MATHEMATICS (M021)

Maximum Marks: 64

Time allowed: ***120 minutes***

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

You will ***not*** *be allowed to write during first* ***10*** *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 three*** *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 and graph papers are provided

SECTION A (34 marks)

(Attempt ***all*** *questions from this* ***Section****)*

Question 1

Choose the correct answers to the questions from the given options. [14]
(Do not copy the questions, write the correct answers only.)

(i) Which of the following linear inequations has the solution set $\{-1, 0, 1, 2, 3\}$?

(a) $\frac{2}{3} + \frac{1}{3}(x+1) > 0, x \in \mathbb{I}$

(b) $2(x-2) < 3x - 2 < 10, x \in \mathbb{I}$

(c) $5x + 7 > 27, x \in \mathbb{I}$

(d) $3x + 12 < 0, x \in \mathbb{I}$

(ii) Point $P(a, b)$ is reflected in the y-axis to $P'(3, -2)$. The values of a and b are:

(a) $a = -5, b = 2$

(b) $a = -3, b = -2$

(c) $a = 5, b = -2$

(d) $a = 2, b = 5$

(iii) Shahina invests ₹ 9620 on ₹ 100 shares at ₹ 80 if the company pays her 18% dividend then her total dividend is:

(a) 2100

(b) 2200

(c) 2160

(d) 2106

(iv) The ratio between 3.6 m and 75 cm is:

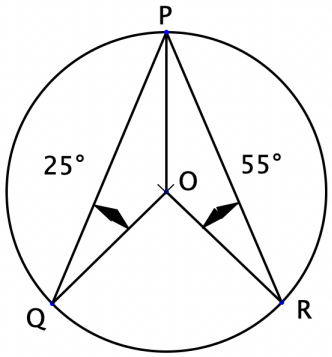
(a) 18 : 275

(b) 6 : 125

(c) 24 : 5

(d) 4 : 5

(v) In the given figure, O is the center of the circle. $\angle OQP = 25°$ and $\angle ORP = 55°$. Find the $\angle QOR$.



(a) 120°

(b) 140°

(c) 160°

(d) 110°

(vi) Evaluate: $(\sin\theta + \cos\theta + 1)^2$, when $\sin\theta\cos\theta = 0$:

(a) $2\sin\theta\cos\theta$

(b) $2 + 2(\sin\theta + \cos\theta)$

(c) $2\cos\theta + \sin\theta$

(d) None of these

(vii) If a customer bought two items worth ₹ 450 and ₹ 200 at 20% and 10% discount respectively, then the amount of bill for the intra-state transaction if the rate of GST is 18%, is:

(a) ₹ 622.20 (c) ₹ 657

(b) ₹ 637.20 (d) ₹ 700

(viii) One root of the quadratic equation $3x^2 - 4x - 4 = 0$ is:

(a) $\frac{3}{2}$ (c) $\frac{2}{3}$

(b) 2 (d) 6

(ix) The value of n, for which the n^{th} term of A.P. 63, 65, 67, ... is equal to the n^{th} term of A.P. 3, 10, 17, ... are equal to each other is:

(a) 13 (c) 15

(b) 12 (d) 17

(x) Mr. Nair gets ₹ 6,455 at the end of one year at the rate of 14% per annum in a recurring deposit amount. The monthly instalment is:

(a) ₹ 400 (c) ₹ 600

(b) ₹ 500 (d) ₹ 700

(xi) If $x - 2$ is a factor of $x^3 + 2x^2 - kx + 10$, then the value of k is:

(a) 3 (c) 13

(b) 8 (d) 26

(xii) If $A = \begin{bmatrix} -2 & 3 \\ 4 & 5 \end{bmatrix}$ and $B = \begin{bmatrix} 5 & 2 \\ -7 & 3 \end{bmatrix}$, then the matrix C, such that $A + B - C = 0$ is:

(a) $\begin{bmatrix} 3 & 5 \\ -3 & 8 \end{bmatrix}$ (c) $\begin{bmatrix} 7 & -1 \\ -11 & -2 \end{bmatrix}$

(b) $\begin{bmatrix} -7 & 1 \\ 11 & 2 \end{bmatrix}$ (d) $\begin{bmatrix} -3 & -5 \\ 3 & -8 \end{bmatrix}$

(xiii) The 11^{th} term of the G.P. $\frac{1}{8}, -\frac{1}{4}, 2, -1, \ldots$ is:

(a) 64

(c) 128

(b) -64

(d) -128

(xiv) Anita buys 400, twenty rupees shares at a discount of 20% and receives a return of 12% on her money. Calculated the amount invested by her.

(a) ₹ 6400

(c) ₹ 6500

(b) ₹ 6401

(d) ₹ 6600

Question 2

(i) Use the factor theorem to factorize completely : $x^3 + x^2 - 4x - 4$. [3]

(ii) Two cylinders have bases of same size. The diameter of each is 14 cm. One of the cylinders is 10 cm high and the other is 20 cm high. Find the ratio between their volumes. [3]

(iii) One-fourth of a herd of camels was seen in the forest. Twice the square root of the herd had gone to mountains and the remaining 15 camels were seen on the bank of a river. Find the total number of camels. [4]

Question 3

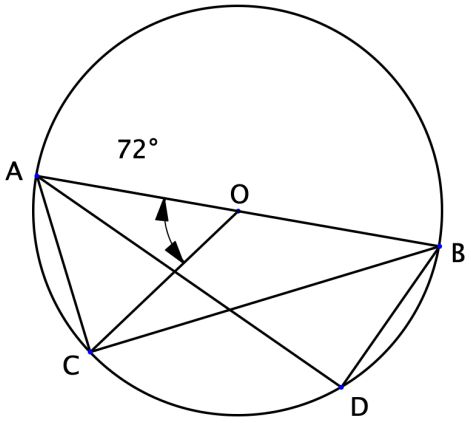
(i) Evaluate: [3]

$$\frac{\cos^2\theta}{1-\tan\theta}+\frac{\sin^3\theta}{\sin\theta-\cos\theta}$$

(ii) In the figure given below, O is the center of the circle and AB is a diameter. [3]

If $AC = BD$ and $\angle AOC = 72°$, Find:

(a) $\angle ABC$ (b) $\angle BAD$ (c) $\angle ABD$



(iii) A man invests ₹ 22,500 in ₹ 50 shares available at 10% discount. If the dividend paid by the company is 12%, calculate: [4]

(a) The number of shares purchased.

(b) The annual dividend received.

(c) The rate of return he gets on his investment. Give your answer correct to the nearest whole number.

SECTION B (30 marks)

*(Attempt **any three** questions from this **Section**)*

Question 4

(i) Given: [3]

$$P = \{x : 5 < 2x - 1 \leq 11,\ x \in \mathbb{R}\}$$
$$Q = \{x : -1 \leq 3 + 4x < 23,\ x \in \mathbb{I}\}$$

Represent P and Q on number lines. Write down the elements of $P \cap Q$.

(ii) Determing the fourth proportional to: [3]

$$x^3 - y^3, x^4 + x^2y^2 + y^4, x - y$$

(iii) Prove that: [4]

$$\frac{\tan^3\theta}{1 + \tan^2\theta} + \frac{\cot^3\theta}{1 + \cot^2\theta} = \sec\theta\text{cosec }\theta - 2\sin\theta\cos\theta$$

Question 5

(i) Find x, y if: [3]

$$\begin{bmatrix} -2 & 0 \\ 3 & 1 \end{bmatrix} \begin{bmatrix} -1 \\ 2x \end{bmatrix} + 3 \begin{bmatrix} -2 \\ 1 \end{bmatrix} = 2 \begin{bmatrix} y \\ 3 \end{bmatrix}$$

(ii) Using properties of proportion solve for x, given: [3]

$$\frac{\sqrt{5x} + \sqrt{2x - 6}}{\sqrt{5x} - \sqrt{2x - 6}} = 4$$

(iii) A shopkeeper brought a washing machine at a discount of 20% from a wholesaler, the printed price of the washing machine being ₹ 18,000. The shopkeeper sells it to a consumer at a discount of 10% on the printed price. If the rate of GST is 8%, find: [4]

(a) The GST paid by the shopkeeper.

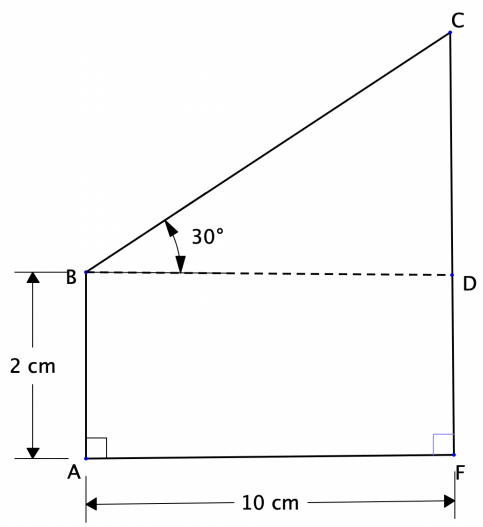
(b) The total amount that the consumer pays for the washing machine.

Question 6

(i) Solve the following inequation and graph their solution set: [3]

$$\frac{2x-5}{x+2} < 2,\ x \in \mathbb{R}$$

(ii) In the fiven figure, find the length CF. [3]



(iii) A company with 500 shares of nominal value ₹ 120 declares an annual dividend of 15%. Calculate: [4]

(a) The total amount of dividend paid by the company.

(b) Annual income of Mr. Sharma who holds 80 shares of the company.

(c) If the return percent of Mr. Sharma from his shares is 10%, find the market value of each share.

Question 7

(i) Two pipes flowing together can fill a cistern in 6 minutes. If one pipe takes 5 minutes more than the other to fill the cistern, find the time in which each pipe would fill the cistern. [4]

(ii) For the following distribution, draw a histogram and find the mode. [6]

Class	Frequency
0-10	5
10-20	9
20-30	16
30-40	22
40-50	26
50-60	10