Stewart Section 2.7

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Derivatives

Definition: The **tangent line** to the curve $y = f(x)$ at the point $P = (a, f(a))$ is the line through P having slope

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

provided the limit exists.

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The slope of the tangent line can also be expressed as

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

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An equivalent way of stating the definition is

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

Interpretation: Derivative as the Slope of a Tangent

Definition: The tangent line to

$$y = f(x)$$

at the point $(a, f(a))$ is the line passing through $(a, f(a))$ whose slope is equal to $f'(a)$, the derivative of f at a.

Interpretation: Derivative as a Rate of Change

Definition: The derivative of f at a, $f'(a)$, is the *instantaneous rate of change of* $y = f(x)$ *with respect to* x *when* $x = a$.