**Non-AP Calculus 2.1** **Definition of Derivative Quiz Review WS #1**

1) Use the Limit Definition of a derivative to find G'(x) if G(x) = $3x^2 - 4x + 5$

2) Use the Alternative definition of the derivative to find $H'(2)$ if $H(x) = \sqrt{5 - x}$

3) Use the Limit Definition of a Derivative to find H'(x) if $H(x) = \sqrt{x - 3}$

4) Use the Limit Definition of a derivative to find f'(3) if $f(x) = \frac{5}{x-2}$

5) Use either general or alternative method above to find the equation of the tangent line to $f(x) = 3x - 4x^2$ at $x = -1$.

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Key

1) Use the Limit Definition of a derivative to find G'(x) if G(x) = $3x^2 - 4x + 5$

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

$$g(x+h) = 3(x+h)^2 - 4(x+h) + 5$$

$$G'(x) = \lim_{h\to 0} \frac{3(x+h)^2 - 4(x+h)+5 - (3x^2-4x+5)}{h}$$

$$G'(x) = \lim_{h\to 0} \frac{3(x^2+2xh+h^2)-4x-4h+5-3x^2+4x-5}{h}$$

$$G'(x) = \lim_{h\to 0} \frac{\cancel{3x^2}+6xh+3h^2-\cancel{4x}-4h+\cancel{5}-\cancel{3x^2}+\cancel{4x}-\cancel{5}}{h}$$

$$G'(x) = \lim_{h\to 0} \frac{\cancel{h}(6x+3h-4)}{\cancel{h}}$$

$$\boxed{G'(x) = 6x - 4}$$

2) Use the Alternative definition of the derivative to find $H'(2)$ if $H(x) = \sqrt{5-x}$

$$h'(c) = \lim_{x\to c} \frac{h(x)-h(c)}{x-c}$$

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

$$h'(2) = \lim_{x\to 2} \frac{\sqrt{5-x}-\sqrt{3}}{x-2}$$

$$h(2) = \sqrt{5-2} = \sqrt{3}$$

$$h'(2) = \lim_{x\to 2} \frac{\sqrt{5-x}-\sqrt{3}}{x-2} \cdot \frac{\sqrt{5-x}+\sqrt{3}}{\sqrt{5-x}+\sqrt{3}}$$

$$= \lim_{x\to 2} \frac{(5-x)-3}{(x-2)(\sqrt{5-x}+\sqrt{3})}$$

$$= \lim_{x\to 2} \frac{5-x-3}{(x-2)(\sqrt{5-x}+\sqrt{3})}$$

$$\lim_{x\to 2} \frac{(\cancel{2-x})(-1)}{(\cancel{x-2})(\sqrt{5-x}+\sqrt{3})}$$

$$\lim_{x\to 2} \frac{-1}{\sqrt{5-2}+\sqrt{3}} = \boxed{\frac{-1}{2\sqrt{3}}}$$

$$\boxed{H'(2) = \frac{-1}{2\sqrt{3}}}$$

3) Use the Limit Definition of a Derivative to find H'(x) if $H(x) = \sqrt{x-3}$

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

$$h(x+h) = \sqrt{x+h-3}$$

0/0

$$h'(x) = \lim_{h\to 0} \frac{\sqrt{x+h-3}-\sqrt{x-3}}{h}$$

$$h'(x) = \lim_{h\to 0} \frac{(\sqrt{x+h-3}-\sqrt{x-3})}{h} \cdot \frac{(\sqrt{x+h-3}+\sqrt{x-3})}{(\sqrt{x+h-3}+\sqrt{x-3})}$$

$$h'(x) = \lim_{h\to 0} \frac{x+h-3-(x-3)}{h(\sqrt{x+h-3}+\sqrt{x-3})}$$

$$h'(x) = \lim_{h\to 0} \frac{\cancel{x}+h-\cancel{3}-\cancel{x}+\cancel{3}}{h(\sqrt{x+h-3}+\sqrt{x-3})}$$

$$h'(x) = \lim_{h\to 0} \frac{1}{\sqrt{x+h-3}+\sqrt{x-3}}$$

$$= \frac{1}{\sqrt{x-3}+\sqrt{x-3}}$$

$$\boxed{h'(x) = \frac{1}{2\sqrt{x-3}}}$$

4) Use the Limit Definition of a derivative to find $f'(3)$ if $f(x) = \frac{5}{x-2}$

$$f'(x) = \lim_{h\to 0} \frac{f(x+h)-f(x)}{h}$$

$$f(x+h) = \frac{5}{x+h-2}$$

$\frac{0}{0}$

$$f'(x) = \lim_{h\to 0} \frac{\frac{5}{x+h-2} - \frac{5}{x-2}}{h} \cdot \frac{(x+h-2)(x-2)}{(x+h-2)(x-2)}$$

$$f'(x) = \lim_{h\to 0} \frac{5(x-2) - 5(x+h-2)}{h(x+h-2)(x-2)}$$

$$\lim_{h\to 0} \frac{\cancel{5x}-\cancel{10}-\cancel{5x}-5h+\cancel{10}}{h(x+h-2)(x-2)}$$

$$f'(x) = \lim_{h\to 0} \frac{-5\cancel{h}}{\cancel{h}(x+h-2)(x-2)}$$

$$f'(x) = \lim_{h\to 0} \frac{-5}{(x-2)(x-2)} = \frac{-5}{(x-2)^2}$$

$$\boxed{f'(x) = \frac{-5}{(x-2)^2}} \qquad f'(3) = \frac{-5}{(3-2)^2} = \boxed{-5}$$

5) Use either general or alternative method above to find the equation of the tangent line to $f(x) = 3x - 4x^2$ at $x = -1$.

General Method

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

$$f'(x) = \lim_{h\to 0} \frac{f(x+h)-f(x)}{h}$$

$$f'(x) = \lim_{h\to 0} \frac{3(x+h)-4(x+h)^2-(3x-4x^2)}{h}$$

$$f'(x) = \lim_{h\to 0} \frac{3x+3h-4(x^2+2xh+h^2)-3x+4x^2}{h}$$

$$f'(x) = \lim_{h\to 0} \frac{\cancel{3x}+3h-\cancel{4x^2}-8xh-4h^2-\cancel{3x}+\cancel{4x^2}}{h}$$

$$f'(x) = \lim_{h\to 0} \frac{\cancel{h}(3-8x-4h)}{\cancel{h}} = 3-8x-4(0)$$

$$\boxed{f'(x) = 3-8x} \qquad \boxed{f(x) = 3x-4x^2}$$

$$f(-1) = 3(-1)-4(-1)^2 = -3-4 = -7$$

point: $(-1, -7)$

slope: $m = \underline{11}$

$$f'(-1) = 3-8(-1) = 11$$

$$\boxed{y+7 = 11(x+1)}$$

$$f(-1) = 3(-1)-4(-1)^2 = -7$$

Alternative Method

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

$$f'(-1) = \lim_{x\to -1} \frac{f(x)-f(-1)}{x-(-1)}$$

$$f'(-1) = \lim_{x\to -1} \frac{3x-4x^2-(-7)}{x+1}$$

$$= \lim_{x\to -1} \frac{-4x^2+3x+7}{x+1}$$

$$= \lim_{x\to -1} \frac{-1(4x^2-3x-7)}{x+1}$$

$-28$; $-7$, $4$; $4$, $4$; $-3$

$$= \lim_{x\to -1} \frac{-1(4x-7)\cancel{(x+1)}}{\cancel{(x+1)}}$$

$$= \lim_{x\to -1} -1(4x-7) = \boxed{11}$$

$$\boxed{f'(-1) = 11}$$