King Saud University
College of Engineering in Al-kharj

Exercises Set 5

Department: EE *Level: 2* *Course: Math 105*

Second Term of 1428/1429

Exercise 1:

a) where is the function $f(x)=\dfrac{x^2-x-2}{x-2}$ discontinuous?

b) Prove that the function $f(x)=\begin{cases}\dfrac{1}{x^2} & if \quad x\neq 0\\ 1 & if \quad x=0\end{cases}$ is discontinuous at x = 0

c) Study the continuity of $f(x)=\begin{cases}\dfrac{x^2-x-2}{x-2} & if \quad x\neq 0\\ 1 & if \quad x=0\end{cases}$ at x =2

Exercise 2:

a) Find value of a and b such that

$$f(x)=\begin{cases}\dfrac{x+\sin x}{|x|} & if \quad x<0\\ b & if \quad x=0\\ x\cos x+a\sqrt{x+1} & if \quad x>0\end{cases}$$

is continuous at x = 0

b) Find value of a and b such that

$$f(x)=\begin{cases}ax+b & if \quad x\leq 1\\ \dfrac{x^3-1}{x-1} & if \quad 1<x<2\\ ax-b & if \quad x\geq 2\end{cases}$$

is continuous at x = 1 and x = 2

c) Find value of a and b such that the given function is continuous at x = 0

c-1) $$f(x)=\begin{cases}\dfrac{\sin 2x}{\sin 3x}+\dfrac{\tan x}{x} & if \quad x>0\\ b & if \quad x=0\\ a+x & if \quad x<0\end{cases}$$

c-2) $$f(x)=\begin{cases}\dfrac{\sin^3 ax}{x^3}+\dfrac{\tan x}{x} & if \quad x>0\\ 8 & if \quad x=0\\ b+x3 & if \quad x<0\end{cases}$$

Exercise 3:

Evaluate the following limits

a) $\lim\limits_{x\to 0}\dfrac{x^2\sin 3x+\sin^3 x}{x^3+2\tan^3 x}$

b) $\lim\limits_{x\to 0}\dfrac{1-\cos x+x}{\sin x}$

c) $\lim\limits_{x\to 0}\dfrac{\sin^2 x}{2x^2}$

Exercise 4:

Find the equation of the tangent line to the hyperbola $y=\dfrac{3}{x}$ at the point (3,1)

Exercise 5:

By using the definition of derivative find $f'(x)$ of the following functions :

a) $f(x)=-3x$

b) $f(x)=x^3-x$

c) $f(x)=\sqrt{x-1}$

Exercise 6:

Differentiate the following functions :

a) $f(x)=\left(\dfrac{1}{2}x\right)^5$

b) $f(x)=\sqrt[3]{x}$

c) $f(x)=\sqrt{x}-2e^x$

d) $f(x)=x\sin x$

e) $f(x)=\dfrac{x}{\cos x}$

f) $f(x)=\dfrac{1+\sin x}{x+\cos x}$

g) $f(x)=\dfrac{\tan x-1}{\sec x}$