Lesson 2-8

Average Rate of Change

Do Now: What is **Average Rate of Change**?

For a function over the domain interval $a \le x \le b$, the function's **average rate of change** is calculated by:

$$\frac{\Delta y}{\Delta x} \quad \text{or} \quad \frac{y_2 - y_1}{x_2 - x_1}$$

Exercise #1: The distance needed to stop a car after applying the brakes varies directly with the square of the car's speed. The table below shows stopping distances for various speeds.

x	**Speed** (mph)	10	20	30	40	50	60	70
y	**Distance** (ft)	6.25	25	56.25	100	156.25	225	306.25

Determine the average rate of change in braking distance, in ft/mph, between one car traveling at 50 mph and one traveling at 70 mph. *Explain what this rate of change means as it relates to braking distance.*

$$\frac{306.25 - 156.25}{70 - 50} = \frac{15}{2} = 7.5$$

Between 50 and 70 mph, each additional mph in speed requires 7.5 more feet to stop.

Exercise #2: An astronaut drops a rock off the edge of a cliff on the Moon. The distance, $d(t)$, in meters, the rock travels after t seconds can be modeled by the function $d(t) = 0.8t^2$. What is the average speed, in meters per second, of the rock between 5 and 10 seconds after it was dropped?

put into y=

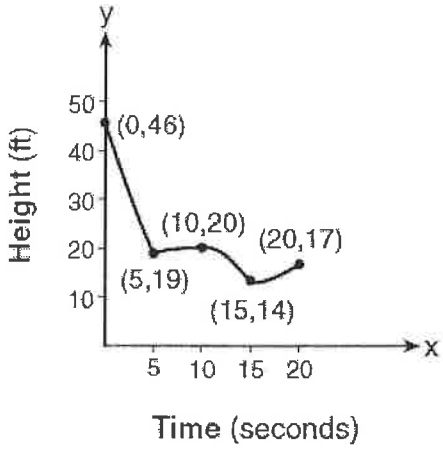
1) 12
2) 20
3) 60
4) 80

x	y
5	20
10	80

$$\frac{80 - 20}{10 - 5} = 12$$

Exercise #3: The graph below models the height of a remote-control helicopter over 20 seconds during flight.

Is the average rate of change greater on the interval [10, 15] or [15, 20]? Justify your answer.



Plickers Practice

1. Given the functions $g(x)$, $f(x)$, and $h(x)$ shown below:

x	f(x)
0	1
1	2
2	5
3	7

$f(x)$

$\frac{7-1}{3-0} = 2$

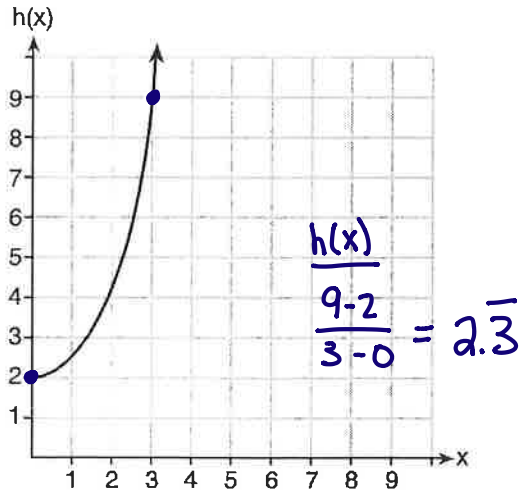
$g(x) = x^2 - 2x$

$(0,0)$

$(3,3)$

$g(x)$

$\frac{3-0}{3-0} = 1$



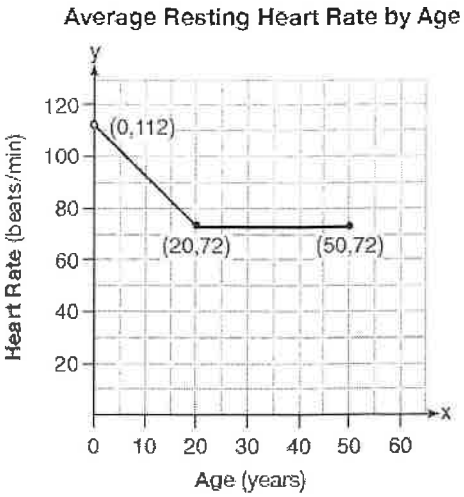
$\frac{h(x)}{\frac{9-2}{3-0}} = 2.3\overline{3}$

The correct list of functions ordered from greatest to least by average rate of change over the interval [0,3] is

1) $f(x), g(x), h(x)$
2) $h(x), g(x), f(x)$
3) $g(x), f(x), h(x)$
4) $h(x), f(x), g(x)$

2. A graph of average resting heart rates is shown below. The average resting heart rate for adults is 72 beats per minute, but doctors consider resting rates from 60-100 beats per minute within normal range.

Which statement about average resting heart rates is *not* supported by the graph shown to the right?



1) A 10-year-old has the same average resting heart rate as a 20-year-old.
2) A 20-year-old has the same average resting heart rate as a 30-year-old. ✓
3) A 40-year-old may have the same average resting heart rate for ten years. ✓
4) The average resting heart rate for teenagers steadily decreases. ✓

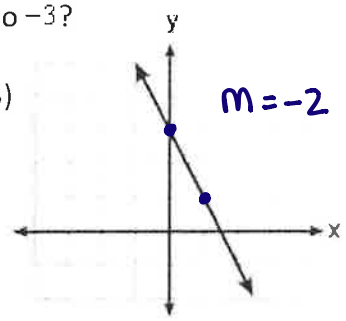
3. Which function has a constant rate of change equal to -3?

1)

x	y
0	2
1	5
2	8
3	11

+3, +3

3)



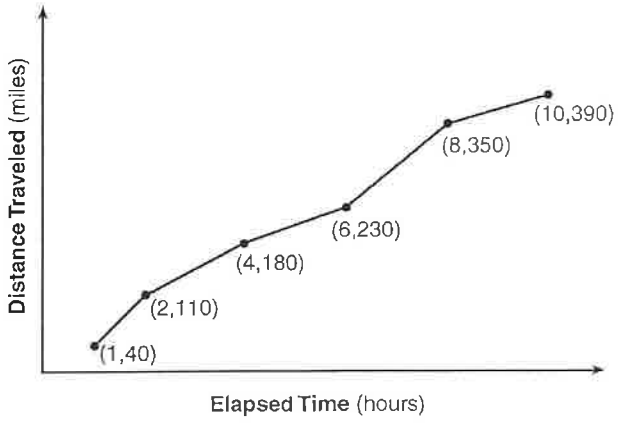
2) $\{(1,5),(2,2),(3,-5),(4,4)\}$

$\frac{4-(-5)}{4-3} = 9 \quad \frac{-5-2}{3-2} = -7$ } not constant!

4) $\frac{2y}{2} = \frac{-6x}{2} + \frac{10}{2}$

$y = -3x + 5$

4. The Jamison family kept a log of the distance they traveled during a trip, as represented by the graph below.



During which interval was their average speed the greatest?

1) the first hour to the second hour
2) the second hour to the fourth hour
3) the sixth hour to the eighth hour
4) the eighth hour to the tenth hour

1) $\frac{110-40}{2-1} = 70$ ✓

2) $\frac{180-110}{4-2} = 35$

3) $\frac{350-230}{8-6} = 60$

4) $\frac{390-350}{10-8} = 20$