Instantaneous Rate of Change … Facts 1

Instantaneous Rate of Change (Derivative):

- Instantaneous rate of change at $x = a$ is the average rate of change over the interval (a, a)
- Instantaneous rate of change cannot be calculated with Algebra alone because the of the equal x-coordinates.
- The denominator of the fraction in the computation would be $\frac{}{a-a}$.
- This gives a fraction with 0 in the denominator. This is undefined.

Instantaneous Rate of Change … Facts 1

Calculus is needed to compute instantaneous rate of change.

Instantaneous rate of change of a function f at $x = a$: Is the average rate of change of the function f at $x = a$.

- The instantaneous rate is essentially the average rate of change over the interval $(a, a + h)$.
- To find the instantaneous rate of change, we take the limit as $h\ approaches\ 0$.
- The instantaneous rate of change is the average rate of change at a single point, since h is changed to zero and we get the interval $(a, a + 0) = (a, a)$

This is the formula to compute instantaneous rate of change of a function $f\ when\ x = a$.

$Instantaneous\ rate\ of\ change\ of\ a\ function\ f\ at\ x = a$

$$Instantaneous\ rate\ of\ change\ = \lim_{h\to 0} \frac{f(a+h)-f(a)}{(a+h)-a} = \lim_{h\to 0} \frac{f(a+h)-f(a)}{h}$$

- Instantaneous rate of change is a measure of the slope of the line connecting the points: $(a, f(a))\ and\ (a + h, f(a + h))$

Instantaneous Rate of Change … Facts 1

We will use the word DERIVATIVE very often this semester.

- The terms instantaneous rate of change and derivative have the same definition and they are interchangeable words.
- The value of a derivative of function f when $x = a$ is just the instantaneous rate of change of the function f at $x = a$

This is the formula to compute derivative of a function f at $x = a$.

Derivative of function f at x = a

Derivative = $f'(a) = \lim_{h \to 0} \frac{f(a+h)-f(a)}{(a+h)-a} = \lim_{h \to 0} \frac{f(a+h)-f(a)}{h}$

- We use the symbol
  $f'(a)$ to $represent$ the $derivative$ of $function$ at $x = a$
- A derivative is a measure of the slope of the line connecting the points: $(a, f(a))$ and
  $(a + h, f(a + h))$