

MATHEMATICS

SECTION -- 1 : (Maximum Marks : 56)

This section contains **FOURTEEN** questions

Each question has **FOUR** options (A), (B), (C) and (D). **ONE OR MORE THAN ONE** of these four option(s) is(are) correct

For each question, darken the bubble(s) corresponding to all the correct option(s) in the ORS

For each question, marks will be awarded in one of the following categories :

Full Marks : +4 If only the bubble(s) corresponding to all the correct option(s) is(are) darkened.

Partial Marks : +1 For darkening a bubble corresponding to **each correct option**, provided NO incorrect option is darkened.

Zero Marks : 0 If none of the bubbles is darkened.

Negative Marks : -2 In all other cases.

For example, if (A), (C) and (D) are all the correct options for a question, darkening all these three will result in +4 marks ; darkening only (A) and (D) will result in +2 marks and darkening (A) and (B) will result in -2 marks, as a wrong option is also darkened.

1. Let L_1 be a line passing through the origin and L_2 be the line $x + y = 1$. If the intercepts made by the circle $x^2 + y^2 - x + 3y = 0$ on L_1 and L_2 are equal then the equation of L_1 can be
- (A) $x + y = 0$ (B) $x - y = 0$
(C) $x + 7y = 0$ (D) $x - 7y = 0$

Space for Rough Work

5. If letters of word "PARKAR" are written in all possible manner and arranged in dictionary manner, then
- (A) rank of word ' PARKAR' is 99. (B) 50th word is ' ARPARK'.
- (C) 50th word is ' ARPAKR'. (D) rank of word ' RAAKPR' is 121.
6. You have n objects, each of weight w. When they are weighed in pairs, the sum of the weights of all the possible pairs is 120. When they are weighed in triplets, the sum of the weights of all possible triplets is 480, then
- (A) n = 8 (B) n = 10
- (C) $w = \frac{4}{3}$ (D) w = 1
7. Let P be a point on ellipse $4x^2 + y^2 = 8$ with eccentric angle $\frac{\pi}{4}$. If tangent at P intersects the x-axis at A and y-axis at B and normal at P intersect the x-axis at A' and y-axis at B'. If area of triangle APA' = a & area of triangle BPB' = b, then
- (A) $a + 4b = 10$ (B) $a - 4b = 0$
- (C) $4ab = 25$ (D) $ab = 10$

Space for Rough Work

8. If the normals at P and Q on the parabola $y^2 = 4ax$ meet on it at R. Then the directrix of the locus of mid-point of PQ is $px + qy + 5a = 0$, then

(A) $p = 2$

(B) $q = 0$

(C) $p + q = 3$

(D) $p - q = 2$

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9. Curve $(\lambda - 1)x^2 + (\lambda - 1)y^2 + 2\lambda xy = 2x + 4y + 5$ represent.

(A) Parabola if $\lambda = \frac{1}{2}$

(B) Ellipse if $\lambda = \frac{1}{4}$

(C) circle if $\lambda = -1$

(D) hyperbola if $\lambda = \frac{1}{3}$

10. If $L : x + y + \lambda = 0$ is a common tangent to the $y^2 = 4x$ and $x^2 + 2y^2 = m$, then

(A) L : touches parabola at $(1, -2)$

(B) L : touches ellipse at $\left(-\frac{2}{3}, -\frac{1}{3}\right)$

(C) L : touches parabola at $(1, 2)$

(D) L : touches ellipse at $(2, 3)$

11. Equation of circle with centre $(4, 3)$ and touching the circle $x^2 + y^2 = 1$ is

(A) $x^2 + y^2 - 8x - 6y + 9 = 0$

(B) $x^2 + y^2 + 8x + 6y - 11 = 0$

(C) $x^2 + y^2 - 8x - 6y - 11 = 0$

(D) $x^2 + y^2 - 7x - 6y - 1 = 0$

Space for Rough Work

12. Normals are drawn to parabola $(y - 4)^2 = 8(x + 2)$ from $(8, 8)$ then coordinates of foot of normals are

(A) $(0, 0)$

(B) $(6, -4)$

(C) $(6, 12)$

(D) $\left(\frac{5}{2}, 10\right)$

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3. Equations of common tangents of ellipse $\frac{x^2}{16} + \frac{y^2}{9} = 1$ & $\frac{x^2}{9} + \frac{y^2}{16} = 1$ are.

(A) $x - y + 5 = 0$

(B) $x - y - 5 = 0$

(C) $x + y + 5 = 0$

(D) $x + y - 5 = 0$

4. Equation of tangent to parabola $y^2 = 4x$ which normal to circle $(x - 1)^2 + (y - 2)^2 = 1$ is $ax + by + 1 = 0$, then

(A) $a + b = 0$

(B) $a - b = 2$

(C) $a - b = -2$

(D) $a + b = 2$

Space for Rough Work

SECTION - 2 : (Maximum Marks : 24)

- This section contains **THREE** paragraphs
- Based on each paragraph, there will be **TWO** questions.
- Each question has **FOUR** options (A), (B), (C) and (D). **ONE OR MORE THAN ONE** of the four option(s) is(are) correct
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- For example, if (A), (C) and (D) are all the correct options for a question, darkening all these three will result in +4 marks ; darkening only (A) and (D) will result in +2 marks and darkening (A) and (B) will result in -2 marks, as a wrong option is also darkened.

Paragraph for Questions Nos. 15 to 16

Consider the two Parabolas

$$C_a : y = \frac{x^2}{4} - ax + a^2 + a - 2 \quad \text{and} \quad C : y = 2 - \frac{x^2}{4}$$

15. If 'a' varies then the equation of the locus of the vertex of C_a , is $ax - by = 4$ then
- (A) $a + b = 3$ (B) $a - b = -1$ (C) $ab = 2$ (D) $2a + 2b = 6$
16. For $a = 3$, if the lines $y = m_1x + c_1$ and $y = m_2x + c_2$ are common tangents to the parabola of C_a and C then the value of $(m_1 + m_2)$ is less than
- (A) -6 (B) -2 (C) 1/2 (D) 3

Space for Rough Work

Paragraph for Question Nos. 17 to 18

Consider an ellipse $\frac{x^2}{4} + y^2 = \alpha$; (α is parameter > 0) & a parabola $y^2 = 8x$. If a common tangent to the ellipse & the parabola meets the co-ordinate axes at A & B respectively, then

Locus of midpoint of AB is

(A) $y^2 = -2x$

(B) $y^2 = -x$

(C) $y^2 = -\frac{x}{2}$

(D) $\frac{x^2}{4} + \frac{y^2}{2} = 1$

If the eccentric angle of a point on the ellipse where the common tangent meets it is $\left(\frac{2\pi}{3}\right)$, then α is divisible by

(A) 4

(B) 5

(C) 26

(D) 36

Paragraph for Question Nos. 19 to 20

There are 4 Apples, 5 Oranges & 6 Banana.

If all fruits of same species are alike then number of ways in which 13 or more fruits can be selected

(A) 12

(B) 10

(C) 9

(D) 15

If all fruits are different then number of ways to select 12 fruits in which at least 2 apples always taken is N then N is divisible by

(A) 11

(B) 41

(C) 3

(D) 17

Space for Rough Work