SECTION A [30 MARKS] ANSWER **ALL** QUESTION	**Full mark**
Question 1	**[30]**
a) **For each question there are FOUR responses: A, B, C and D. Choose the corresponding letter of your response and CIRCLE it neatly. NO score will be awarded, if you circle more than ONE letter.**	
i. If you write $3 \times 10^2 + 4 \times 10^{-2} + 5 \times 10^{-3}$ in standard form, what will be the place value of 4?	**[2]**
A Tens. B Tenth. C Hundreds. **D Hundredth.** ***Sample response:*** **D Hundredth** $3 \times 10^2 + 4 \times 10^{-2} + 5 \times 10^{-3} = 300.0\underline{4}5$	
ii. If you were asked to choose a perfect square without calculating, which of the following number would you choose?	**[2]**
A 112 **B 256** C 347 D 398 ***Sample response:*** **B 256** Because perfect square numbers do not have 2, 3, 7, and 8 in ones place.	
iii. Mr X knows the area of a circle and wants to find the radius of a circle. Which equation would help him to find the radius of a circle?	**[2]**
A $r = \pi\sqrt{A}$	

B $r = \frac{\sqrt{A}}{\pi}$

C $r = \sqrt{\frac{A}{\pi}}$

D $r = \frac{A}{\pi}$

Sample response: **C** $r = \sqrt{\frac{A}{\pi}}$

$A = \pi r^2$

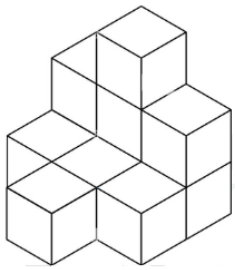
$\frac{A}{\pi} = r^2$

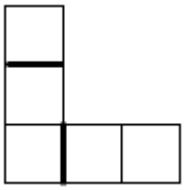
$r^2 = \frac{A}{\pi}$

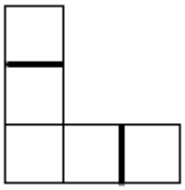
$\sqrt{r^2} = \sqrt{\frac{A}{\pi}}$

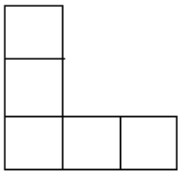
$r = \sqrt{\frac{A}{\pi}}$

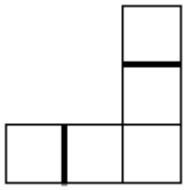
iv. Which of the following is the **LEFT** view of the image given? **[2]**

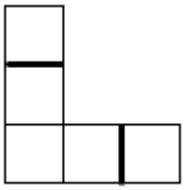


A 

B 

C 

D 

Sample response: **B** 

v. Study the clues provided: **[2]**

- The denominator is 4.
- The numerator is between 10 and 20.
- The fraction is greater than 3 but less than 5.

What is the rational number?

	A $\frac{1}{4}$ B $\frac{12}{4}$ **C** $\frac{16}{4}$ D $\frac{20}{4}$ ***Sample response:*** **C** $\frac{16}{4}$ $\frac{10 to 20}{4}$ $\frac{12 to 19}{4}$ $\frac{16+4}{4}$ **Answer =** $\frac{16}{4}$	
vi.	Jigme bought a notebook for Nu 30 and 4 pens. Kinley bought a notebook for Nu 50 and 3 of the same pens. Both of them paid the same amount. How much did each pen cost?	**[2]**
	A Nu 5 B Nu 15 **C Nu 20** D Nu 80 ***Sample response:*** **C Nu 20** Let the cost of a pen be x Jigme $4x + 30$ Kinley $3x + 50$ $4x + 30 = 3x + 50$	

$4x - 3x = 50 - 30$ $x = 20$	
vii. Which of the following expressions represents the model given? 	**[2]**
A $(3x + 1) + (x - 3)$ B $(3x + 1) - (x - 3)$ **C** $\boldsymbol{(3x + 1) + (-x - 3)}$ D $(3x + 1) - (-x - 3)$ ***Sample response:*** **C** $\boldsymbol{(3x + 1) + (-x - 3)}$	
viii. The circle graph shows the list of countries winning the FIFA world cup out of 22 world cup played till date.  How many times did Argentina win the FIFA world cup?	**[2]**
A **3** B 8 C 14 D 22	

Sample response: **A 3** 14% of 22 $0.14 \times 22 = 3.08$ Thus, Argentina won 3 world cup.		
ix.	The perimeter of a rectangle is 24 cm. Four students were asked to calculate the area of a rectangle with the same perimeter. The calculations were as shown: Dorji: If P=24 cm, length = 13 cm and width = 11 cm, therefore area = 143 cm^2 Sonam: If P=24 cm, length = 9 cm and width = 3 cm, therefore area = 12 cm^2 Padam: If P=24 cm, length = 4 cm and width = 3 cm, therefore area = 12 cm^2 Wangmo: If P=24 cm, length = 7 cm and width = 5 cm, therefore area = 35 cm^2 Whose calculation is correct?	**[2]**
	A Dorji. B Sonam. C Padam. **D Wangmo.** ***Sample response:*** **D Wangmo** P = 24 (l + w + l + w) OR (7 + 5 + 7 + 5) L = 7 W = 5 Area = 35 cm^2	
x.	The ratio of boys to girls in a class is as shown. If there are 30 students in the class, how many students will be boys?	**[2]**

A **12**

B 18

C 20

D 24

Sample response: **A** **12**

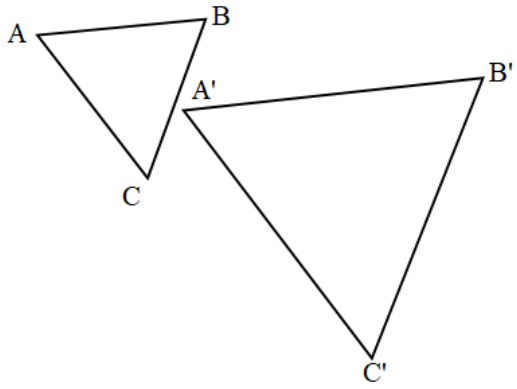
Ratio of boys to girls = 2:3

Total Ratio = 5

Number of boys = 12

2 : 5 = __ : 30

xi. Which of the following statement is **TRUE** about the transformation shown? **[2]**



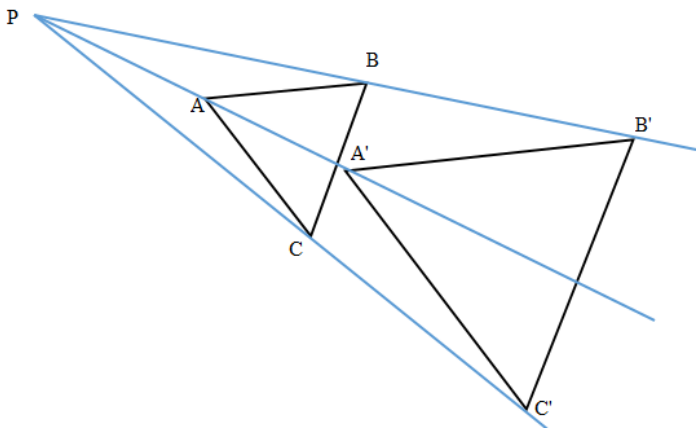
A **Triangle $A'B'C'$ is a dilated image of triangle ABC.**

B Triangle $A'B'C'$ is a rotated image of triangle ABC.

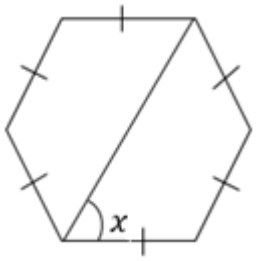
C Triangle $A'B'C'$ is a reflected image of triangle ABC.

D Triangle $A'B'C'$ is a translated image of triangle ABC.

Sample response: **A** **Triangle $A'B'C'$ is a dilated image of triangle ABC.**



xii. What is the value of ***x*** in the image? **[2]**



A 120^0

B 90^0

C $\mathbf{60^0}$

D 30^0

Sample response: **C** $\mathbf{60^0}$

Sum of the interior angle of a hexagon = $180^0 \times (n - 2)$

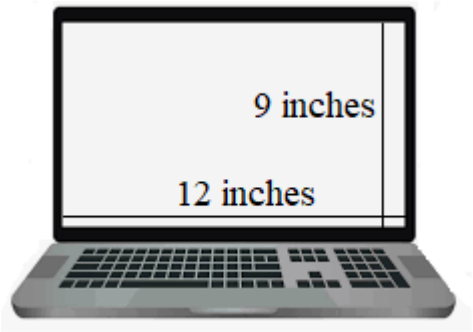
$180^0 \times (6 - 2)$

$180^0 \times 4$

720^0

Each interior angle = $\frac{720^0}{6} = 120^0$

Value of $x = \frac{120}{2} = 60^0$

xiii.	Sonam paid Nu 1,200 for a shirt that is usually sold at Nu 1,500. What is the discount percentage?	**[2]**
	A 300% B 80% C 25% **D 20%** ***Sample response:* D 20%** CP = Nu 1,500 RSP = Nu 1,200 Discount = Nu 300 Discount % = $\frac{300}{1500} \times 100\% = 20\%$	
xiv.	The screen size of a laptop is usually measured diagonally.  What is the size of the laptop shown?	**[2]**
	A 18 inches. **B 15 inches.** C 12 inches. D 9 inches. ***Sample response:* B 15 inches** $a = 12, b = 9 \; and \; c =?$ $c^2 = a^2 + b^2$	

$c^2 = 12^2 + 9^2$

$c^2 = 144 + 81$

$c^2 = 225$

$c = \sqrt{225}$

$c = 15$

xv. Dema flipped a fair coin for 40 times and recorded her result in the table. **[2]**

Event	**Number of trials**
Head	16
Tail	24

What is the difference between the theoretical probability and experimental probability of getting head?

A $\frac{1}{2}$

B $\frac{2}{5}$

C $\frac{3}{5}$

D $\frac{1}{10}$

Sample response: **D** $\frac{1}{10}$

Theoretical probability of getting head = $\frac{1}{2}$

Experimental probability as of Dema's Experiment = $\frac{16}{40} = \frac{2}{5}$

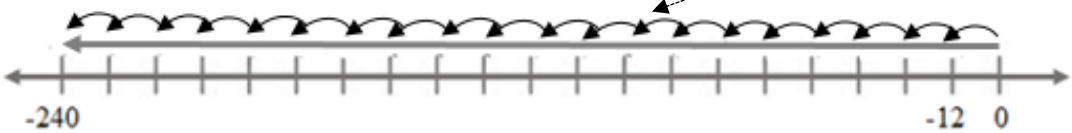
Difference = $\frac{1}{2} - \frac{2}{5} = \frac{5}{10} - \frac{4}{10} = \frac{1}{10}$

SECTION B (50 MARKS)

ANSWER **All** QUESTIONS

Question 2

a) The state of Colorado covers about 2.67×10^5 square kilometers. The Indian Ocean covers about 7.272×10^7 square kilometers.	
i. Which one covers the larger area? ***Sample response:*** $2.67 \times 10^5 < 7.272 \times 10^7$ ---------- [1 mark] **OR** 7.272×10^7 is greater ---------- [1 mark] **OR** Indian Ocean covers larger area than Colorado. ---------- [1 mark] **OR** 72,720,000 ---------- [1 mark]	[1]
ii. Calculate the differences in the area and write the answer in scientific notation. ***Sample answer:*** $2.67 \times 10^5 = 267{,}000$ ---------- [0.5 mark] $7.272 \times 10^7 = 72{,}720{,}000$ ---------- [0.5 mark] 72,720,000 – 267,000 = 72,453,000 ---------- [0.5 mark] $72{,}453{,}000 = 7.2453 \times 10^7$ ---------- [0.5 mark] **OR**	[2]

72,720,000 – 267,000 = 72,453,000 ---------- [1.5 mark] $72,453,000 = 7.2453 \times 10^7$ ---------- [0.5 mark] **OR** Award 1.5 mark for correct difference and 0.5 mark for correct scientific notation	
b) A submarine is descending at a constant rate of 12 metres per minute. How many minutes did it descend based on the diagram?  ***Sample response***: [1mark]  (Award 1 mark for the usage of diagram only) **OR** $-12 \times \_\_ = -240$ $-12 \times 20 = -240$ ---------- [1 mark] **OR** – 240 ÷ – 12 = 20 ---------- [1 mark] **OR** 20 minutes ---------- [2 marks]	[2]
Question 3	
a) Tashi estimates that the $\sqrt{639,000} \approx 60$. Is he correct? Justify your answer.	[3]

***Sample response**:*

No. ---------- [1 mark]

$\sqrt{639{,}000} = \sqrt{63.9 \times 10000}$ ---------- [0.5 mark]

$\sqrt{639{,}000} = \sqrt{63.9}\ x\ \sqrt{10000}$ ---------- [0.5 mark]

$\sqrt{639{,}000} = 8 \times 100 = 800$ ---------- [1 mark]

OR

No. ---------- [1 mark]

$60 \times 60 = 3600$ ---------- [1 mark]

639,000 is not equal to 3600 ---------- [1 mark]

OR

No ---------- [1 mark]

2 marks for correct process or justification "Example: Because 60 × 60 is 3600".

b) 6% of the cost of a computer was paid as a tax. If the tax was Nu 1800, what was the cost of the computer? [2]

***Sample response**:*

Tax: 6% = 1800, CP: 100% = ? ---------- [0.5 mark]

%	6	1	100
Nu	1800	300	**30000**

[0.5] [0.5]

The cost of a computer is Nu 30,000. ---------- [0.5 mark]

OR

Let the CP be x

$6\% of\ x = 1800$ ---------- [0.5 mark]

$\frac{6}{100}\ of\ x = 1800$ ---------- [0.5 mark]

$x = \frac{180000}{6}$ ---------- [0.5 mark]

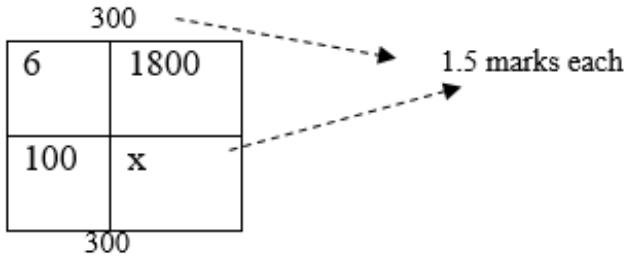
$x = 30,000$ ---------- [0.5 mark]

OR

$\frac{6}{100} = \frac{1800}{x}$ ---------- [1 mark]

(Solving award 0.5 mark and final answer 0.5 mark)

OR



$x = 30,000$ ---------- [0.5 mark]

Question 4

a) Bank of Bhutan offers an education loan at the rate of 8.13% per annum.

i. How much interest will you have to pay if you borrow Nu 50,000 for 3 years? [2]

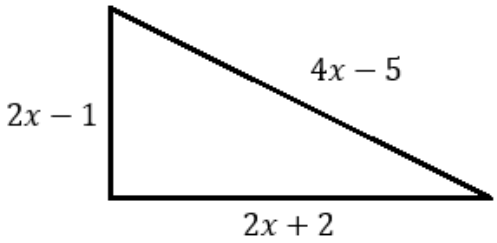
***Sample response**:*

P = Nu 50,000 T = 3 years R = 8.13% = 0.0813 I =?

I = PRT

I = 50,000 × 0.0813 × 3 ---------- [1 mark] OR $\frac{50{,}000\,x\,8.13\,x\,3}{100}$ ---------- [1 mark] I = 12,195 ---------- [1 mark]	
ii. How much amount will you have to pay altogether? ***Sample response**:* Amount = Principal + Interest [Amount = Nu 50,000 + 12,195] Amount = Nu 62,195 ---------- [1 mark]	[1]
b) The coordinates of a line on the graph are (5, 16), (3, 10), (1, 4). What type of slope does this line have? Explain without calculating the slope. ***Sample response**:* The slope is positive. ---------- [1 mark] Because as the value of *x* increases, the value of *y* also increases. **OR** ---------- [1 mark] Value of *x* decreases, the value of *y* also decreases. **OR** Correct graphical representation ------- [1 mark]	[2]
Question 5	
a) Dorji walks 3.5 kilometres and Sonam walks 4.5 kilometres every day. What will be the average distance covered by them in a week?	[1.5]
***Sample response**:*	

$\frac{(3.5+4.5)7}{2}$ ---------- [1 mark] **OR** $\frac{(8)7}{2}$ ---------- [1 mark] $\frac{56}{2}=28$ ---------- [0.5 mark] **OR** Dorji $3.5 \times 7 = 24.5$ ---------- [0.5 mark] Sonam $4.5 \times 7 = 31.5$ ---------- [0.5 mark] Average = $\frac{(24.5+31.5)}{2}=\frac{56}{2}=28$ ---------- [0.5 mark] **OR** $\frac{3.5+4.5}{2}=\frac{8}{2}$ OR 4 ---------- [0.5 + 0.5 mark] $\frac{8}{2}x7\ OR 4\ x7=28$ ---------- [0.5 mark]	
b. A school allows students to read a book after class in the library. Gopal reads a book for $1\frac{1}{2}$ hours every day. He completes the entire book in 6 days. How many hours does he take to complete the entire book? ***Sample response**:* $1\frac{1}{2}\times 6$ ---------- [0.5 mark] $\frac{3}{2}\times\frac{6}{1}$	[1.5]

$\frac{18}{2} = 9$ ---------- [1 mark] **OR** Repeated Addition --------- (0.5 mark) 9 -------- (1 mark)	
c. Find the perimeter of the triangle given.  ***Sample response**:* Perimeter = $(2x - 1) + (2x + 2) + (4x - 5)$ ---------- [1 mark] **OR** Use of algebraic tiles correctly ---------- [1 mark] $8x - 4$ ---------- [1 mark] **OR** Award full marks if the candidate substitute the value of "x" CORRECTLY to show the total perimeter with the strong justification.	[2]
Question 6	
a) Draw any pattern up to figure number 4 and write an equation to describe the pattern.	[3]

***Sample response**:*

Figure 1 Figure 2 Figure 3 Figure 4 ---------- [1 mark]

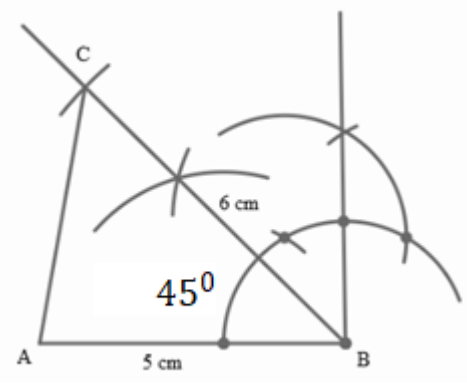
Figure number (f)	Number of dots (d)	d = 3 × f – 1
1	2	3 × 1 – 1 = 2
2	5	3 × 2 – 1 = 5
3	8	3 × 3 – 1 = 8
4	11	3 × 4 – 1 = 11

---------- [1 mark]

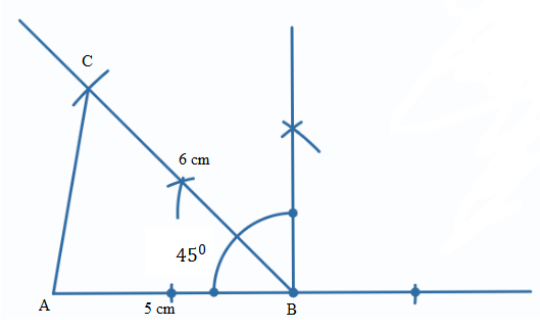
[1 mark]

b) Construct a triangle ABC with AB = 5 cm, angle B = 45^0, and BC = 6 cm. [2]

***Sample response**:*



OR



Constructing 90^0 ---------- [0.5 mark]

Bisecting 90^0 ---------- [0.5 mark]

Finding side BC ---------- [0.5 mark]

Complete construction ---------- [0.5 mark]

OR

Award full marks for the use of protractor for drawing triangle correctly.

Question 7

a) The bird house is made out of plywood. The nesting box has a volume of 16,000 cm^3. [2]

Calculate the width of a nesting box.

***Sample response**:*

l = 50 cm, w = ? cm, h = 40 cm, and v = 16,000 cm^3

volume = $l \times w \times h$

$$w = \frac{v}{l\,x\,h}$$

$$w = \frac{16,000\,cm^3}{40\,cm \times 25\,cm}$$ ----------[1 mark]

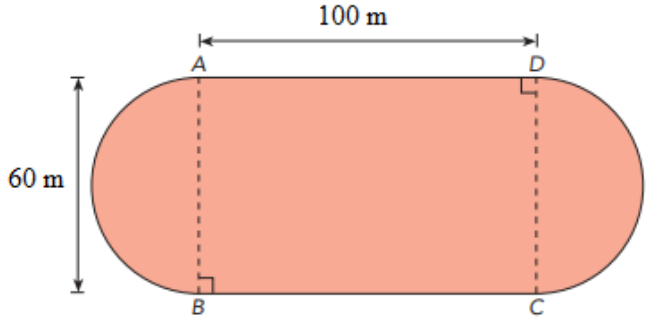
$w = 16\,cm$ ----------[1 mark]

OR

Award full marks for solving as given:

"16,000 = 40 × 25 × 16"

b) The outer layer of the athletic field is marked as shown. [3]



A gardener cuts the grass at an average rate of 20 square meters per minute. How many hours will the gardener take to finish the entire athletic field?

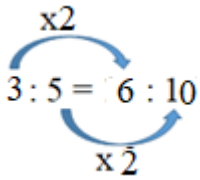
***Sample response**:*

Area of a circle:

r = 30 m ---------- [0.5 mark]

$A = \pi r^2$

$A = 3.14 \times (30\ m)^2$ $A = 3.14 \times 900\ m^2$ $A = 2826\ m^2$ ---------- [0.5 mark] **Area of a rectangle:** $l = 100\ m$ $w = 60\ m$ $A = 100\ m \times 60\ m$ $A = 6{,}000\ m^2$ ---------- [0.5 mark] **Total area =** $2826\ m^2 + 6{,}000\ m^2 = 8{,}826\ m^2$ ---------- [0.5 mark] **Time taken:** $20\ m^2 = 1$ minute $18{,}826\,cm^2 = \frac{8{,}826}{20} = 441.3$ Minutes. ---------- [0.5 mark] $\frac{441.3}{60} = 7.355$ hours ---------- [0.5 mark]	
Question 8	
a) A ladder measuring 10 metres long is placed against a vertical wall, reaching the top. The ratio of the height of the wall to the length of the ladder is 3:5. How far is the base of the ladder placed away from the wall? ***Sample response**:* Ladder = 10 m Ratio of the height of the wall to the length of a ladder = 3:5	[3]



Therefore height of the wall = 6 m ---------- [1 mark]

Distance from base of the wall to base of the ladder:

$c^2 = a^2 + b^2$

$a^2 = c^2 - b^2$ ---------- [0.5 mark]

OR

$a^2 = 10^2 - 6^2$ ---------- [0.5 mark]

$a^2 = 100 - 36$ ---------- [0.5 mark]

OR

$a^2 = 64$ ---------- [0.5 mark]

$a = \sqrt{64}$ ---------- [0.5 mark]

a = 8 or 8 m ---------- [0.5 mark]

OR

$c^2 = a^2 + b^2$

$5^2 = 3^2 + b^2$ ---------- [0.5]

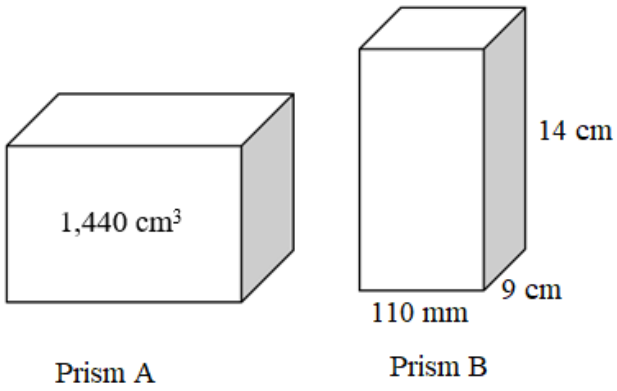
$25 = 9 + b^2$

$25 - 9 = b^2$ ---------- [0.5]

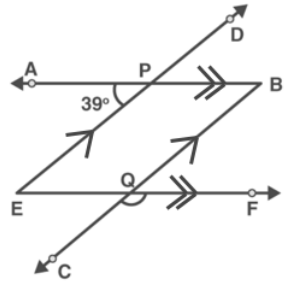
$\sqrt{16} = b^2$

b = 4 ---------- [0.5]

= 4 × 2 = 8 OR 8 ---------- [0.5]

b) Study the rectangular prisms given.  Which rectangular prism has a greater volume? Show your work. ***Sample response:*** Prism B l = 110 mm = 11 cm ---------- [0.5 mark] w = 9 cm h = 14 cm v = 11 cm × 9 cm × 14 cm = 1386 cm^3 ---------- [1 mark] Prism A has a greater volume than prism B (1,440 cm^3 > 1386 cm^3) **OR** ---------- [0.5 mark] Prism B is greater than prism A (1386 cm^3 > 1.440 cm^3)	[2]
Question 9	

a) Study the diagram and fill in the table. [3]

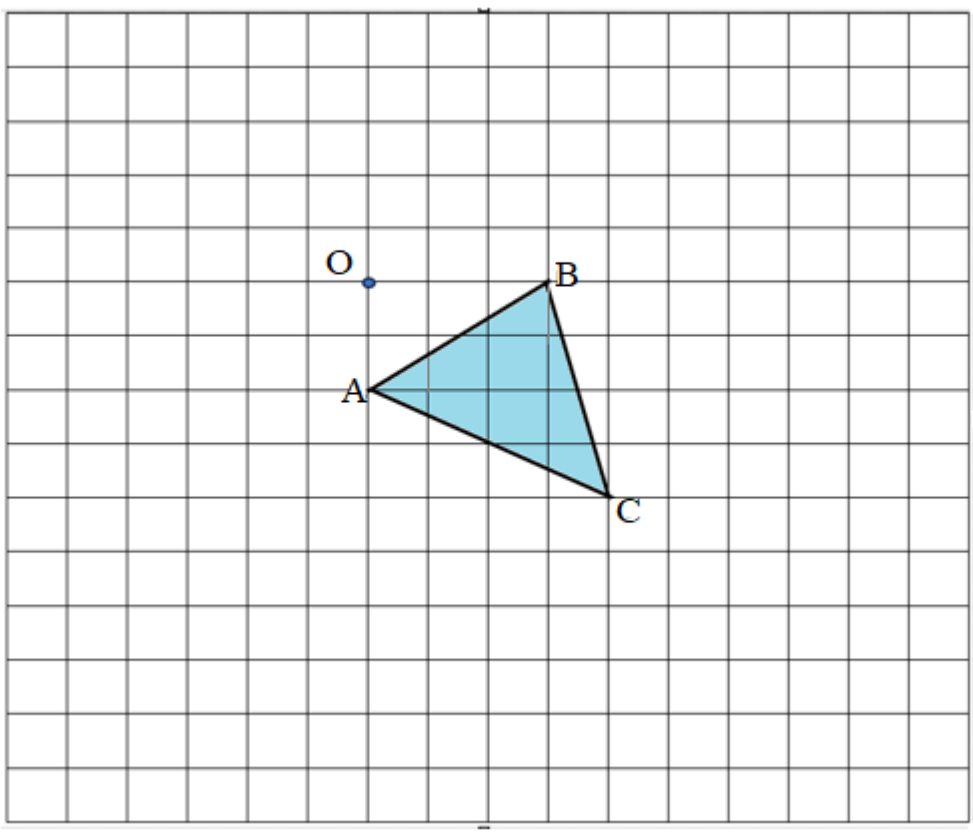


Angle	Degree measure	Reason
$\angle APD$		
$\angle DEF$		
$\angle BQF$		

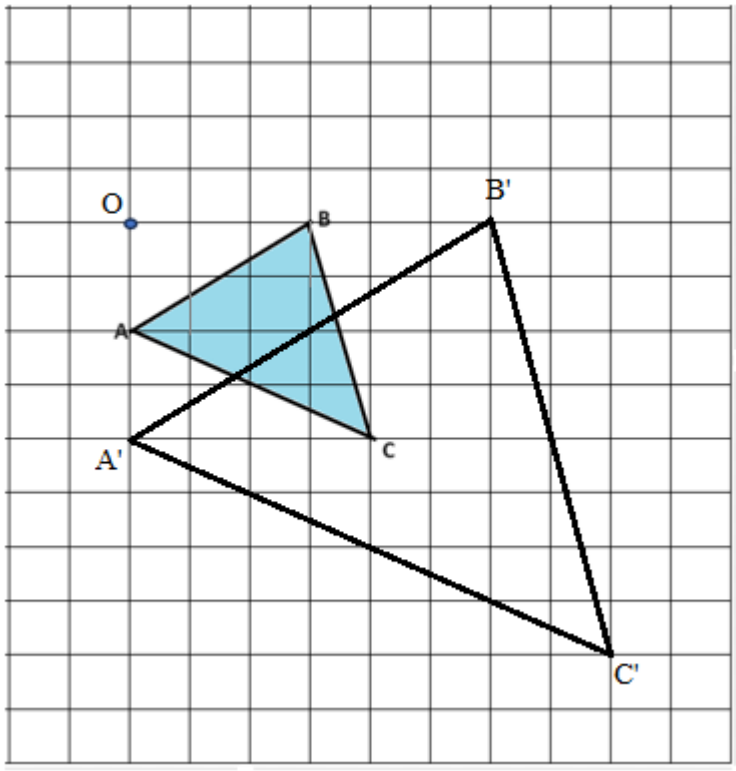
Sample response:

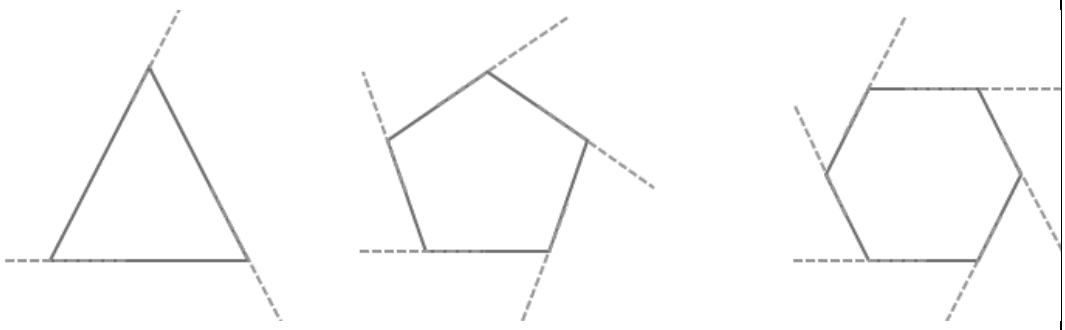
Angle	Degree measure	Reason
$\angle APD$	141^0	Adjacent/Supplementary angle OR Straight line **OR** $180^0 - 39^0 = 141^0$
$\angle DEF$	39^0	Alternate angles **OR** Angle APE = Angle DEF
$\angle BQF$	39^0	Corresponding angles **OR** Angle APE/Angle DEF = Angle BQF

b) Dilatate triangle ABC by a scale factor of 2 with dilatation centre O. [2]



Sample response:



[Award 0.5 mark each for the correct coordinate for the image and 0.5 for the completion of the drawing]	
Question 10	
a) What is common in the exterior angles of all these polygons?  ***Sample response:*** The sum of the exterior angles equals 360^0 in all these polygons. ---------- [2 marks]	[2]
b) Sonam has a jar containing 3 red marbles, 1 black marble and 2 green marbles.	
i. What is the probability of drawing a red marble? ***Sample response:*** $P(E) = \frac{Number\ of\ favourable\ outcomes}{Number\ of\ possible\ outcomes}$ $P(red) = \frac{3}{6}$ ---------- [1 mark] **OR** $P(red) = \frac{1}{2}$ ---------- [1 mark]	[1]
ii. Sonam took one marble and then replaced it. Then she took another marble. What is the complement of getting red and black marbles?	[2]

Sample response:

	R	**R**	**R**	**B**	**G**	**G**
R	RR	RR	RR	RB	RG	RG
R	RR	RR	RR	RB	RG	RG
R	RR	RR	RR	RB	RG	RG
B	BR	BR	BR	BB	BG	BG
G	GR	GR	GR	GB	GG	GG
G	GR	GR	GR	GB	GG	GG

P *(red and black)*= $\frac{6}{36}$ or $\frac{1}{6}$ ---------- [1 mark]

$P(Not\ red\ and\ black) = 1 - \frac{1}{6} = \frac{6}{6} - \frac{1}{6} = \frac{5}{6}$ ---------- [1 mark]

OR

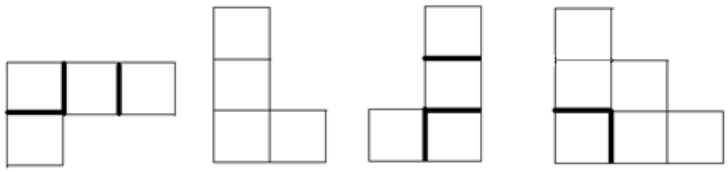
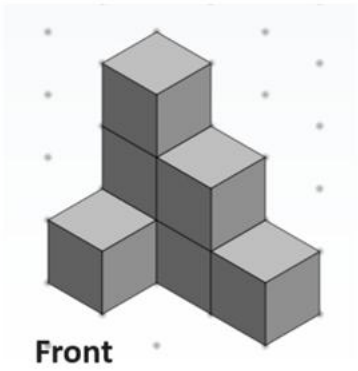
$P(red) = \frac{3}{6} = \frac{1}{2}$

$P(black) = \frac{1}{6}$

$P(red\ then\ black) = \frac{1}{2} \times \frac{1}{6} = \frac{1}{12}$ ----------[0.5 mark]

$P(black\ then\ red) = \frac{1}{6} \times \frac{1}{2} = \frac{1}{12}$ ----------[0.5 mark]

$P(red\ and\ black) = \frac{1}{12} + \frac{1}{12} = \frac{2}{12} = \frac{1}{6}$ ----------[0.5 mark]

$P(Not\ red\ and\ black) = 1 - \frac{1}{6} = \frac{6}{6} - \frac{1}{6} = \frac{5}{6}$ ----------[0.5 mark]	
Question 11	
a) Draw a structure that matches this set of orthographic drawings:  Top view Left view Right View Front view ***Sample response:***  Representing left view. ---------- [0.5 mark] Representing right view. ---------- [0.5 mark] Representing top view. ---------- [0.5 mark] Representing front view. ---------- [0.5 mark] **OR** Award 0.5 for correct drawing for the face views. Deduct 0.5 for the incorrect usage of the dot paper.	[2]
b) You have collected the height of 100 students in your school. Which graph would you choose to display the information?	[3]

Provide any two reasons to support your answer.

Sample response:

Histogram ---------- [1 mark]

- **Continuous Data**: Histograms are usually used to display continuous data by grouping into bins or intervals. Heights are continuous data and they can take on any value within a range.
- **Frequency Distribution**: A histogram effectively shows the distribution of heights by displaying the frequency of students falling within each height range. This makes it easy to see patterns, such as which height ranges are most common.
- **Comparative Analysis**: By looking at the height of the bars, you can quickly compare the number of students in different height ranges, providing a clear visual representation of the data distribution.

(Award 1 mark each for any two relevant reasoning).

OR

Using a circle graph (pie chart) to display the heights of students is generally not recommended. However, if students consider using a pie chart, award marks based on his/her reasoning.

- **Re-proportional Comparison**: If you categorize the heights into distinct groups and calculate percentage or degree, a pie chart can visually display this information.
- **Simple Overview**: A pie chart might make it easy to quickly grasp the relative sizes of each height category. It can provide an immediate sense of the proportions without needing to interpret a more complex histogram. Example, pie chart can chow us what percent of students are within the height range.
- **Limited Categories**: If you have a limited number of height categories a pie chart might be used. For example, if heights are grouped into just three or four broad categories, a pie chart can display this without overwhelming the viewer with too many segments.

(Award 1.5 marks each for any two relevant reasoning)
