ALLAMA IQBAL OPEN UNIVERSITY, ISLAMABAD.
(Department of Mathematics)

Note: Attempt all questions and each question carries equal marks.

Assignment No. 1
(Unit 1-5)

Question No.1 **[20]**

    (a) Find δy and dy if $y = \tan \sqrt{x}$ and when x changes from $\frac{\pi}{6}$ to $\frac{\pi}{3}$.

    (b) Integrate $\int 2x \sin x^2 \cot x^2 \, dx$

Question No.2 **[20]**

    (a) Integrate $\int e^x \frac{1 - \tan^2 x}{1 + \tan^2 x} \, dx$

    (b) Evaluate $\int_0^{\frac{\pi}{3}} \frac{\cos x + 1}{\sin^2 x} \, dx$

Question No.3 **[20]**

    (a) Draw the graph of $y = \cos\left(\frac{3x}{2}\right); \quad x \in \left[\frac{-\pi}{2}, \frac{\pi}{2}\right]$.

    (b) Given $f(x) = 2a(x - 5)^3 + bx^2$ find values a and b if $f(2) = 7$ and $f(-3) = -2$.

Question No.4 **[20]**

    (a) For $f(x) = \sqrt{2x^2 + 3}$; prove that $f\left(f^{-1}(x)\right) = x$.

    (b) If $\frac{\sin 3x}{\sin 4x} \leq g(x) \leq \frac{\cot 4x}{\csc 34}$. Find $\lim_{x \to 0} g(x)$.

Question No.5 **[20]**

    (a) Differentiate $x^4 \tan 4x$ **w. r. t.** $e^{\sqrt[3]{\sin 3x}}$.

    (b) Find $\frac{d^2 y}{dx^2}$ if $y = \ln \sqrt{\frac{1+x}{1+3x}}$.

Total Marks: 100
Pass Marks: 50

Assignment No. 2
(Unit: 6-9)

Note: Attempt all questions and each question carries equal marks.

Question No.1 [20]

(a) Find the local extrema of $h(x) = \frac{x}{\sqrt{2}} + \cos x - \frac{\sqrt{2}}{2}$ in the interval $(0, 2\pi)$.

(b) Write equations of two tangents from $(1,7)$ to the circle $3x^2 + 3y^2 = 15$.

Question No.2 [20]

(a)   Prove that the composition $f \circ g$ is continuous if the functions f and g are continuous.

(b) Sketch the graph of the function $f(x) = \begin{cases} x^2 & if\ x \leq 1 \\ 3x & if\ 1 < x \leq 2 \\ x^3 & if\ x > 2 \end{cases}$

Question No.3 [20]

(a) Find $\frac{dy}{dx}$ by definition where $y = \sqrt{x} - \sin x$.

(b) Find $\frac{dy}{dx}$ if $y = \alpha(\tan t - \csc^2 t);\ x = \ln\sqrt{e^{2t} - e^{-2t}}$.

Question No.4 [20]

(a) If $x = \cos\theta;\ y = 3\cos 5\theta$, then find an equation involving $\frac{dy}{dx}$ and $\frac{d^2y}{dx^2}$.

(b) Divide 66 into two equal parts so that sum of their squares will be minimum.

Question No.5 [20]

(a) Find tangent line to $f(x) = \tan x + 9\cos x$ at $x = \pi$.

(b) Find $\frac{d^2y}{dx^2}$ if $y = e^{-3x}(\log_5(\csc^2 x + e^x))$.

(c) Evaluate $\lim\limits_{y \to 7} \frac{y^2 - 4y - 21}{3y^2 - 17y - 28}$.

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Course: Calculus-I (MATH3004)　　　　　　　　　Semester: Autumn, 2025

Level:　BS　　　　　　　　　　　　　　　　　　Total Marks: 100

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