Slope of secant line between $(x_1, f(x_1))$ and $(x_2, f(x_2))$
$$= \text{average rate of change}$$
$$= \frac{f(x_2) - f(x_1)}{x_2 - x_1}$$
$$= = \frac{\Delta f(x)}{\Delta x}$$
where $\Delta x = $ change in $x = x_2 - x_1$
and $\Delta f(x) = $ change in $f(x) = f(x_2) - f(x_1)$

Slope of tangent line to f at $x_1 = $ instantaneous rate of change

$$= lim_{x_2 \to x_1} \frac{f(x_2) - f(x_1)}{x_2 - x_1}$$

$$= lim_{x_1 + h \to x_1} \frac{f(x_1 + h) - f(x_1)}{x_1 + h - x_1}$$

$$= lim_{h \to 0} \frac{f(x_1 + h) - f(x_1)}{h}$$

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

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

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

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

and $h'(-5) =$

1

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

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

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?

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

Suppose $f(x) = -2x + 12$ represents the population of a household x years after 2000. Find the average change in the population between 2001 and 2003 (i.e., $x = 1$ and $x = 3$). What are the units?

Find the instantaneous change in the population 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?

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

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Find the instantaneous change in the population at $x = 1$: What are the units?

Suppose $f(x) = \frac{x+3}{4x+1} + 2$ 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 $f(x) = \frac{x+3}{4x+1} + 2$ represents the population of a household x years after 2000. Find the average change in the population between 2001 and 2003 (i.e., $x = 1$ and $x = 3$). What are the units?

Find the instantaneous change in population at $x = 1$: What are the units?

The volume of a right circular cylinder is given by the formula $V = \pi r h^2$ where r is the radius of the base in meters and h is the height of the cylinder in meters.

Find the rate of change of the volume of the cylinder with respect to the height?

Find the rate of change of the volume of the cylinder with respect to the radius?