LESSON MAKER PRO

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

To find average rate of change from x = a to x = b, use (f(b) - f(a))/(b - a). Compare the change in the output to the change in the input, then include units when the situation has units.

WORKED EXAMPLE

For r(x) = 11x + 13, find the average rate of change from x = 14 to x = 16.

1. Find the endpoint outputs: r(14) = 167 and r(16) = 189.
2. Find the change in output: 189 - 167 = 22.
3. Find the change in input: 16 - 14 = 2.
4. Divide: 22/2 = 11.

Answer: 11

PRACTICE 6 problems

1 Find the average rate of change of f(x) = 5x - 2 from x = 0 to x = 4.

ANSWER _____

2 Find the average rate of change of g(x) = x^2 from x = -2 to x = 2.

ANSWER _____

3 A function p has p(-4) = 10 and p(2) = -8. Find the average rate of change from x = -4 to x = 2.

ANSWER _____

4 The graph of y = h(x) passes through (-5, 7) and (-1, 19). Find the average rate of change between these points.

ANSWER _____

5 Find the average rate of change of k(x) = $3x^2$ - 1 from x = 1 to x = 3.

ANSWER _____

6 A town's water level is modeled by w(t) = 30 - 4t, where t is measured in days. Find the average rate of change from t = 2 to t = 5, then interpret the result.

ANSWER _____

APPLY IT Show your work

1 Use the table to find the average rate of change in phone battery percentage from 1 hour to 3 hours. Interpret the result.

PHONE BATTERY DURING A CONCERT

Time after arrival (hours)	Battery (%)
0	88
1	76
2	64
3	52

ANSWER _____

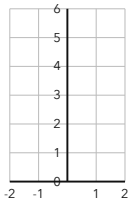
2 The height h(t), in feet, of a basketball after it is launched is modeled by $h(t) = -t^2 + 8t + 5$, where t is time in seconds. Find the average rate of change in height from t = 2 to t = 5. Interpret the result.

WORK SPACE

ANSWER _____

CHALLENGE One step up

Graph the piecewise function on the grid. Then find its average rate of change from x = -2 to x = 2. Explain why you use the two endpoint values even though the graph changes slope at x = 1: $p(x) = x + 2$ for x less than or equal to 1, and $p(x) = x^2 + 2$ for x greater than 1.



WORK SPACE AND ANSWER

ANSWER KEY

Rate Change Lab

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PART 1 · PRACTICE

#	PROBLEM	ANSWER
1	Find the average rate of change of $f(x) = 5x - 2$ from $x = 0$ to $x = 4$.	**5**
2	Find the average rate of change of $g(x) = x^2$ from $x = -2$ to $x = 2$.	**0**
3	A function p has $p(-4) = 10$ and $p(2) = -8$. Find the average rate of change from $x = -4$ to $x = 2$.	**-3**
4	The graph of $y = h(x)$ passes through $(-5, 7)$ and $(-1, 19)$. Find the average rate of change between these points.	**3**
5	Find the average rate of change of $k(x) = 3x^2 - 1$ from $x = 1$ to $x = 3$.	**12**
6	A town's water level is modeled by $w(t) = 30 - 4t$, where t is measured in days. Find the average rate of change from $t = 2$ to $t = 5$, then interpret the result.	**-4 units per day; the water level decreases by an average of 4 units each day.**

PART 2 · APPLY IT

1. **-12 percentage points per hour; the battery percentage decreases by an average of 12 percentage points each hour.** Use the values at 1 hour and 3 hours: (52 - 76)/(3 - 1) = -24/2 = -12. The negative rate means the battery percentage is going down.
2. **1 foot per second; from 2 to 5 seconds, the basketball's height increases by an average of 1 foot each second.** Find h(2) = 17 and h(5) = 20. Then (20 - 17)/(5 - 2) = 3/3 = 1 foot per second.

CHALLENGE

3/2. Use p(-2) = 0 and p(2) = 6, so (6 - 0)/(2 - (-2)) = 6/4 = 3/2. Average rate of change over an interval compares only the endpoint values, even when the slope changes within the interval.

Accept equivalent forms such as 1.5 for 3/2. For interpretation answers, accept equivalent wording that correctly states the direction of change and the units.