What you'll Learn About

- Definition of the derivative
- Notation

$$\lim_{x \to a} \frac{f(x)-f(a)}{x-a}$$

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

Use the substitution h = x - a to create ~~the~~ another definition of the derivative

$\Delta x = h$

A$_1$) Set-up a formula for the slope of $f(x) = x^2$ at $x = -1$

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

$$\lim_{h-1 \to -1} \frac{(h-1)^2-1}{h} = \boxed{\lim_{h \to 0} \frac{(h-1)^2-1}{h}}$$

$$\frac{h^2-2h+1-1}{h} \quad \frac{\cancel{h}(h-2)}{\cancel{h}}$$

A$_2$) Use the substitution h = x - a to set-up the definition of the derivative

$$\lim_{x \to a} \frac{f(x)-f(a)}{x-a} \qquad \boxed{\lim_{h \to 0} \frac{f(x+h)-f(x)}{h}}$$

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

$$\frac{1}{(5)-2} = f(5)$$

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

B$_1$) Set-up a formula for the slope of $f(x) = \dfrac{1}{x-2}$ at $x = 4$

$$\boxed{\lim_{x \to 4} \frac{\frac{1}{x-2} - \frac{1}{2}}{x-4}}$$

$$\lim_{h \to 0} \frac{\frac{1}{x+h-2} - \frac{1}{x-2}}{h}$$

$$\lim_{h \to 0} \frac{\frac{1}{4+h-2} - \frac{1}{4-2}}{h}$$

Δx

B$_2$) Use the substitution h = x - a to set-up the definition of the derivative

$h = x - 4$

$\boxed{h+4 = x}$

$$\lim_{h+4 \to 4} \frac{\frac{1}{(h+4)-2} - \frac{1}{2}}{h+4-4}$$

$$\boxed{\lim_{h \to 0} \frac{\frac{1}{h+2} - \frac{1}{2}}{h}}$$

	Given a definition of the derivative(slope) find the function that you are taking the derivative of and the point you are finding the derivative(slope) at
$\lim_{x \to a} \frac{f(x)-f(a)}{x-4}$	A) $\boxed{\lim_{x \to 4} \frac{\sqrt{x}-2}{x-4}}$ $f(x)=\sqrt{x}$ $x=4$ $y=2$
	B) $\lim_{x \to 2} \frac{\overset{f(x)}{\ln x} - \overset{f(a)}{\ln 2}}{x-\underset{a}{2}}$ $f(x)=\ln x$ $(2, \ln 2)$
$\lim_{h \to} \frac{f(x+h)-f(x)}{h}$	C) $\lim_{h \to 0} \frac{\overset{f(x+h)}{(2+h)^3} - \overset{f(x) \to f(2)}{8}}{h}$ $f(x)=x^3$ $(2,8)$
	D) $\lim_{h \to 0} \frac{\frac{2}{3+h}-\frac{2}{3}}{h}$ $\rightarrow$ $f(x)=\frac{2}{x}$ $(3, \frac{2}{3})$
	Another Definition: $\lim_{h \to 0} \frac{f(x+h)-f(x-h)}{2h}$