

MATHEMATICS	Intermediate Part-II (12th) (1st A 425)	Paper: II	First Group
Time: 2:30 Hours	SUBJECTIVE	Marks: 80	

Note: Section I is compulsory. Attempt any THREE (3) questions from Section II.

SECTION – I

2. Write short answers / solve any EIGHT (8) questions: (2x8 = 16)

- Define parametric function and give an example.
- Given $f(x) = x^3 - ax^2 + bx + 1$. If $f(2) = -3$ and $f(-1) = 0$. Find the values of 'a' and 'b'.
- Show that the parametric equations $x = a \cos \theta$, $y = b \sin \theta$ represent the equation of ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$.
- The real valued functions 'f' and 'g' are defined below. Find $f(g(x))$ and $g(f(x))$:
 $f(x) = \frac{1}{\sqrt{x-1}}$, $x \neq 1$, $g(x) = (x^2 + 1)^2$
- Evaluate: $\lim_{x \rightarrow \infty} \frac{4x^4 - 5x^3}{3x^5 + 2x^2 + 1}$
- Find the derivative of the function by definition method: $f(x) = c$
- Find the derivative of $y = (2\sqrt{x} + 2)(x - \sqrt{x})$ with respect to x .
- Differentiate w.r.t 'x': $x^{-3} + 2x^{\frac{3}{2}} + 3$
- If $y = x^4 + 2x^2 + 2$, prove that $\frac{dy}{dx} = 4x\sqrt{y-1}$
- Find $\frac{dy}{dx}$ if $y = x \cos y$
- Find $\frac{dy}{dx}$ if $y = \sinh^{-1}(ax + b)$
- Find $f'(x)$ if $f(x) = x^x e^{\frac{1}{x}}$ ($x \neq 0$)

3. Write short answers / solve any EIGHT (8) questions: (2x8 = 16)

- Evaluate: $\int x(\sqrt{x} + 1) dx$, $x > 0$
- Integrate: $\int \frac{x^2}{4+x^2} dx$
- Find the integral $\int x \ln x dx$
- Evaluate: $\int e^x \left(\frac{1}{x} + \ln x \right) dx$
- Evaluate: $\int_1^{\sqrt{e}} (x^3 + 1) dx$
- Find $\int \frac{\sin \theta}{1 + \cos^2 \theta} d\theta$
- Find the area between the x -axis and the curve $y = \sin 2x$ from $x = 0$ to $x = \frac{\pi}{3}$
- Find the distance between the points A(-8, 3) and B(2, -1)
- Find the midpoint of the line joining points A(3, 1) and B(-2, -4)
- Find the slope and inclination of line joining (3, -2) and (2, 7)
- Write an equation of the line through A(-6, 5) having slope 7.
- Check whether two lines are perpendicular $3y = 2x + 5$, $3x + 2y - 8 = 0$

4. Write short answers / solve any NINE (9) questions: (2x9 = 18)

- Define optimal solution of the system of linear inequalities.
- Graph the solution set of inequality $5x - 4y \leq 20$.
- Write down an equation of tangent to the circle $x^2 + y^2 = 25$ at (4, 3).
- Find the centre and radius of circle whose equation is $x^2 + y^2 - 6x + 4y + 13 = 0$
- Find centre and foci of the ellipse whose equation is $25x^2 + 9y^2 = 225$
- Find equation of hyperbola with centre (0, 0), focus (6, 0) and vertex (4, 0).

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- Write the general form of an equation of a circle.
- If 'O' is the origin and $\overrightarrow{OP} = \overrightarrow{AB}$, find point 'P' where A(-3, 7) and B(1, 0).
- Find α so that $|\alpha \underline{i} + (\alpha + 1)\underline{j} + 2\underline{k}| = 3$
- Find a real number 'a' so that $\underline{u} = 2a\underline{i} + \underline{j} - \underline{k}$ and $\underline{v} = \underline{i} + a\underline{j} + 4\underline{k}$ are perpendicular.
- Prove that vectors $\underline{i} - 2\underline{j} + 3\underline{k}$, $-2\underline{i} + 3\underline{j} - 4\underline{k}$ and $\underline{i} - 3\underline{j} + 5\underline{k}$ are coplanar.
- Define direction cosines and direction angles of a vector.
- Find a vector of length 5 in the direction opposite that of $\underline{v} = \underline{i} - 2\underline{j} + 3\underline{k}$.

SECTION – II

5. (a) Find the values 'm' and 'n' so that function 'f' is continuous at $x = 3$ (5)

$$f(x) = \begin{cases} mx & \text{if } x < 3 \\ n & \text{if } x = 3 \\ -2x + 9 & \text{if } x > 3 \end{cases}$$

(b) Show that $\frac{dy}{dx} = \frac{y}{x}$ if $y = \tan^{-1} \frac{x}{y}$. (5)

6. (a) If $x = \sin \theta$ and $y = \sin m\theta$, show that $(1 - x^2)y_2 - xy_1 + m^2y = 0$ (5)

(b) Use differentials to approximate the value of $\sqrt{17}$ (5)

7. (a) Graph the solution region by shading. Also, find all corner points for the system of inequalities: (5)

$$\begin{aligned} 3x + 7y &\leq 21 \\ 2x - y &\leq -3 \\ y &\geq 0 \end{aligned}$$

(b) Evaluate the integral: $\int_0^{\frac{\pi}{4}} x \cos x dx$ (5)

8. (a) Find the equation of tangent to circle $x^2 + y^2 = 2$ parallel to the $x - 2y + 1 = 0$ (5)

(b) Check whether the lines $4x - 3y - 8 = 0$, $3x - 4y - 6 = 0$, $x - y - 2 = 0$ are concurrent. If so, find the point where they meet. (5)

9. (a) Find the centre, foci, eccentricity and vertices of the hyperbola: (5)

$$\frac{(y+2)^2}{9} - \frac{(x-2)^2}{16} = 1$$

(b) Find the volume of the tetrahedron whose vertices are A(2, 1, 8), B(3, 2, 9), C(2, 1, 4) and D(3, 3, 0). (5)

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Roll No. of Candidate : 

MATHEMATICS		Intermediate Part- II (12 th) (1 st A 425-I)		Paper: II	Second Group
Time: 30 Minutes		OBJECTIVE Code: 8192		Marks: 20	
Q. No. 1	You have four choices for each objective type question as A, B, C and D. The choice which you think is correct, fill that circle in front of the relevant question number. Use marker or pen to fill in the circles. Cutting or filling of two or more circles will result zero mark in that question.				
S. #	Questions	A	B	C	D
1	Which one is identity function	$f(x) = \sin x$	$f(x) = \sqrt{x}$	$f(x) = x^2$	$f(x) = x$
2	If $f(x)$ is continuous at point $x = a$, then _____.	$f(x) = \lim_{x \rightarrow a} f(x)$	$f(a) = \lim_{x \rightarrow a} f(x)$	$f(0) = \lim_{x \rightarrow a} f(x)$	$f(a) = \lim_{x \rightarrow 0} f(x)$
3	Geometrical meaning of the derivative is _____.	Slope of Tangent line	Slope of Normal	Slope of x-axis	Slope of y-axis
4	If $x = f(\theta)$, $y = g(\theta)$, then $\frac{dy}{dx} =$ _____.	$\frac{dy}{d\theta} \cdot \frac{d\theta}{dx}$	$\frac{d\theta}{dy} \cdot \frac{dx}{d\theta}$	$\frac{dy}{d\theta} \cdot \frac{d\theta}{dx}$	$\frac{d\theta}{dx} \cdot \frac{d\theta}{dy}$
5	$\frac{d}{dx}(\cos^2 x - \sin^2 x) =$ _____.	$2\cos 2x$	$-2\sin 2x$	$2\sin 2x$	$-2\cos 2x$
6	$\frac{d}{dx}(e^{f(x)}) =$	$e^{f(x)}$	$\frac{f'(x)}{e^x}$	$\frac{e^x}{f'(x)}$	$e^{f(x)} \cdot f'(x)$
7	If $y = x^2 - 1$, then $dy =$ _____	$2x dx$	$(x - 1) dx$	$(2x - 1) dx$	$2x dx + c$
8	$\int \cot x dx$ is equal to	$\ln \sec x + c$	$\ln \csc x + c$	$\ln \sin x + c$	$\ln \cos x + c$
9	When the expression $\sqrt{a^2 - x^2}$ involves in integration, we substitute _____.	$x = a \operatorname{cosec} \theta$	$x = a \sin \theta$	$x = a \tan \theta$	$x = a \sec \theta$
10	$\int_2^4 \frac{1}{x} dx =$ _____.	$\ln 4$	4	2	$\ln 2$
11	If a straight line is perpendicular to y-axis, then its slope is	1	-1	0	Undefined
12	If $m_1 = m_2$, then lines are	Parallel	Perpendicular	Not parallel	None of these
13	The lines represented by $ax^2 + 2hxy + by^2 = 0$ are imaginary if	$h^2 - ab = 0$	$h^2 - ab < 0$	$h^2 - ab > 0$	$h^2 - ab \neq 0$
14	Point (1, 2) lies in the region of inequality _____.	$2x + y > 5$	$2x + y \geq 5$	$2x + y < 3$	$2x + y < 5$
15	The conic is called circle if _____.	$e = 1$	$e < 1$	$e = 0$	$e > 1$
16	In an ellipse, the foci lie on the _____.	Major axis	Minor axis	Directrix	z-axis
17	Centre of the hyperbola $\frac{(x+1)^2}{9} - \frac{(y-2)^2}{4} = 1$ is	(1, 2)	(1, -2)	(2, 1)	(-1, 2)
18	A vector perpendicular to both vectors $\underline{a}$ and $\underline{b}$ is	$\underline{a} \cdot \underline{b}$	$\underline{a} \times \underline{b}$	$\frac{\underline{a} \cdot \underline{b}}{ \underline{a} }$	$\underline{b} \cdot \underline{n}$
19	Scalar triple product of coplanar vectors is	1	-1	0	2
20	The unit vector along y-axis is	$\underline{j}$	$\underline{i}$	$\underline{k}$	1

MATHEMATICS	Intermediate Part- II (12th) (1st A 425)	Paper: II	Second Group
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Note: Section I is compulsory. Attempt any THREE (3) questions from Section II.

SECTION – I

2. Write short answers / solve any EIGHT (8) questions:

(2x8 = 16)

- Prove the identity $\sinh 2x = 2 \sinh x \cosh x$
- The real valued function $f(x) = 2x + 1$. Find $\text{fof}(x)$
- Express the limit $\lim_{x \rightarrow \infty} \left(\frac{x}{1+x} \right)^x$ in terms of e
- Evaluate: $\lim_{x \rightarrow 0} \frac{\sin x}{\sin 2x}$
- Define identity function. Also give one example.
- State Quotient Rule of differentiation.
- Differentiate $\frac{2x-3}{2x+1}$ w.r.t 'x'
- Find $\frac{dy}{dx}$ if $xy + y^2 = 2$
- Differentiate $\cos^{-1} \frac{x}{a}$ w.r.t 'x'
- Find y_2 if $y = \sin 3x$
- Determine the intervals in which f is increasing or decreasing for the domain mentioned in $f(x) = \cos x : x \in \left(-\frac{\pi}{2}, \frac{\pi}{2}\right)$
- Apply Maclaurin series expansion to prove that $e^{2x} = 1 + 2x + \frac{4x^2}{2!} + \frac{8x^3}{3!} + \dots$

3. Write short answers / solve any EIGHT (8) questions:

(2x8 = 16)

- Using differential find $\frac{dx}{dy}$ in $xy + x = 4$
- Evaluate: $\int \left(\sqrt{x} - \frac{1}{\sqrt{x}} \right)^2 dx$
- Evaluate: $\int x^3 \ln x \, dx$
- Evaluate definite integral $\int_1^2 (x^2 + 1) \, dx$
- Find the area, above the x-axis and under the curve $y = 5 - x^2$ from $x = -1$ to $x = 2$
- Solve the differential equation $\frac{dy}{dx} = \frac{1-x}{y}$
- Evaluate: $\int \sin(a+b)x \, dx$
- Show that the points $A(3, 1)$, $B(-2, -3)$ and $C(2, 2)$ are vertices of an Isosceles Triangle.
- Find the point three fifth of the way along the line segment from $A(-5, 8)$ to $B(5, 3)$
- Find the equation of line through points $(-2, 1)$ and $(6, -4)$
- Find the lines represented by $10x^2 - 23xy - 5y^2 = 0$
- Transform the equation $2x - 4y + 11 = 0$ into two intercepts form.

4. Write short answers / solve any NINE (9) questions:

(2x9 = 18)

- Define theorem of Linear Programming.
- Find the solution region of the linear inequality $3x - 4y \leq 12$ by shading
- Find the equation of circle whose centre is $(5, -2)$ and radius is 4.
- Find the equation of normal to the circle $x^2 + y^2 = 25$ at the point $(4, 3)$.
- Find the vertex of the parabola $y = 6x^2 - 1$

Turn Over

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- Find the centre and length of minor axis of the ellipse $\frac{(2x-1)^2}{4} + \frac{(y+2)^2}{16} = 1$
- Find the length of latus rectum of hyperbola $\frac{x^2}{4} - \frac{y^2}{9} = 1$
- Find 'a' such that the vectors $2\vec{i} + \vec{j} + 5\vec{k}$ and $3\vec{i} + \vec{j} + \vec{k}$ are perpendicular.
- Find the direction cosines of the vector $\vec{PQ}$ when $P(2, 1, 5)$ and $Q(1, 3, 1)$ are given.
- Find the vector from point A to origin when $\vec{AB} = 4\vec{i} - 2\vec{j}$ and B is the point $(-2, 5)$.
- If $\vec{a} \cdot \vec{b} = 0$ and $\vec{a} \times \vec{b} = 0$, then what conclusion can be drawn about $\vec{a}$ and $\vec{b}$.
- Find the value of $2\vec{i} \times 2\vec{j} \cdot \vec{k}$
- A force $\vec{F} = 7\vec{i} + 4\vec{j} - 3\vec{k}$ is applied at $P(1, -2, 3)$. Find the moment of $\vec{F}$ about the point $Q(2, 1, 1)$.

SECTION – II

- If $f(x) = \begin{cases} \frac{\sqrt{2x+5} - \sqrt{x+7}}{x-2} & x \neq 2 \\ k & x = 2 \end{cases}$
Find the value of 'k', so that $f(x)$ is continuous at $x = 2$
 - Differentiate w.r.t 'x' $\sec^{-1} \left(\frac{x^2+1}{x^2-1} \right)$
- If $y = e^{3x} \sin x$, show that $\frac{d^2y}{dx^2} - 2a \frac{dy}{dx} + (a^2 + b^2)y = 0$
 - Evaluate: $\int \sqrt{a^2 - x^2} \, dx$
- Find the area between the x-axis and the curve $y = \sqrt{2ax - x^2}$, when $a > 0$
 - Graph the feasible region of the following system of linear inequalities and find the corner points also
 $5x + 7y \leq 35$
 $x - 2y \leq 4$
 $x \geq 0, y \geq 0$
- Find the distance between the given parallel lines. Sketch the lines. Also find an equation of the parallel line lying midway between them: $3x - 4y + 3 = 0$; $3x - 4y + 7 = 0$
 - Show that the lines $3x - 2y = 0$ and $2x + 3y - 13 = 0$ are tangents to the circle $x^2 + y^2 + 6x - 4y = 0$
- Write an equation of the parabola with, directrix $y = 1$, length of latusrectum is 8.
Opens downward.
 - Find the volume of the tetrahedron whose vertices are $A(2, 1, 8)$, $B(3, 2, 9)$, $C(2, 1, 4)$ and $D(3, 3, 0)$.

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