



COMSATS University Islamabad (CUI)
Islamabad Campus
Midterm Exam, FALL 2024

Program: BEE-1D
Calculus & Analytical Geometry (MTH-104)
Nov. 06, 2024.

Marks: 25
Time Allowed: 90 mins.
Instructor: Dr. Shagufta

Instruction for attempting papers:

1. Mobile phones will not be allowed in the examination hall.
2. Attempt all the questions.

Q.1. [CLO1(PLO1)]

- i) Sketch the graph of the equation $y = \frac{1}{2}(x^2 - 2x + 3)$ by translating, reflecting, compressing, and stretching the graph of $y = x^2$.
- ii) Find the formula for $f^{-1}(x)$ when $f(x) = \sqrt[3]{4x+2}$. Also state the domain of $f^{-1}(x)$.

Q.2. [CLO2(PLO2)]

i) Let
$$g(t) = \begin{cases} t-2, & t < 0 \\ t^2, & 0 \leq t \leq 2 \\ 2t, & t > 2 \end{cases}$$

Check the continuity of the function at $t = 0$ and $t = 2$

(ii) Use implicit differentiation to find all points on the graph of $y^4 + y^2 = x(x-1)$ at which the tangent line is vertical.

(iii) Find the equation of horizontal asymptote to the curve $y = \sqrt{x^2 - 3x} - x$.

Q.3. [CLO3(PLO1)]

Let $y = x^2 + 1$

- (i) Find the average rate of change of y with respect to x over the interval $[3, 5]$.
- (ii) Find the instantaneous rate of change of y with respect to x when $x = -4$.

Q.4. [CLO3(PLO1)]

Find $\frac{dy}{dx}$

(i) $\frac{xy^3}{1+\sec y} = 1 + y^4$ (ii) $y = \ln((x^2 + x)^5 \sin^8 x)$