Day 2 on 11-3

Definition of a Derivative: This is the formula for the slope of the tangent line to the graph of f, provided the limit exists.

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

$\frac{dy}{dx}$ $\frac{d}{dx}$

Ex 1) Find the derivative of $f(x) = 3x^2 - 2x$.

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

$$= \frac{3(x^2 + 2xh + h^2) \cancel{-2x} - 2h - 3x^2 \cancel{+2x}}{h}$$

$$= \frac{\cancel{3x^2} + 6xh + 3h^2 - 2h \cancel{-3x^2}}{h} = \frac{3h^2 + 6xh - 2h}{h}$$

$$= \frac{\cancel{h}(3h + 6x - 2)}{\cancel{h}} = \lim_{h \to 0} 3h + 6x - 2 = 3(0) + 6x - 2$$

$$f'(x) = 6x - 2$$

Ex 2) $f(x) = \sqrt{x}$. Find f ' (x) and the slope of the graph at points (1, 1) and (4, 2).

$$f'(x) = \frac{(\sqrt{x+h} - \sqrt{x})}{h} \cdot \frac{(\sqrt{x+h} + \sqrt{x})}{(\sqrt{x+h} + \sqrt{x})}$$

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

$$= \frac{\cancel{h}}{\cancel{h}(\sqrt{x+h} + \sqrt{x})}$$

$$= \lim_{h \to 0} \frac{1}{\sqrt{x+h} + \sqrt{x}} = \frac{1}{\sqrt{x+0} + \sqrt{x}}$$

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

$$(\overset{x}{1}, 1) \rightarrow \frac{1}{2\sqrt{1}} = \boxed{\frac{1}{2}}$$

$$(\overset{x}{4}, 2) \rightarrow \frac{1}{2\sqrt{4}} = \boxed{\frac{1}{4}}$$