King Fahd University of Petroleum &Minerals
Department of Mathematical Sciences

Quiz 2 Math101-9 Semester 032

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

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

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

$$f'(x)=0 \Rightarrow x^2-2x-1=0 \rightarrow x=\frac{2\pm\sqrt{4-4(1)(-1)}}{2}=\frac{2\pm\sqrt{8}}{2}$$

$$\therefore x=\frac{2\pm2\sqrt{2}}{2}=1\pm\sqrt{2}$$

Q2. Let $f(x)=\sqrt{1-3x}$ .Use the **definition** of the derivative to find $f'(x)$.

$$f'(x)=\lim_{h\to0}\frac{\sqrt{1-3(x+h)}-\sqrt{1-3x}}{h}=\lim_{h\to0}\frac{\sqrt{1-3(x+h)}-\sqrt{1-3x}}{h}\cdot\frac{\sqrt{1-3(x+h)}+\sqrt{1-3x}}{\sqrt{1-3(x+h)}+\sqrt{1-3x}}$$

$$=\lim_{h\to0}\frac{1-3(x+h)-(1-3x)}{h(\sqrt{1-3(x+h)}+\sqrt{1-3x})}=\lim_{h\to0}\frac{-3\cancel{h}}{\cancel{h}(\sqrt{1-3(x+h)}+\sqrt{1-3x})}$$

$$=\lim_{h\to0}\frac{-3}{\sqrt{1-3(x+h)}+\sqrt{1-3x}}=\frac{-3}{\sqrt{1-3x}+\sqrt{1-3x}}=\frac{-3}{2\sqrt{1-3x}}$$

Q3. Find k if the curve $y=2x^2+3x-2$ is tangent to the line $y=11x-4k$.

slope $=\frac{dy}{dx}=4x+3$

slope of $y=11x-4k$ is 11

$\Rightarrow 4x+3=11 \Rightarrow x=2$

$y=2(2)^2+3(2)-2=8+6-2=12$

The tangent point is $(2,12) \Rightarrow 12=11(2)-4k$

$4k=22-12=10$

$k=\frac{10}{4}=\frac{5}{2}$