Average Rate of Change … Facts 1

Average rate of change:

The average rate of change of function f over the interval (a, b) is given by this equation:

$$\boldsymbol{Average\ rate\ of\ change = \frac{f(b)-f(a)}{b-a}}$$

- Average rate of change is a measure of how much a function changes per unit, on average, over that interval.
- Average rate of change is just the slope of the straight line connecting the interval's endpoints on the graph of the function.

Average Rate of Change … Facts 1

<u>Average rate of example 1:</u>

Find the average rate of change for each function over the given interval. Sketch a graph to model your answer. (You may use your calculator obtain the graph, be sure to label the necessary points.)

$f(x) = -2x^2 + 4x - 5$ between $x = 1 \; and \; x = 3$

Average Rate of Change … Facts 1

Create 2 points using the given x values.

$$x = 1; \quad f(1) = -2(1)^2 + 4(1) - 5 = -3$$

Creates the point: $(1, -3)$

$$x = 3; \quad f(3) = -2(3)^2 + 4(3) - 5 = -11$$

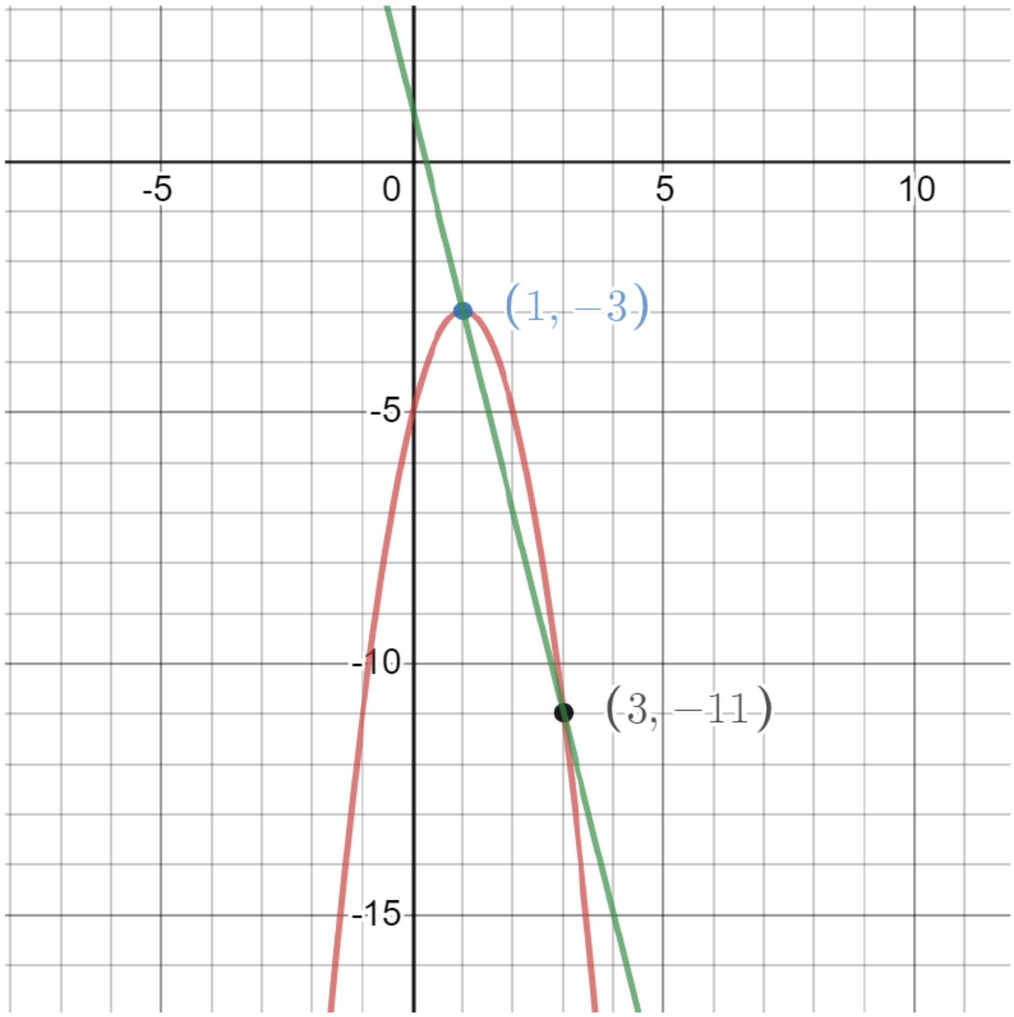
Creates the point: $(3, -11)$

Average rate of change is just the slope of the line that connects the points.

$$Average\ Rate\ of\ Change = \frac{-11-(-3)}{3-1} = \frac{-8}{2} = -4$$

Answer: Average Rate of Change = -4

Average Rate of Change … Facts 1



Average Rate of Change … Facts 1

Average rate of change example 2:

At 10 AM a car's odometer read 10,300 miles. At noon, the car's odometer read 10,420 miles. What is the car's average rate of change measured in miles per hour?

Average Rate of Change … Facts 1

We need to create two points.

Since we are asked to find the average rate of change in miles per hour

$x - coordinate$ of the points must be time in hours (hours are mentioned second)

$y - coordinate$ of the points must be distance in miles (miles are mentioned first)

$(time, miles)$

These are the points needed: $(10,\ 10300)\ (12,\ 10420)$

$$Average\ Rate\ of\ Change = \frac{10420-10300\ (miles)}{12-10\ \ (hours)} = \frac{120\ miles}{2\ hours} =$$
$60\ miles\ per\ hour$

Answer: Average Rate of Change (velocity): $60\ mph$

Average Rate of Change … Facts 1

- Average rate of change tells us the average rate at which a function changes over an interval.

- The average rate of change only tells us an average change between two values of x. It gives no specific information in-between the two values of x.

    - That is, we have no idea how the function behaves at any specific instant in the interval between the given values of x.

- In the car example we computed the average rate of change (velocity) was $60\ miles\ per\ hour$ over the 2-hour trip. This is an average speed for the entire trip. This does not mean the car traveled at precisely $60\ mph$ for the entire trip. This is just the average speed. In fact, it likely went faster than $60\ mph$ at times and slower than $60\ mph$ at other times. The car could have been stopped for a chunk of time.

    - We need to calculate the car's **instantaneous rate of change** to know its speed (velocity) at a specific moment.