

Calculus 1 Lab

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Assignment 3 :

- Use the limit process to find the equation of the line tangent to the indicated point.

1) $f(x)=4x$ at $x=2$

Handwritten solution for finding the derivative of $f(x) = 4x$ at $x = 2$ using the limit process:

$$\begin{aligned} f(x) &= 4x \text{ at } x=2 \\ f'(x) &= \lim_{\Delta x \rightarrow 0} \frac{f(x+\Delta x) - f(x)}{\Delta x} \\ f'(x) &= \lim_{\Delta x \rightarrow 0} \frac{4(x+\Delta x) - (4x)}{\Delta x} \\ &= \lim_{\Delta x \rightarrow 0} \frac{4x + 4\Delta x - 4x}{\Delta x} \\ &= \lim_{\Delta x \rightarrow 0} \frac{4\Delta x}{\Delta x} \\ &= \lim_{\Delta x \rightarrow 0} 4 \\ &= 4 \end{aligned}$$

2) $g(x) = -3x^2 + 2$ at $x=1$

$$g(x) = -3x^2 + 2 \quad \text{at } x=1$$

$$g'(x) = \lim_{\Delta x \rightarrow 0} \frac{g(x+\Delta x) - g(x)}{\Delta x}$$

$$\lim_{\Delta x \rightarrow 0} \frac{(-3(x+\Delta x)^2 + 2) - (-3x^2 + 2)}{\Delta x}$$

$$\lim_{\Delta x \rightarrow 0} \frac{-3x^2 - 3\Delta x^2 - 6x\Delta x + 2 + 3x^2 - 2}{\Delta x}$$

$$\lim_{\Delta x \rightarrow 0} \frac{-3\Delta x^2 - 6x\Delta x}{\Delta x}$$

$$\lim_{\Delta x \rightarrow 0} \frac{\Delta x (-3\Delta x - 6x)}{\Delta x}$$

$$\lim_{\Delta x \rightarrow 0} (-3\Delta x - 6x) = -6x$$

$$\text{at } x=1 \Rightarrow -6(1) = -6$$

3) $x(t)=5t+3$ at $t=5$

$$x(t) = 5t + 3 \quad \text{at } t=5$$

$$x'(t) = \lim_{\Delta t \rightarrow 0} \frac{x(t-\Delta t) - x(t)}{\Delta t}$$

$$\lim_{\Delta t \rightarrow 0} \frac{(5(t-\Delta t)+3) - (5t+3)}{\Delta t}$$

$$\lim_{\Delta t \rightarrow 0} \frac{5t - 5\Delta t + 3 - 5t - 3}{\Delta t}$$

$$\lim_{\Delta t \rightarrow 0} \frac{5\Delta t}{\Delta t}$$

$$\lim_{\Delta t \rightarrow 0} = 5$$

$$\rightarrow \text{at } t=5 \Rightarrow 5$$