

Assignment

Write

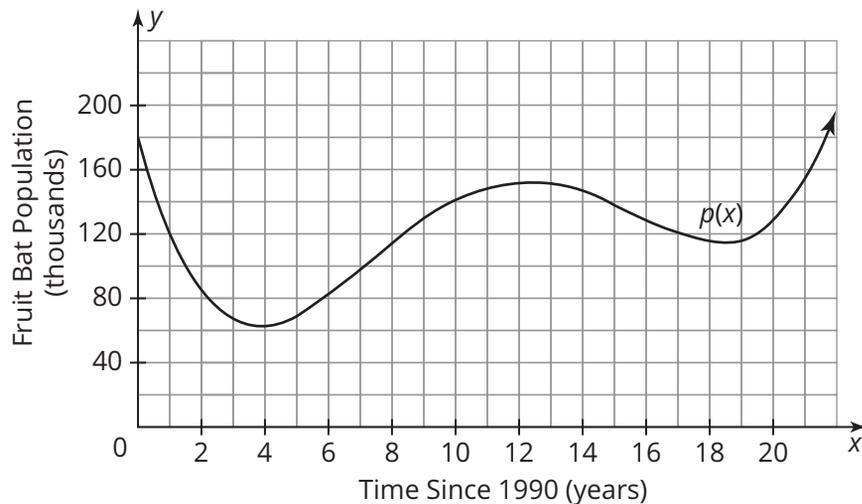
Write a definition for the term *average rate of change* in your own words.

Remember

The formula for average rate of change is $\frac{f(b) - f(a)}{b - a}$ for an interval (a, b) . The expression $b - a$ represents the change in the input of the function f . The expression $f(b) - f(a)$ represents the change in the function f as the input changes from a to b .

Practice

1. Biologists conducted a 20-year study of fruit bat populations in a small African country. The polynomial function $p(x)$ models the fruit bat population from the year 1990 (when $x = 0$) to the year 2010 (when $x = 20$).



- a. Determine the intervals over which the fruit bat population increased.
- b. Determine the intervals over which the fruit bat population decreased.
- c. During the 20-year study, a law was passed that banned the use of a pesticide known to be harmful to the fruit bat. Predict the year in which the law was passed. Explain your reasoning.
- d. During the 20-year study, a logging company signed a 6-year government contract to harvest the timber from a large forest known to be the habitat of the fruit bat. Predict the year in which the company started harvesting the timber. Explain your reasoning.
- e. Estimate when the fruit bat population was 100,000. Explain your reasoning.
- f. At what point during the 20-year study was the fruit bat population the highest? What was the population at that time?
- g. Determine the average rate of change of the fruit bat population from the year 1994 to the year 2002. Explain the meaning of your answer in terms of the problem situation.
- h. Determine the average rate of change of the fruit bat population over the entire 20-year study. Explain the meaning of your answer in terms of the problem situation.

Stretch

A biologist studied the population of mosquitoes over a 10-year period from 2000 to 2010 in a rural county of her state. The population of mosquitoes had the following characteristics:

- The population first increased, then decreased, then increased, and then decreased.
- The average rate of change of the population of mosquitoes over the 10-year period was 10,000 mosquitoes per year.
- The average rate of change of the population of mosquitoes from 2003 to 2005 was $-10,000$ per year.
- The maximum number of mosquitoes during the 10-year period was 175,000.
- The number of mosquitoes in the year 2007 was 150,000, which was the same as the year 2010.

Draw a possible graph for the population of mosquitoes that has the given characteristics.

Review

1. Sketch a graph of a polynomial function with the characteristics given. If the graph is not possible to sketch, explain why.

Characteristics:

- 4 imaginary zeros
- as $x \rightarrow \infty$, $f(x) \rightarrow -\infty$
as $x \rightarrow -\infty$, $f(x) \rightarrow -\infty$

2. Determine 1 linear function and 1 quadratic function such that the product of the 2 functions will build a cubic function with a double zero at 2 and a y -intercept at $(0, -4)$.

Write the equation of the cubic function. Explain your reasoning.

3. Consider the functions $k(x) = x + 2$, $m(x) = x - \frac{1}{2}$, $n(x) = x - 1$, and $f(x) = k(x) \cdot m(x) \cdot n(x)$.

a. Graph $k(x)$, $m(x)$, $n(x)$, and $f(x)$. b. Determine the zeros of $f(x)$. Explain your reasoning.

4. Solve each equation.

a. $x^2 - 8x + 18 = 0$

b. $x^2 + 49 = 0$