

Graphs and Volume Day 1: In Class

Average Rate of Change

$$\frac{40 \text{ min}}{60 \text{ min}} = \frac{2}{3}$$

1. Suppose your family decides to drive down to Saint George. It is about 275 miles from Highland to Saint George and according to Google Maps it will take approximately 3 hours and 40 minutes. At what constant speed would you have to drive in order to arrive in Saint George in exactly 3 hours and 40 minutes?

$$\text{Speed: } \frac{\text{mile}}{\text{hour}} \Rightarrow \frac{275 \text{ miles}}{3\frac{2}{3} \text{ hours}} = \frac{75.14 \text{ mile}}{1 \text{ hour}}$$

Suppose your family decides to leave at 8:00 am on Saturday morning and your dad drives. Because it's a long drive, and you get bored for the first couple of hours, you decide to note the time that has passed and the distance you have traveled. Below is a table representing how far you have traveled as time passes.

Time	Total Distance Traveled (miles)
8:00	0
8:15	5
8:20	10
8:30	20
8:50	45
9:05	64
9:35	94
9:45	108
9:50	114
10:00	126

Handwritten calculations for the table:

- 5 miles / 15 min = $\frac{1}{3} \text{ m/min}$
- 10 miles / 20 min = 1 m/min
- 20 miles / 30 min = 1 m/min
- 45 miles / 50 min = 1.2 m/min
- 64 miles / 95 min = 1.26
- 94 miles / 155 min = 1
- 108 miles / 175 min = 1.4 (84 miles / 1 hour)
- 114 miles / 190 min = 1.2
- 126 miles / 210 min = 1.2

2. During what time interval did you go the farthest?

9:05 - 9:35

3. When were you going the fastest? How do you know?

Average rate of change 9:35-9:45 $\frac{14 \text{ miles}}{10 \text{ min}}$

Average Rate of Change

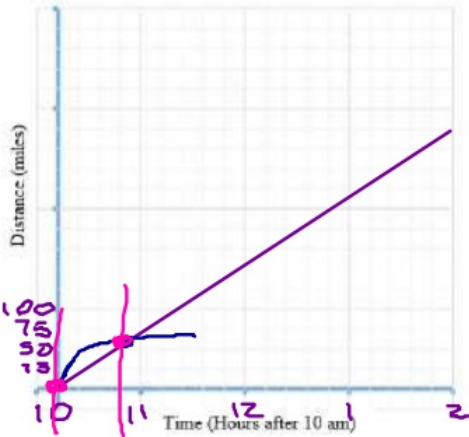
$$\frac{\Delta y}{\Delta x} = \frac{\text{output}}{\text{input}} = \frac{\text{Dep}}{\text{Ind}} = m \text{ between Intervals.}$$

$$8:00 \text{ to } 10:00 \Rightarrow 126 \text{ mil. } \frac{126 \text{ mil}}{2 \text{ hrs}} = \frac{63 \text{ miles}}{1 \text{ hour}}$$

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At 10:00 you notice that your dad put the car on cruise control and set the speed to be 75 miles per hour. Soon after 10:00 you got sleepy and took a nap for about 40 minutes. Before you fell asleep you noticed a bright yellow truck pass your car. Shortly after you woke up, you realize that you just passed that same yellow truck. Draw a possible time-distance graph with two lines or curves on it, one representing your car and the other representing the truck.



Did your car or the truck have a higher average rate of change in the time interval 10:00-10:40? Why?

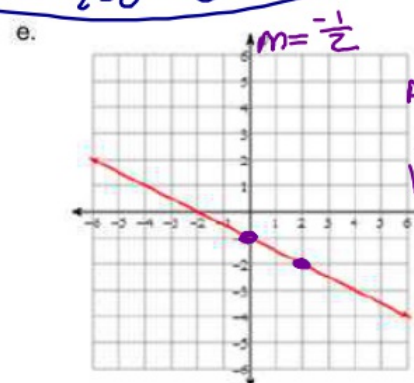
4. Find the average rate of change of the following functions on the interval $[0, 2]$.

a. $f(x) = 2^x$
 $f(0) = 2^0 = 1$
 $f(2) = 2^2 = 4$
 $(0, 1)$ and $(2, 4)$
 Ave. Rate $m = \frac{4-1}{2-0} = \frac{3}{2}$

b. $g(x) = 7x + 2$
 $g(0) = 7(0) + 2 = 2$
 $g(2) = 7(2) + 2 = 16$
 $(0, 2)$ and $(2, 16)$
 $m = \frac{16-2}{2-0} = \frac{14}{2} = 7$

c. $h(x) = x^2 - 2x + 1$
 $h(0) = 0^2 - 2(0) + 1 = 1$
 $h(2) = 2^2 - 2(2) + 1 = 1$
 $(0, 1)$ and $(2, 1)$
 $m = \frac{1-1}{2-0} = \frac{0}{2} = 0$

d. $r(x) = 3$
 $r(0) = 3$
 $r(2) = 3$
 $(0, 3)$ and $(2, 3)$
 $m = \frac{3-3}{2-0} = \frac{0}{2} = 0$



Average linear between 2 point or interval

