Section 3.5  Instantaneous rate of change

Example:

$m = \text{average rate of } \Delta$
(aka: secant line)

10 minutes later

we will find each individual slope and then find how the value changes as closer to end

$tangent \ line \ (\text{instantaneous rate of } \Delta)$

Technical Formula we will be working with:

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

Instantaneous rate of change \\

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

\[ f'(x) \]

1 \text{ as } h \to 1
* Average rate of \( \Delta \) = average velocity 
  \[(\text{Slope})\]

* Difference quotient aka: \( \lim_{h \to 0} \frac{f(x+h)-f(x)}{h} \)

  AKA

  Instantaneous rate of \( \Delta \)
  AKA

  Instantaneous velocity
  \( \text{(first derivative)} \)

* Leibniz notation

  Example of uses:

  \[\text{Instantaneous rate of } \Delta = \frac{\text{dy}}{\text{dx}} \text{ of } y = f(x)\]

  \[\lim_{h \to 0} \frac{f(x+h)-f(x)}{h} \text{ (first derivative)}\]

  HW Questions Review 3.5

1. Estimate \( g'(7) = 5 \) because both sides getting closer to 5.
   Clue: \([7, 7+h]\) on right \((7+h)\)
   \([7+h, 7]\) on left \((7+h)\)

2. Estimate \( s'(\theta) = -0.6 \) bc both approaching on right and left to \(-0.6\)
Remember This

*** First derivative represents the slope of the tangent line (red line on HW #13-#16) ***

\#14

![Graph showing the slope of a tangent line at point P.(approx.) at (2,4).]

- If horizontal line = \( y = c \)
  - Slope always = 0

- Vertical lines = \( x = c \)
  - Slope always undefined

\#16

- (0,4) ? then determine (4,2) slope by finding
  - \( \frac{\Delta y}{\Delta x} = \frac{2-4}{4-0} = \frac{-2}{2} = -1 \)

*"
Problem 18

Just to get an idea of how steep slopes are.

P = -\frac{1}{2}
Q = -2
R = -3

greatest slope = P because is largest of the slopes.
least slope = R

Problem 260

a. 0
b. 3
c. 1

P = 0 flattest
Q = 3 steepest
R = 1 b/c not as flat