ST JOSEPH'S INSTITUTION
END-OF-YEAR EXAMINATION 2020
YEAR 1

CANDIDATE NAME			
CLASS		INDEX NUMBER	

MATHEMATICS

Paper 1 **5 October 2020**

Candidates answer on the Question Paper. **1 hour 15 minutes (0800 – 0915)**

READ THESE INSTRUCTIONS FIRST

Write your class, index number and name on all the work you hand in.
Write in dark blue or black pen on both sides of the paper.
Do not use staples, paper clips, glue or correction fluid.

Answer **all** questions.
If working is needed for any question it must be shown with the answer.
Omission of essential working will result in loss of marks.
The use of an approved scientific calculator is expected, where appropriate.
If the degree of accuracy is not specified in the question, and if the answer is not exact, give the answer to three significant figures. Give answers in degrees to one decimal place.
For π, use either your calculator value or 3.142, unless the question requires the answer in terms of π.

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.

The total marks for this paper is 50.

/50

	$1600 < 1820$ The claim is not true. The cylinder is not completely filled after 20 s. **OR** Volume $= \pi r^2 h$ $= \pi(5.25)^2(21)$ $= 1818.393098 cm^3$ Time taken $= 1818.393098 \div 80$ $= 22.72991373$ $= 22.7s\,(3sf)$ $22.7s > 20s$ The claim is not true. The cylinder takes 22.7s to be completely filled up, not 20 seconds.	Must show comparison Must show comparison

Answer **all** the questions

1 The statement below describes a positive integer.

- It is a product of two different prime numbers.

Write the numbers less than or equal to 20 that fit the above statement.

Answer ..... [2]

2 (a) Express 450 as the product of its prime factors.

Answer 450 = ... [1]

2 (b) Mr Ng distributed 150 rulers, 450 pens and 350 pencils equally among his students.

(i) Calculate the largest possible number of students in his class.

Answer ..... [1]

(ii) Find the number of rulers, pens and pencils that were given to each student.

Answer ..... rulers

..... pens

..... pencils [1]

3 The temperature in New York is $-3°C$ and the temperature in Moscow is $-8°C$.

(a) Write down how many degrees **colder** it is in Moscow than it is in New York.

Answer .....°C [1]

(b) New York is 10 degrees **warmer** than Anchorage.

Write down the temperature in Anchorage.

Answer .....°C [1]

4 (a) Write the following in order of size, starting with the smallest.

$0.\dot{3}$ $\frac{3}{10}$ 302% π $\sqrt{0.3}$

Answer ..... [1]

(b) Write down the rational numbers from the following set of numbers.

3.14 $0.8\dot{1}\dot{0}$ π $(-2)^2$ $3\sqrt{3} \times \sqrt{3}$ $\sqrt[3]{-10}$

Answer ..... [2]

5 The diameter of the earth at the equator is 12700 kilometres.
This value has been rounded to 3 significant figures.

Find the largest and the smallest possible value of the diameter of the earth.

Answer Largest = ... km

Smallest = ... km [2]

6 (a) By rounding the numbers to 1 significant figure, estimate the value of $\frac{\sqrt{101.3} \times 64.231}{(1.98)^3}$. Show your working clearly.

Answer ..... [2]

(b) Without using the calculator, determine whether the value found in **(a)** is an over or under estimation. Give a reason for your answer.

Answer .....

.....

..... [1]

7 (a) Find the value of $x^3 + x^2$ when $x = -2$.

Answer ..... [1]

(b) Factorise completely $6ab - 2a^2$.

Answer ..... [1]

8 (a) Subtract the sum of $4y - 2x$ and $5x + y$ from the sum of $11x - 3y$ and $3(2x + 5)$.

Answer ..... [2]

(b) If $a = x + y + z$, simplify $[(a - x) + (a - y) + (a - z)]^2$.

Answer ..... [2]

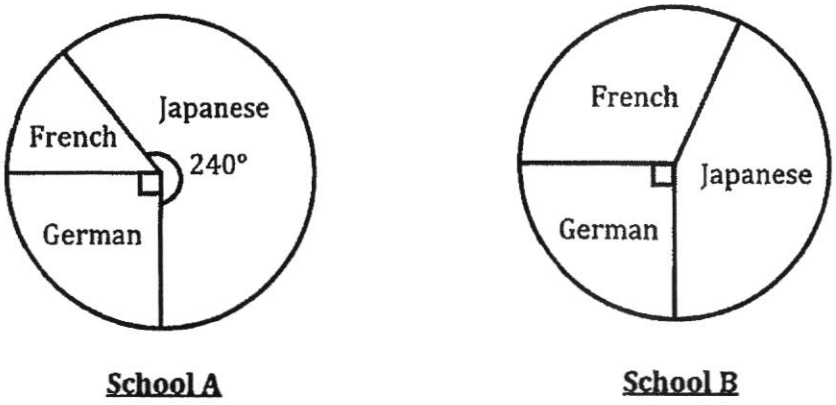
9 (a) It is given that $x = 2$ is the solution of the equation $10 - 3px = 6p - 4x$.
Find the value of p.

Answer ..... [2]

(b) Solve the equation $\frac{x-2}{4} = 1 - \frac{2x+5}{3}$.

Answer ..... [3]

10 The pie charts represent the number of students who took up a third language in School A and School B.



School A **School B**

(a) Express the number of students taking German and Japanese as a percentage of the total number of students in School A.

Answer ..... % [2]

(b) There are 300 students taking a third language in School A.

Find the number of students taking French in School A.

Answer ..... [2]

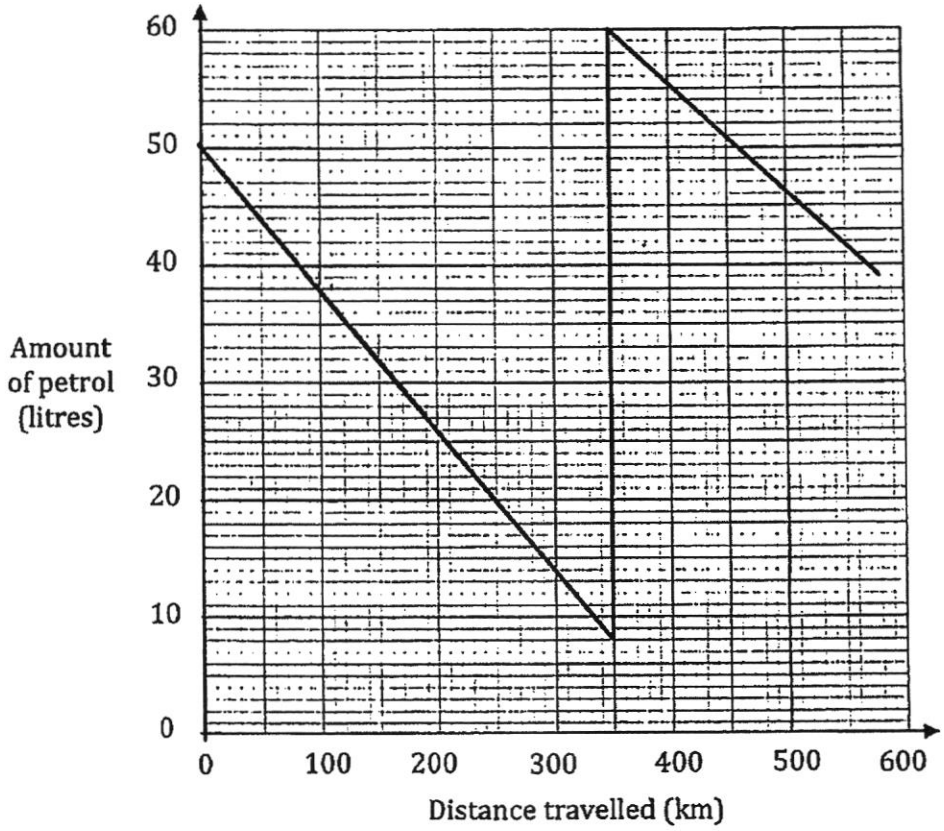
(c) Sally claims that there are more students taking up French in School B than in School A. Is she correct? Explain your answer.

Answer .....

.....

..... [1]

11 The graph shows the amount of petrol in the fuel tank of Anthony's car during a journey.



(a) How much petrol did the car use on the journey?

Answer ..... litres [1]

Anthony stopped once on the journey to fill the tank fully with petrol. He paid $2.42 per litre for the petrol.

(b) How much did he spend filling up the tank?

Answer $ ..... [2]

12 A 50-inch HD TV set was sold at $920 after a 20% discount.

(a) Find the original price of the 50-inch HD TV set.

Answer $ ..... [1]

(b) During a clearance sale, the original price of the 50-inch HD TV set was sold at a 30% discount followed by another 5% discount on the discounted price.

What was the selling price of each 50-inch HD TV set during the clearance sale?

Answer $ ..... [3]

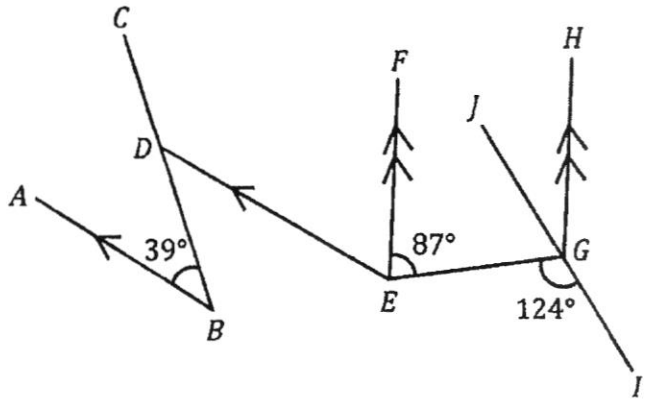
13 (a) If eight students can assemble 76 toy trains in 2 hours, how many toy trains can ten students assemble in the same period of time?

Answer ..... [2]

(b) Simplify the ratio 48 minutes : 0.6 hour : $\frac{1}{3}$ hour.

Answer ..... [2]

14 In the diagram, BC and IJ are straight lines. AB is parallel to DE and EF is parallel to GH. $\angle ABC = 39°, \angle FEG = 87°$ and $\angle EGI = 124°$.



By stating your reasons clearly, find

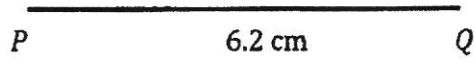
(a) $\angle CDE$,

Answer ..... ° [2]

(b) $\angle HGI$.

Answer ..... ° [2]

15 (a) Construct a quadrilateral $PQRS$ such that
$PQ = 6.2$ cm, $PR = 8.2$ cm, $PS = 7.2$ cm, $SR = 5$ cm and $\angle QPR = 38°$.
The line PQ has been drawn for you.



Answer ..... On space above ..... [2]

(b) Measure and write down the size of $\angle PRS$.

Answer ..... ° [1]

(c) Measure and write down the length of SQ.

Answer ..... cm [1]

END OF PAPER

ST JOSEPH'S INSTITUTION
END-OF-YEAR EXAMINATION 2020
YEAR 1

CANDIDATE NAME			
CLASS		INDEX NUMBER	

MATHEMATICS

Paper 2 **7 October 2020**

Candidates answer on the Question Paper. **1 hour 15 minutes (0800 – 0915)**

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At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.

The total marks for this paper is 50.

/50

Answer **all** the questions

1 (a) Point *A* is 7.2 km away from point *B*. At 08 00, Timothy ran at 3 m/s from point *A* for *x* m before he slowed down to 2 m/s until he reached point *B*. The total time taken was 55 minutes.

Find the value of *x*.

Answer ..... [3]

(b) At 08 05, Wilson started his run from point *A* to point *B* at 2.5 m/s.

Will he be able to catch up with Timothy? Explain with appropriate workings.

Answer ..... On space above [2]

2 Company X produces a rectangular tray with dimensions 32 cm by 24 cm. Consumers request that the dimensions of a new rectangular tray be increased in the ratio of 5 : 4.

Find

(a) the length and width of the new rectangular tray,

Answer Length = ... cm

Width = ... cm [2]

(b) the ratio of the perimeter of the original rectangular tray to the new rectangular tray.

Answer ..... [3]

3 The first four terms of a sequence are 3, 7, 11 and 15.

(a) Write down the 9th term, T_9, of the sequence.

Answer $T_9 =$ ..... [1]

(b) Find the n^{th} term, T_n, of the sequence.

Answer $T_n =$ ..... [2]

Consider the pattern below.

$$\begin{aligned} L_1 &= 1\times3-1 = 2 \\ L_2 &= 2\times7-2 = 12 \\ L_3 &= 3\times11-3 = 30 \\ L_4 &= 4\times15-4 = 56 \end{aligned}$$

(c) By using the result from part **(b)**, find an expression, in terms of n, for L_n.

Answer $L_n =$ ..... [2]

(d) Hence find L_{25}.

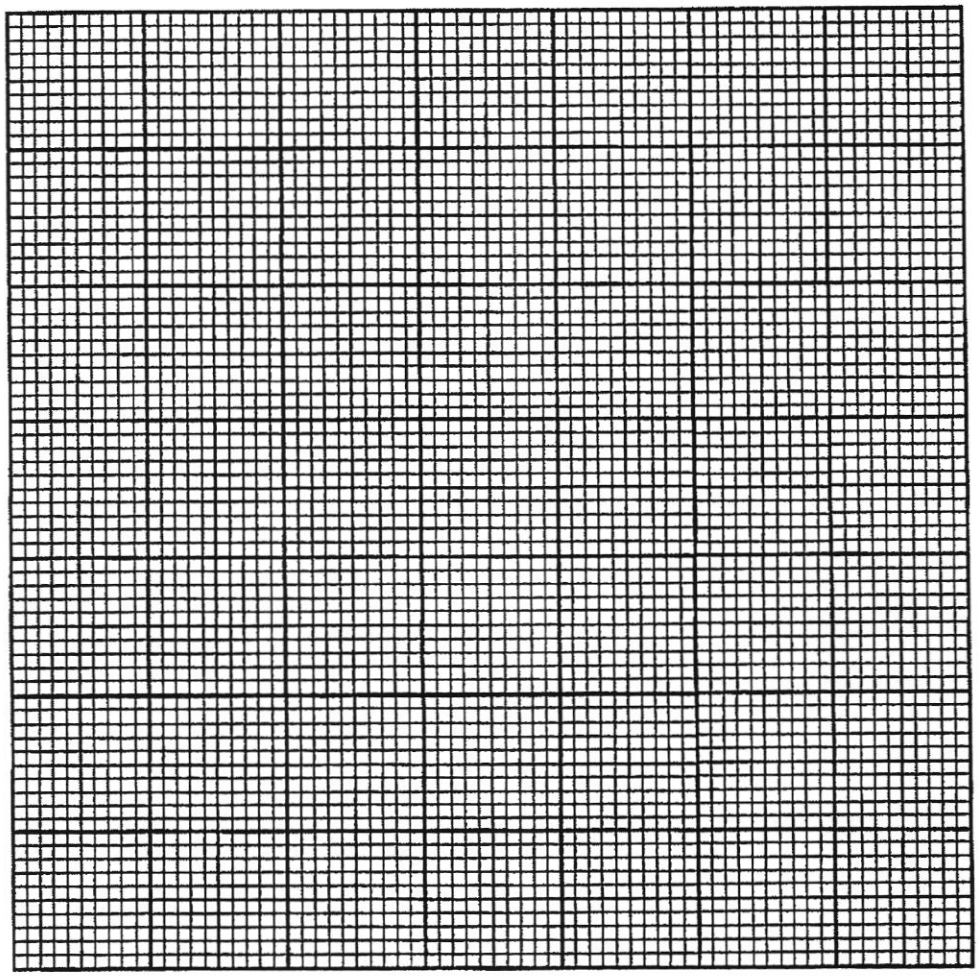
Answer $L_{25} =$ ..... [1]

4 A tap at the bottom of a portable aquarium is turned on to allow water to flow out from the nozzle at a steady rate. After the tap is turned on for x minutes, the height of water remaining in the tank is represented by y cm.

Some corresponding values of x and y are given in the following table.

x (min)	0	2	4
y (cm)	188	94	0

(a) Using a scale of 2 cm to represent 1 minute, draw a horizontal x-axis for $0 \leq x \leq 4$.
Using a scale of 1 cm to represent 20 cm, draw a vertical y-axis for $0 \leq y \leq 200$.
On your axes, plot the points given in the table and join them with a straight line. [3]



4 (b) Use your graph to find the time at which the height of water is 80 cm.

Answer ..... min [1]

(c) Find the gradient of the graph.

Answer ..... [2]

(d) Hence, explain what the gradient in part **(c)** represents.

Answer .....

..... [1]

(e) State how the steepness of the graph will change if the nozzle of the tap becomes smaller in diameter. Briefly explain your answer.

Answer .....

..... [1]

5 (a) (i) The interior angle of a regular polygon is 135°. Find the number of sides of the polygon.

Answer ..... [2]

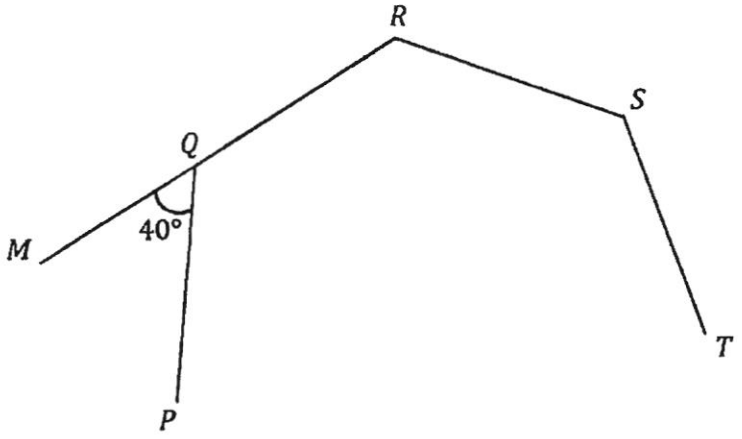
(ii) Write down the special name given to the polygon in part **(a)(i)**.

Answer ..... [1]

5 (b) (i) Each exterior angle of a regular polygon is 22.5°.
Find the number of sides of the polygon.

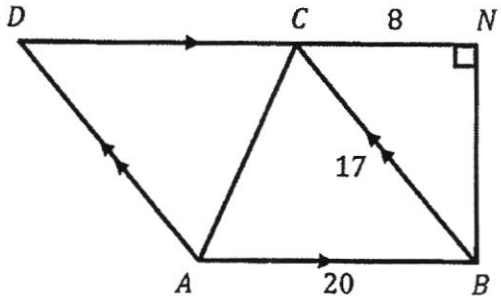
Answer ..... [2]

(ii) In the diagram, *PQRST* is part of a regular polygon.
MQR is a straight line with $\angle PQM = 40°$.
Find $\angle STQ$.



Answer ..... ° [2]

6 $ABCD$ is a parallelogram. BN is perpendicular to DC produced.
The area of triangle CNB is 60 cm^2.
AB = 20 cm, BC = 17 cm and CN = 8 cm.



Calculate

(a) the length of BN,

Answer ..... cm [2]

(b) the area of trapezium $ABND$.

Answer ..... cm^2 [2]

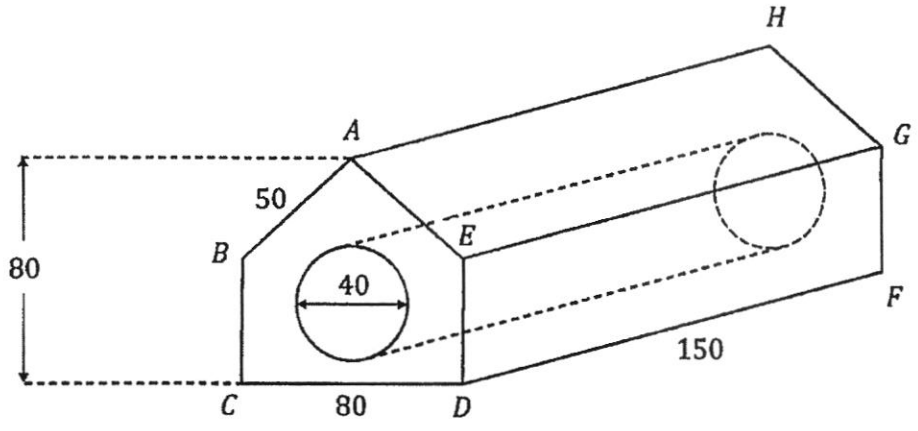
6 (c) the area of parallelogram $ABCD$,

Answer ..... cm^2 [2]

(d) the perpendicular length from C to AD, giving your answer to 2 decimal places.

Answer ..... cm [3]

7 The diagram shows a solid pentagonal aluminium prism of height 80 cm with a cylindrical hole of diameter 40 cm drilled through it.
$AB = BC = AE = ED = 50$ cm, $CD = 80$ cm and $DF = 150$ cm.



(a) Calculate

(i) the area of the cross section of the solid $ABCDE$ (with the circle removed),

Answer ..... cm^2 [2]

(ii) the volume of the solid.

Answer ..... cm^3 [1]

7 (b) Find the total surface area of the solid.

Answer ..... cm^2 [3]

(c) Find the mass of the solid given that the density of the material is $2.6\ g/cm^3$. $\left[\text{Density} = \frac{\text{Mass}}{\text{Volume}}\right]$

Answer ..... g [2]

(d) The solid is melted to form a cube.
Find the length of the cube.

Answer ..... cm [2]

END OF PAPER

2020 YEAR 1 EOY PAPER 1 (SOLUTIONS)

1 The statement below describes a positive integer.

- It is a product of two different prime numbers

Write the numbers less than or equal to 20 that fit the above statement.

6, 10, 14, 15

Answer	6, 10, 14, 15	[2]

2 (a) Express 450 as the product of its prime factors.

$450 = 2 \times 3^2 \times 5^2$

Answer	$450 = 2 \times 3^2 \times 5^2$	[1]

2 (b) Mr Ng distributed 150 rulers, 450 pens and 350 pencils equally among his students.

(i) Calculate the largest possible number of students in his class.

$150 = 2 \times 3 \times 5^2$
$350 = 2 \times 5^2 \times 7$

HCF of 150, 450 and 350 is $2 \times 5^2 = 50$

Largest possible number of students = **50**

Answer	50	[1]

(ii) Find the number of rulers, pens and pencils that were given to each student.

3 rulers, 9 pens and 7 pencils

Answer	3 rulers	
	9 pens	
	7 pencils	[1]

3 The temperature in New York is $-3°C$ and the temperature at Moscow is $-8°C$.

(a) Write down how many degrees **colder** it is in Moscow than it is in New York.

5 degrees colder

Answer	5 °C	[1]

(b) New York is 10 degrees **warmer** than Anchorage.
Write down the temperature in Anchorage.

Temp at Anchorage $= -3 - 10$
$= -13°C$

Answer	-13 °C	[1]

4 (a) Write the following in order of size, starting with the smallest.

$0.\dot{3}$ $\quad \frac{3}{10}$ $\quad 302\%$ $\quad \pi$ $\quad \sqrt{0.3}$

$\frac{3}{10}$, $0.\dot{3}$, $\sqrt{0.3}$, 302% , π

Answer	$\frac{3}{10}$, $0.\dot{3}$, $\sqrt{0.3}$, 302% , π	[1]

(b) Write down the rational numbers from the following set of numbers.

3.14 $\quad 0.8\dot{1}\dot{0}$ $\quad \pi$ $\quad (-2)^2$ $\quad 3\sqrt{3} \times \sqrt{3}$ $\quad \sqrt[3]{-10}$

$3.14,\quad 0.8\dot{1}\dot{0},\quad (-2)^2,\quad 3\sqrt{3} \times \sqrt{3},$

Answer	$3.14,\quad 0.8\dot{1}\dot{0},\quad (-2)^2,\quad 3\sqrt{3} \times \sqrt{3},$	[2]

5 The diameter of the earth at the equator is 12700 kilometres. This value has been rounded to 3 significant figures.
Find the largest and the smallest possible value of the diameter of the earth.

12749 and 12650

Answer	Largest = 12749 km	
	Smallest = 12650 km	[2]

6 (a) By rounding the numbers to 1 significant figure, estimate the value of $\frac{\sqrt{101.3} \times 64.231}{(1.98)^3}$. Show your working clearly.

$$\frac{\sqrt{101.3} \times 64.231}{(1.98)^3} = \frac{10 \times 60}{8}$$
$$= 75$$

Answer	75	[2]

(b) Without using the calculator, was this estimate an over or under estimate?
Give a reason for your answer.

Underestimate. The numbers in the **numerator** have been **rounded down** and the number in the **denominator** has been **rounded up**, making the final answer smaller than the actual value.

Answer	Underestimate. The numbers in the **numerator** have been **rounded down** and the number in the **denominator** has been **rounded up**, making the final answer smaller than the actual value.	[1]

7 (a) Find the value of $x^3 + x^2$ when $x = -2$.

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

Answer	-4	[1]

(b) Factorise completely $6ab - 2a^2$.

$6ab - 2a^2 = 2a(3b - a)$

Answer	$2a(3b - a)$	[1]

8 (a) Subtract the sum of $4y - 2x$ and $5x + y$ from the sum of $11x - 3y$ and $3(2x + 5)$.

$[11x - 3y + 3(2x + 5)] - (4y - 2x + 5x + y)$
$= 17x - 3y + 15 - 5y - 3x$
$= 14x - 8y + 15$

Answer	$14x - 8y + 15$	[2]

(b) If $a = x + y + z$, simplify $[(a - x) + (a - y) + (a - z)]^2$.

$[(a - x) + (a - y) + (a - z)]^2$
$= [3a - (x + y + z)]^2$
$= [3a - (a)]^2$
$= [2a]^2$
$= 4a^2$

Answer	$4a^2$	[2]

9 (a) It is given that $x = 2$ is the solution of the equation $10 - 3px = 6p - 4x$. Find the value of p.

Sub $x = 2$ into equation,

$10 - 3(2)p = 6p - 4(2)$

$12p = 18$

$p = \frac{3}{2}$ or $1\frac{1}{2}$ or 1.5

Answer	$1\frac{1}{2}$	[2]

(b) Solve the equation $\frac{x-2}{4} = 1 - \frac{2x+5}{3}$.

$\frac{x-2}{4} = 1 - \frac{2x+5}{3}$

$\frac{x-2}{4} + \frac{2x+5}{3} = 1$

$\frac{3(x-2)}{12} + \frac{4(2x+5)}{12} = 1$

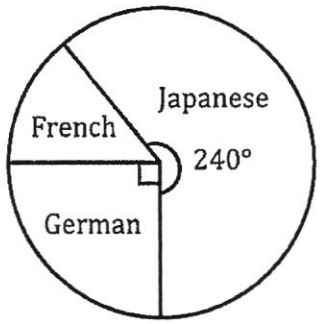
$3x - 6 + 8x + 20 = 12$

$11x = -2$

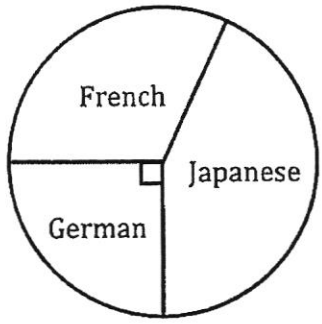
$x = -\frac{2}{11}$

Answer	$-\frac{2}{11}$	[3]

10 The pie charts show information about the number of students who took up a third language in School A and School B.



School A



School B

(a) Express the number of students taking German and Japanese as a percentage of the total number of students in School A.

Percentage taking German and Japanese
$= \frac{11}{12} \times 100\%$
$= 91.7\%$ (3 sf)

Answer	91.7%	[2]

(b) There are 300 students taking a third language in School A.
Find the number of students taking French in School A.

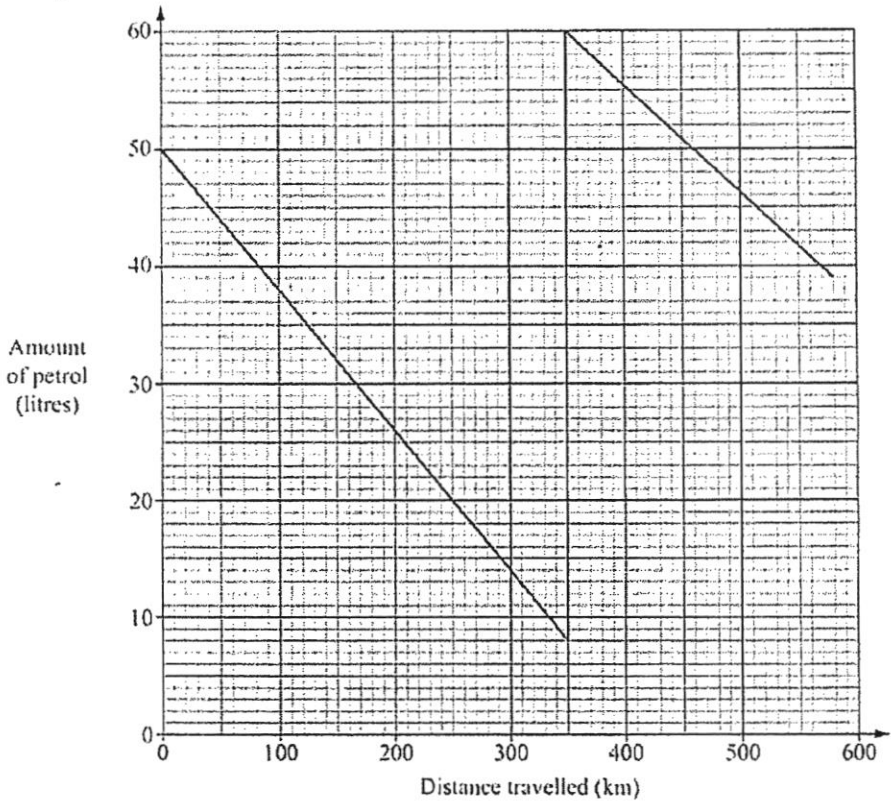
No. of students taking French $= \frac{1}{12} \times 300$
$= 25$

Answer	25	[2]

(c) Sally claims that there are more students taking up French in School B than in School A. Is she correct? Explain your answer.

Answer	She is **not correct**. Pie chart **shows the proportion** and **not the number of students** who took French. Therefore, more information is required, e.g. the number of students in School B.	A1

11 The graph shows the amount of petrol in the fuel tank of Anthony's car during a journey.



(a) How much petrol did the car use on the journey?

Petrol used = (50 − 8) + (60 − 39)
= 63 litres

Answer	63 litres	[1]

Anthony stopped once on the journey to fill the tank fully with petrol. He paid $2.42 per litre for the petrol.

(b) How much did he spend filling up the tank?

Amount of petrol to fill up the tank = 60 − 8
= 52 litres

Amount spent filling it up = $2.42 × 52
= $125.84

Answer	$ 125.84	[2]

12 A 50 inch HD TV set was sold at \$920 after a 20% discount.

(a) Find the original price of the 50 inch HD TV set.

80% of total = \$920

20% of total = $\$920 \times \frac{80\%}{20\%}$

= \$230

∴ Original price of the 50 inch HD TV set

= $\$230 \times \frac{100\%}{20\%}$

= \$1150

Answer	\$1150	[1]

(b) During a clearance sale, the original price of the 50 inch HD TV set was sold at a 30% discount followed by another 5% on the discounted price. What was the selling price of each 50 inch HD TV set during the clearance sale?

Original price = \$1150

Discounted price = \$1150 ÷ 10 × 7

= \$805

New price = $\$805 \times \frac{95\%}{100\%}$

= \$764.75

Answer	\$764.75	[3]

13 (a) If eight students can assemble 76 toy trains in 2 hours, how many toy trains can ten students assemble in the same period of time?

8 students can assemble 76 toy trains in 2 hours
1 student can assemble $\frac{76}{8}$ toy trains in 2 hours
10 students can assemble $\frac{76}{8} \times 10$
$= 95$ toy trains in 2 hours

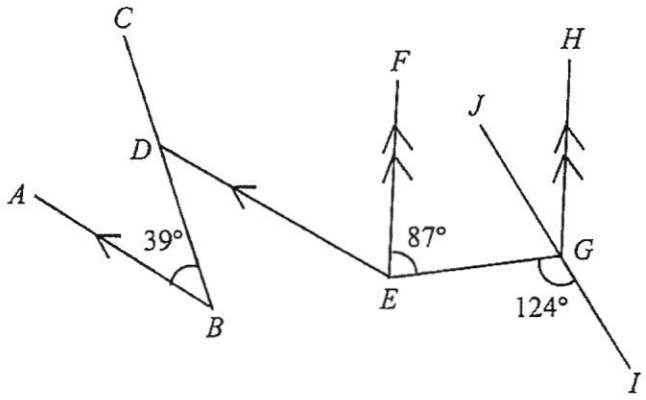
Answer	95	[2]

(b) Simplify 48 minutes : 0.6 hour : $\frac{1}{3}$ hour

48 minutes : 0.6 hour : $\frac{1}{3}$ hour
= 48 minutes : 36 minutes : 20 minutes
= 12 : 9 : 5

Answer	12 : 9 : 5	[2]

14 In the diagram, BC and IJ are straight lines. AB is parallel to DE and EF is parallel to GH. $\angle ABC = 39°, \angle FEG = 87°$ and $\angle EGI = 124°$.



By stating your reasons clearly, find

(a) $\angle CDE$,

$\angle BDE = 39°$ (alt. $\angle s$, AB // DE)
$\angle CDE = 180° - 39°$ (adj. $\angle s$ on a str. line)
$= 141°$

Answer	141°	[2]

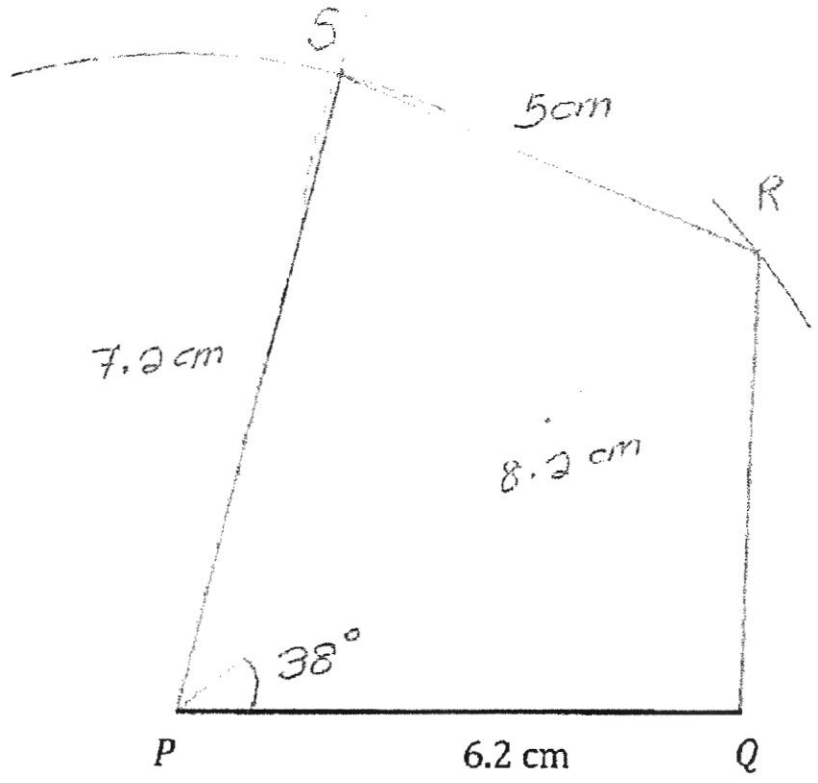
(b) $\angle HGI$.

$\angle HGE = 180° - 87°$ (int. $\angle s$, EF // GH)
$= 93°$
$\angle HGI = 360° - 124° - 93°$ ($\angle s$ at a point)
$= 143°$

Answer	143°	[2]

15 (a) Using ruler and compasses, construct a quadrilateral $PQRS$ such that $PQ = 6.2$ cm, $PR = 8.2$ cm, $PS = 7.2$ cm, $SR = 5$ cm and $\angle QPR = 38°$. The line PQ has been drawn for you.

Arcs at R and S. Correct quadrilateral.



Answer .....On space above..... [2]

(b) Measure and write down the size of $\angle PRS$.

Answer	60° (±1°)	[1]

(c) Measure and write down the length of SQ.

Answer	8.2 cm (±1 cm)	[1]

END OF PAPER

2020 YEAR 1 EOY PAPER 2 (SOLUTIONS)

1 (a) Point A is 7.2 km away from point B. At 08 00, Timothy ran at 3 m/s from point A for x m before he slowed down to 2 m/s until he reached point B. The total time taken was 55 minutes. Find the value of x.

$$\frac{x}{3}+\frac{7200-x}{2}=55\times 60$$

$$2x+21600-3x=19800$$

$$x=1800$$

Answer	1800	[3]

(b) At 08 05, Wilson started his run from point A to point B at 2.5 m/s. Will he be able to catch up with Timothy? Explain with appropriate workings.

Time taken $=\frac{7200}{2.5}$

$= 2880\text{s} = 48$ min

Time $= 08\ 05 + \frac{2880}{60}$

$= 08\ 53$

Yes. Since Wilson **finished the run at 0853**, he would have caught up with **Timothy**, who reached point B at **0855**.

Answer .....On space above..... [2]

2 Company X produces a rectangular tray with dimensions 32 cm by 24 cm. Consumers request that the dimensions of the rectangular tray be increased in the ratio of 5 : 4. Find

(a) the new length and width of the rectangular tray,

New length of rectangular tray
$= \frac{5}{4} \times 32$
$= 40$ cm
New width of rectangular tray
$= \frac{5}{4} \times 24$
$= 30$ cm

Answer	Length = 40 cm	
	Breadth = 30 cm	[2]

(b) the ratio of the perimeter of the original rectangular tray to the second rectangular tray.

Perimeter of original rectangular tray
$= (2 \times 32 + 2 \times 24) = 112cm$
Perimeter of 2nd rectangular tray
$= (2 \times 40 + 2 \times 30) = 140cm$
Ratio of perimeters of original to 2nd rectangular tray
= 112 : 140
= 4 : 5

Alternative Mtd:

(32x2+24x2)x1.25 = 140
112: 140
=4:5

OR

1 : 5/4
4 : 5

Answer	4 : 5	[3]

3 Consider the following sequence: 3, 7, 11, 15, ...

(a) Find the 9th term, T_9.

$T_9 = 35$

Answer	$T_9 = 35$	[1]

(b) Find the n^{th} term, T_n, of the sequence.

$T_n = 3 + 4(n-1)$
$= 4n - 1$

Answer	$T_n = 4n - 1$	[2]

Consider the following number pattern:

$$L_1 = 1\times3-1 = 2$$
$$L_2 = 2\times7-2 = 12$$
$$L_3 = 3\times11-3 = 30$$
$$L_4 = 4\times15-4 = 56$$

(c) By using the result from part **(b)**, find an expression, in terms of n, for L_n.

Observe that $L_n = n\times T_n - n$
$L_n = n(4n-1)-n$
$= 4n^2 - n - n$
$= 4n^2 - 2n$ OR $= 2n(2n-1)$

Answer	$L_n = 2n(2n-1)$	[2]

(d) Hence find L_{25}.

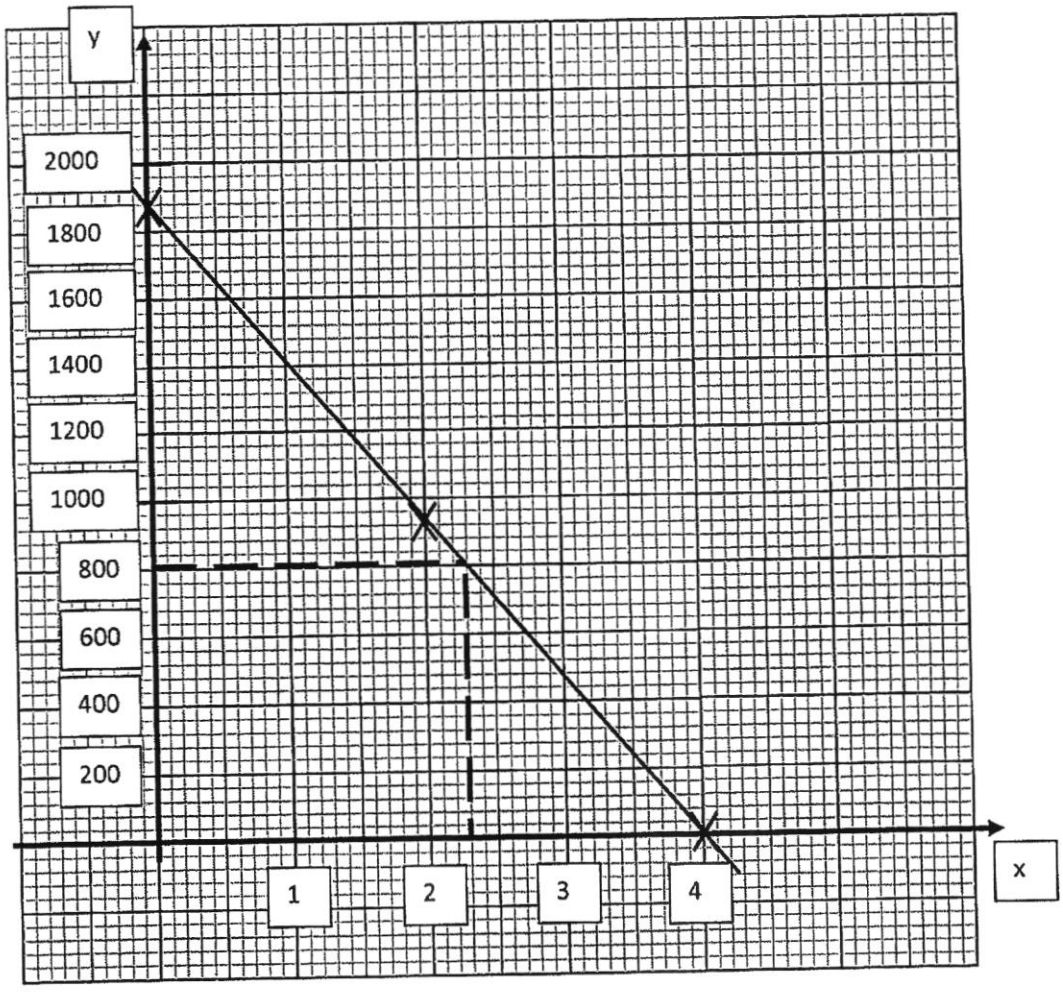
$L_{25} = 4(25)^2 - 2(25)$
$= 2450$

Answer	$L_{25} = 2450$	[1]

4 A tap at the bottom of a portable aquarium is turned on to allow water to flow out from the nozzle at a steady rate. After the tap is turned on for x minutes, the height of water remaining in the tank is represented by y cm. The table below shows some values of x with their corresponding values of y.

x (min)	0	2	4
y (cm)	188	94	0

(a) On the graph paper provided, using a scale of 2 cm to represent 1 minute, draw a horizontal x-axis for $0 \leq x \leq 4$, and using a scale of 1 cm to represent 20 cm, draw a vertical y-axis for $0 \leq y \leq 200$. On your axes, plot the points given in the table and join them with a straight line.



(b) Use your graph to find the time at which the height of water is 80 cm.

At $y = 80$, $x = 2.3$ minutes

Answer	2.3 min	[1]

(c) Find the gradient of the graph.

Gradient $= \frac{188-0}{0-4}$ $= -47$

Answer	-47	[2]

(d) Hence, explain what the gradient in part **(c)** represents.

Answer	**Height of water decreases** at **47 cm / minute**.	[1]

(e) State how the steepness of the graph will change if the nozzle of the tap becomes smaller in diameter. Briefly explain your answer.

Answer	Less steep/ gentler slope. The height of the water will decrease more slowly *or* water will flow out slower *or* it will take a longer time for all the water to flow out.	[1]

All 3 points plotted correctly with crosses. Points joined with a smooth line. Scale, axes and labels (x & y with units).

5 (a) (i) The interior angle of a regular polygon is 135°. Find the number of sides of the polygon.

Exterior angle
$= 180° - 135°$
$= 45°$

No. of sides
$= \frac{360}{45}$
$= 8$

Answer	8	[2]

(ii) Write down the special name given to the polygon in **(i)**.

Octagon

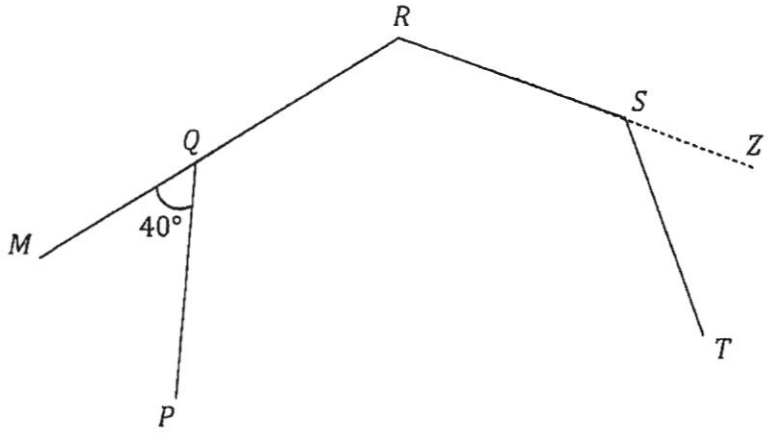
Answer	Octagon	[1]

5 (b) (i) Each exterior angle of a regular polygon is 22.5°.
Find the number of sides of the polygon.

$22.5n = 360$
$n = 16$

Answer .....16..... [2]

(ii) In the diagram, $PQRST$ is part of a regular polygon.
MQR is a straight line with $\angle PQM = 40°$.
Find $\angle STQ$.

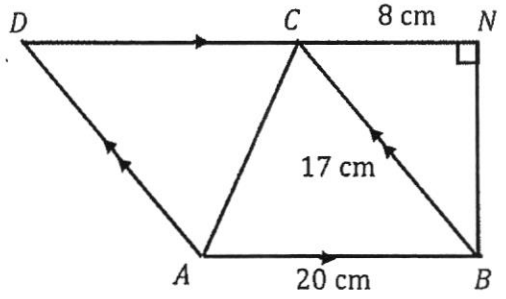


$\angle ZST = 40°$ (ext. angle of a polygon)

$\angle STQ = 40°$ (alt. angle, SZ//QT)

Answer .....40..... [2]

6 $ABCD$ is a parallelogram. BN is perpendicular to DC produced. The area of triangle CNB is 60 cm^2, AB = 20 cm, BC = 17 cm and CN = 8 cm.



Calculate the

(a) length of BN,

$$\frac{1}{2} \times 8 \times BN = 60$$
$$4BN = 60$$
$$BN = 15 \text{ cm}$$

Answer	15 cm	[2]

(b) area of trapezium $ABND$,

Area of trapezium $ABND$
$$= \frac{1}{2} \times (20 + 28) \times 15$$
$$= 360 \text{ cm}^2$$

Answer	360 cm^2	[2]

(c) area of parallelogram $ABCD$,

Area of parallelogram $ABCD$
$= 20 \times 15$
$= 300 \text{ cm}^2$

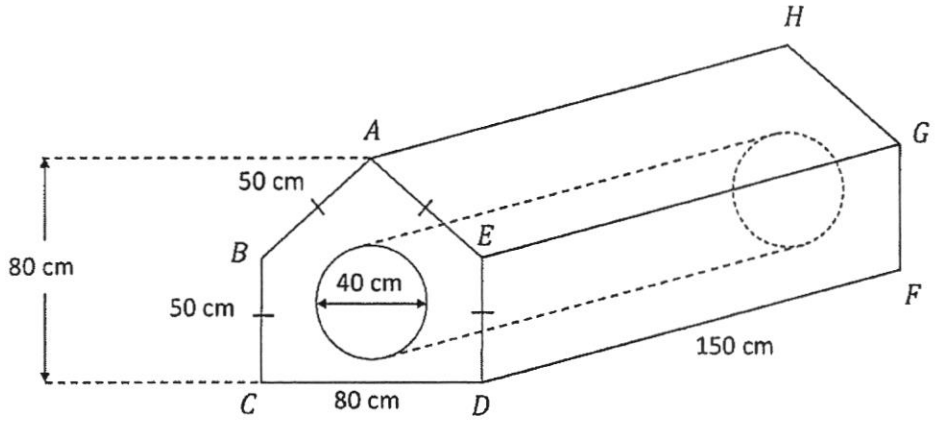
Answer	300 cm²	[2]

(d) perpendicular length from C to AD, giving your answer to 2 decimal places.

Area of ΔABC
$= \frac{1}{2} \times 20 \times 15$
$= 150 \text{ cm}^2$
Area of ΔACD
$= 300 - 150$
$= 150 \text{ cm}^2$
Let the perpendicular length from C to AD be d cm.
$\frac{1}{2} \times 17 \times d = 150$
$8.5d = 150$
$d = 17.65$

Answer	17.65 cm	[3]

7 The diagram shows a solid pentagonal wooden prism of length $DF = 150$ cm. A cylindrical hole of diameter 40 cm is drilled through it. It is given that $AB = BC = AE = ED = 50$ cm and $CD = 80$ cm.



(a) Calculate the

(i) area of the cross section of the solid $ABCDE$ (with the circle removed),

Area of cross-section

$= (50 \times 80) + \left(\frac{1}{2} \times 80 \times 30\right) - \pi(20)^2$

$= 3943.3$

$= 3940 \text{ cm}^2$

Answer	3940 cm²	[2]

(ii) total volume of the solid,

Volume of solid

$= 3943.3 \times 150$

$= 591\,495$

$= 591\,000 \text{ cm}^3$ Or $592\,000 \text{ cm}^3$

Answer	591000 cm³	[1]

7 (b) Find the total surface area of the solid.

Total surface area
$= (50 + 50 + 50 + 50 + 80) \times 150$
$+(2 \times 3943.3)$
$+2\pi(20)(150)$
$= 68\,736$
$= 68\,700\ \text{cm}^2$

Answer	68 700 cm^2	[3]

(c) Find the mass of the solid given that the density of the material is $0.025\ \text{g/cm}^3$. $\left[\text{Density} = \frac{\text{Mass}}{\text{Volume}}\right]$

Mass of solid
$= 591495 \times 2.6$
$= 1\,537\,887$
$= 1\,540\,000\ \text{g}$

Answer	1 540 000 g	[2]

(d) The solid is melted to form a cube. Find the length of each side of the cube.

Length of each side of cube
$= \sqrt[3]{591\,495}$
$= 83.9\ \text{cm}$

Answer	83.9 cm	[2]

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