## SECTION A [20 MARKS]

ANSWER **ALL** QUESTIONS

**Question 1** **[20]**

**Direction: For each question, there are four alternatives: A, B, C and D. Choose the correct alternative and circle it. DO NOT circle more than ONE alternative. If there is more than ONE choice circled, NO score will be awarded.**

i) The element at (3, 2) in the given matrix is

$$\begin{bmatrix} -1 & 0 & 2 \\ 4 & 1 & -3 \\ 9 & -2 & 5 \end{bmatrix}$$

A –3.
B –2.
C 0.
D 5.

ii) Yangchen has Nu 120,000 which she wants to invest in Punjab National Bank shares with a face value of Nu 500 but the bank was selling at a premium of 15%. How many shares can she buy?

A 208
B 209
C 240
D 282

iii) Expressing $x$ as a function of $y$ for the equation, $5x-2y=10$ is

A $y=\frac{5}{2}x-5.$

B $y=\frac{5}{2}x+5.$

C $x=\frac{2}{5}y-2.$

D $x=\frac{2}{5}y+2.$

iv) Karma is building a rectangular table with an area of 18,000 cm$^2$. He wants to put wood trim around the four edges. What is the shortest length of trim he could use (*nearest to hundredth*)?

A 134.16 cm
B 475.60 cm
C 536.66 cm
D 4500.00 cm

v) The value of each symbol in $(3x-\theta)^2 = 9x^2 - \Delta x + 4$ are

A $\theta = 2 \; and \; \Delta = 12.$

B $\theta = 3 \; and \; \Delta = 18.$

C $\theta = 4 \; and \; \Delta = 24.$

D $\theta = 5 \; and \; \Delta = 30.$

vi) The double stem and leaf plot below shows the number of hours spent by 18 people watching TV in a week.

| **Female** | | **Male** |
|---|---|---|
| 5 | 1 | 1 5 5 6 8 9 |
| 5 2 | 2 | 3 4 6 |
| 8 | 3 | 1 |
| 9 8 6 | 4 | 2 |

Which of the following is **NOT** true?

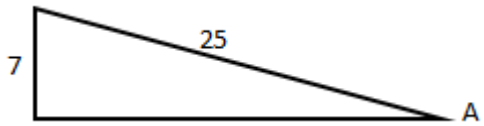
A The mean time is about 26.8 hours.

B The least time recorded is 11 hours.

C Males spend a lot more time in watching TV than females.

D Females spend a lot more time in watching TV than males.

vii) The cosine of $\angle A$ in the figure is



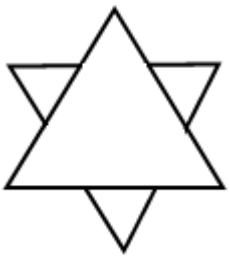

A 0.28.

B 0.29.

C 0.96.

D 1.04.

viii) How many lines of symmetry does the figure have?



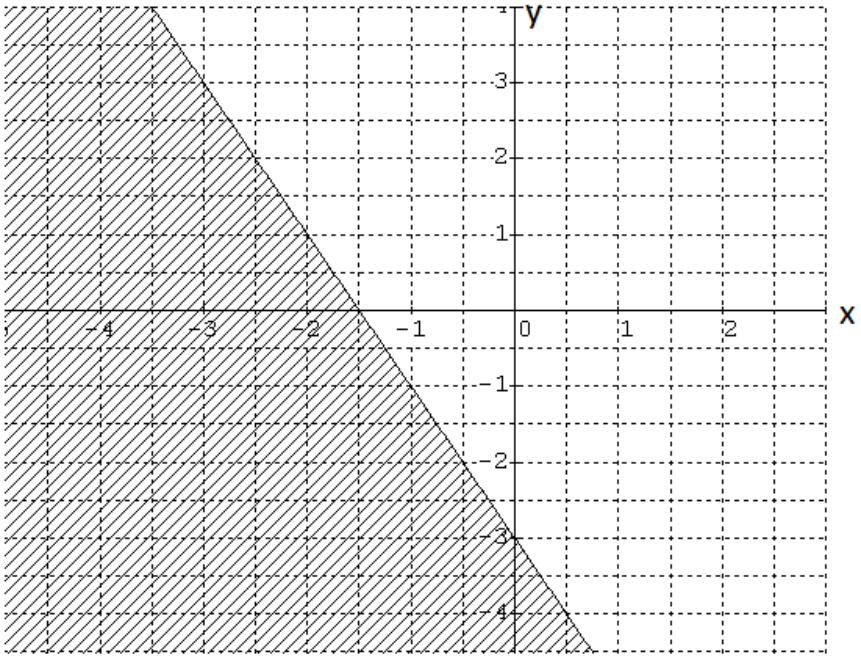
A 6

B 5

C 4

D 3

ix) The inequality for the graph is




A $y \geq -2x+3.$

B $y \geq -2x-3.$

C $y \leq -2x-3.$

D $y \leq -2x+3.$

x) *A box plot of the data looks as if the box was shifted to the left. The right whisker is longer, and the median is closer to the left side of the box.* This type of distribution is a

A normal distribution.

B uniform distribution.

C left skewed distribution.

D right skewed distribution.

**SECTION B [32 MARKS]**
ANSWER **ALL** QUESTIONS

**Question 2**

a) For the given matrices, calculate $-B+2A$. **[2]**

$$\text{Matrix } A=\begin{bmatrix}-1 & 3 & 0\\ 4 & 2 & -2\end{bmatrix} \text{ and Matrix } B=\begin{bmatrix}-2 & 5 & -5\\ 1 & -7 & 0\end{bmatrix}$$

b) Create a digraph for the matrix and then simplify. **[2]**

$$\begin{bmatrix}0 & 2 & 1\\ 1 & 1 & 1\\ 1 & 2 & 0\end{bmatrix}$$

**Question 3**

Karma borrowed Nu 50,000 at a rate of 15% compounded monthly. He agreed to the following repayment plan:

- Nu 20,000 at the end of first month
- Nu 25,000 at the end of second month
- A final repayment of the remaining at the end of third month

a) Calculate the amount of the final repayment. **[3]**

b) Find the total interest. **[1]**

**Question 4** **[2]**

Complete the table of values for the function $f(x)=3x-2$. State whether it represents a function or not. Explain.

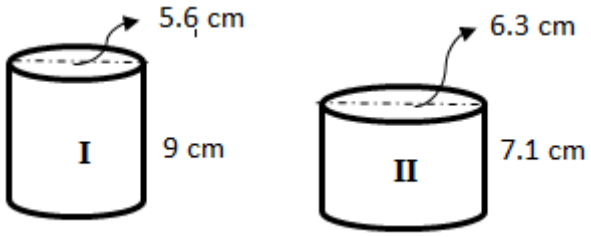
| $x$ | $f(x)$ |
|---|---|
| $-2$ | ..... |
| $-1$ | ..... |
| 0 | ..... |
| 1 | ..... |

**Question 5** **[2]**

Solve: $4x-2y=3$ and $-3x+y=-2$

**Question 6**

The two cylinders hold the same amount of water.




a) Determine the total surface area of each cylinder. **[2]**

b) Which of the two cylinders is more efficient? Explain why? **[1]**

**Question 7**

The height of a right triangle is 7 cm less than its base. If the hypotenuse is 13 cm, find the lengths of the other two sides. **[2]**

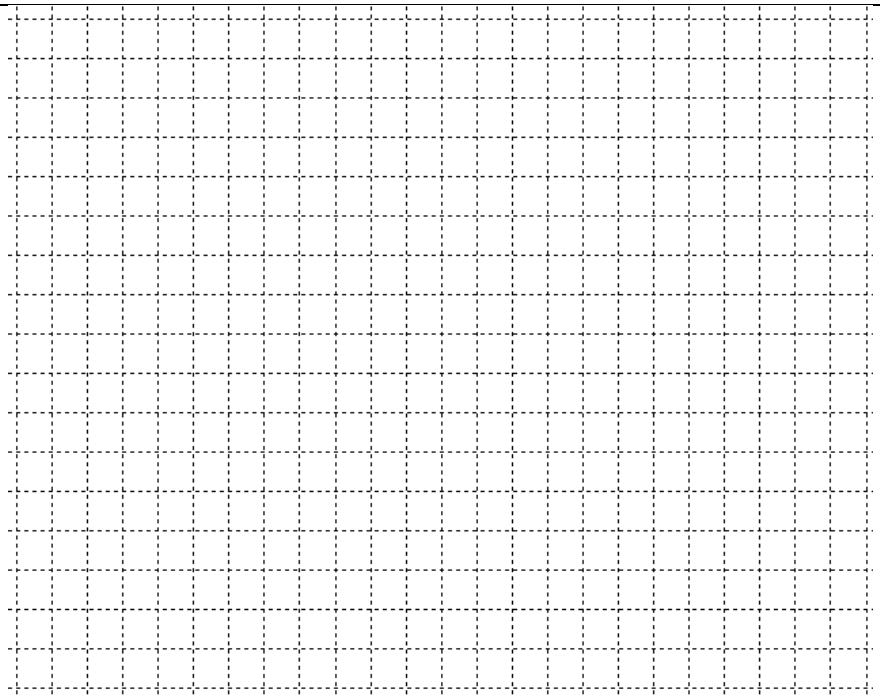
**Question 8**

For the function $f(x)=x^2-2x-3$:

a) Determine the $x$-intercept and $y$-intercept. **[1.5]**

b) Find the coordinates of the vertex of the function. **[1]**

c) Sketch the graph using a) and b). **[1.5]**



**Question 9**

A pair of dice is rolled at the same time. Calculate the probability of getting:

a) the same number on both the dice. **[1]**

b) different numbers on both the dice. **[1]**

**Question 10**

Choki recorded the number of people visiting Ta-Dzong in Paro each day for a period of 31 days.

| | | | | | | |
|---|---|---|---|---|---|---|
| 12 | 15 | 17 | 13 | 20 | 5 | |
| 7 | 10 | 30 | 21 | 6 | 10 | |
| 12 | 17 | 15 | 19 | 23 | 13 | |
| 18 | 7 | 8 | 11 | 10 | 4 | |
| 27 | 9 | 29 | 19 | 25 | 20 | 16 |

**[3]**

Calculate 5-number summary and create a box plot.

**Question 11**

Dodo and Vishnu are 18 m apart on a level ground with an electric pole in between them. Dodo is looking up at the top of the pole with an angle of elevation of $25^0$ and Vishnu with an angle of elevation of $33^0$. Their eye levels are 1.3 m above the ground. How tall is the electric pole? **[3]**

**Question 12**

a) Create **TWO** 2-D shapes with five lines of symmetry and show the lines of symmetry. **[2]**

b) Create a 2-D shape with a turn symmetry of order 6 that is not a regular hexagon. **[1]**

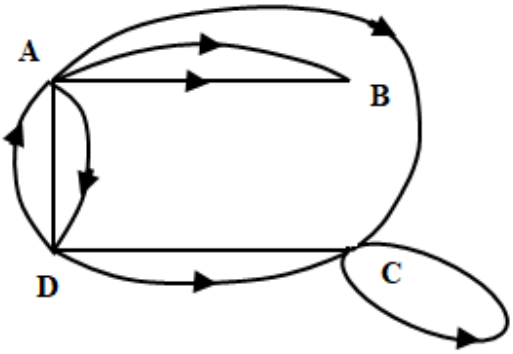
## SECTION C [48 MARKS]

**Direction: Under this section, there are 8 questions (Question 13 – 20). Each question has two parts, I and II. Attempt either I or II from each question.**

**Question 13(I)**

a)

i) Describe the given digraph with a matrix. **[1]**




ii) By looking at the matrix you have created, how can you tell the following? **[2]**

A. The number of vertices in the digraph.

B. If there are loops in the digraph.

C. That two vertices are not connected.

D. The total number of edges.

b) Find the missing values. **[3]**

$$\begin{bmatrix} 3 & 2 & -2 \\ \boldsymbol{x} & 0 & 1 \end{bmatrix} \times \begin{bmatrix} 1 & 0 \\ -1 & \boldsymbol{y} \\ -3 & -1 \end{bmatrix} = \begin{bmatrix} \boldsymbol{z} & 6 \\ -4 & -1 \end{bmatrix}$$

**OR**

**Question 13(II)**

a) Phuntsho factored every multiple of 4 from 4 to 40 into prime factors. He used a matrix to show how many times each prime factor (2, 3, 5 and 7) appeared in each number. Create Phuntsho's matrix. **[3]**

b) Matrix $A = \begin{bmatrix} 2 & -1 & 0 \\ 1 & 3 & -2 \end{bmatrix}$ and Matrix $B = \begin{bmatrix} 1 & 0 \\ -1 & 2 \\ -2 & 0 \end{bmatrix}$

i) Calculate $A \times B$. **[2]**

ii) Is $B \times A$ possible? Explain. **[1]**

**Question 14(I)**

a) What interest rate compounded monthly, is equivalent to 13% p.a. compounded semi-annually? **[3]**

b) Thukten bought 100 shares of a stock with a face value Nu 500 which were sold at a discount of 18%. A 22% dividend rate was paid at the end of the year. He then sold the stock at a 10% premium.

i) How much profit did he make? **[2]**

ii) How much was his profit as a percent of his investment? **[1]**

## OR

**Question 14(II)**

a) Pelki borrowed Nu 20,000 at a rate of interest compounded quarterly. The balance was Nu 18,250 after making her quarterly payment of Nu 2,500. Calculate the rate of interest. **[3]**

b) Khendum bought shares worth Nu 40,000 with a face value Nu 100 at par. She borrowed 70% of her investment money at an interest rate of 14% compounded annually. At the end of the first year, how much more did she earn in dividends than interest paid on her loan if the annual dividend rate was 25%? **[3]**

**Question15(I)**

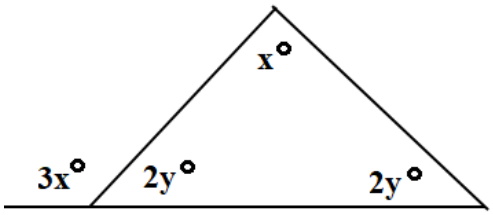
a) On a 100 chart, you can make L shape by shading four numbers as shown below.

| | | | | | |
|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 |
| 11 | 12 | 13 | 14 | 15 | 16 |
| 21 | 22 | 23 | 24 | 25 | 26 |
| 31 | 32 | 33 | 34 | 35 | 36 |
| 41 | 42 | 43 | 44 | 45 | 46 |

i. Write a function to describe the sum of the values in the L in terms of greatest value in the L. **[2]**

ii. What is the greatest value in the L if the sum of the values is 71? **[1]**

b) Calculate the values of $x$ and $y$ in the diagram. **[3]**

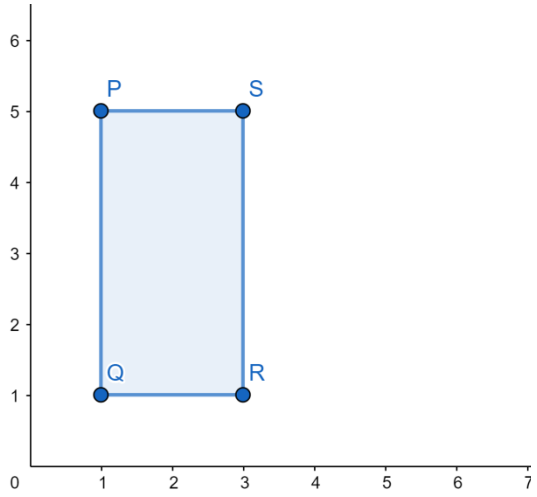



**OR**

**Question 15(II)**

a) Sketch the graph of $5x-2y>20$. Show your work. **[3]**

b) A rectangle has these vertices: P(1, 5), Q(1, 1), R(3, 1), and S(3, 5).

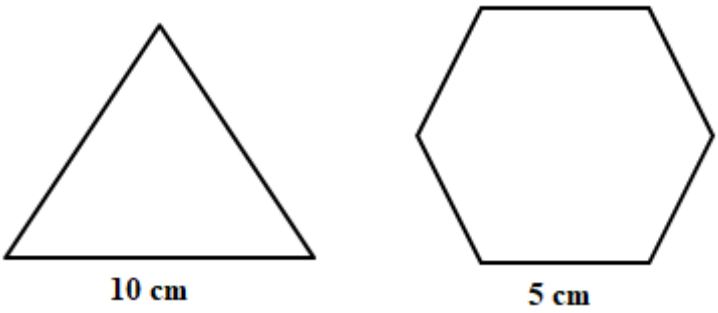



i) Determine the equations of each diagonal PR and QS. **[2]**

ii) Determine the point of intersection of the diagonals. **[1]**

**Question 16(I)**

a) These two regular polygons have a perimeter of 30 cm each.




Calculate the areas of each polygon. Which polygon is more efficient? Explain why? **[3]**

b)

i) Determine the total surface area of a sphere with a diameter of 20 cm. **[1]**

ii) Determine the edge length of a cube that has the same total surface area as the sphere above. **[1]**

iii) Which one of the above objects will have more volume? Explain. **[1]**

**OR**

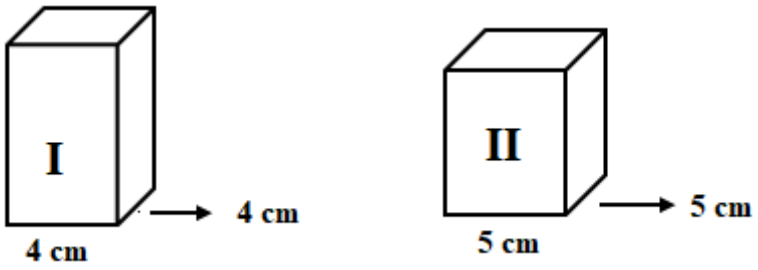
**Question 16(II)**

a)

i) Dolay wants to fence his rectangular garden. A metre of fence costs Nu 35. What is the greatest area he can enclose by spending Nu 8000? **[1.5]**

iii. How much more area can he enclose if the garden was circular? **[1.5]**

b) Two square-based prisms each have a total surface area of 192 $cm^2$.




i) Determine the height of each prism. **[2]**

ii) Which prism is more efficient? Explain. **[1]**

**Question 17(I)**

a) Write the coordinates of the vertex of the graph for each function.

i) $f(x)=x^2-5$ **[0.5]**

| | |
|---|---|
| | |

ii) $f(x)=(x+3)^2$ **[0.5]**

| | |
|---|---|
| | |

iii) $f(x)=-3(x-1)^2-7$ **[0.5]**

| | |
|---|---|
| | |

iv) $f(x)=-\frac{3}{4}(x-2)^2$ **[0.5]**

| | |
|---|---|
| | |

b) A ladder is leaning against a wall. The top of the ladder is 15 m above the floor. The ladder is 1 m longer than twice the distance from the bottom of the wall to the bottom of the ladder. How far is the ladder from the bottom of the wall? What is the length of the ladder? **[4]**

| | |
|---|---|
| | |

**OR**

**Question 17(II)**

a) Write the equation of the parabola that would result from applying each transformation or composite transformation to the graph of $y=x^2$.

i) $(x,y)\rightarrow(x-3,y)$ **[0.5]**

| | |
|---|---|
| | |

ii) $(x,y)\rightarrow(x,-\frac{2}{5}y)$ **[0.5]**

| | |
|---|---|
| | |

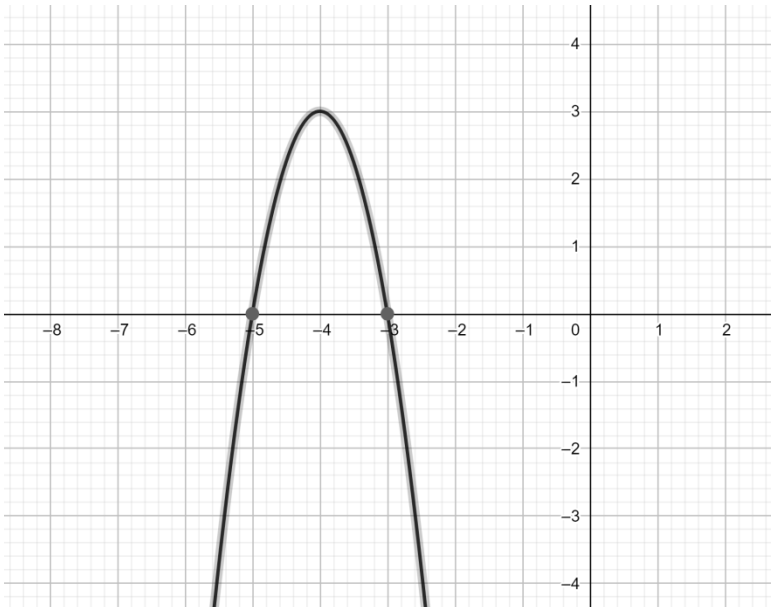
iii) $(x,y)\rightarrow(x+5,y-2)$ **[0.5]**

| | |
|---|---|
| | |

iv) $(x,y)\rightarrow(x-7,-2y+4)$ **[0.5]**

| | |
|---|---|
| | |

b) What is the equation of the parabola? **[2]**



c) Write an equation in the form $ax^2 + bx + c = 0$ that would match the roots or zeros of $-2 \text{ and } \frac{3}{5}$. **[2]**

**Question 18(I)**

a) Padam randomly chooses an integer between 1 to 50.

*Event A*: The number is a multiple of 3.

*Event B*: The number is a multiple of 4.

What is the probability of :

i) event A happening? **[0.5]**

ii) event B happening? **[0.5]**

iii) both events A and B happening? **[1]**

iv) Are the events A and B dependent or independent? Explain. **[1]**

b) The data represents the number of tickets sold in Trowa theatre in the month of June.

| | | | | | |
|---|---|---|---|---|---|
| 125 | 108 | 150 | 107 | 128 | 132 |
| 137 | 96 | 99 | 122 | 134 | 122 |
| 117 | 142 | 127 | 130 | 132 | 127 |
| 126 | 127 | 145 | 120 | 144 | 129 |
| 150 | 143 | 127 | 119 | 108 | 119 |

**[3]**

Create a frequency table and a histogram for the data.

## OR

**Question 18(II)**

a) A bag contains 5 black, 6 white and 7 green balls.

i) You draw a black ball and replaced it. What is the probability of drawing a white ball next? **[0.5]**

| | |
|---|---|
| | |

ii) You draw a green ball and do not replace it. What is the probability of drawing a black ball next? **[0.5]**

| | |
|---|---|
| | |

iii) You draw a green ball and do not replace it. What is the probability of drawing another green ball? **[0.5]**

| | |
|---|---|
| | |

iv) You draw a white ball and replaced it. What is the probability of drawing another white ball? **[0.5]**

| | |
|---|---|
| | |

v) Which of the above events are dependent? Explain. **[1]**

| | |
|---|---|
| | |

b) The following data shows the distribution of heights of a group of 40 students.

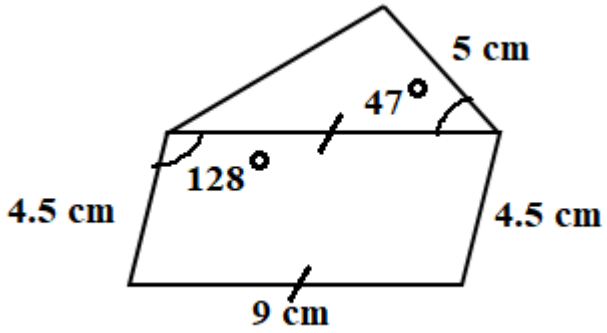
| Heights (cm) | No. of students |
|---|---|
| 135 – 140 | 1 |
| 140 – 145 | 4 |
| 145 – 150 | 11 |
| 150 – 155 | 12 |
| 155 – 160 | 6 |
| 160 – 165 | 4 |
| 165 – 170 | 2 |

Determine the mean, median and mode for the data. **[3]**

**Question 19(I)**

a) A tree, 7.8 m tall casts a shadow that is 15.2 m long. At what angle do the rays from the sun meet the top of the tree? **[2]**

b) Calculate the area of the shape given below. **[2]**



c) Fill in the blanks. **[2]**

i) $\sin 29° = \cos$ _____

ii) $\sin$ _____ $= 0.9$

iii) $\cos$ _____ $= 0.8$

iv) $\tan$ _____ $= 2.7$

## OR

**Question 19(II)**

a) Sherab looks at the top of a tree from a window 20 m above the ground at an angle of elevation of $35^0$. He then looks at the base of the tree at an angle of depression of $65^0$. Find the height of the tree. **[3]**

b) Calculate the other five trigonometric ratios based on $\sec x = 3$. **[3]**

**Question 20(I)**

a)

i) How many planes of symmetry are there in a square based prism that is not a cube? Sketch and show the planes using lines. **[1.5]**

ii) Describe the turn symmetry for the above prism. **[1.5]**

b) Construct $\Delta PQR$, where $PQ = \frac{1}{2}PR$ and $\angle P = 35^0$. Then, locate the centroid of the triangle that you have constructed. **[3]**

**OR**

**Question 20(II)**

a)

i) How many planes of symmetry are there in a regular pentagon-based pyramid? Sketch and show the planes using lines. **[1.5]**

ii) Describe the turn symmetry for the above prism. **[1.5]**

b) Construct $\Delta ABC$, where $AB = \frac{3}{4}AC$ and $\angle C = 55^0$. Then, construct the incircle of the triangle that you have constructed. **[3]**

## Rough Work

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