

BOARD OF INTERMEDIATE EDUCATION, KARACHI

INTERMEDIATE EXAMINATION

MODEL PAPER 2026

MATHEMATICS PAPER – II

Max. Marks:80

(Science General Groups)

Time: 2 Hours 40 Minutes

INSTRUCTION: The use of scientific calculator is allowed. All notations are used in their usual meanings.

SECTION ‘B’ (SHORT-ANSWER QUESTIONS) (Marks: 40)

NOTE: Answer **Ten part questions** from this section. All part questions carry equal marks.

2. i) Find the value of k if $f(x) = \begin{cases} \frac{\sin kx}{x}, & x \neq 0 \\ 2, & x = 0 \end{cases}$ is continuous at $x = 0$.
- ii) Find $f'(x)$ for the function $f(x) = (2x+5)^{\frac{5}{2}}$ by using definition.
- iii) A particle moves along the curve $x = 2t^2$, $y = t^2 - 4t$ and $z = 3t - 5$ where t is the time. Find the components of its velocity at time $t = 1$ in the direction of $\hat{i} - 3\hat{j} + 2\hat{k}$.
- iv) Compute $\int_{-\frac{\pi}{4}}^{\frac{\pi}{4}} \tan^2 x dx$ by using basic properties.
- v) Attempt either part (a), or part (b).
- a) Evaluate $\int \sec^6 x dx$
- b) Find a root of $3x - \cos x - 1 = 0$ by Newton’s Raphson Method, correct up to 4 decimal places.
- vi) Attempt either part (a), or part (b).
- a) Find the area, above the x-axis under the curve $y = \frac{1}{9+x^2}$, between the ordinates $x = -\sqrt{3}$, $x = \sqrt{3}$.
- b) Find the orthogonal trajectory of the curve $y = ax^2$.
- vii) Attempt either part (a), or part (b).
- a) Find the equation of the straight line which is at a distance of 9 units from the origin and the perpendicular from the origin to the line makes an angle of 30° with the positive direction of x-axis.
- b) Find the equation of parabola whose vertex is $(2, 3)$ and focus is $(2, 7)$.
- viii) Attempt either part (a), or part (b).
- a) Find the equation of a line through the intersection of the lines $3x + 2y = 8$, $5x - 11y + 1 = 0$ and parallel to $6x + 13y = 25$.
- b) Find the equation of the circle passing through $(-3, -4)$ and is concentric with the circle whose equation is $x^2 + y^2 - 6x + 8y - 24 = 0$. Also identify the outer circle.
- ix) Attempt either part (a), or part (b).
- a) Find eccentricity, foci and equation of directrices for the conic $\frac{(x-3)^2}{25} + \frac{(y+4)^2}{16} = 1$.
- b) Find equation of tangent to $x^2 + y^2 = 36$ with the slope $\sqrt{3}$.
- x) Attempt either part (a), or part (b).
- a) Find the Taylor’s series of the expansion of $\log_a(1+x)$ centered at $b = 1$.
- b) Verify Euler’s theorem for $f(x, y) = xy + y^2$.

SECTION ‘C’ (DETAILED-ANSWER QUESTIONS) (Marks: 40)

NOTE: Answer **Five questions** from this section. All questions carry equal marks.

3. Evaluate any two of the following:

a) $\int_0^1 \tan^{-1} x dx$ b) $\int \frac{x^3}{\sqrt{x^2+4}} dx$ c) $\int \frac{\sec^2 x dx}{(1+\tan x)(2+\tan x)}$

4. Attempt either part (a), or part (b).

- a) Solve the differential equation $\frac{dy}{dx} = \frac{x-2y+2}{2x+y-1}$.
- b) If the population of a certain town doubles in 10 years. in how many years will it triple under the assumption that the rate of increase in population is proportional to the number of inhabitants.

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5. Attempt either part (a), or part (b).

a) Evaluate any two of the following:

$$* \quad \lim_{x \rightarrow 0} \frac{1 - \cos mx}{1 - \cos nx}$$

$$* \quad \lim_{x \rightarrow 0} \frac{3e^{-5x} - 5e^{-2x} + 2}{x}$$

$$* \quad \lim_{x \rightarrow 1} \frac{\frac{1}{\sqrt{x}} - 1}{1 - x}$$

b) Evaluate $\frac{dy}{dx}$ of any two of the following:

$$* \quad y = (\sin x)^{\ln x}$$

$$* \quad x = 4(t - \sin t) \text{ and } y = 4(1 + \cos t)$$

$$* \quad \ln(\cos h^{-1} x) + \sin h^{-1} y = c$$

6. Attempt either part (a), or part (b).

a) Find the maximum and minimum values of the function $f(x) = e^x \sin x$, where $f: \mathbb{R} \rightarrow \mathbb{R}$.

b) Evaluate the integral $\int_0^{\frac{\pi}{4}} \sin x \, dx$ with 6 interval by using Simpson $\frac{3}{8}$ rule.

7. Attempt either part (a), or part (b).

a) Find the equations of the pair of lines represented jointly by the equation $5x^2 + 13xy - 6y^2 = 0$, state the nature of pair of lines and also find the acute angle between the lines.

b) Find the equation of the hyperbola with centre $(1, 3)$, focus $(2, 3)$ and eccentricity is $\sqrt{3}$, where as transverse axis is parallel to x-axis.

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Max. Marks:20

(Science General Groups)

Time: 20 Minutes

SECTION 'A'**(MULTIPLE CHOICE QUESTIONS) – (M.C.Qs.)****(Marks : 20)****NOTE:**

- i) This section consists of 20 part questions and all are to be answered. Each part question carries one mark.
 ii) Do not copy the part questions in your answerscript. Write only the answer in full against the proper number of the question and its part.
 iii) All notations are used in their usual meanings. The use of Scientific Calculator is allowed.

1. Choose the correct answer for each from the given options:

- i) This Maple command used to evaluate π to 5 digits is:
 A) `>evalf(Pi, 5);` B) `>eval(Pi, 5);` C) `>expf(Pi, 5);` D) `>exp(Pi, 5);`
- ii) This Maple command `> Matrix(2)`: returns?:
 A) $\begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$ B) $\begin{bmatrix} 2 & 2 \\ 2 & 2 \end{bmatrix}$ C) $\begin{bmatrix} 0 & 0 \\ 0 & 0 \end{bmatrix}$ D) $\begin{bmatrix} 2 & 0 \\ 0 & 2 \end{bmatrix}$
- iii) $\lim_{x \rightarrow 0} \frac{3^x - 1}{x} = :$
 A) $\ln 3$ B) $\ln e$ C) $\ln \pi$ D) 1
- iv) $\lim_{n \rightarrow \infty} a_n =$, solve $a_n = \frac{(n+1)!}{n! - (n+1)!}$:
 A) $\frac{5}{7}$ B) 3 C) -1 D) ∞
- v) Average rate of change of $f(x) = x^2 + 4$, from 2 to 2.3 is:
 A) 4 B) 4.3 C) 0.3 D) 2
- vi) Derivative of $\cos^2 x$ w.r.t $\sin^2 x$ is:
 A) $\cos^2 x$ B) $\sin^2 x$ C) $\tan^2 x$ D) -1
- vii) If $xy = k^2$, then $y'' = ?$:
 A) $\frac{2k^{-2}}{x}$ B) $\frac{-2k^2}{x^3}$ C) $\frac{3k^2}{x^3}$ D) $\frac{2k^2}{x^3}$
- viii) $f(x) = \tan^2 x$ is decreasing at:
 A) $\frac{\pi}{4}$ B) $\frac{\pi}{6}$ C) $\frac{\pi}{2}$ D) $\frac{3\pi}{4}$
- ix) The vector function $\vec{G}(t) = e^t \hat{i} + \cos t \hat{j}$ is continuous at:
 A) $t = 1$ B) $t = 0$ C) $t = 2$ D) $t = \pi$
- x) $\int e^x (2x^2 + 4x) dx = ?$:
 A) $e^x x^2 + c$ B) $2e^x x^2 + c$ C) $\frac{2e^x}{x^2} + c$ D) $\frac{x^2}{2e^x} + c$
- xi) $\int_0^{\pi/2} \cos x dx$ equals to:
 A) $-\int_0^{\pi/2} \cos x dx$ B) $\int_0^{\pi/2} \sin x dx$ C) $-\int_{\pi/2}^0 \cos x dx$ D) $\int_{\pi/2}^0 \cos x dx$
- xii) The point which divides the line segment joining $(4, -1)$ and $(4, 3)$ in the ratio 3 : 1 internally is:
 A) $(2, 4)$ B) $(4, 2)$ C) $(-2, -4)$ D) $(-4, 2)$

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- xiii) The normal form of $3x + 4y - 12 = 0$ is:
 A) $\frac{3}{5}x + \frac{4}{5}y = \frac{12}{5}$ B) $\frac{3}{5}x + \frac{4}{5}y = -\frac{12}{5}$ C) $-\frac{3}{5}x + \frac{4}{5}y = \frac{12}{5}$ D) $\frac{3}{5}x - \frac{4}{5}y = \frac{5}{12}$
- xiv) The centre of the circle $x^2 + y^2 + 6x + 8 = 0$ is:
 A) on x-axis B) on y-axis C) in 1st quadrant D) at origin
- xv) The length of the tangent to the circle $x^2 + y^2 + 2y - 1 = 0$ from $(5, 2)$ is:
 A) $\sqrt{24}$ B) $\sqrt{33}$ C) $\sqrt{32}$ D) $\sqrt{31}$
- xvi) The Latus rectum of $\frac{x^2}{25} + \frac{y^2}{16} = 1$ is :
 A) $\frac{5}{32}$ units B) $\frac{32}{5}$ units C) $\frac{50}{4}$ units D) $\frac{4}{50}$ units
- xvii) Conjugate hyperbola to $\frac{x^2}{5} - \frac{y^2}{6} = 1$ is:
 A) $\frac{x^2}{5} - \frac{y^2}{6} = 1$ B) $\frac{y^2}{6} - \frac{x^2}{5} = 1$ C) $\frac{x^2}{6} - \frac{y^2}{5} = 1$ D) $\frac{x^2}{5} - \frac{y^2}{6} = 0$
- xviii) The differential equation of $x^2 + y^2 = r^2$ is:
 A) $\frac{dy}{dx} = r^2$ B) $\frac{dy}{dx} = -\frac{y}{x}$ C) $\frac{dy}{dx} = -\frac{x}{y}$ D) $\frac{dy}{dx} = \frac{x^2}{y^2}$
- xix) If $f(x, y) = ye^x$, then $\frac{\partial f}{\partial x}$ and $\frac{\partial f}{\partial y}$ are respectively:
 A) ye^x and e^x B) e^x and ye^x C) e^x and 0 D) ye^x and 0
- xx) In Simpson One Third Method, the number of sub interval is the multiplier of:
 A) 4 B) 1 C) 2 D) 3

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