AB Calculus Name______________________________

Quiz 2 Date________________ Period____

Use the function $g(x) = 3x^2 - 4x + 6$ to answer questions 1 – 3

$g(4) = 3(4)^2 - 4(4) + 6 = 3(16) - 16 + 6 = 48 - 16 + 6 = 38$

1) Use the original limit definition of the derivative to find $g'(x)$

$$\lim_{h \to 0} \frac{g(x+h) - g(x)}{h}$$

$g(x+h) = 3(x+h)^2 - 4(x+h) + 6$

$g(x+h) = 3(x^2 + 2xh + h^2) - 4x - 4h + 6$

$g(x+h) = 3x^2 + 6xh + 3h^2 - 4x - 4h + 6$

$$\lim_{h \to 0} \frac{\cancel{3x^2} + 6xh + 3h^2 - \cancel{4x} - 4h + \cancel{6} - \cancel{3x^2} + \cancel{4x} - \cancel{6}}{h}$$

$$\lim_{h \to 0} \frac{6x\cancel{h} + 3h^{\cancel{2}} - 4\cancel{h}}{\cancel{h}}$$

$$\lim_{h \to 0} 6x + 3h - 4 = \boxed{6x - 4 = g'(x)}$$

2) Find the equation of a tangent line at $x = 4$

$x = 4$, $g(4) = 38$, $g'(4) = 6(4) - 4$

original $g(x)$

$= 24 - 4$

$= 20$

$y - 38 = 20(x - 4)$

3) Find the equation of a normal line at $x = 4$

$\perp \rightarrow$ perpendicular

(opposite, reciprocal)

$y - 38 = -\frac{1}{20}(x - 4)$

4) If $f(x)=\sqrt{3x}$ use the alternative definition of the derivative to find $f'(2)$

$$f'(2)=\lim_{x\to 2}\frac{f(x)-f(2)}{x-2}$$

$$=\lim_{x\to 2}\frac{(\sqrt{3x}-\sqrt{6})}{(x-2)}\cdot\frac{(\sqrt{3x}+\sqrt{6})}{(\sqrt{3x}+\sqrt{6})}$$

$$\lim_{x\to 2}\frac{3x-6}{(x-2)(\sqrt{3x}+\sqrt{6})}$$

$$\lim_{x\to 2}\frac{3\cancel{(x-2)}}{\cancel{(x-2)}(\sqrt{3x}+\sqrt{6})}$$

$$\frac{3}{\sqrt{6}+\sqrt{6}}$$

$$f'(2)=\frac{3}{2\sqrt{6}}$$

If M.C

$$\frac{3}{2\sqrt{6}}\cdot\frac{\sqrt{6}}{\sqrt{6}}\to\frac{3\sqrt{6}}{12}$$

$$\frac{\sqrt{6}}{4}$$

$\leftrightarrow$ Same answer

Using calculus (LIMITS), explain whether or not $f(x)$ is continuous at $x=3$

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

$7(3)+6=(3)^3$

$27=27$

$$\boxed{\lim_{x\to 3}f(x)=f(3)=27}$$ yes.

Using calculus (LIMITS), explain whether or not $f(x)$ is $\boxed{\text{differentiable}}$ at $x=4$

↳ But ALWAYS check continuity 1st

6) $f(x)=\begin{cases}5x-4, & x\leq 4\\ x^2, & x>4\end{cases}$

$5(4)-4=4^2$ True ✓

$$f'(x)=\begin{cases}5, & x<4\\ 2x, & x>4\end{cases}$$

$5\neq 2(4)$ Not differentiable

$$\boxed{\lim_{x\to 4^-}f'(x)\neq\lim_{x\to 4^+}f'(x)}$$

