

2024 EXAMINATION
SPECIMEN QUESTION PAPER
MATHEMATICS

Maximum Marks: 80

Time allowed: Two and half hours

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

You will not be allowed to write during 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 question, write the correct answers only.)

(i) If $A = \begin{bmatrix} -1 & 2 \end{bmatrix}$ and $B = \begin{bmatrix} 1 & -2 \\ 0 & 3 \end{bmatrix}$

Which of the following operation is possible?

- (a) $A - B$
- (b) $A + B$
- (c) AB
- (d) BA

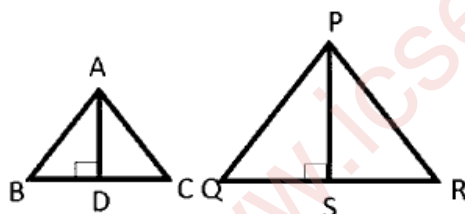
- (ii) If $x^2 + kx + 6 = (x - 2)(x - 3)$ for all values of x , then the value of k is:
- (a) -5
 - (b) -3
 - (c) -2
 - (d) 5
- (iii) A retailer purchased an item for ₹1500 from a wholesaler and sells it to a customer at 10% profit. The sales are intra-state and the rate of GST is 10%. The amount of GST paid by the customer:
- (a) ₹15
 - (b) ₹30
 - (c) ₹150
 - (d) ₹165
- (iv) If the roots of equation $x^2 - 6x + k = 0$ are real and distinct, then value of k is:
- (a) > -9
 - (b) > -6
 - (c) < 6
 - (d) < 9
- (v) Which of the following is/are an Arithmetic Progression (A.P.)?
1. $1, 4, 9, 16, \dots$
 2. $\sqrt{3}, 2\sqrt{3}, 3\sqrt{3}, 4\sqrt{3}, \dots$
 3. $8, 6, 4, 2, \dots$
- (a) only 1.
 - (b) only 2.
 - (c) only 2. and 3.
 - (d) all 1., 2. and 3.

- (vi) The table shows the values of x and y , where x is proportional to y .

x	6	12	N
y	M	18	6

What are the values of M and N ?

- (a) $M = 4, N = 9$
(b) $M = 9, N = 3$
(c) $M = 9, N = 4$
(d) $M = 12, N = 0$
- (vii) In the given diagram, $\triangle ABC \sim \triangle PQR$ and $\frac{AD}{PS} = \frac{3}{8}$. The value of $AB : PQ$ is:

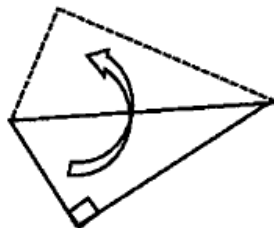


- (a) $8 : 3$
(b) $3 : 5$
(c) $3 : 8$
(d) $5 : 8$
- (viii) A right angle triangle shaped piece of hard board is rotated completely about its hypotenuse, as shown in the diagram. The solid so formed is always:

1. a single cone
2. a double cone

Which of the statement is valid?

- (a) only 1.
(b) only 2.
(c) both 1. and 2.
(d) neither 1. nor 2.



(ix) Event A: The sun will rise from east tomorrow.

Event B: It will rain on Monday.

Event C: February month has 29 days in a leap year.

Which of the above event(s) has probability equal to 1?

- (a) all events A, B and C
- (b) both events A and B
- (c) both events B and C
- (d) both events A and C

(x) The three vertices of a scalene triangle are always equidistant from a fixed point.

The point is:

- (a) Orthocentre of the triangle.
- (b) Incentre of the triangle.
- (c) Circumcentre of the triangle.
- (d) Centroid of the triangle.

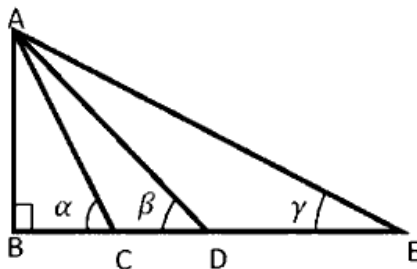
(xi) In a circle with radius R , the shortest distance between two parallel tangents is equal to:

- (a) R
- (b) $2R$
- (c) $2\pi R$
- (d) πR

(xii) An observer at point E , which is at a certain distance from the lamp post AB , finds the angle of elevation of top of lamp post from positions C , D and E as α , β and γ . It is given that B , C , D and E are along a straight line.

Which of the following condition is satisfied?

- (a) $\tan \alpha > \tan \beta$
- (b) $\tan \beta < \tan \gamma$
- (c) $\tan \gamma > \tan \alpha$
- (d) $\tan \alpha < \tan \beta$



- (xiii) 1. Shares of company A, paying 12%, ₹100 shares are at ₹80.
 2. Shares of company B, paying 12%, ₹100 shares at ₹100.
 3. Shares of company C, paying 12%, ₹100 shares are at ₹120.

Shares of which company are at premium?

- (a) Company A
 (b) Company B
 (c) Company C
 (d) Company A and C
- (xiv) Which of the following equation represent a line passing through origin?
 (a) $3x - 2y + 5 = 0$
 (b) $2x - 3y = 0$
 (c) $x = 5$
 (d) $y = -6$
- (xv) For the given 25 variables: $x_1, x_2, x_3, \dots, x_{25}$

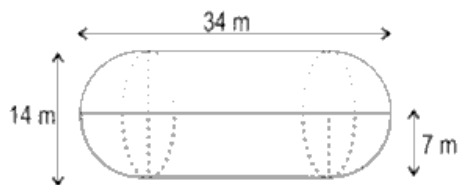
Assertion (A): To find median of the given data, the variate needs to be arranged in ascending or descending order.

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) Shown below is a horizontal water tank composed of a cylinder and two hemispheres. The tank is filled up to a height of 7 m. Find the surface area of the tank in contact with water. Use $\pi = \frac{22}{7}$. [4]



(ii) In a recurring deposit account for 2 years, the total amount deposited by a person is ₹ 9600. If the interest earned by him is one-twelfth of his total deposit, then find: [4]

- (a) the interest he earns.
- (b) his monthly deposit.
- (c) the rate of interest.

(iii) Find: [4]

- (a) $(\sin \theta + \operatorname{cosec} \theta)^2$
- (b) $(\cos \theta + \sec \theta)^2$

Using the above results prove the following trigonometry identity.

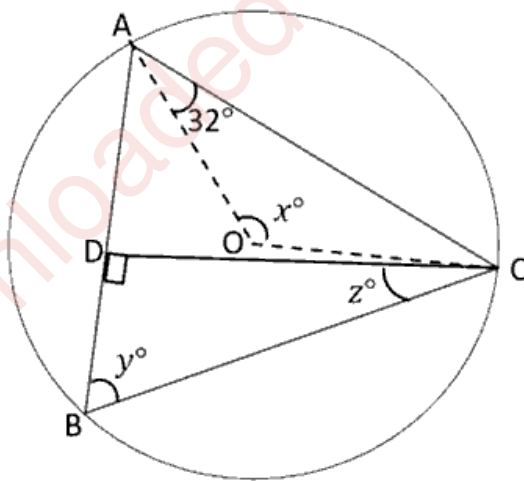
$$(\sin \theta + \operatorname{cosec} \theta)^2 + (\cos \theta + \sec \theta)^2 = 7 + \tan^2 \theta + \cot^2 \theta$$

Question 3

(i) If a, b and c are in continued proportion, then prove that: [4]

$$\frac{3a^2 + 5ab + 7b^2}{3b^2 + 5bc + 7c^2} = \frac{a}{c}$$

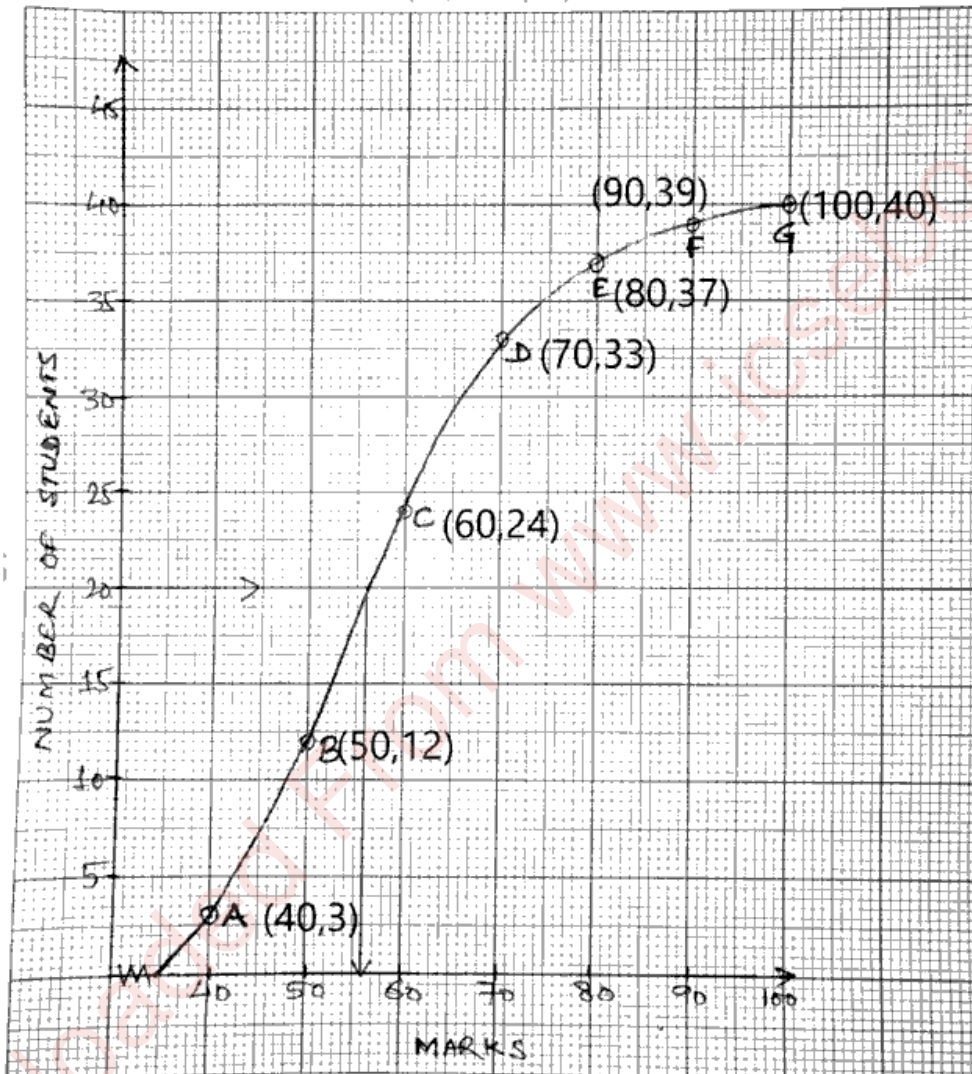
(ii) In the given diagram, O is the centre of circle circumscribing the ΔABC . CD is perpendicular to chord AB. $\angle OAC = 32^\circ$. Find each of the unknown angles x, y and z. [4]



(iii) Study the graph and answer each of the following:

[5]

- (a) Name the curve plotted
- (b) Total number of students
- (c) The median marks
- (d) Number of students scoring between 50 and 80 marks



SECTION B

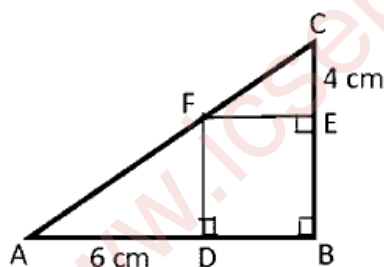
(Attempt any four questions from this Section.)

Question 4

- (i) If $A = \begin{bmatrix} 4 & -4 \\ -4 & 4 \end{bmatrix}$, find A^2 . If $A^2 = pA$, then find the value of p . [3]
- (ii) Solve the given equation $x^2 - 4x - 2 = 0$ and express your answer correct to two places of decimal. [3]
(You may use mathematical tables for this question).
- (iii) In the given diagram, $\triangle ABC$ is right angled at B. BDFE is a rectangle. [4]

AD = 6 cm, CE = 4 cm and BC = 12 cm

- (a) prove that $\triangle ADF \sim \triangle FEC$
- (b) prove that $\triangle ADF \sim \triangle ABC$
- (c) find the length of FE
- (d) find area $\triangle ADF$: area $\triangle ABC$



Question 5

- (i) Shown below is a table illustrating the monthly income distribution of a company with 100 employees. [3]

Monthly Income (in ₹10, 000)	0 - 4	4 - 8	8 - 12	12 - 16	16 - 20	20 - 24
Number of employees	55	15	06	08	12	4

Using step-deviation method, find the mean monthly income of an employee.

- (ii) The following bill shows the GST rate and the marked price of articles: [3]

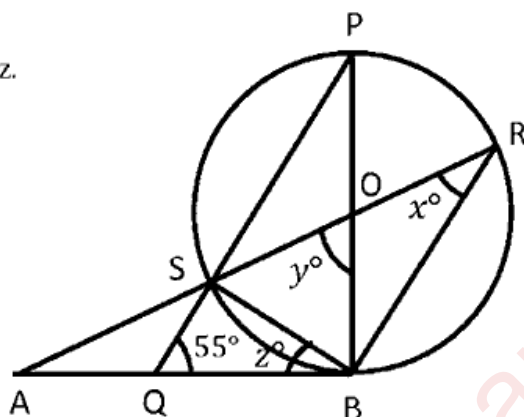
Vidhyut Electronics				
S. No.	Item	Marked Price	Quantity	Rate of GST
(a)	LED TV set	₹ 12000	01	28%
(b)	MP4 player	₹ 5000	01	18%

Find the total amount to be paid (including GST) for the above bill.

- (iii) In the given figure, O is the centre of the circle and AB is a tangent to the circle at B. [4]

If $\angle PQB = 55^\circ$.

- (a) find the value of the angles x , y and z .
 (b) prove that RB is parallel to PQ.



Question 6

- (i) There are three positive numbers in a Geometric Progression (G.P.) such that: [3]

- (a) their product is 3375
 (b) the result of the product of first and second number added to the product of second and third number is 750.

Find the numbers.

- (ii) The table given below shows the ages of members of a society. [3]

Age (in years)	Number of Members of the Society
25 – 35	05
35 – 45	32
45 – 55	69
55 – 65	80
65 – 75	61
75 – 85	13

Use graph sheet for this question.

Take 2cm = 10 years along one axis and 2cm=10 members along the other axis.

- (a) Draw a histogram representing the above distribution.
 (b) Hence find the modal age of the members.

(iii) A tent is in the shape of a cylinder surmounted by a conical top. If the height and radius of [4]
the cylindrical part are 7 m each and the total height of the tent is 14 m. Find the:

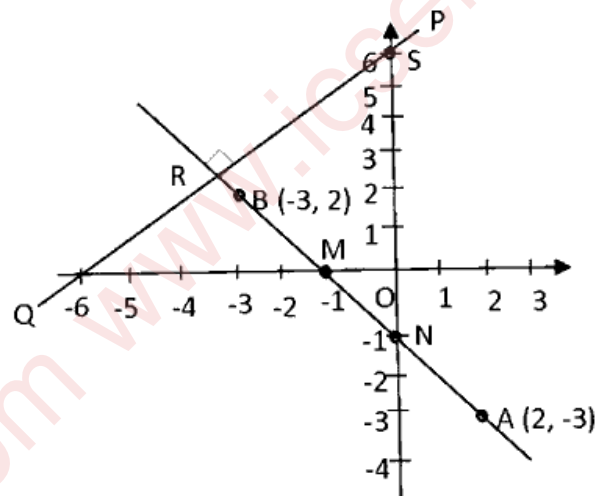
- (a) quantity of air contained inside the tent.
- (b) radius of a sphere whose volume is equal to the quantity of air inside the tent.

Use $\pi = \frac{22}{7}$

Question 7

(i) The line segment joining A(2,-3) and B(-3, 2) is intercepted by the x-axis at the point M [5]
and the y axis at the point N. PQ is perpendicular to AB produced at R and meets the y- axis
at a distance of 6 units from the origin O, as shown in the diagram, at S. Find the:

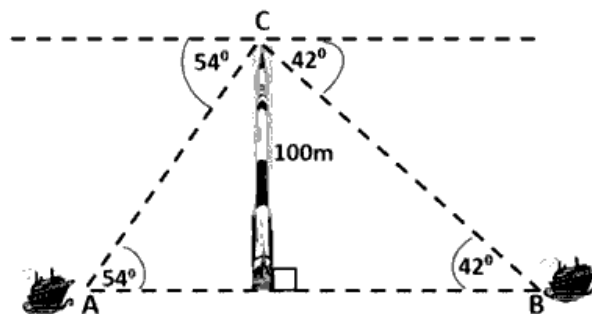
- (a) coordinates of M and N
- (b) coordinates of S
- (c) slope of AB.
- (d) equation of line PQ.



(ii) The angle of depression of two ships A and B on opposite sides of a light house of height [5]
100m are respectively 42° and 54° . The line joining the two ships passes through the foot
of the lighthouse.

- (a) Find the distance between the two ships A and B.
- (b) Give your final answer correct to the nearest whole number.

(Use mathematical tables for this question)



Question 8

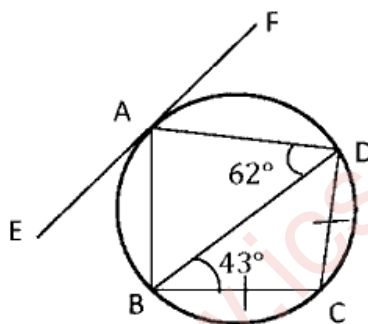
- (i) Solve the following inequation write the solution set and represent it on the real number line. [3]

$$3 - 2x \geq x + \frac{1-x}{3} > \frac{2x}{5}, x \in R$$

- (ii) ABCD is a cyclic quadrilateral in which $BC = CD$ and EF is a tangent at A. [3]

$\angle CBD = 43^\circ$ and $\angle ADB = 62^\circ$. Find:

- (a) $\angle ADC$
(b) $\angle ABD$
(c) $\angle FAD$



- (iii) A (a, b), B(-4, 3) and C(8,-6) are the vertices of a $\triangle ABC$. Point D is on BC such that $BD : DC$ is 2 : 1 and M (6, 0) is mid point of AD. Find: [4]

- (a) coordinates of point D.
(b) coordinates of point A.
(c) equation of a line passing through M and parallel to line BC.

Question 9

- (i) Using componendo and dividendo, find the value of x, when: [3]

$$\frac{x^3 + 3x}{3x^2 + 1} = \frac{14}{13}$$

- (ii) The total expense of a trip for certain number of people is ₹18000. If three more people join them, then the share of each reduces by ₹3000. Taking x to be the original number of people, form a quadratic equation in x and solve it to find the value of x. [3]

(iii) Using ruler and compass only construct $\angle ABC = 60^\circ$, $AB = 6$ cm and $BC = 5$ cm. [4]

(a) construct the locus of points equidistant from AB and BC.

(b) construct the locus of points equidistant from A and B.

(c) Mark the point which satisfies both the conditions (a) and (b) as P.

Hence, construct a circle with centre P and passing through A and B.

Question 10

(i) Using remainder and factor theorem, factorize completely, the given polynomial: [3]

$$2x^3 - 9x^2 + 7x + 6$$

(ii) Each of the letter of the word "HOUSEWARMING" is written on cards and put in a bag. [3]

If a card is drawn at random from the bag after shuffling, what is the probability that the letter on the card is:

(a) a vowel

(b) one of the letters of the word SEWING.

(c) not a letter from the word WEAR.

(iii) Use graph sheet for this question. Take 2 cm = 1 unit along the axes. [4]

(a) Plot A (1, 2), B(1, 1) and C (2, 1)

(b) Reflect A, B and C about y-axis and name them as A', B' and C'.

(c) Reflect A, B, C, A', B' and C' about x-axis and name them as A'', B'', C'', A''', B''' and C''' respectively.

(d) Join A, B, C, C'', B'', A'', A''', B''', C''', C', B', A' and A to form a closed figure.