National University of Computer & Emerging Sciences, Karachi
Fall-2023 FAST School of Computing
MT-1003 Calculus and Analytical Geometry

ASSIGNMENT 1

Q1. Compute the limit of

$$f(x) = \begin{cases} x^3 + 4, & x < 1 \\ 7, & x = 1 \\ x + 6, & x > 1 \end{cases}$$

Evaluate $\lim_{x\to 1^+} f(x)$, $\lim_{x\to 1^-} f(x)$, $\lim_{x\to 1} f(x)$ and $f(1)$

Q2. Compute the limit of

$$f(x) = \begin{cases} -x^2, & x < 2 \\ -x - 1, & x \geq 2 \end{cases}$$

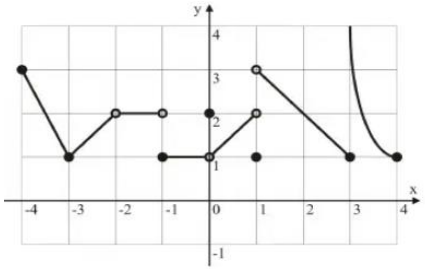
Evaluate $\lim_{x\to -2} f(x)$, $\lim_{x\to 2} f(x)$, $\lim_{x\to 4} f(x)$ and $f(-2), f(2), f(4)$

Q3. Evaluate

1. $\lim_{x\to 0^-} \frac{3x+4}{x^2}$
2. $\lim_{x\to 3^+} \frac{x^2-9}{\sqrt{x-3}}$
3. $\lim_{x\to -2} \frac{x^2-4}{x^2-x-6}$
4. $\lim_{t\to 1} \frac{t^3+t^2-5t+3}{t^3-3t+2}$
5. $\lim_{x\to 0} \frac{\sqrt{x+64}-8}{x}$
6. $\lim_{y\to 0} \frac{5y^3+8y^2}{3y^4-16y^2}$

Q4. Use the function $y = f(x)$ defined by the graph to find each limit

$\lim_{x\to -4^-} f(x)$, $\lim_{x\to -2^-} f(x)$, $\lim_{x\to -1} f(x)$ and $\lim_{x\to 3} f(x)$



Q5. Find the derivative of the following.

1. $g(x) = \frac{tan3x}{(x+7)^4}$
2. $r = tan\sqrt{\vartheta}\sec(\frac{1}{\vartheta})$
3. $y = \left[\frac{t^2}{t^{3-4t}}\right]^3$
4. $q = tan\left[\frac{cost}{t}\right]$
5. $y = \left(t^{\frac{-3}{4}} sint\right)^{\frac{4}{3}}$
6. $f(x) = [x^4 - \sec(4x^2 - 2)]^{-4}$

Q6. Show that $y = x^3 + 3x + 1$ satisfies $y''' + xy'' - 2y' = 0$.

Q7. Find the derivative by Impicit differentiation.

1. $5y^2 = x^2y + \frac{2}{xy^2}$
2. $x^{\frac{3}{2}} + y^{\frac{3}{2}} = 2$
3. $x^5 + 3x^2y^3 + 3x^3y^2 + y^5 = 8$

Q8. Compute the derivative of the following by using Chain Rule

1. If $y = x^3$and $x = \frac{1}{\sqrt{t^2+5}}$
2. If $y = x^2 + 3x + 2$ and $x = \frac{t-1}{t+1}$
3. $f(u) = \frac{5}{(u+\frac{1}{\sqrt{u}})^4}$