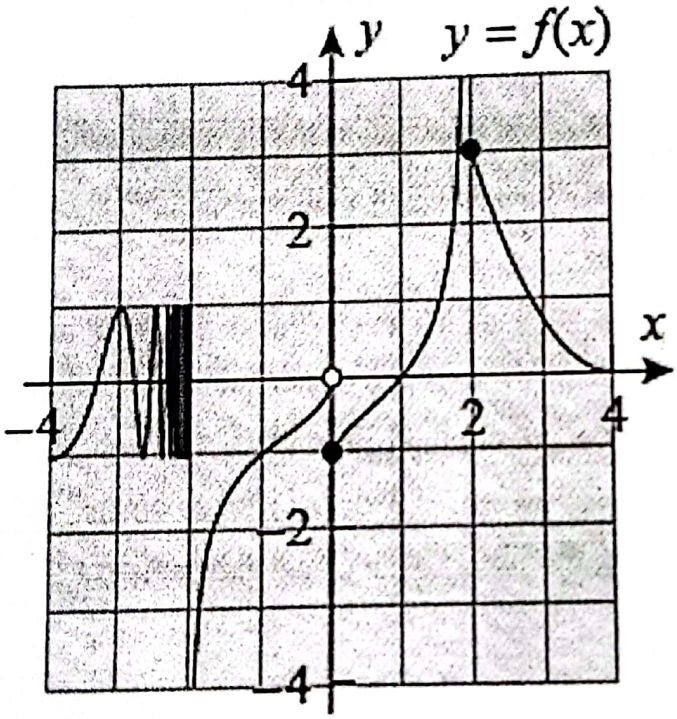
Air University
(Mid-Term Examination: Fall 2023)

Subject: Calculus & Analytical Geometry
Course Code: MA-110
Class: BS-CYS
Semester: III
Section: A & B
HoD Signatures: 13/10/23

Total Marks: 50
Date: 13-11-2023
Time: 9:00-11:00 AM
Duration: 2 Hours
FM Name: Dr. Sadia Ahsan
FM Signatures:

Note:
- All questions must be attempted.
- This examination carries 25% weight towards the final grade.
- Return the question paper with the answer sheet

	Q. No. 1 (CLO 1)	13 Marks
a)	Find formulas for $f \circ g$ and $g \circ f$, and state the domains of the compositions. $f(x) = x^2 + 3$ and $g(x) = \sqrt{x}$.	4
b)	(i). Explain why the function $f(x) = \frac{(x+2)(x^2-1)}{(x+2)(x-1)}$ has one or more holes in its graph, and state the x-values at which those holes occur. (ii). Find a function g whose graph is identical to that of f, but without holes.	5
c)	Find the formula for the inverse of $y = \frac{4x-1}{2x+3}$ with x as an independent variable and state the domain of f^{-1}.	4
	Q. No. 2 (CLO 2)	**12 Marks**
a)	Find values of the constants m and k, if possible, that will make the function f continuous everywhere. $f(x) = \begin{cases} x^2+5 & x > 2 \\ m(x+1)+k & -1 < x \le 2 \\ 2x^3+x+7 & x \le -1 \end{cases}$	6
b)	(i) Find the $\lim_{x \to \frac{\pi}{4}} \frac{\cos x - \sin x}{x - \frac{\pi}{4}}$.	6
	Q. No. 3 (CLO 3)	**13 Mark**
a)	A robot moves in the positive direction along a straight line so that after t minute its distance is $s = 6t^4$ feet from the origin. (i). Find the average velocity of robot over the interval $[2,4]$. (ii). Find the instantaneous velocity at $t = 2$.	7
b)	Find the equation of tangent line to the graph of $y = 2x^3 + 1$, at $x = -1$ by evaluating $f'(x)$ by definition.	6

	Q. No. 4 (CLO 2)	12 Marks
a)	Find the value of x (if any), at which the given function f is not continuous, and determine wheather each such value is a removeable discontinuity. $$f(x)=\begin{cases}2x-3, & x\le 2,\\ x^2, & x>2.\end{cases}$$	4
b)	Find the function f graphed in the accompanying figure, find **(i)** $\lim_{x\to -2^-} f(x)$ **(ii)** $\lim_{x\to -2^+} f(x)$ **(iii)** $\lim_{x\to 0^-} f(x)$ **(iv)** $\lim_{x\to -0^+} f(x)$ **(v)** $\lim_{x\to 2^-} f(x)$ **(vi)** $\lim_{x\to 2^+} f(x)$ **(vii)** the vertical asymptotes of the graph of f. 	8

********** End of Question Paper **********