



COMSATS University (CU)
Islamabad Campus
Midterm Exam, FALL 2022

Program: BEE-1 (A&B)
Subject: (MTH-104) Calculus & Analytical Geometry
Instructor: Dr. Shagufta

Marks: 25
Time: 80 mins.
Date: 14, Nov. 2022

Instruction for attempting papers:

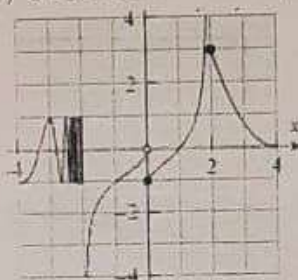
1. Mobile phones are not allowed in the examination hall.
2. Attempt all the question

Q.1. [CLO1]: An open box is to be constructed from a rectangular sheet of metal, 8 in by 15 in, by cutting out squares with sides of length x from each corner and bending up the sides.

- (a) Express volume V as function of x .
- (b) Find the domain of V .
- (c) Plot the graph of function V obtained in part (a)
- (d) and estimate the range of this function.

Q.2. [CLO2]: (i) For the function $\phi(x)$ graphed in the accompanying figure, find

- (a) $\lim_{x \rightarrow -2^-} \phi(x)$
- (b) $\lim_{x \rightarrow -2^+} \phi(x)$
- (c) $\lim_{x \rightarrow 0^-} \phi(x)$
- (d) $\lim_{x \rightarrow 0^+} \phi(x)$



(ii) Find the vertical and horizontal asymptotes of the function $f(x) = \frac{x}{\sqrt{3-x}}$.

Q.3. [CLO3] (i) Find the formula for $f^{-1}(x)$ when $f(x) = \sqrt[5]{4x+2}$. Also state the domain of $f^{-1}(x)$.

(ii) Find the equation of tangent line to the graph of $y = f(x)$ at $x = -3$ if $f(-3) = 2$ and $f'(-3) = 5$.

Q.4. [CLO3] Discuss the continuity and differentiability of $f(x) = \begin{cases} \sin\left(\frac{1}{x}\right) & x \neq 0, \\ 0 & x = 0 \end{cases}$ at $x = 0$.

Q.5. [CLO4] A 10 ft ladder leans against a wall at an angle θ with the horizontal. The top of the ladder is x feet above the ground. If the bottom of the ladder is pushed toward the wall, find the rate at which x changes with respect to theta when $\theta = 60^\circ$. Express the answer in units of feet/degree.