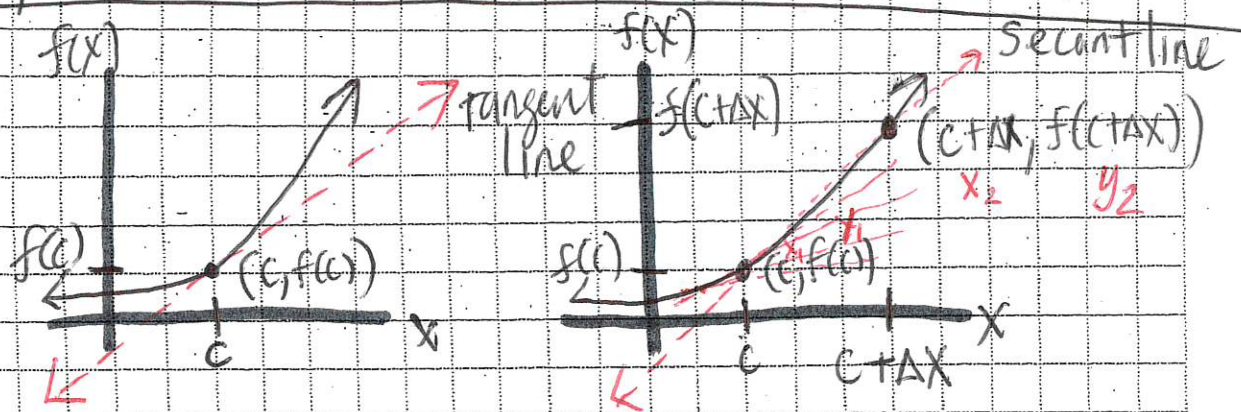


Slope of Tangent Line

9/20

ES: How do we find the slope of a point on a curve?

How do we find the slope of a tangent line?



$$m = \frac{y_2 - y_1}{x_2 - x_1}$$

$$m_{\text{secant}} = \frac{f(c+\Delta x) - f(c)}{c+\Delta x - c} = \frac{f(c+\Delta x) - f(c)}{\Delta x}$$

Definition of tangent line with slope

$$\lim_{\Delta x \rightarrow 0} \frac{f(c+\Delta x) - f(c)}{\Delta x} = m$$

ex 1

$$f(x) = 2x - 3 \quad c = 2$$

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

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

$$= \lim_{\Delta x \rightarrow 0} \frac{4 + 2\Delta x - 3 - (4 - 3)}{\Delta x}$$

$$= \lim_{\Delta x \rightarrow 0} \frac{4 + 2\Delta x - 4}{\Delta x} = \lim_{\Delta x \rightarrow 0} \frac{2\Delta x}{\Delta x}$$

$$= \lim_{\Delta x \rightarrow 0} 2$$

$$m = 2$$

Derivative
of a
function

What is a derivative?

The derivative of f at x is the slope of a tangent line at x .

$$f'(x) = \lim_{\Delta x \rightarrow 0} \frac{f(x+\Delta x) - f(x)}{\Delta x}, \text{ for all } x \text{ where the limit exist}$$

Other
names

the derivative is the:

- Instantaneous rate of change
- Rate of change
- Slope

Notation
for derivative

$$f'(x) \quad y' \quad \frac{dy}{dx} \quad \frac{d}{dx} [f(x)]$$

(ex)

$$f(x) = x^2 + 2$$

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

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

How do we
find the
derivative
function?

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

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

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

$$= \lim_{\Delta x \rightarrow 0} \frac{\cancel{\Delta x} (2x + \Delta x)}{\cancel{\Delta x}}$$

$$= \lim_{\Delta x \rightarrow 0} (2x + \Delta x) = 2x + 0$$

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

$$f(x) = x^2 + 2$$

Summary

Hw 3B pg 103 # 5-10 all,
12-18 even, 19-23 odd,
25-31 odd (a) (b) only.

due 9/24