

MATHEMATICS — OBJECTIVE

Intermediate Part-II · 1st Annual 2024 — Group: I

Time: 30 Minutes	OBJECTIVE	Marks: 20
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NOTE: 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.

QUESTION NO. 1

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

MATHEMATICS — SUBJECTIVE

Intermediate Part-II · 1st Annual 2024 — Group: I

Time: 02:30 Hours	SUBJECTIVE	Marks: 80
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SECTION - I

QUESTION NO. 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 $f(x) = \{ 2x + 5, x \leq 2; 4x + 1, x > 2 \}$ 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.

QUESTION NO. 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. $P(\frac{3}{2}, \frac{5}{2})$; $O'(\frac{-1}{2}, \frac{7}{2})$
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 $x^2 - 2xy \sec \alpha + y^2 = 0$

QUESTION NO. 4 Attempt any NINE parts:

18

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 $\overrightarrow{OP} = \overrightarrow{AB}$, 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 $f(x) = \{ \frac{\sqrt{2x+5} - \sqrt{x+7}}{x-2}, x \neq 2; k, x = 2 \}$, 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 $y = xe^x$ 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

Notes on this transcription: This paper has no Urdu column; it is English throughout. • Objective Q3 prints its four options in a 2x2 block on the source paper rather than a single row; they are listed here in the usual A-D order. • Typeset by Tayarri from the original board paper; no answer key included.