

Roll No. : _____

Objective

Paper Code

8197

Intermediate Part Second

MATHEMATICS (Objective) Group - I

Time: 30 Minutes

Marks: 20

FSD-1-24



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 the relevant circle in front of that question number on computerized answer sheet. Use marker or pen to fill the circles. Cutting or filling two or more circles will result in zero marks in that question. Attempt as many questions as given in objective type question paper and leave other circles blank.

S.#	Questions	A	B	C	D
1	Two non-parallel lines intersect each other at:	1 point	0 point	∞ point	2 points
2	Equation of a straight line passing through P(c,d) and parallel to x-axis is:	$x=0$	$y=0$	$x=d$	$y=d$
3	Normal form of equation of straight line is:	A	$y=mx+c$	B	$x \sin(90^\circ - \alpha) + y \cos(90^\circ - \alpha) = p$
		C	$\frac{x}{a} + \frac{y}{b} = 1$	D	$x = \frac{y}{2} - \frac{5}{2}$
4	$ax + b > 0$ is:	An identity	A linear equation	Equation	Inequality
5	For hyperbola $b^2 = ?$	$c^2 - a^2$	$a^2 - c^2$	$c^2 + a^2$	$ac - 1$
6	Parametric equations of a circle are:	$x = a \cos \theta$, $y = b \sin \theta$	$x = a \sin \theta$, $y = b \cos \theta$	$x = a \cos \theta$, $y = a \sin \theta$	$x = b \cos \theta$, $y = a \sin \theta$
7	The equation $ax^2 + by^2 + 2gx + 2fy + c = 0$ will represent circle if:	$a < b$	$a = b$	$a > b$	$a \neq b$
8	If terminal point B of vector AB coincides with its initial point A, then such a vector is called:	Null vector	Unit vector	Coincident vector	Free vector
9	If α, β, γ are direction angles of a vector, then	$0 < \alpha < \frac{\pi}{2}$	$0 \leq \alpha \leq \frac{\pi}{2}$	$0 < \alpha < \pi$	$0 \leq \alpha \leq \pi$
10	If $\vec{u} = a\hat{i} + b\hat{j} + c\hat{k}$, then projection of \vec{u} along \hat{k} is equal to:	a	b	c	$\vec{u} \cdot \hat{k}$
11	The equations of the form $x = a \cos \theta$, $y = a \sin \theta$ are called:	Implicit equations	Explicit equations	Parametric equations	Homogeneous equations
12	Domain of $f(x) = 2 + \sqrt{x-1} \forall x \in \mathbb{R}$ is:	$[-1, +\infty)$	$[0, +\infty)$	$[1, +\infty)$	$[2, +\infty)$
13	If $f(x) = c^3$, where c is any constant, then $f'(x) = ?$	$3c^2$	c^2	$\frac{3}{c}$	0
14	If $y = x^4 + 2x^2 + 3$, then $\frac{dy}{dx} = ?$	$4x\sqrt{y-1}$	$4x\sqrt{y-2}$	$4x\sqrt{y-3}$	$4x\sqrt{y-4}$
15	At a point of maximum value of a function, its derivative is:	Zero	Positive	Negative	Infinite
16	If $y = \sin 3x$, then $y_2 = ?$	$3 \cos 3x$	$-9 \sin 3x$	$-27 \cos 3x$	$81 \sin 3x$
17	$\int_0^{\sqrt{3}} \frac{1}{1+x^2} dx = ?$	$\frac{\pi}{6}$	$\frac{\pi}{4}$	$\frac{\pi}{3}$	$\frac{\pi}{2}$
18	$\int \frac{\sin x + \cos x}{\sqrt{1 + \sin 2x}} dx = ?$ is:	$x + c$	$\sin x + c$	$\cos x + c$	$\cos^2 x + c$
19	$\int \tan^2 x dx = ?$	$\tan x + x + c$	$2 \tan x \sec^2 x + c$	$\sec x - x + c$	$\tan x - x + c$
20	$\int \ell n x dx = ?$	$x \ell n x + c$	$x \ell n x - x + c$	$x \ell n x + x + c$	$\ell n x + x + c$

15

MATHEMATICS (Subjective) Group – I

Time: 02:30 Hours Marks: 80

FSD-1-24

SECTION – I

2. Attempt any EIGHT parts:

16

- (i) Show that parametric equations $x = a \cos \theta$, $y = b \sin \theta$ represent the equation of Ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$
- (ii) If $f(x) = \sqrt{x+1}$, $g(x) = \frac{1}{x^2}$, find $(f \circ g)(x)$
- (iii) Evaluate the limit: $\lim_{x \rightarrow 0} \frac{\sin ax}{\sin bx}$
- (iv) Discuss the continuity of $f(x) = \begin{cases} 2x+5, & x \leq 2 \\ 4x+1, & x > 2 \end{cases}$ at $x = 2$
- (v) Use definition to find the derivative of $x(x-3)$ w.r.t. 'x'
- (vi) Differentiate $x^4 + 2x^3 + x^2$ w.r.t. 'x'
- (vii) Differentiate $(1+x^2)^n$ w.r.t. x^2
- (viii) Find $\frac{dy}{dx}$ when $x = y \sin y$
- (ix) If $y = e^{-2x} \sin 2x$, find $\frac{dy}{dx}$
- (x) Find $\frac{dy}{dx}$ when $y = \sinh^{-1}(x^3)$
- (xi) Use Maclaurin Series to prove that $e^x = 1 + x + \frac{x^2}{2!} + \frac{x^3}{3!} + \frac{x^4}{4!} + \dots$
- (xii) Find the interval where $f(x) = 4 - x^2$, $x \in (-2, 2)$ is increasing or decreasing in the given domain.

3. Attempt any EIGHT parts:

16

- (i) Use differentials, find $\frac{dy}{dx}$ and $\frac{dx}{dy}$ of $x^2 + 2y^2 = 16$
- (ii) Evaluate $\int \sin^2 x \, dx$
- (iii) Find $\int \frac{dx}{x(\ln 2x)^2}$
- (iv) Evaluate $\int \sin^{-1} x \, dx$
- (v) Evaluate $\int_1^2 \ln x \, dx$
- (vi) Find area above the x-axis, bounded by curve $y^2 = 3 - x$ from $x = -1$ to $x = 2$
- (vii) Solve differential equation $1 + \cos x \tan y \frac{dy}{dx} = 0$
- (viii) Find point three-fifth of way along the line segment from $A(-5, 8)$ to $B(5, 3)$
- (ix) Two points P and O' are given in xy-coordinate system. Find XY-coordinates of P. $P\left(\frac{3}{2}, \frac{5}{2}\right)$; $O'\left(-\frac{1}{2}, \frac{7}{2}\right)$
- (x) Find an equation of line through $(-4, -6)$ and perpendicular to the line having slope $-\frac{3}{2}$
- (xi) Express the system $3x + 4y - 7 = 0$, $2x - 5y + 8 = 0$, $x + y - 3 = 0$ in matrix form and check whether three lines are concurrent.
- (xii) Find lines represented by $x^2 - 2xy \sec \alpha + y^2 = 0$

(Continued P/2)

F

4. Attempt any NINE parts:

- (i) Graph the solution set of linear inequality $5x - 4y \leq 20$ in xy -plane.
- (ii) Define corner point of solution region.
- (iii) Find center and radius of the circle $5x^2 + 5y^2 + 14x + 12y - 10 = 0$
- (iv) Find equation of parabola whose focus is $F(-3, 4)$ and directrix is $3x - 4y + 5 = 0$
- (v) Find length of the tangent drawn from the point $(-5, 4)$ to the circle $5x^2 + 5y^2 - 10x + 15y - 131 = 0$
- (vi) Find focus and vertices of Ellipse $\frac{x^2}{9} + \frac{y^2}{4} = 1$
- (vii) Find equation of tangent to conic $y^2 = 4ax$ at $(at^2, 2at)$
- (viii) Find equation of hyperbola with center $(0, 0)$, focus $(6, 0)$ vertex $(4, 0)$.
- (ix) If O is origin and $\overline{OP} = \overline{AB}$, find the point P when A and B are $(-3, 7)$ and $(1, 0)$ respectively.
- (x) Find direction cosines of vector $\underline{v} = \underline{i} - \underline{j} - \underline{k}$
- (xi) Find cosine of the angle θ between vectors $\underline{u} = 3\underline{i} + \underline{j} - \underline{k}$, $\underline{v} = 2\underline{i} - \underline{j} + \underline{k}$
- (xii) A force $\underline{F} = 7\underline{i} + 4\underline{j} - 3\underline{k}$ is applied at $P(1, -2, 3)$, find its moment about $Q(2, 1, 1)$
- (xiii) Find the volume of the parallelepiped determined by $\underline{u} = \underline{i} + 2\underline{j} - \underline{k}$, $\underline{v} = \underline{i} - 2\underline{j} + 3\underline{k}$, $\underline{w} = \underline{i} - 7\underline{j} - 4\underline{k}$

SECTION – II Attempt any THREE questions. Each question carries 10 marks.
--

5. (a) If $f(x) = \begin{cases} \frac{\sqrt{2x+5} - \sqrt{x+7}}{k}, & x \neq 2 \\ k, & x = 2 \end{cases}$, find the value of 'k' so that f is continuous at $x = 2$. 05
- (b) Prove that $y \frac{dy}{dx} + x = 0$ if $x = \frac{1-t^2}{1+t^2}$, $y = \frac{2t}{1+t^2}$ 05
6. (a) Show that $y = x^x$ has minimum value at $x = \frac{1}{e}$ 05
- (b) Evaluate: $\int \frac{dx}{(1+x^2)^{3/2}}$ 05
7. (a) Find the area between x -axis and curve $y = \sqrt{2ax - x^2}$, when $a > 0$ 05
- (b) Minimize $z = 3x + y$; subject to constraints $3x + 5y \geq 15$; $x + 3y \geq 9$, $x, y \geq 0$ 05
8. (a) Find the length of the chord cut off from the line $2x + 3y = 13$ by the circle $x^2 + y^2 = 26$ 05
- (b) Use vector method to show that $\sin(\alpha - \beta) = \sin \alpha \cos \beta - \cos \alpha \sin \beta$ 05
9. (a) Write an equation of the parabola with given elements:
Focus $(-3, 1)$; directrix $x - 2y - 3 = 0$ 05
- (b) Find the distance between the given parallel lines. Sketch the lines. Also find an equation of the parallel line lying midway between them:
 $3x - 4y + 3 = 0$; $3x - 4y + 7 = 0$ 05

Roll No. : _____

Objective
Paper Code
8196

Intermediate Part Second
MATHEMATICS (Objective) Group - II
Time: 30 Minutes Marks: 20



FSD-2-24

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 the relevant circle in front of that question number on computerized answer sheet. Use marker or pen to fill the circles. Cutting or filling two or more circles will result in zero marks in that question. Attempt as many questions as given in objective type question paper and leave other circles blank.

S.#	Questions	A	B	C	D
1	The suitable substitution for $\sqrt{x^2 - a^2}$ to be integrated:	$x = a \sin \theta$	$x = a \sec \theta$	$x = a \tan \theta$	$x = a \cos \theta$
2	$\int (ax + b)^n dx = :$	$\frac{(ax + b)^{n+1}}{a(n+1)} + c$	$\frac{(ax + b)^{n+1}}{b(n+1)} + c$	$\frac{(ax + b)^{n+1}}{a(n-1)} + c$	$\frac{a(ax + b)^{n+1}}{n+1} + c$
3	$\int \sqrt{1 - \cos 2x} dx = :$	$-\sqrt{2} \cos x + c$	$\sqrt{2} \sin x + c$	$\sqrt{2} \cos x + c$	$-\sqrt{2} \sin x + c$
4	$\int e^x \left(\frac{1}{x} + \ln x \right) dx = :$	$\frac{1}{x} e^x + c$	$e^x (\ln x) + c$	$\frac{e^x}{\ln x} + c$	$\frac{\ln x}{e^x} + c$
5	$\frac{d}{dx} (y^n) = :$	ny^{n-1}	ny^{n+1}	$ny^{n-1} \frac{dy}{dx}$	$ny^{n-1} \frac{dx}{dy}$
6	$\frac{d}{dx} (3^x) = :$	$3^x \ln 3$	3^x	$x3^{x-1}$	3^{x+1}
7	If $f(x) = \frac{1}{x-1}$, then $f'(2) = :$	-1	1	0	2
8	$f(x) = -3x^2$ has maximum value at:	$x = -2$	$x = -1$	$x = 0$	$x = 1$
9	The function $f(x) = (x+2)^2$ is:	Even	Odd	Both A and B	Neither even nor odd
10	$\lim_{x \rightarrow 0} (1+3x)^{\frac{2}{x}} = :$	e^2	e^8	e^6	e^4
11	$(\underline{i} \times \underline{k}) \times \underline{j} = :$	\underline{i}	$-\underline{j}$	0	\underline{i}
12	$ \cos \alpha \underline{i} + \sin \alpha \underline{j} + 0 \underline{k} = :$	0	1	2	-1
13	If $\underline{a} + \underline{b} + \underline{c} = 0$ then:	$\underline{a} \times \underline{b} \times \underline{c} = 0$	$\underline{a} \times \underline{b} = \underline{b} \times \underline{c} = \underline{c} \times \underline{a}$	$\underline{a} \cdot \underline{b} = \underline{b} \cdot \underline{c} = \underline{c} \cdot \underline{a}$	$\underline{a} = \underline{b} = \underline{c}$
14	Focus of the parabola $x^2 = -16y$ is:	(0, 4)	(0, -4)	(4, 0)	(-4, 0)
15	A circle is called a point circle if:	$r = 1$	$r = 0$	$r = 2$	$r = 3$
16	Eccentricity of ellipse is:	$e = 0$	$e > 1$	$0 < e < 1$	$e = 1$
17	The point (-1, 2) satisfies the inequality:	$x - y > 4$	$x - y \geq 4$	$x + y < 4$	$x + y > 5$
18	Equation of horizontal line through (7, -9) is:	$y = -9$	$y = 7$	$x = -9$	$x = 7$
19	If m_1 and m_2 are the slopes of two lines then lines are perpendicular if:	$m_1 m_2 = 0$	$m_1 m_2 + 1 = 0$	$m_1 m_2 + 2 = 0$	$m_1 = m_2$
20	Distance of point (1, -2) from y-axis is:	2	1	3	4

1210-XII124-20000

SECTION - I

16

2. Attempt any EIGHT parts:

- (i) If $f(x) = \begin{cases} x+2, & x \leq -1 \\ c+2, & x > -1 \end{cases}$, then find c so that $\lim_{x \rightarrow -1} f(x)$ exists.
- (ii) Evaluate $\lim_{x \rightarrow \infty} \left(\frac{x}{1+x} \right)^x$
- (iii) If $g(x) = \frac{3}{x-1}$, $x \neq 1$; then find $g \circ g(x)$
- (iv) Determine whether $f(x) = \frac{3x}{x^2+1}$ is even or odd.
- (v) Differentiate $\frac{2x-3}{2x+1}$ w.r.t x
- (vi) Find $\frac{dy}{dx}$ if $x = \theta + \frac{1}{\theta}$ and $y = \theta + 1$
- (vii) Differentiate $\cos \sqrt{x} + \sqrt{\sin x}$ w.r.t x
- (viii) Differentiate $\sqrt{\tan x}$ w.r.t x
- (ix) Find $f'(x)$ if $f(x) = \ln(e^x + e^{-x})$
- (x) Find y_2 if $x^3 - y^3 = a^3$
- (xi) Prove that $\cos x = 1 - \frac{x^2}{2!} + \frac{x^4}{4!} - \frac{x^6}{6!} + \dots$
- (xii) Determine the interval in which $f(x) = \sin x$ is decreasing; $x \in (-\pi, \pi)$

16

3. Attempt any EIGHT parts:

- (i) Find dy and δy for the function $y = \sqrt{x}$ when x changes from 4 to 4.41
- (ii) Evaluate $\int (3x^2 - 2x + 1) dx$
- (iii) Evaluate the integral $\int \frac{1-x^2}{1+x^2} dx$
- (iv) Evaluate $\int x^3 \ln x dx$
- (v) Evaluate $\int \frac{2x}{x^2 - a^2} dx$
- (vi) Solve the definite integral $\int_{-1}^3 (x^3 + 3x^2) dx$
- (vii) Find the area between x -axis and the curve $y = \cos \frac{1}{2}x$ from $x = -\pi$ to $x = \pi$
- (viii) Find 'h' such that points $A(-1, h)$, $B(3, 2)$ and $C(7, 3)$ are collinear.
- (ix) Find the slope and inclination of the line joining the points $(4, 6)$ and $(4, 8)$.
- (x) Find the equation of line through $(-4, 7)$ and parallel to the line $2x - 7y + 4 = 0$
- (xi) Check whether the lines $4x - 3y - 8 = 0$; $3x - 4y - 6 = 0$ and $x - y - 2 = 0$ are concurrent or not.
- (xii) Find the angle between the pair of lines $x^2 + 2xy \sec \alpha + y^2 = 0$

(Continued P/2)

FSD-2-24

4. Attempt any NINE parts:

- (i) Indicate solution set of linear inequalities $3x + 7y \geq 21$, $x - y \leq 2$
- (ii) Define optimal solution.
- (iii) Find center and radius of the circle $x^2 + y^2 - 6x + 4y + 13 = 0$
- (iv) Find length of tangent drawn from point $(-5, 4)$ to the circle $5x^2 + 5y^2 - 10x + 15y - 131 = 0$
- (v) Find the vertex and directrix of parabola $x^2 = 5y$
- (vi) Find equation of ellipse with data vertices $(-1, 1)$, $(5, 1)$ Foci : $(4, 1)$, $(0, 1)$
- (vii) Find equation of hyperbola with data Foci $(0, \pm 9)$, directrices $y = \pm 4$
- (viii) Find equation of normal to $\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$ at $(a \sec \theta, b \tan \theta)$
- (ix) Find unit vector in the direction of vector $\underline{v} = -\frac{\sqrt{3}}{2} \underline{i} - \frac{1}{2} \underline{j}$
- (x) Find direction cosines of vector $\underline{v} = 6\underline{i} - 2\underline{j} + \underline{k}$
- (xi) Show that the set of points $P(1, 3, 2)$, $Q(4, 1, 4)$ and $R(6, 5, 5)$ forms a right triangle.
- (xii) Compute cross product $\underline{b} \times \underline{a}$ if $\underline{a} = 3\underline{i} - 2\underline{j} + \underline{k}$, $\underline{b} = \underline{i} + \underline{j}$
- (xiii) Prove that vectors $\underline{i} - 2\underline{j} + 3\underline{k}$, $-2\underline{i} + 3\underline{j} - 4\underline{k}$, $\underline{i} - 3\underline{j} + 5\underline{k}$ are coplaner.

SECTION – II Attempt any THREE questions. Each question carries 10 marks.

- 5. (a) If $f(x) = \begin{cases} \frac{\sqrt{2x+5} - \sqrt{x+7}}{k}, & x \neq 2 \\ k, & x = 2 \end{cases}$ find the value of 'k' for which f is continuous at $x = 2$. 05
- (b) Find $\frac{dy}{dx}$, if $y = x \sin^{-1}\left(\frac{x}{a}\right) + \sqrt{a^2 - x^2}$ 05
- 6. (a) Show that $y = x^x$ has minimum value at $x = \frac{1}{e}$ 05
- (b) Evaluate the indefinite integral $\int \sqrt{4 - 5x^2} dx$ 05
- 7. (a) Evaluate $\int_{\frac{\pi}{6}}^{\frac{\pi}{2}} \frac{\cos x}{\sin x(2 + \sin x)} dx$ 05
- (b) Graph the feasible region of linear inequalities and find corner points:
 $2x + 3y \leq 18$; $2x + y \leq 10$; $x + 4y \leq 12$ 05
- 8. (a) Find an equation of circle passes through $A(5, 1)$ and tangent to line $2x - y - 10 = 0$ at $B(3, -4)$ 05
- (b) Prove that the angle in a semi-circle is a right angle. 05
- 9. (a) Find the focus, vertex and directrix of the parabola; $y^2 = -8(x - 3)$ 05
- (b) Find the lines represented by $9x^2 + 24xy + 16y^2 = 0$ and also find measure of the angle between them. 05