LESSON MAKER PRO

Rate Detectives

Find how fast a function changes over an interval.

GRADE 8 · 8A.AF.J.31

8A.AF.J.31 "Calculate and interpret the average rate of change of a function (presented symbolically or as a table) over a specified interval. Estimate the rate of change from a graph. Limit to linear, quadratic, exponential…"

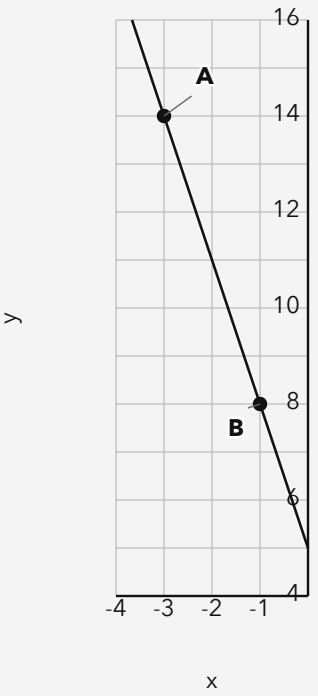
NAME _____ DATE _____

CHANGE OVER AN INTERVAL

Average rate of change is the change in output divided by the change in input: (ending output - starting output)/(ending input - starting input). For a graph, read the two points as closely as you can, then divide.

WORKED EXAMPLE

Use the graph to find the average rate of change from point A to point B.



1. Read the points: A is (-3, 14) and B is (-1, 8).
2. Change in output: 8 - 14 = -6.
3. Change in input: -1 - (-3) = 2.
4. Average rate: -6/2 = -3.

Answer: -3 output units per input unit

PRACTICE 6 problems

1 Find the average rate of change of $f(x) = -2x + 9$ from $x = 0$ to $x = 4$.

ANSWER _____

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

ANSWER _____

3 Use the table to find the average rate of change from $x = 1$ to $x = 3$.

FUNCTION VALUES

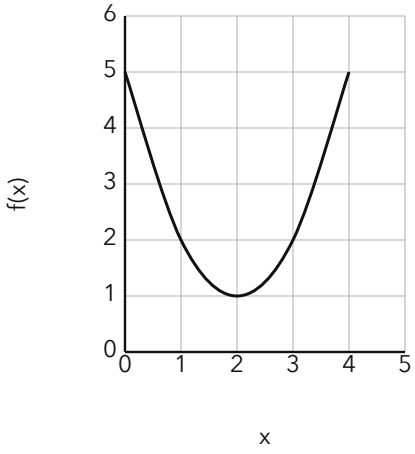
x	f(x)
0	3
1	6
2	12
3	24

ANSWER _____

4 Find the average rate of change of $f(x) = |x - 2|$ from $x = 0$ to $x = 6$.

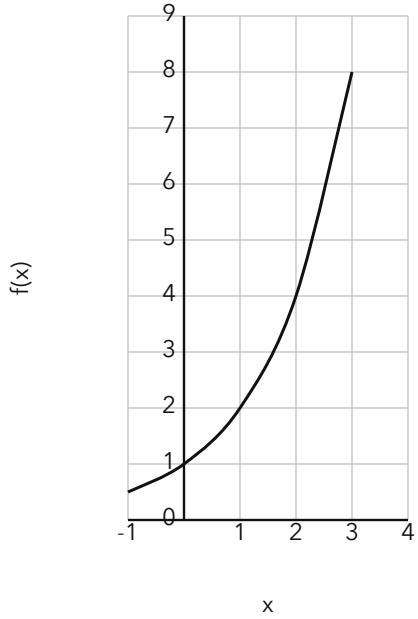
ANSWER _____

5 Estimate the average rate of change from $x = 1$ to $x = 4$ using the graph.



ANSWER _____

6 Estimate the average rate of change from $x = 0$ to $x = 2$ using the graph.



ANSWER _____

APPLY IT Show your work

1 A phone's battery charge is shown in the table. Find its average rate of change from 15 to 45 minutes. What does your answer mean?

CHARGING A PHONE

Time (minutes)	Charge (%)
0	20
15	32
30	44
45	56

ANSWER _____

2 In a basketball video game, a ball's height in feet is modeled by $h(t) = -t^2 + 6t$, where t is time in seconds. Find the average rate of change from t = 1 to t = 5. What does it tell you about the ball's height at those two times?

WORK SPACE

ANSWER _____

CHALLENGE One step up

For $f(x) = |x - 3|$, find the average rate of change on each interval: x = 0 to x = 3, x = 3 to x = 6, and x = 0 to x = 6. Explain why the rate for the full interval is 0 even though the rates for the shorter intervals are not.

WORK SPACE AND ANSWER

Rate Detectives

PART 1 · PRACTICE

#	PROBLEM	ANSWER
1	Find the average rate of change of f(x) = -2x + 9 from x = 0 to x = 4.	**-2**
2	Find the average rate of change of $f(x) = x^2 - 2x$ from x = 0 to x = 5.	**3**
3	Use the table to find the average rate of change from x = 1 to x = 3.	**9**
4	Find the average rate of change of f(x) = |x - 2| from x = 0 to x = 6.	**1/3**
5	Estimate the average rate of change from x = 1 to x = 4 using the graph.	**About 1**
6	Estimate the average rate of change from x = 0 to x = 2 using the graph.	**About 3/2**

PART 2 · APPLY IT

1. **4/5 percentage point per minute. The battery charge increased by an average of 4/5 percentage point each minute during that interval.** The charge rose by 56 - 32 = 24 percentage points in 45 - 15 = 30 minutes. Divide 24/30 = 4/5.
2. **0 feet per second. The ball was at the same height at t = 1 and t = 5.** h(1) = 5 and h(5) = 5, so the average rate is (5 - 5)/(5 - 1) = 0.

CHALLENGE

The rates are -1, 1, and 0, respectively. The output falls from 3 to 0, then rises back to 3, so the total change in output is 0.

Accept 1.5 for 3/2 on the graph problem and any equivalent fraction for 4/5. For the challenge, accept explanations that identify equal starting and ending outputs.