King Fahd University of Petroleum &Minerals
Department of Mathematical Sciences

Quiz 2 | Math101-13 | Semester 032

I.D.#: Ser.#: Name:

Q1. Find x-coordinate of the points so that the graph of $f(x)=\dfrac{x^2+1}{x+1}$ has **horizontal** tangent line.

$$0=f'(x)=\frac{(x+1)(2x)-(x^2+1)(1)}{(x+1)^2}=\frac{2x^2+2x-x^2-1}{(x+1)^2}$$

$$=\frac{x^2+2x-1}{(x+1)^2}=0 \Rightarrow x^2+2x-1=0$$

$$x=\frac{-2\pm\sqrt{4-4(1)(-1)}}{2}=\frac{-2\pm\sqrt{8}}{2}=\frac{-2\pm2\sqrt{2}}{2}$$

$$x=-1\pm\sqrt{2}$$

Q2. Let $f(x)=\cos x$. Use the **definition** of the derivative to find $f'(x)$.

$$f'(x)=\lim_{h\to0}\frac{\cos(h+x)-\cos x}{h}=\lim_{h\to0}\frac{\cos h\cos x-\sin h\sin x-\cos x}{h}$$

$$=\lim_{h\to0}\frac{\cos x(\cos h-1)-\sin h\sin x}{h}=\lim_{h\to0}\frac{\cos x(\cos h-1)}{h}-\lim_{h\to0}\frac{\sin h\sin x}{h}$$

$$=\cos x\lim_{h\to0}\frac{\cos h-1}{h}-\sin x\lim_{h\to0}\frac{\sin h}{h}$$

$$=(\cos x)(0)-(\sin x)(1)=-\sin x$$

Q3. Find k if the curve $y=2x^2-3x-2$ is tangent to the line $y=5x-2k$.

slope $=\dfrac{dy}{dx}=4x-3$

slope of $y=5x-2k$ is 5

$\Rightarrow 5=4x-3$

$\Rightarrow \underline{x=2}$

$\therefore\ y=2(2)^2-3(2)-2=8-6-2=0$

The tangent point is $(2,0)$ $\Rightarrow 0=5(2)-2k$

$\Rightarrow 2k=10 \Rightarrow k=5$