

# MATHEMATICS

## (Two hours and a half)

Answers to this Paper must be written on the paper provided separately.

You will not be allowed to write during the first 15 minutes.

This time is to be spent in reading the question paper.

The time given at the head of this Paper is the time allowed for writing the answers.

Attempt **all** questions from Section A and **any four** questions from Section B  
*All working, including rough work, must be clearly shown, and must be done on the same sheet as the rest of the answer.*

**Omission of essential working will result in loss of marks.**

The intended marks for questions or parts of questions are given in brackets [ ]

**Mathematical tables are provided.**

### SECTION A

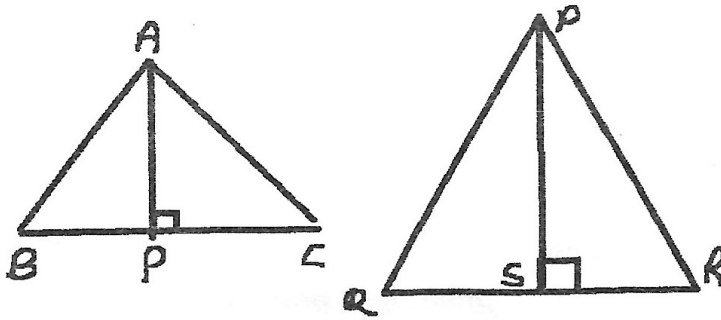
*(Attempt all questions from this Section)*

**Question 1.** Choose the correct answers to the questions from the given options. [15]

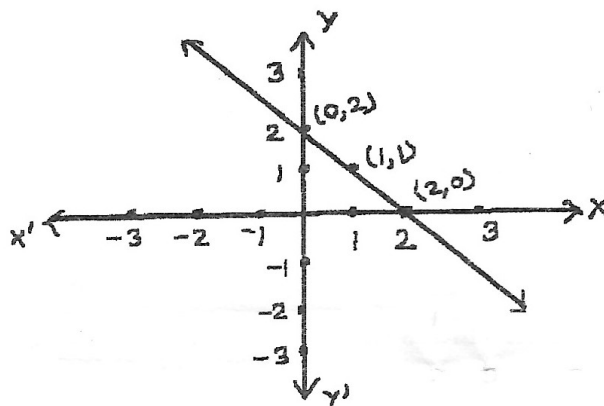
(Do not copy the questions, write the correct answer only)

- i. If  $A = \begin{bmatrix} 5 & -2 \end{bmatrix}$  and  $B = \begin{bmatrix} -7 \\ 11 \end{bmatrix}$ , which of the following operation is/are possible
1.  $A - B$       2.  $A + B$       3.  $AB$       4.  $BA$
- a. Only 3      b. Both 1 and 2      c. Only 4      d. Both 3 and 4      e. None of these
- ii. If  $x^2 + kx - 28 = (x - 7)(x + 4)$  for all values of  $x$ , then the value of  $k$  is
- a.  $-11$       b.  $-3$       c.  $3$       d.  $11$       e. None of these
- iii. A retailer purchased an item for ₹2500 from a wholesaler and sells it to a customer at 12% profit. The sales are intrastate and the rate of GST is 18%. The amount of tax paid by the customer to the central government is
- a. ₹252.00      b. ₹504.00      c. ₹27.00      d. ₹54.00      e. None of these
- iv. If the roots of the quadratic equation  $x^2 + 12x - k = 0$  are real and different, then the values of  $k$  are
- a.  $> 36$       b.  $> -36$       c.  $< 36$       d.  $< -36$       e. None of these
- v. Which of the following is/are an Arithmetic Progression (A.P.)?
1.  $8, 1, -6, -13, \dots$
2.  $5, 5, 5, 5, \dots$
3.  $\sqrt{3}, \sqrt{12}, \sqrt{27}, \sqrt{48}, \dots$
- a. Only 1      b. Only 1 and 2      c. Only 2      d. All 1, 2 and 3      e. None of these
- vi. The table shows the values of  $x$  &  $y$ , where  $x$  is proportional to  $y$
- |     |   |    |   |
|-----|---|----|---|
| $x$ | M | 12 | 4 |
| $y$ | 9 | 18 | N |
- What are the values of M and N?
- a.  $M = 6$  and  $N = 9$       b.  $M = 9$  and  $N = 6$       c.  $M = 9$  and  $N = 9$
- d.  $M = 6$  and  $N = 6$       e. None of these

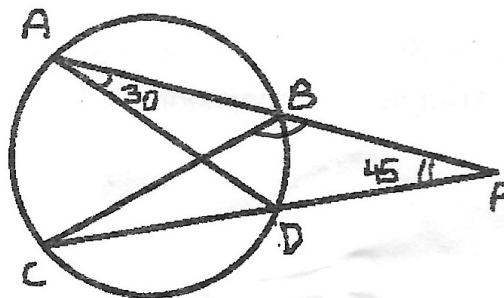
- vii. In the given figure,  $\Delta ABC \sim \Delta PQR$  and  $\frac{AP}{PS} = \frac{5}{11}$ . The ratio of Perimeter( $\Delta ABC$ ):Perimeter( $\Delta PQR$ ) is



- a. 11 : 5      b. 5 : 6      c. 5 : 11      d. 6 : 11      e. None of these
- viii. A cylindrical vessel of diameter 4cm is partly filled with water. 300 lead balls are dropped in it. The rise in water level is 0.8cm. The diameter of each ball is
- a. 0.8cm      b. 0.4cm      c. 0.5cm      d. 0.2cm      e. None of these
- ix. Choose the equation whose graph is shown in the given figure

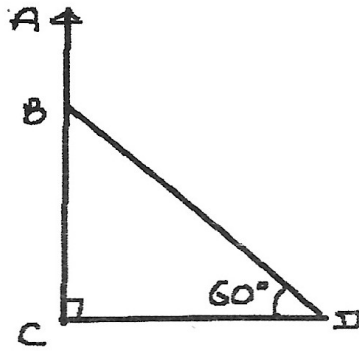


- a.  $x + y - 2 = 0$       b.  $x - y - 2 = 0$       c.  $2x + 3y - 6 = 0$
- d.  $2x - 3y + 6 = 0$       e. None of these
- x. Two chords AB and CD of a circle cut each other when produced outside the circle at P. AD and BC are joined. If  $\angle PAD = 30^\circ$  and  $\angle CPA = 45^\circ$ , then find  $\angle CBP$



- a.  $105^\circ$       b.  $115^\circ$       c.  $125^\circ$       d.  $135^\circ$       e. None of these
- xi. An electrician has to repair an electric fault on a pole of height 5m. He has to reach a point 1.3m below the top of the pole to undertake the repair work. How far from the foot of the pole should he place the foot of the ladder? (Take  $\sqrt{3} = 1.732$ )





- a. 3.14m                      b. 2.14m                      c. 2.26m                      d. 3.16m

xii. Which of the following is a better investment?

1. 10% ₹50 shares quoted at ₹80
2. 5% ₹100 shares at a discount of ₹20
3. 15% ₹30 shares at par

- a. Only 1      b. Only 2      c. Only 3      d. Both 1 and 2      e. None of these

xiii. A (-3, 4), B (-3, -2) and C (1, -2) are the vertices of a right angled triangle. Find the coordinates of its orthocentre.

- a. (-3, 4)      b. (-3, -2)      c. (1, -2)      d. (-1, 1)      e. None of these

xiv. A point A (p, q) is invariant when reflected about a line  $x = p$ , the coordinates of the reflected point is

- a. (p, q)      b. (-p, q)      c. (-p, -q)      d. (p, -q)      e. None of these

xv. For the given 49 variables  $x_1, x_2, x_3, \dots, \dots, x_{49}$

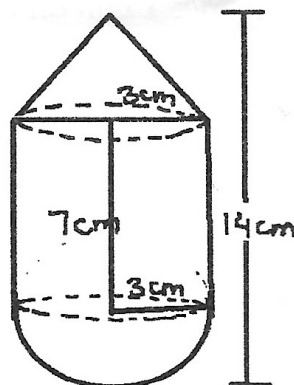
Assertion (A) : To find median of the given data, the variable needs to be arranged in ascending or descending order

Reason (R) : The median is the central most term of the arranged data

- a. A is true, R is false
- b. A is false, R is true
- c. Both A and R are true
- d. Both A and R are false.

**Question 2.**

i. The adjoining figure shows a model of a toy, which has a hemispherical base surmounted by a cylinder and a cone. If the height of the cylindrical part is 7cm, and the total height of the toy is 14cm. Find [4]



- a. Volume of the toy to the nearest  $cm^3$
  - b. Surface area of the toy.
  - c. If the scale factor is 1 : 20, find the volume of the toy in  $m^3$ . [Take  $\pi = 3.1$ ]
- ii. In a recurring deposit account for 2 years, the total amount deposited by Arsh is ₹14400. If the interest earned is three-eighth of his total deposit. Find [4]
- a. The interest he earns
  - b. His monthly deposit
  - c. The rate of interest

iii. Find: [4]

a.  $\sqrt{\frac{1-\cos A}{1+\cos A}}$

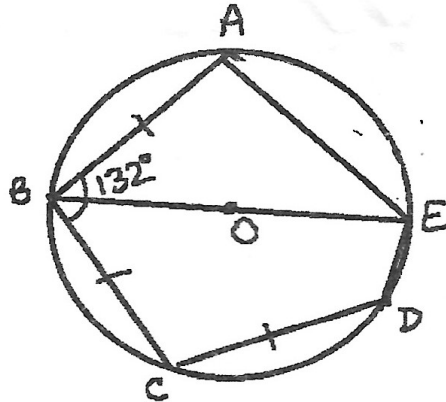
b.  $\sqrt{\frac{1+\cos A}{1-\cos A}}$

- c. Using the above results prove the following trigonometric identity

$$\sqrt{\frac{1-\cos A}{1+\cos A}} + \sqrt{\frac{1+\cos A}{1-\cos A}} = 2\operatorname{cosec} A$$

Question 3.

- i. If  $b$  is the mean proportion between  $a$  and  $c$ , prove that [4]
- $$a^2b^2c^2(a^{-4} + b^{-4} + c^{-4}) = b^{-2}(a^4 + b^4 + c^4)$$
- ii. The adjoining figure shows a circle circumscribing a pentagon in which  $AB = BC = CD$  and  $\angle ABC = 132^\circ$ . Calculate the value of [4]



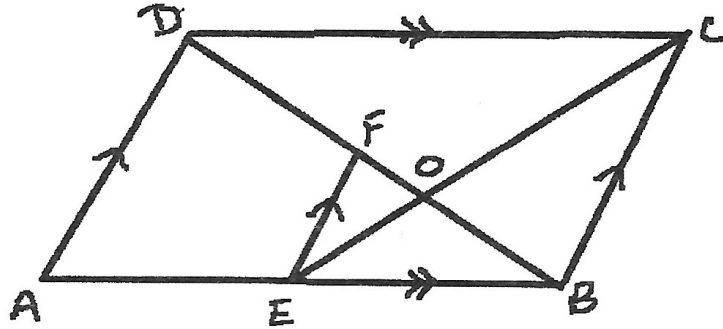
- a.  $\angle AEB$
  - b.  $\angle AED$
  - c.  $\angle COD$
  - d.  $\angle BOD$
- iii. Use graph paper for this question. Take 2 cm = 1 unit on both axes [5]
- a. Plot the points  $A(-3, 0)$ ,  $B(1, 3)$ ,  $C(1, 1)$ ,  $D(3, 1)$ ,  $E(3, 3)$  and  $F(7, 0)$
  - b. Reflect the points  $B, C, D$  and  $E$  about the x-axis and name them as  $B', C', D'$  and  $E'$  respectively.
  - c. From the above points ( $A$  to  $F$ ) name the invariant point(s) after reflection about x-axis.
  - d. Give the geometrical name of the closed figure by joining the points  $ABCDEF E' D' C' B' A$  in order.
  - e. Name a line of symmetry.

## SECTION B

(Attempt any four questions from this section)

Question 4.

- i. For two matrices A and B,  $2A + B = \begin{bmatrix} 3 & -4 \\ 2 & 7 \end{bmatrix}$  and  $A - 2B = \begin{bmatrix} 4 & 3 \\ 1 & 1 \end{bmatrix}$ , find AB. [3]
- ii. Solve the given equation  $2x^2 - 9x - 6 = 0$  and express your answer correct to one place of decimal. (You may use mathematical tables for this question) [3]
- iii. In the given figure ABCD is a parallelogram, E is a point on AB, CE intersects the diagonal BD at O and  $EF \parallel BC$ . If  $AE : EB = 2 : 3$ , find [4]



Value of tan 54°  
= 1.3764

- a.  $EF : AD$
- b.  $ar(\triangle ABD) : ar(trap. AEFD)$
- c. Prove that:  $\triangle FEO \sim \triangle BCO$
- d.  $ar(\triangle FEO) : ar(\triangle BCO)$

Question 5.

- i. Use step-deviation method to find the mean of monthly wages of the following distribution. [3]

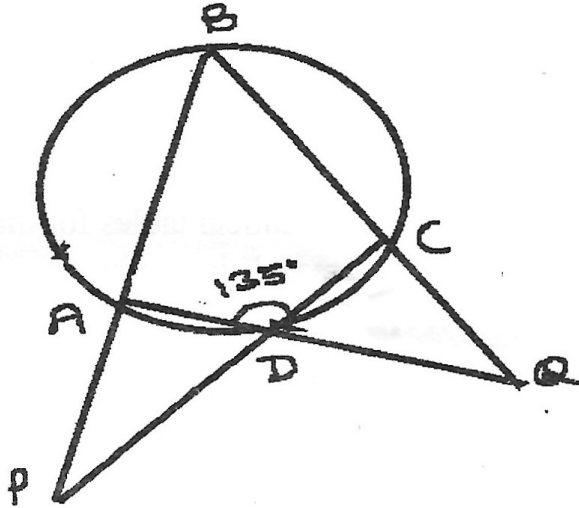
Monthly Wages (in ₹1000)	90 – 110	110 – 130	130 – 150	150 – 170	170 – 190
Number of Men	4	6	4	8	18

- ii. DTDC has three types of courier service for its premium clients. An industrial house has given following orders. Find the amount of the bill. [3]

Types of Services	Plus	Gold	Platinum
Number of Services	45	18	16
Cost of each service (in ₹)	150	200	300
Discount (%)	Net	10%	20%
GST	12%	18%	28%



- iii. In the given figure ABCD is a cyclic quadrilateral,  $\angle ADC = 135^\circ$ . Sides BA and CD are produced to meet at P, sides AD and BC are produced to meet at Q, if  $\angle P : \angle Q = 2 : 1$ , find: [4]



- $\angle P$
- $\angle Q$
- $\angle DCB$

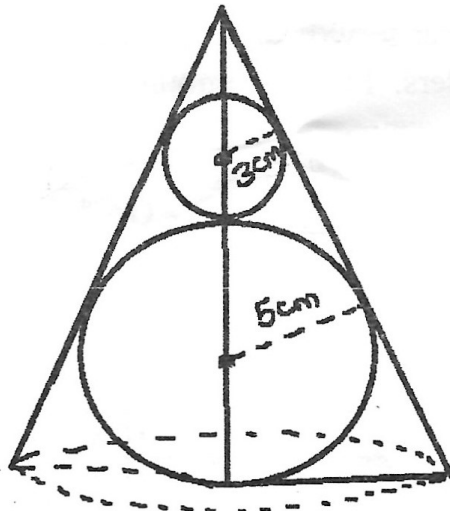
**Question 6.**

- Find the geometric progression whose 5<sup>th</sup> term is 48 and 8<sup>th</sup> term is 384. [3]
- The following table shows the expenditure of 60 boys on books [3]

Expenditure (in ₹)	20 – 25	25 – 30	30 – 35	35 – 40	40 – 45	45 – 50
No. of Students	14	7	12	6	3	18

Use graph sheet for this question. Take 2 cm = ₹5 on one axis and 2cm = 2 students on another axis.

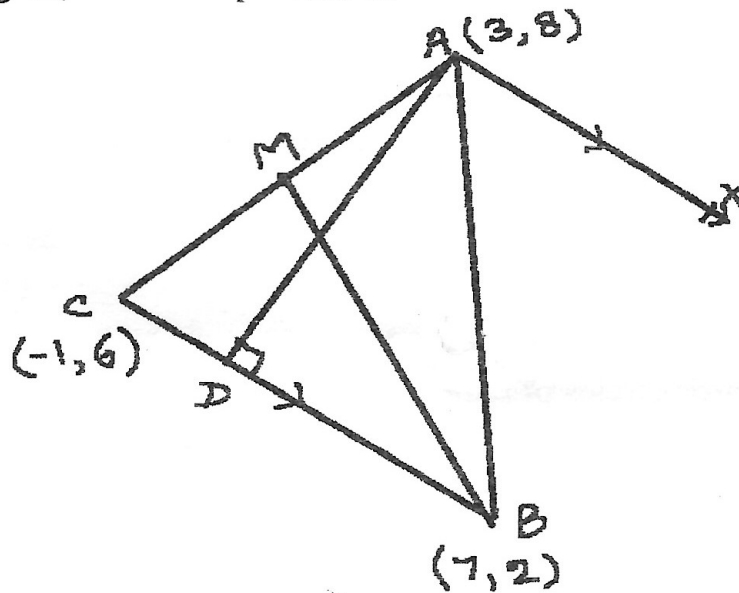
- Draw a histogram representing the above distribution
  - Find the mode of their expenditure.
- iii. Two spheres of radii 3cm and 5cm are kept one on the other and then covered by a cone as shown in the figure. Find the height of the cone. [4]



### Question 7.

i. From the figure, find the equations of

[5]



- Altitude AD
  - Median BM
  - Line AX.
- ii. The angle of depression of two cars A and B on the opposite side of a skyscraper of height 100m are respectively  $42^\circ$  and  $54^\circ$ . The line joining the two cars passes through the floor of the skyscraper. Find the distance between the two cars A and B, give your answer correct to the nearest whole number. [5]

### Question 8.

- Solve the following inequation, write the solution set and represent it on the real number line. [3]  
$$2x - 3 \geq \frac{2x+1}{3} > \frac{2x}{5}; x \in R$$
- A man has some shares of ₹100 at par value paying 6% dividend. He sells half of these at a discount of 10% and invests the proceeds in 7% ₹50 shares at a premium of ₹10. This transaction decreases his annual income from dividend by ₹120. Find [3]
  - The number of shares before transaction
  - The number of shares he sold
  - His initial annual income from shares.
- The length of a rectangular garden is 12m more than its breadth. The numerical value of its area is equal to four times the numerical value of its perimeter. Assuming the breadth of the garden to be 'x'. Write [4]
  - The expression for the area
  - The expression for the perimeter
  - Frame the equation in terms of x
  - Find the dimension of the rectangular garden.

**Question 9.**

- i. Using properties of proportion, solve for  $x$ : [3]

$$\frac{1+x+x^2}{1-x+x^2} = \frac{13(1+x)}{14(1-x)}$$

- ii. Each of the letter of the word 'HOUSEWARMING' is written on cards and put in a bag. If a card is drawn at random from the bag after shuffling, what is the probability that the letter on the card is: [3]

- A vowel
- One of the letters of the word 'SEWING'
- Not a letter from the word 'WEAR'

- iii. Construct two concentric circles of radii 3cm and 5cm. Taking a point P on the outer circle, construct the pair of tangents to the other circle. Measure and record the length of a tangent. [4]

**Question 10.**

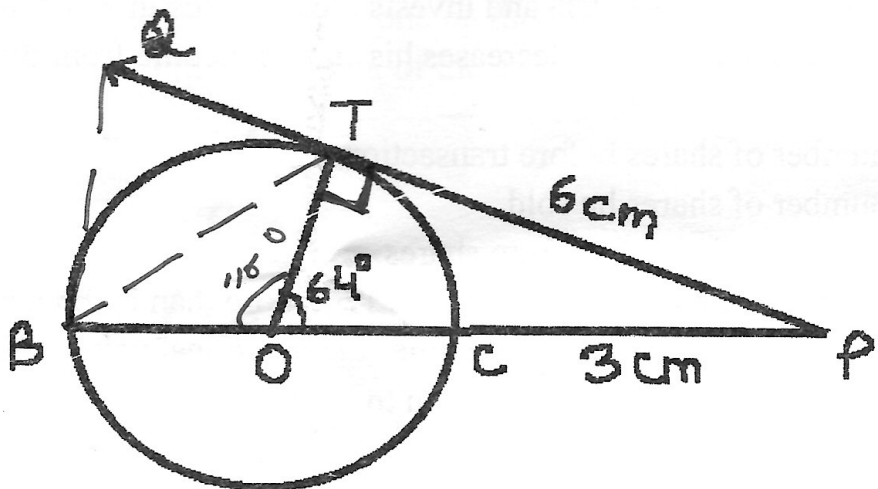
- i. The distribution of height (in cm) of 96 children is given below:

Height (in cm)	124 – 128	128 – 132	132 – 136	136 – 140	140 – 144	144 – 148	148 – 152	152 – 156	156 – 160
No. of Children	5	9	17	24	16	12	6	4	3

Use 2cm = 4cm on one axis and 2cm = 10children on another axis. [6]

- Draw a less than cumulative frequency curve for the above data.
- Calculate the median
- Lower Quartile
- Upper Quartile
- Calculate the number of children whose height is above 150cm.

- ii. In the figure given, O is the centre of the circle and PT is a tangent at T. If PC = 3cm, PT = 6cm and  $\angle COT = 64^\circ$ . Find. [4]



- Radius of the circle
- $\angle QTB$