

Slope of secant line between  $(x_1, f(x_1))$  and  $(x_2, f(x_2))$

$$\begin{aligned}
 &= \text{average rate of change} \\
 &= \frac{f(x_2) - f(x_1)}{x_2 - x_1} \\
 &= \frac{\Delta f(x)}{\Delta x}
 \end{aligned}$$

where  $\Delta x = \text{change in } x = x_2 - x_1$   
 and  $\Delta f(x) = \text{change in } f(x) = f(x_2) - f(x_1)$

Slope of tangent line to  $f$  at  $x_1 = \text{instantaneous rate of change}$

$$\begin{aligned}
 &= \lim_{x_2 \rightarrow x_1} \frac{f(x_2) - f(x_1)}{x_2 - x_1} \\
 &= \lim_{x_1 + h \rightarrow x_1} \frac{f(x_1 + h) - f(x_1)}{x_1 + h - x_1} \\
 &= \lim_{h \rightarrow 0} \frac{f(x_1 + h) - f(x_1)}{h}
 \end{aligned}$$

Definition  $f'(a) = \text{slope of tangent line to } f \text{ at } a = \lim_{h \rightarrow 0} \frac{f(a+h) - f(a)}{h}$ .

If  $f(x) = 2x - 4$ , then  $f'(8) =$

If  $g(x) = 3$ , then  $g'(1) =$

If  $h(x) = |x|$ , then  $h'(5) =$

and  $h'(-5) =$

Definition: Given  $f$ , then define the function  $f'$  (the derivative of  $f$ ) as follows:

$$f'(x) = \text{slope of tangent line to } f \text{ at } x = \lim_{h \rightarrow 0} \frac{f(x+h) - f(x)}{h}.$$

$x$  is in the domain of  $f'$  if  $x$  is in the domain of  $f$  and the above limit exists.

If  $f(x) = 2x - 4$ , then  $f'(x) =$

If  $g(x) = 3$ , then  $g'(x) =$

If  $h(x) = |x|$ , then  $h'(x) =$

Suppose  $f(x) = -2x + 12$  represents the distance traveled from home in miles after  $x$  hours. Find the average velocity between  $x = 1$  and  $x = 3$ . What are the units?

Find the instantaneous velocity at  $x = 1$ : What are the units?

Suppose  $f(x) = -2x + 12$  represents the cost of stock after  $x$  days from purchase. Find the average change in the cost of the stock between  $x = 1$  and  $x = 3$ . What are the units?

Find the instantaneous change in the cost of the stock at  $x = 1$ : What are the units?

Suppose  $f(x) = 8$  represents the distance traveled from home in miles after  $x$  hours. Find the average velocity between  $x = 1$  and  $x = 3$ . What are the units?

Find the instantaneous velocity at  $x = 1$ : What are the units?

Suppose  $f(x) = 8$  represents the cost of stock after  $x$  days from purchase. Find the average change in the cost of the stock between  $x = 1$  and  $x = 3$ . What are the units?

Find the instantaneous change in the cost of the stock at  $x = 1$ : What are the units?

Suppose  $f(x) = \frac{x+3}{4x-5}$  represents the distance traveled from home in miles after  $x$  hours. Find the average velocity between  $x = 1$  and  $x = 3$ . What are the units?

Find the instantaneous velocity at  $x = 1$ : What are the units?

Suppose  $f(x) = \frac{x+3}{4x-5}$  represents the cost of stock after  $x$  days from purchase. Find the average change in the cost of the stock between  $x = 1$  and  $x = 3$ . What are the units?

Find the instantaneous change in the cost of the stock at  $x = 1$ : What are the units?

HW

2.7) 1, 2, 3, 9, 13, 15, 17, 27

2.8) 3, 4, 5, 7, 15, 25, 29, 33, 35, 36

2.9) 4, 7, 9, 21, 27, 29, 37, 38

3.1) 3, 23, 29, 31, 45

and