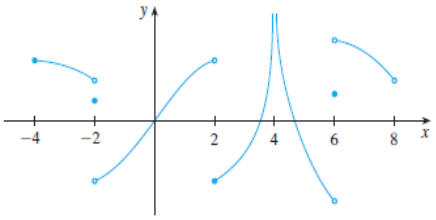
Assignment 2 MT1003
(Calculus and Analytical Geometry)

National University of Computer and Emerging Sciences, Islamabad, Pakistan

Q1. Write the intervals on the function given in the graph is continuous and identify the points on which the function is discontinuous.



Q2. For what values of x the given function $f(x) = \frac{x^2-9}{x^2-5x+6}$ is discontinuous? Justify your answer.

Q3. By using continuity of the function $f(x) = x^3 - x - 1$. Show that the equation $f(x) = 0$ has one real root in the interval $[1, 2]$. Justify your answer.

Q4. Find the value(s) of x at which the function $f(x) = \left|4 - \frac{8}{x^4+x}\right|$ is not continuous. Justify your answer.

Q5. Find the value of h and m if possible that will make the function continuous everywhere

$$\varphi(x) = \begin{cases} x^2 + 5, & x > 2, \\ m(x+1) + h & -1 < x \leq 2 \\ 2x^3 + x + 7, & x \leq -1. \end{cases}$$

Q6. Determine whether the following functions have removable discontinues or not? Justify in each case.

- $f(x) = \frac{|x|}{x}$.
- $f(x) = \frac{x^2+3x}{x+3}$.
- $f(x) = \frac{x-2}{|x|-2}$.

Q7. Evaluate the following limits(if possible).

$$(i) \quad \lim_{x\to-\infty} \frac{4x^2 - x}{2x^3 - 5}, \quad (ii) \quad \lim_{x\to+\infty} \frac{5x^3 - 2x^2 + 1}{1 - 3x}.$$

Write a note about the limit at infinity and infinite limits, the differences if there are any with appropriate examples.

Q8. Recall asymptote of a function (both horizontal as well vertical). For the following function $f(x) = \sqrt{x^2 + 3x} - x$, determine if there is any horizontal and vertical asymptote.

Q9. Discuss the limits and explain in your own words

- $\lim_{x \to 0} \sin \frac{1}{x}$.
- $\lim_{x \to 0} \frac{\sin x}{x}$.

Q10. Discuss the continuity of the function $\ln(\cos x + 1)$.