GUESS PAPER 1

PART-III

MATHEMATICS

PAPER-I(B)

Time : 3 Hours | Max. Marks : 75

SECTION - A (10 × 2 = 20)

Note : (i) Answer **all** questions.

(ii) Each question carries **two** marks.

(iii) All are **Very Short Answer Type Questions**.

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1. Find the equation of the line containing the points (2, –3) and (0, –3).

2. Write the equation of the reflection of the line x = 1 in the Y-axis.

3. Show that the points (2, 3, 5), (–1, 5, –1) and (4, –3, 2) form a right angled isosceles triangle.

4. Reduce the equation x + 2y – 3z – 6 = 0 of the plane to the normal form.

5. Compute the following limit $\lim_{x \to 0} x^2 \cos \frac{2}{x}$.

6. Compute $\lim_{x \to 2^+} ([x] + x)$ and $\lim_{x \to 2^-} ([x] + x)$

7. Find the derivatives of the following functions f(x).

   $\log_7(\log x)\ (x > 0)$

8. If $f(x) = 1 + x + x^2 + \dots + x^{100}$ then find f'(1).

9. Find Δy and dy for the following functions for the values of x and Δx which are shown against each of the function.

   $y = x^2 + 3x + 6$, x = 10 and Δx = 0.01

10. Find the approximations of the following $\sqrt{25.001}$.

SECTION - B (5 × 4 = 20)

Note : Short answer type questions.

(i) Attempt any **five** questions.

(ii) Each question carries **four** marks.

- - -

11. Find the equation of locus of P, if the line segment joining (2, 3) and (–1, 5) subtends a right angle at P.

12. When the axes are rotated through an angle $\frac{\pi}{6}$, find the transformed equation of $x^2 + 2\sqrt{3}\,xy - y^2 = 2a^2$.

13. Find the point on the straight line 3x + y + 4 = 0 which is equidistant from the points (–5, 6) and (3, 2).

14. $\lim_{x \to a} \left(\frac{\sqrt{a+2x} - \sqrt{3x}}{\sqrt{3a+x} - 2\sqrt{x}} \right)$

15. Find the derivatives of the following function $\sin^{-1}\left(\frac{b + a\sin x}{a + b\sin x}\right)$ $(a > 0, b > 0)$

16. Find the lengths of normal and subnormal at a point on the curve $y = \frac{a}{2}\ (e^{x/a} + e^{-x/a})$.

17. Find the equations of tangent and normal to the curve $xy = 10$ at $(2, 5)$.

SECTION - C $(5 \times 7 = 35)$

Note : Long answer type questions.

(i) Attempt any **five** questions.

(ii) Each question carries **seven** marks.

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18. Find the circumcenter of the triangle whose sides are given by $x + y + 2 = 0$; $5x - y - 2 = 0$ and $x - 2y + 5 = 0$.

19. Find the product of the lengths of the perpendiculars drawn from $(2, 1)$ upon the lines $12x^2 + 25xy + 12y^2 + 10x + 11y + 2 = 0$.

20. Show that the straight lines $y^2 - 4y + 3 = 0$ and $x^2 + 4xy + 4y^2 + 5x + 10y + 4 = 0$ form a parallelogram and find the length of its sides.

21. If a ray makes angles $\alpha, \beta, \gamma, \delta$ with the four diagonals of a cube find $\cos^2\alpha + \cos^2\beta + \cos^2\gamma + \cos^2\delta$.

22. If $ax^2 + 2hxy + by^2 = 1$ then prove that $\frac{d^2y}{dx^2} = \frac{h^2 - ab}{(hx + by)^3}$

23. Find the angle between the curves $xy = 4$ and $y\ (x^2 + 4) = 8$.

24. Find the maximum area of the rectangle that can be formed with fixed perimeter 20 units.

PART-III

MATHEMATICS

PAPER-I(B)

GUESS PAPER 2

Time : 3 Hours

Max. Marks : 75

SECTION - A (10 × 2 = 20)

Note : (i) Answer **all** questions.

(ii) Each question carries **two** marks.

(iii) All are **Very Short Answer Type Questions.**

- - -

1. Find the slopes of the lines (i) parallel to and (ii) perpendicular to the line passing through (6, 3) and (–4, 5).
2. Find the value of x, if the slope of the line passing through (2, 5) and (x, 3) is 2.
3. Show that the points (5, 4, 2), (6, 2, – 1) and (8, – 2, – 7), are collinear.
4. Show that 2x + 3y + 7 = 0 represents a plane perpendicular to XY–plane.
5. Show that $\lim\limits_{x \to 0^-} x^3 \cos \dfrac{3}{x} = 0$
6. Compute the following limit $\lim\limits_{x \to 0} \left(\sqrt{x} + x^{5/2}\right)$ (x > 0).
7. If $f(x) = 2x^2 + 3x - 5$ then prove that $f'(0) + 3f'(-1) = 0$.
8. Find the derivatives of the function $\tan(e^x)$.
9. Find the approximations of the cos (60°5').
10. Find the slope of the tangent to the curve $y = x^3 - 3x + 2$ at the point whose x–coordinate is 3.

SECTION - B (5 × 4 = 20)

Note : Short answer type questions.

(i) Attempt any **five** questions.

(ii) Each question carries **four** marks.

- - -

11. If the distance from P to the points (2, 3) and (2, – 3) are in the ratio 2:3, then find the equation of the locus of P.
12. Find the transformed equation of $17x^2 - 16xy + 17y^2 = 225$ when the axes are rotated through an angle of 45°.
13. Find the equation of the straight line passing through the points (–1, 2) and (5, –1) and also find the area of the triangle formed by it with the axes of coordinates.
14. $\lim\limits_{x \to 0} \left(\dfrac{(1+x)^{1/8} - (1-x)^{1/8}}{x}\right)$
15. $\tan^{-1}\left(\dfrac{\cos x}{1+\cos x}\right)$

16. Find the angle between the curves $x + y + 2 = 0$ and $x^2 + y^2 - 10y = 0$

17. A container is in the shape of inverted cone has height 8m and radius 6m at the top. If it is filled with water at the rate of $2m^3$/minute, how fast is height of water changing when the level is 4m?

SECTION - C (5 × 7 = 35)

Note : Long answer type questions.

(i) Attempt any **five** questions.

(ii) Each question carries **seven** marks.

- - -

18. Find the equations of straight lines passing through the point $(-10, 4)$ and making an angle θ with the line $x - 2y = 10$ such that $\tan\theta = 2$

19. Find the condition for the chord $lx + my = 1$ of the circle $x^2 + y^2 = a^2$ (whose centre is the origin) to subtend a right angle at the origin.

20. Find the centroid and the area of triangle formed by the following lines.

$2y^2 - xy - 6x^2 = 0$, $x + y + 4 = 0$.

21. If $(6, 10, 10)$, $(1, 0, -5)$, $(6, -10, 0)$ are vertices of a triangle, find the direction ratios of its sides. Determine whether it is right angled or isosceles.

22. Find the derivatives of the function $x^x + (\cot x)^x$.

23. The profit function $P(x)$ of a company selling 'x' items per day is given by $P(x) = (150 - x)x - 1000$. Find the number of items that the company should manufacture to get maximum profit. Also find the maximum profit.

24. If the curved surface of right circular cylinder inscriped in a sphere of radius 'r' is maximum, show that the height of the cylinder is $\sqrt{2}r$.

PART-III

MATHEMATICS

MODEL PAPER 1

PAPER-I (B)

Time : 3 Hours

Max. Marks : 75

Note : This question paper consists of **three** sections **A, B** and **C.**

SECTION - A (10 × 2 = 20)

I. **Very short** answer type questions.

(i) Attempt **all** questions.

(ii) Each question carries **two** marks.

- - -

1. Find the equation of the straight line passing through (–4, 5) and cutting off equal and non zero intercepts on the coordinate axes.

2. Find the condition for the points (a, 0), (h, k) and (0, b) where a, b ≠ 0, to be collinear.

3. Find 'x' if the distance between (5,–1, 7) and (x, 5,1) is 9 units.

4. Find the intercepts of the plane 4x + 3y – 2z + 2 = 0 on the coordinate axes.

5. Show that $\lim_{x \to 0+} \left(\frac{2|x|}{x} + x + 1 \right) = 3$

6. $\lim_{x \to \infty} \frac{11x^3 - 3x + 4}{13x^3 - 5x^2 - 7}$.

7. Find the derivative of $\sqrt{x + 1}$ using first principle.

8. Find the derivative of cos (log(cot x))

9. Find Δy and dy for $y = e^x + x$, $x = 5$ and $\Delta x = 0.02$.

10. Find the equations of tangent and normal to the curve x = cost, y = sint at t = $\frac{\pi}{4}$.

SECTION - B (5 × 4 = 20)

II. **Short answer** type questions.

(i) Attempt any **five** questions.

(ii) Each question carries **four** marks.

- - -

11. Find the equation of the locus of a point, the difference of whose distances from (–5, 0) and (5, 0) is 8.

12. When the axes are rotated through an angle α, find the transformed equation of x cos α + y sin α = p.

13. Find the equations of the straight lines passing through th point (–3, 2) and making an angle of 45° with the straight line 3x – y + 4 = 0.

14. Find real constants a,b so that the function 'f' given by

$$f(x) = \begin{cases} \sin x & \text{if } x \le 0 \\ x^2 + a & \text{if } 0 < x < 1 \\ bx + 3 & \text{if } 1 \le x \le 3 \\ -3 & \text{if } x > 3 \end{cases}$$ is continuous on R.

15. Find the derivatives of $(x^x)^x$

16. At any point 't' on the curve $x = a(t + \sin t)$, $y = a(1 - \cos t)$, find the lengths of tangent, normal, subtangent and subnormal.

17. Show that the curves $6x^2 - 5x + 2y = 0$ and $4x^2 + 8y^2 = 3$ touch each other at $\left(\frac{1}{2}, \frac{1}{2}\right)$.

SECTION - C (5 × 7 = 35)

III. **Long answer** type questions.

(i) Attempt **any five** questions.

(ii) Each question carries **seven** marks.

- - -

18. Find the incenter of the triangle formed by the lines $x = 1$, $y = 1$ and $x + y = 1$.

19. If the equation $ax^2 + 2hxy + by^2 + 2gx + 2fy + c = 0$ represents a pair of intersecting lines, then show that the square of the distance of their point of intersection from the origin is $\frac{c(a+b) - f^2 - g^2}{ab - h^2}$.

Also show that the square of this distance is $\frac{f^2 + g^2}{h^2 + b^2}$ if the given lines are perpendicular.

20. Find the angle between the lines joining the origin to the points of intersection of the curve $x^2 + 2xy + y^2 + 2x + 2y - 5 = 0$ and the line $3x - y + 1 = 0$.

21. Show that the lines whose d.c's are given by $l + m + n = 0$, $2mn + 3nl - 5lm = 0$ are perpendicular to each other.

22. Find the derivative of $(\sin x)^x + x^{\sin x}$

23. From a rectangular sheet of dimensions 30 cm × 80 cm, four equal squares of side x cm are removed at the corners, and the sides are then turned up so as to form an open rectangular box. Find the value of x, so that the volume of the box is greatest.

24. Find the rectangle of maximum perimeter that can be inscribed in a circle.

PART-III

MATHEMATICS

MODEL PAPER 2

PAPER-I (B)

Time : 3 Hours | Max. Marks : 7

Note : This question paper consists of **three** sections **A, B and C.**

SECTION - A (10 × 2 = 20)

I. **Very short** answer type questions.

(i) Attempt **all** the questions.

(ii) Each question carries **two** marks.

- - -

1. Find the value of p, if the straight lines x + p = 0, y + 2 = 0, and 3x + 2y + 5 = 0 are concurrent.

2. A straight line with slope 1 passes through Q(−3, 5) and meets the straight line x + y − 6 = 0 at P. Find the distance PQ.

3. Show that the points A(3, 2, − 4), B(5, 4, − 6) and C(9, 8, − 10) are collinear and find the ratio in which B divides $\overline{AC}$.

4. Show that 2x + 3y + 7 = 0 represents a plane perpendicular to XY - plane.

5. $\lim_{x \to 0} \frac{e^{\sin x} - 1}{x}$

6. $\lim_{x \to \infty} \left(\sqrt{x+1} - \sqrt{x}\right)$

7. Find the derivative of log (tan 5x).

8. Find the derivative of $\tan^{-1} \sqrt{\frac{1 - \cos x}{1 + \cos x}}$

9. Find the approximations of $\sqrt[3]{65}$.

10. Find the lengths of subtangent and subnormal at a point on the curve $y = b \sin\left(\frac{x}{a}\right)$

SECTION - B (5 × 4 = 20)

II. **Short answer** type questions.

(i) Attempt any **five** questions.

(ii) Each question carries **four** marks.

- - -

11. Find the equation of the locus of P, if A = (4, 0), B = (−4, 0) and $|PA - PB| = 4$.

12. When the axes are rotated through an angle $\frac{\pi}{4}$, find the transformed equation of $3x^2 + 10xy + 3y^2 = 9$.

13. Find the equations of the straight lines passing through the point of intersection of the lines 3x + 2y + 4 = 0 and 2x + 5y = 1 and whose distance from (2, −1) is 2.

14. $\lim_{x \to a} \left(\frac{x \sin a - a \sin x}{x - a} \right)$.

15. Find $\frac{dy}{dx}$ for $x = 3\cos t - 2\cos^3 t$, $y = 3\sin t - 2\sin^3 t$.

16. Find the angle between the curves $x + y + 2 = 0$; $x^2 + y^2 - 10y = 0$.

17. The volume of a cube is increasing at the rate of 8 cm³/sec. How fast is the surface area increasing when the length of an edge is 12 cm?

SECTION - C $(5 \times 7 = 35)$

III. **Long answer** type questions.

(i) Attempt **any five** questions.

(ii) Each question carries **seven** marks.

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18. Find the circumcenter of the triangle whose sides are $x = 1$, $y = 1$ and $x + y = 1$.

19. If the second degree equation,

$S = ax^2 + 2hxy + by^2 + 2gx + 2fy + c = 0$ in two variables x and y represents a pair of straight lines, then prove that

(i) $abc + 2fgh - af^2 - bg^2 - ch^2 = 0$

(ii) $h^2 \geq ab$, $g^2 \geq ac$, $f^2 \geq bc$.

20. If the equation $S = ax^2 + 2hxy + by^2 + 2gx + 2fy + c = 0$ represents a pair of parallel straight lines, then

(i) $h^2 = ab$

(ii) $af^2 = bg^2$

(iii) Distance between parallel lines $= 2\sqrt{\frac{g^2 - ac}{a(a+b)}}$.

21. The vertices of a triangle are A(1, 4, 2), B(– 2, 1, 2), C(2, 3, – 4). Find $\angle A$, $\angle B$, $\angle C$

22. Establish the following

If $x^y + y^x = a^b$ then $\frac{dy}{dx} = -\left[\frac{yx^{y-1} + y^x \log y}{x^y \log x + xy^{x-1}} \right]$.

23. If the curved surface of right circular cylinder inscriped in a sphere of radius 'r' is maximum, show that the height of the cylinder is $\sqrt{2}\, r$.

24. Show that area of rectangle inscribed in a circle is maximum when it is a square.

PART-III

MATHEMATICS

MODEL PAPER 3

PAPER-I (B)

Time : 3 Hours

Max. Marks : 75

Note : This question paper consists of **three** sections **A, B** and **C.**

SECTION - A (10 × 2 = 20)

I. **Very short** answer type questions.

(i) Attempt **all** the questions.

(ii) Each question carries **two** marks.

- - -

1. Find the slopes of the lines x + y = 0 and x – y = 0.

2. Find the length of the perpendicular drawn from the point given against the following straight lines. 3x – 4y + 10 = 0 ..... (3, 4).

3. If (3, 2, – 1), (4, 1, 1) and (6, 2, 5) are three vertices and (4, 2, 2) is the centroid of a tetrahedron, find the fourth vertex.

4. Find angle between the planes 2x – y + z = 6 and x + y + 2z = 7.

5. $\lim\limits_{x \to 3} \dfrac{x^2 - 8x + 15}{x^2 - 9}$

6. Compute $\underset{x \to 0}{\text{Lt}} \left(\dfrac{a^x - 1}{b^x - 1}\right) (a > b > 0, b \neq 1)$

7. Find the derivatives of the following functions $\sin^{-1}(3x - 4x^3)$.

8. If $y = ae^{nx} + be^{-nx}$ then prove that $y'' = n^2 y$.

9. Show that at any point (x , y) on the curve $y = be^{x/a}$, the length of the subtangent is a constant and the length of the subnormal is $\dfrac{y^2}{a}$.

10. If $y = f(x) = x^2 + x$, x = 10, Δx = 0.1 find Δy, dy

SECTION - B (5 × 4 = 20)

II. **Short answer** type questions.

(i) Attempt any **five** questions.

(ii) Each question carries **four** marks.

- - -

11. If A(5, 3) and B(3, –2) are two fixed points. Find the equation of locus of P, so that the area of triangle PAB is 9.

12. When the origin is shifted to the point (2,3), the transformed equation of a curve is $x^2 + 3xy - 2y^2 + 17x - 7y - 11 = 0$. Find the original equation of the curve.

13. Find the equation of the line perpendicular to the line $3x + 4y + 6 = 0$ and making an intercept -4 on the X-axis.

14. $\lim_{x \to 0} \left(\frac{\cos ax - \cos bx}{x^2}\right)$

15. Find the derivative of the function $x \sin x$ from the first principle.

16. Find the lengths of subtangent, subnormal at a point 't' on the curve

$x = a(\cos t + t\sin t)$,

$y = a(\sin t - t\cos t)$

17. Find the angle between the curves given below.

$x + y + 2 = 0$; $x^2 + y^2 - 10y = 0$

SECTION - C $(5 \times 7 = 35)$

III. **Long answer** type questions.

(i) Attempt **any five** questions.

(ii) Each question carries **seven** marks.

- - -

18. Find the orthocentre of the triangle formed by the lines $x + 2y = 0$, $4x + 3y - 5 = 0$ and $3x + y = 0$

19. Write down the equation of the pair of straight lines joining the origin to the points of intersection of the line $6x - y + 8 = 0$ with the pair of straight lines $3x^2 + 4xy - 4y^2 - 11x + 2y + 6 = 0$. Show that the lines so obtained make equal angles with the coordinate axes.

20. Show that area of the triangle formed by the lines $ax^2 + 2hxy + by^2 = 0$ and $lx + my + n = 0$ is

$$\left|\frac{n^2\sqrt{h^2 - ab}}{(am^2 - 2hlm + bl^2)}\right|$$

21. Find the direction cosines of two lines which are connected by the relations $l - 5m + 3n = 0$ and $7l^2 + 5m^2 - 3n^2 = 0$.

22. Establish the following

If $a > b > 0$ and $0 < x < \pi$; $f(x) = (a^2 - b^2)^{-1/2} \cos^{-1}\left(\frac{a\cos x + b}{a + b\cos x}\right)$ then $f'(x) = (a + b\cos x)^{-1}$

23. A window is in the shape of a rectangle surmounted by a semicircle. If the perimeter of the window is 20ft. Find the maximum area.

24. A wire of length 'l' is cut into two parts which are bent respectively in the form of a square and a circle. What are the lengths of the pieces of the wire respectively so that the sum of the areas is the least

BOARD MODEL PAPER

MATHEMATICS - IB

Time: 3 Hours. **Max. Marks:75**

NOTE : **The Question Paper consists of three sections A, B and C.**

SECTION - A

I. Very Short Answer Questions. **10 × 2 = 20 Marks**

i) Answer All questions.

ii) Each Question carries Two marks.

1. Find the value of x, if the slope of the line passing through (2, 5) and (x, 3) is 2.
2. Transform the equation $x + y + 1 = 0$ into the normal form.
3. Show that the points (1, 2, 3), (2, 3, 1) and (3, 1, 2) form an equilateral Triangle.
4. Find the angle between the planes $2x - y + z = 6$ and $x + y + 2z = 7$.
5. Show that $\underset{x \to 0^+}{\text{Lt}} \left\{ \frac{2|x|}{x} + x + 1 \right\} = 3$.
6. Find $\lim_{x \to 0} \frac{e^{x+3} - e^3}{x}$.
7. If $f(x) = a^x e^{x^2}$, find $f'(x)$ (where $a > 0,\ a \neq 1$).
8. If $y = \log[\sin(\log x)]$, find $\frac{dy}{dx}$.
9. Find the approximate value of $\sqrt[3]{65}$.
10. Find the value of 'C' in Rolle's theorem for the function $f(x) = x^2 + 4$ on $[-3, 3]$.

SECTION - B

II. Short Answer Questions. **5 × 4 = 20 Marks**

i) Answer Any Five questions.

ii) Each Question carries Four marks.

11. A(2, 3) and B(−3, 4) are two given points. Find the equation of the locus of P, so that the area of the triangle PAB is 8.5 sq.units.

12. When the axes are rotated through an angle $\frac{\pi}{6}$ find the transformed equation of $x^2 + 2\sqrt{3}xy - y^2 = 2a^2$.

13. Find the points on the line $3x - 4y - 1 = 0$ which are at a distance of 5 unit from the point (3, 2).

14. Show that $f(x) = \begin{cases} \frac{\cos ax - \cos bx}{x^2} & \text{if } x \neq 0 \\ \frac{1}{2}(b^2 - a^2) & \text{if } x = 0 \end{cases}$, where a and b are real constants is continuous at '0'.

15. Find the derivative of sin 2x from the first principle.

16. A particle is moving in a straight line so that after t seconds its distance s (in cms) from a fixed point on the line is given by $s = f(t) = 8t + t^3$. Find (i) the velocity at, time t = 2 sec (ii) the initial velocity (iii) acceleration at t = 2 sec.

17. Show that the tangent at any point θ on the curve $x = c \sec\theta$, $y = c \tan\theta$ is $y \sin\theta = x - c\cos\theta$.

SECTION - C

II. Long Answer Questions. **$5 \times 7 = 35$ Marks**

i) Answer Any Five questions.

ii) Each Question carries Seven marks.

18. Find the equation of straight lines passing through (1, 2) and making an angle of 60° with the line $\sqrt{3}x + y + 2 = 0$.

19. Show that the area of the triangle formed by the lines $ax^2 + 2hxy + by^2 = 0$ and $lx + my + n = 0$ is $\left|\frac{n^2\sqrt{h^2 - ab}}{am^2 - 2hlm + bl^2}\right|$.

20. Find the value of k, if the lines joining the origin to the points of intersection of the curve $2x^2 - 2xy + 3y^2 + 2x - y - 1 = 0$ and the line $x + 2y = k$ are mutually perpendicular.

21. If a ray with d.c's l, m, n makes angles α, β, γ and δ with four diagonals of a cube, then show that $\cos^2\alpha + \cos^2\beta + \cos^2\gamma + \cos^2\delta = \frac{4}{3}$.

22. If $x = \frac{3at}{1+t^3}, y = \frac{3at^2}{1+t^3}$, then find $\frac{dy}{dx}$.

23. At any point t on the curve $x = a(t + \sin t)$, $y = a(1 - \cos t)$ find lengths of tangent and normal.

24. A wire of length *l* is cut into two parts which are bent respectively in the form of a square and a circle. Find the lengths of the pieces of the wire, so that the sum of the areas is the least.

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