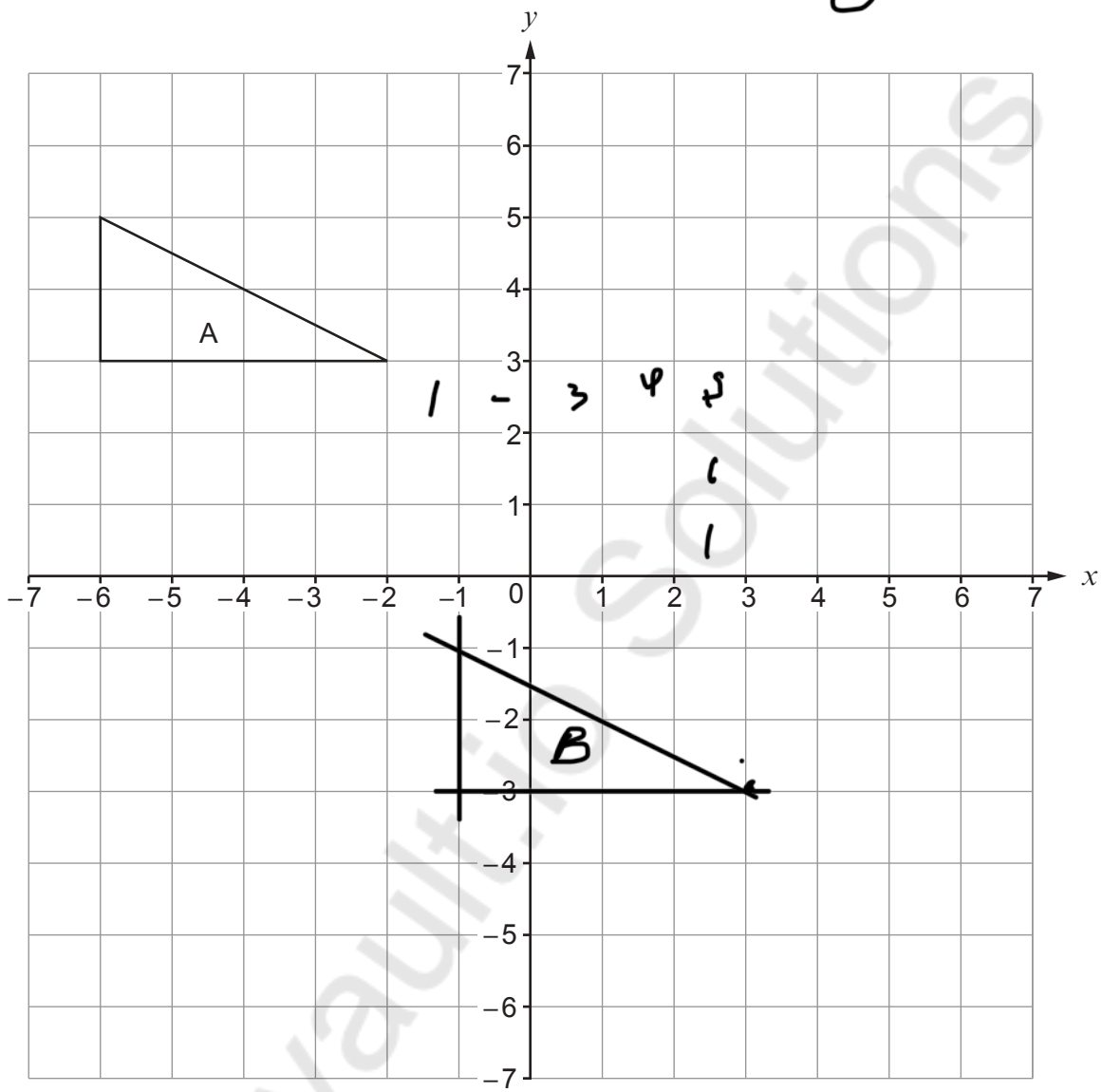
2. *(a)* Describe fully the single transformation that transforms triangle A onto triangle B. [2]



$x = -2$ (reflection)

Examiner only

(b) (i) Translate triangle A using the column vector $\begin{pmatrix} 5 \\ -6 \end{pmatrix}$. [2]



(ii) Write down the column vector that will reverse the translation in part (i). [1]

$\begin{pmatrix} 5 \\ -6 \end{pmatrix} = \begin{pmatrix} -5 \\ 6 \end{pmatrix}$

Examiner only

3. *(a)* Write down the first three terms of the sequence whose nth term is given by $n^2 - 6$. [2]

$(1)^2 - 6$ $(2)^2 - 6$ $(3)^2 - 6$

$1 - 6$ $4 - 6$ $9 - 6$

-5 -2 3

-5 -2 3

1st term = ... 2nd term = ... 3rd term = ...

(b) Write down an expression for the nth term of the following sequence. [2]

5, 11, 17, 23, …

$T_n = 5 + (n-1)6$

$= 5 + 6n - 6$

$n = 6n - 1$

Examiner only

4. Circle the correct answer for each of the following.

(a) $81 =$ $9 \times 9 = 3 \times 3 \times 3 \times 3$ [1]

3^3 9^3 9^4 18^2 3^4

(b) $2{\cdot}1^5 =$ [1]

32·5 10·5 40·84101 30·84101 32·1

(c) $(12{\cdot}96)^{\frac{1}{2}} =$ $\sqrt{12{\cdot}96} = 3{\cdot}6$ [1]

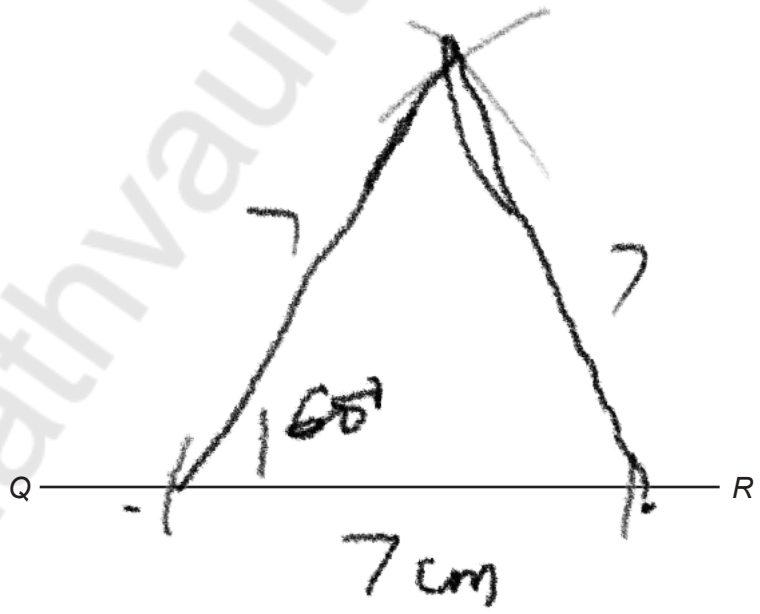
6·48 3·6 4·32 3·3 2·16

Examiner only

5. *(a)* Using only a ruler and a pair of compasses, construct a triangle PQR, so that it satisfies **both** of the following conditions:

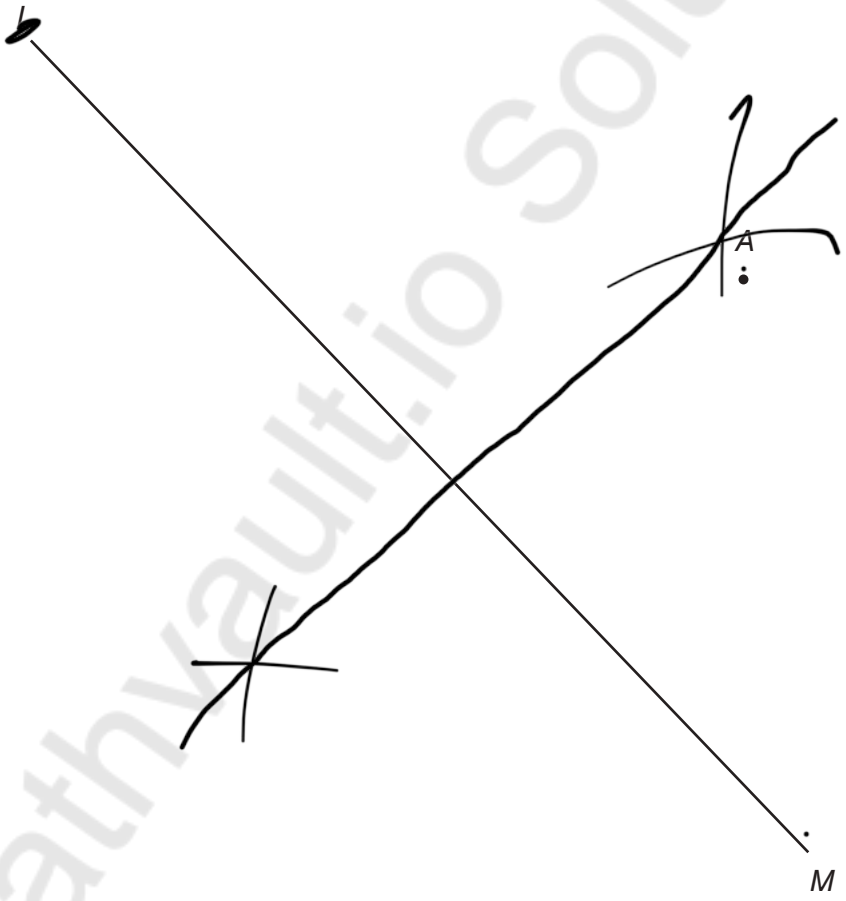
- $P\hat{Q}R = 60°$,
- $PQ = 7$ cm.

Side QR has been drawn for you. [2]



Examiner only

(b) Using only a ruler and a pair of compasses, construct a line from the point *A* that is perpendicular to the line *LM*. [2]



Examiner only

6. Dylan is having a weekend break in Wrexham.
The probability that he will visit *Erddig Gardens* is 0·7.
The probability of Dylan going to the *Bersham Heritage Centre* is independent of him visiting *Erddig Gardens*.

The probability that he visits *Erddig Gardens* **and** goes to the *Bersham Heritage Centre* is 0·28.

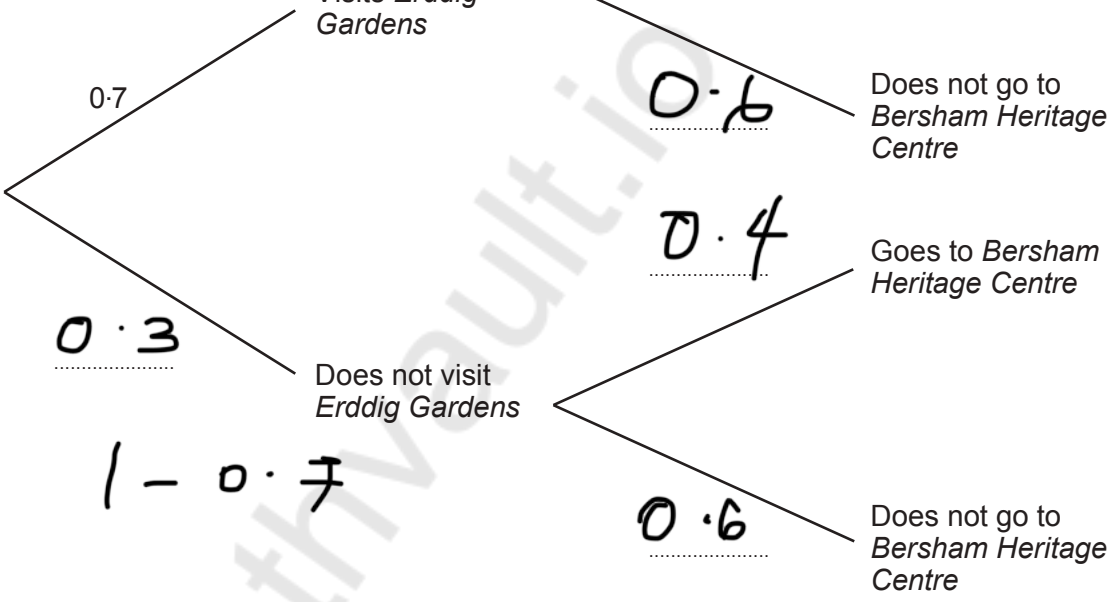
(a) Complete the following tree diagram. [4]

$0.7 \times x = 0.28$

$x = 0.28$

$= 0.4$

$1 - 0.4$



(b) Calculate the probability that Dylan visits *Erddig Gardens* but does not go to the *Bersham Heritage Centre*. [2]

0.7×0.6

$= 0.42$

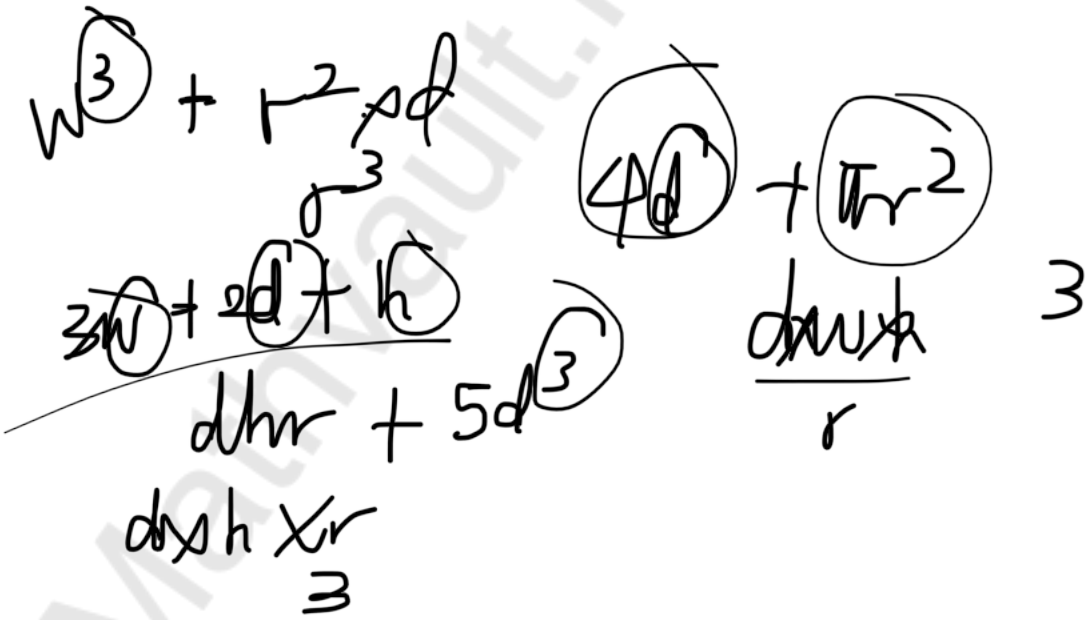
Examiner only

7. In the following formulae, each measurement of length is represented by a letter.

Consider the dimensions implied by the formulae.
For each case, write down whether the formula could be for a **length**, an **area**, a **volume** or **none of these**.

The first one has been done for you. [3]

Formula	Formula could be for
$3{\cdot}14r^2 - dw$	area
$w^3 + r^2d$	volume
$3w + 2d + h$	length
$dhr + 5d^3$	volume
$4d + \pi r^2$	None
$\frac{dwh}{r}$	volume



Examiner only

8. *(a)* Factorise $x^2 + 4x - 21$. Hence, solve $x^2 + 4x - 21 = 0$. [3]

7, -3

$(x+7)(x-3)$

$x+7=0 \quad x-3=0$

$x=-7, \quad x=3$

(b) Solve the equation $\frac{2x-3}{5}+\frac{4x+5}{2}=\frac{11}{2}$. [4]

$5 \times 2 = 10$

$2(2x-3)+5(4x+5)=55$

$4x-6+20x+25=55$

$24x = 55-19$

$24x = 36$

$x = \frac{36}{24} \quad \div 3 \quad \div 2$

$x = \frac{3}{2}$

Examiner only

9. A cuboid has dimensions of 40 mm, 25 mm and 12 mm.
All of these measurements are correct to the nearest mm.

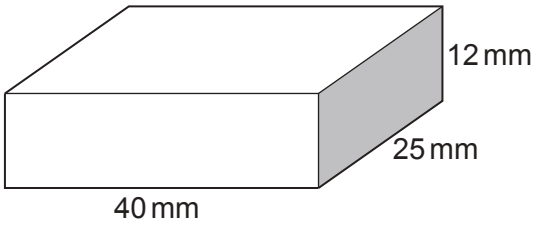


Diagram not drawn to scale

Four of these cuboids are stacked together as shown below.

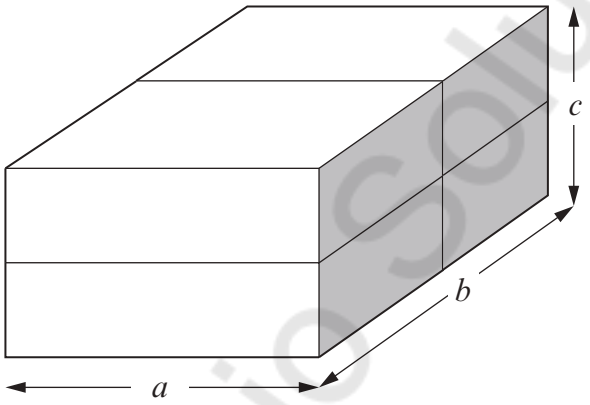


Diagram not drawn to scale

± 0.5

(a) Write down the **greatest** possible value of length a.
Give your answer in mm. [1]

$40 + 0.5 = 40.5$ mm

(b) Calculate the **greatest** possible value of length b.
Give your answer in mm. [1]

$25.5 + 25.5 = 51.0$ mm

(c) Calculate the **least** possible value of length c.
Give your answer in mm. [1]

$12 - 0.5 = 11.5$

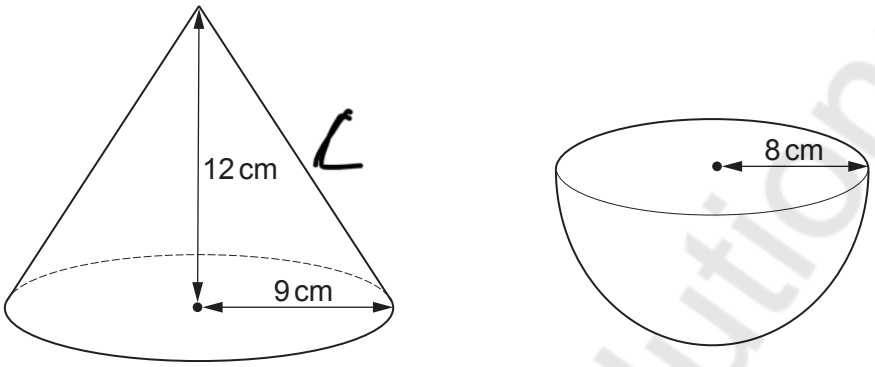
$12 - 0.5 = 11.5$

$11.5 + 11.5 = 23.0$ mm

Examiner only

10. *In this question, you will be assessed on the quality of your organisation, communication and accuracy in writing.*

The diagrams below show a solid cone and a solid hemisphere.



Diagrams not drawn to scale

The cone has a base radius of 9 cm and a vertical height of 12 cm.
The hemisphere has a radius of 8 cm.

Which of the two solids has the greater **curved** surface area?
You should express any areas in terms of π.
You must show all your working. [7 + 2 OCW]

$SA = \pi r l$

$l^2 = 12^2 + 9^2$

$144 + 81$

$\sqrt{225}$

$L = 15$ cm

$= \pi \times 9 \times 15$

$= 135\pi$ cm^2

$S.A = \frac{2}{2} \times \pi r^2$

$= 2\pi r^2$

$= 2\pi 64$

$= 128\pi$ cm^2

cone > hemisphere

Examiner only

11. The illuminance of light, I, from a lamp depends on the distance, d, from the lamp.
The unit used to measure the illuminance of light is the lux.

It is known that I is inversely proportional to the square of d.

Carys has a desk lamp in her room.
For her lamp, Carys measures the illuminance, I, to be 5 lux when the distance, d, is 2 m.

What is the illuminance of light from this lamp at a distance of 0·5 m? [4]

$L = \frac{K}{d^2}$

$5 = \frac{K}{2^2}$

$K = 20$

$L = \frac{20}{0.5^2}$

$= \frac{2080}{0.25}$

$= 80$

Examiner only

12. The points *A*, *B*, *C* and *D* lie on the circumference of a circle.
The straight line *EDF* is a tangent to the circle at *D*.

$B\hat{A}C = x$ and $C\hat{D}E = 2x$, where x is measured in degrees.

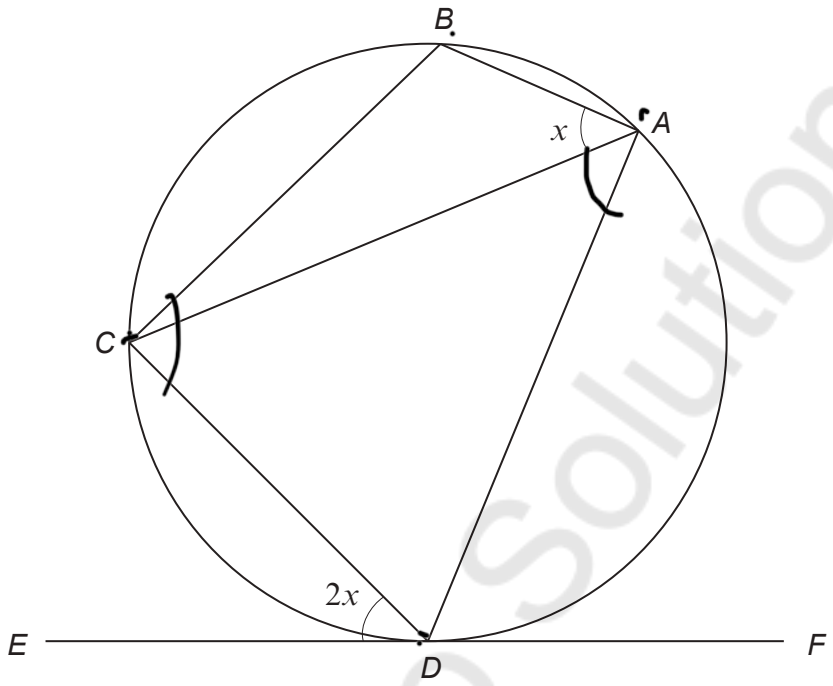


Diagram not drawn to scale

Find the size of $B\hat{C}D$ in terms of x.
Express your answer in its simplest form.
You must give a reason for each step of your solution. [4]

$CAD = 2x$
Alternate segment theorem

$BCD = 180 - (x + 2x)$
$= 180 - 3x$
opp. angles in cyclic quadr sum up to 180°

Examiner only

13. *(a)* Show that [3]

$$6x(8x + 1) - 3(4x + 1)(4x - 1) \equiv 6x + 3.$$

$48x^2 + 6x - (12x - 3)(4x - 1)$

$-12x(4x - 1) - 3(4x - 1)$

$-48x^2 + 12x - 12x + 3$

$48x^2 - 48x^2 + 12x - 12x + 6x + 3$

$6x + 3 \equiv 6x + 3$

(b) **Hence**, write down the value of x for which $6x(8x + 1) - 3(4x + 1)(4x - 1) = 0$. [1]

$6x + 3 = 0$

$6x = -3$

$x = -\frac{3}{6}$ 1 2

$x = -\frac{1}{2}$

Examiner only

14. *(a)* Express $0\dot{4}\dot{7}\dot{5}$ as a fraction. [2]

$x = 0.475757575\ldots$

$10x = 4.75757575\ldots$ — (1)

$1000x = 475.7575\ldots$ — (2)

(2) − (1)

$990x = 471$

$x = \frac{471}{990}$

(b) Circle the correct answer for the following statement. [1]

$16^{-\frac{3}{4}}$ is equal to

–12 $\frac{1}{8}$ –8 $\frac{1}{12}$ –16·75

$16^{-3/4} = \frac{1}{16^{3\times\frac{1}{4}}} = \frac{1}{(\sqrt[4]{16})^3}$

$= \frac{1}{(2)^3} = \frac{1}{8}$

Examiner only

15. Simplify

$$\left(2+\sqrt{5}\right)^2-\frac{\sqrt{500}}{\left(\sqrt{5}\right)^3}$$

and indicate whether your answer is rational or irrational. [5]

$(2+\sqrt{5})(2+\sqrt{5}) - \frac{\sqrt{100}\times\sqrt{5}}{(\sqrt{5})^2\times\sqrt{5}}$

$4+2\sqrt{5}+2\sqrt{5}+(\sqrt{5})^2 - \frac{10\sqrt{5}}{5\sqrt{5}}$

$4+5+4\sqrt{5} - 2$

$9-2+4\sqrt{5}$

$7+4\sqrt{5}$

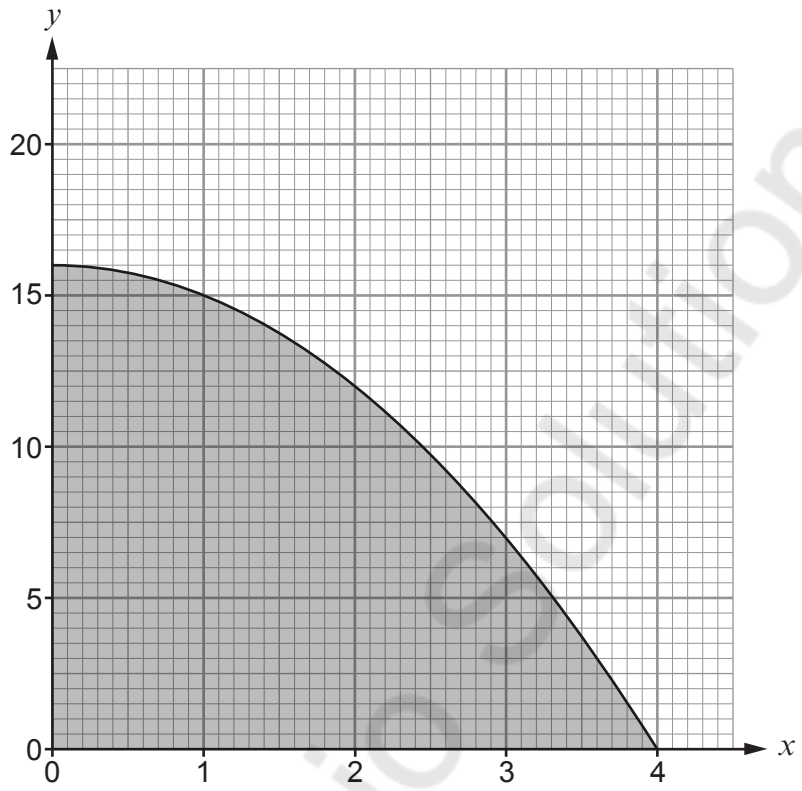
irrational

The answer is: rational ☐

irrational ☑

Examiner only

16. The graph of $y = 16 - x^2$ has been drawn below, for values of x from $x = 0$ to $x = 4$.



(a) Use the trapezium rule, with the ordinates $x = 0$, $x = 1$, $x = 2$, $x = 3$ and $x = 4$, to estimate the area of the shaded region shown above. [3]

$T \approx \frac{h}{2}[y_0 + 2(y_1 + y_2 + y_3) + y_4]$

$h = \frac{4-0}{4} = 1$

$y_0 = 16$
$y_1 = 15$
$y_2 = 12$
$y_3 = 7$
$y_4 = 0$

$= \frac{1}{2}[16 + 2(34) + 0]$

$= \frac{1}{2} \times 16 + 68$

$= \frac{1}{2} \times 84$

$= 42$

Examiner only

(b) The area can be estimated again, using ordinates at every half unit, namely $x = 0$, $x = 0{\cdot}5$, $x = 1$, $x = 1{\cdot}5$, $x = 2$, $x = 2{\cdot}5$, $x = 3$, $x = 3{\cdot}5$ and $x = 4$.

Without calculating the new area, tick one of the following boxes.

The new area will be **equal to** the estimated area found in part *(a)*. ☐

The new area will be **greater than** the estimated area found in part *(a)*. ✓

The new area will be **less than** the estimated area found in part *(a)*. ☐

You must give a reason for your answer. [1]

Increasing the number of strips improves accuracy

17. Simplify the following expression. [4]

$$\frac{2x^2 - 13x + 20}{2x - 8}$$

$$\frac{(2x-5)(x-4)}{2(x-4)}$$

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

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

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

Examiner only

18. Sixteen balls are placed in a bag.
Ten of the balls are green and six are yellow.
Two balls are selected at random and not replaced.

Benjamin states that the probability of selecting two balls of the **same colour** is equal to the probability of selecting two balls of **different colours.**

Is Benjamin correct?
You must show all your working to justify your answer. [4]

$\frac{10}{16} \times \frac{9}{15}$

$gg = \frac{3}{8}$

$\frac{6}{16} \times \frac{5}{15}$

$yy = \frac{1}{8}$

$\frac{3}{8} + \frac{1}{8}$

$\frac{3+1}{8} = \frac{4}{8}$

$\frac{10}{16} \times \frac{6}{15}$

$gy = \frac{1}{4}$

$\frac{6}{16} \times \frac{10}{15}$

$= \frac{1}{4}$

$\frac{1}{4} + \frac{1}{4}$

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

$\frac{1}{2}$

END OF PAPER

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

Same colour = $\frac{1}{2}$ = $\frac{1}{2}$ Different Colour

Benjamin was correct

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