I am a lean, mean, derivative as limit machine! ____________________________________

**The Three Forms of Derivative as Limit** let $h = \Delta x$

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

$$f'(c) = \lim_{x\to c} \frac{f(x) - f(c)}{x - c} \quad \text{where } c \in \text{ Reals}$$

$$f'(c) = \lim_{h\to 0} \frac{f(c+h) - f(c)}{h} \quad \text{where } c \in \text{ Reals}$$

Examples: see page 105 in our textbook

49. $\frac{d}{dx}(5 - 3x)$ to be evaluated at $x = 1$

50. $\frac{d}{dx}(x^3)$ to be evaluated at $x = -2$

51. $\frac{d}{dx}(-x^2)$ to be evaluated at $x = 6$

51. $\frac{d}{dx}(2\sqrt{x})$ to be evaluated at $x = 9$

On a separate piece of paper rewrite the following as derivatives, then evaluate

1. $\lim_{h\to 0} \frac{x^2 - 25}{x - 5}$

2. $\lim_{h\to 0} \frac{(x+h)^4 - x^4}{h}$

3. $\lim_{h\to 0} \frac{\frac{1}{\sqrt{x+h}} - \frac{1}{\sqrt{x}}}{h}$

4. $\lim_{h\to o} \frac{\cos\left(\frac{\pi}{2} + h\right) - \cos\left(\frac{\pi}{2}\right)}{h}$

5. $\lim_{h\to 0} \frac{(2+h)^3 - 2^3}{h}$

6. $\lim_{h\to 0} \frac{[3(1+h)+3] - [6]}{h}$

7. $\lim_{x\to 25} \frac{\sqrt{x} - 5}{x - 25}$

8. $\lim_{h\to 0} \frac{\sin(\pi + h) - \sin\pi}{h}$

9. $\lim_{x\to 5} \frac{-x^2 + 25}{x - 5}$

10. $\lim_{h\to 0} \frac{[3(4+h) - 3] - [3(4) - 3]}{h}$