

Rate Change Lab

Find how fast a quantity changes over an interval.

HIGH SCHOOL • MA.912.F.1.3

MA.912.F.1.3 "Calculate and interpret the average rate of change of a real-world situation represented graphically, algebraically or in a table over a specified interval."

NAME _____

DATE _____

AVERAGE RATE OF CHANGE

Average rate of change tells how much an output changes for each 1-unit change in the input. Use $(\text{new output} - \text{old output})/(\text{new input} - \text{old input})$, then include units when they are given.

WORKED EXAMPLE

For a delivery service, $C(x)$ is the total cost in dollars for x miles. The graph includes the points $(12, 30)$ and $(16, 50)$. Find the average rate of change from 12 to 16 miles.

1. Find the outputs: $C(12) = 30$ and $C(16) = 50$.
2. Average rate of change $= (50 - 30)/(16 - 12)$.
3. $= 20/4 = 5$.

Answer: \$5 per mile

PRACTICE 6 problems

- 1** Find the average rate of change of $g(x) = 7x + 9$ from $x = -2$ to $x = 2$.

ANSWER _____

- 2** A table shows values of f . Find the average rate of change from $x = -3$ to $x = 3$. x : -3, 3; $f(x)$: -9, 9.

ANSWER _____

- 3** A graph has a line segment connecting the points $(-7, 10)$ and $(1, -6)$. Find the average rate of change from $x = -7$ to $x = 1$.

ANSWER _____

- 4** Find the average rate of change of $h(x) = x^2$ from $x = 6$ to $x = 7$.

ANSWER _____

- 5** A graph has a line segment connecting the points $(2, -1)$ and $(8, 11)$. Find the average rate of change.

ANSWER _____

- 6** Find the average rate of change of $q(x) = -3x + 14$ from $x = -4$ to $x = 3$.

ANSWER _____

APPLY IT Show your work

- 1** A music playlist has 14 saves at 1 p.m. and 38 saves at 9 p.m. What is the average rate of change in saves per hour during this time?

WORK SPACE

ANSWER _____

- 2** A phone battery is at 92% at 10:00 a.m. and 78% at 5:00 p.m. What is the average rate of change in battery percentage points per hour?

WORK SPACE

ANSWER _____

CHALLENGE One step up

CHALLENGE

The distance $d(t)$, in meters, traveled by a robot is $d(t) = t^2$, where t is time in seconds. Find the average rate of change from $t = 1$ to $t = 9$. Then explain why this rate does not mean the robot traveled at the same speed every second.

PART 1 • PRACTICE

#	PROBLEM	ANSWER
1	Find the average rate of change of $g(x) = 7x + 9$ from $x = -2$ to $x = 2$.	7
2	A table shows values of f . Find the average rate of change from $x = -3$ to $x = 3$. x : -3, 3; $f(x)$: -9, 9.	3
3	A graph has a line segment connecting the points $(-7, 10)$ and $(1, -6)$. Find the average rate of change from $x = -7$ to $x = 1$.	-2
4	Find the average rate of change of $h(x) = x^2$ from $x = 6$ to $x = 7$.	13
5	A graph has a line segment connecting the points $(2, -1)$ and $(8, 11)$. Find the average rate of change.	2
6	Find the average rate of change of $q(x) = -3x + 14$ from $x = -4$ to $x = 3$.	-3

PART 2 • APPLY IT

- 3 saves per hour** The number of saves changed by $38 - 14 = 24$ over $9 - 1 = 8$ hours. Divide 24 by 8.
- 2 percentage points per hour** The battery changed by $78 - 92 = -14$ percentage points over 7 hours. Divide -14 by 7.

CHALLENGE

10 meters per second. The average rate uses the total distance change over the whole interval, so it does not show the robot's speed at each moment.

Accept equivalent fraction, decimal, or unit forms when correct. For the challenge, accept explanations that distinguish an average rate over an interval from a constant or instantaneous speed.