Lab 3
CALCULUS FOR IT - 501031

1 Exercises

Exercise 1: Write a computer program to find the limit of functions

(a) $\lim_{x\to 3} \mid x^2 - x - 7 \mid$

(b) $\lim_{x\to 1} \dfrac{\mid x-1 \mid}{x^2-1}$

(c) $\lim_{x\to 1} \sqrt[x]{e}$

(d) $\lim_{x\to 2} \dfrac{x^4-16}{x-2}$

(e) $\lim_{x\to -1} \dfrac{x^3-x^2-5x-3}{(x+1)^2}$

(f) $\lim_{x\to 3} \dfrac{x^2-9}{\sqrt{x^2+7}-4}$

(g) $\lim_{x\to 1} \dfrac{\mid x \mid}{sin(x)}$

(h) $\lim_{x\to 0} \dfrac{1-cosx}{xsinx}$

(i) $\lim_{x\to 0} \dfrac{2x^2}{3-3cosx}$

(j) $\lim_{x\to \infty} \left(\dfrac{3+x}{-1+x}\right)^x$

(k) $\lim_{x\to \infty} \left(1-\dfrac{2}{3+x}\right)^x$

(l) $\lim_{x\to \infty} \sqrt[x]{\dfrac{1}{x}}$

(m) $\lim_{x\to \infty} \dfrac{-\sqrt[3]{x}+\sqrt[3]{1+x}}{-\sqrt{x}+\sqrt{1+x}}$

(n) $\lim_{x\to \infty} \dfrac{x!}{x^x}$

Exercise 2: Graph the functions which were defined in the previous exercise, and then show the limit points on the graph if possible.

Exercise 3: The f functions are defined as

1. $f(x) = \dfrac{1}{1+2^{\frac{1}{x}}}$

2. $f(x) = \dfrac{x^2+x}{\sqrt{x^3+x^2}}$

Find $\lim_{x\to 0^+} f(x), \lim_{x\to 0^-} f(x), \lim_{x\to 0} f(x)$ if they exist then show on the graph.

Exercise 4: Let $f(x) = \begin{cases} 0, & x \le 0 \\ sin(\frac{1}{x}) & x > 0 \end{cases}$

1. Does $\lim_{x\to 0^+} f(x)$ exist? If so, what is it? If not, show on the screen to explain
2. Does $\lim_{x\to 0^-} f(x)$ exist? If so, what is it? If not, show on the screen to explain
3. Does $\lim_{x\to 0} f(x)$ exist? If so, what is it? If not, show on the screen to explain

Exercise 5: Prove that the function is continuous at c.

(a) $f(x) = x^2 - 7, c = 1$

(b) $f(x) = \sqrt{2x-3}, c = 2$

Exercise 6: Write a program computer to verify at what points are the functions following continuous?

(a) $g(x) = \begin{cases} \dfrac{x^2 - x - 6}{x - 3} & x \neq 0 \\ 5 & x = 0 \end{cases}$

(b) $f(x) = \begin{cases} \dfrac{x^3 - 8}{x^2 - 4} & x \neq 2, x \neq -2 \\ 3 & x = 2 \\ 4 & x = -2 \end{cases}$

(c) $f(x) = \begin{cases} \dfrac{x^2 - x - 2}{x - 2} & x \neq 2 \\ 1 & x = 2 \end{cases}$

(d) $f(x) = \begin{cases} \dfrac{1}{x^2} & x \neq 0 \\ 1 & x = 0 \end{cases}$

Exercise 7: Write a program computer to verify where are each of the following functions discontinuous?

1. $f(x) = \dfrac{x^2 - x - 2}{x - 2}$
2. $f(x) = \dfrac{x^2 - 2x - 3}{2x - 6}$

Exercise 8: Write a program computer to verify that the function $f(x) = 1 - \sqrt{1 - x^2}$ is continuous on the interval $[-1, 1]$ or not.

Hint:

- Find the limit of function $\lim\limits_{x \to -1} f(x)$
- Find the limit of function $\lim\limits_{x \to 1} f(x)$
- Check $\lim\limits_{x \to -1} f(x)$ equals $\lim\limits_{x \to 1} f(x)$ or not.

Exercise 9: Given *P(1, 0)* lies on $y = sin(10\pi/x)$. Q has $(x, sin(10\pi/x))$, finding slope of secant PQ with *x = 2, 1.5, 1.4, 1.3, 1.2, 1.1, 0.5, 0.6, 0.7, 0.8, 0.9*. Write a computer program to show the result.

Exercise 10: Define L so that the functions are continuous

(a) $f(x) = \begin{cases} \dfrac{sin(x)}{x}, x \neq 0 \\ L, x = 0 \end{cases}$

(b) $f(x) = \begin{cases} \dfrac{x^2 + x - 6}{x^2 - 4} & x \neq 2 \\ L & x = 2 \end{cases}$