1.2 Rates of Change

AP Precalculus

Solutions

1.2 Practice

Find the average rate of change of the function on the given interval.

1. $h(t) = 3t - t^2$ over the interval $2 \le t \le 5$.

$$\frac{h(5)-h(2)}{5-2}$$

$$\frac{[15-25]-[6-4]}{3}$$

$$\frac{-10-2}{3}$$

$$\frac{-12}{3} = \boxed{-4}$$

2. $b(w) = w + 2^w$ over the interval $[-1, 2]$.

$$\frac{b(2)-b(-1)}{2--1}$$

$$\frac{[2+2^2]-[-1+2^{-1}]}{3}$$

$$\frac{6-(-1+\frac{1}{2})}{3}$$

$$\frac{6.5}{3} = \boxed{\frac{13}{6} \text{ or } 2.1666}$$

3. $f(x) = \ln 3x$ over the interval $1 \le x \le 4$.

$$\frac{f(4)-f(1)}{4-1}$$

$$\frac{\ln(12)-\ln(3)}{3}$$

$$\boxed{0.462}$$

Use the information in each table to find the average rate of change on the given interval.

4.

t Minutes	3	10	21	43	55
$d(t)$ meters	5	102	135	140	143

a. $3 \le t \le 55$

$\frac{143-5}{55-3}$

$\frac{138}{52}$

$\boxed{2.6538 \text{ meters/min}}$

b. $10 \le t \le 43$

$\frac{140-102}{43-10}$

$\frac{38}{33}$

$\boxed{1.1515 \text{ meters/min}}$

c. $21 \le t \le 55$

$\frac{143-135}{55-21}$

$\frac{8}{34}$

$\boxed{0.235 \text{ meters/min}}$

5.

t months	6	12	24	48	72
$d(t)$ hair follicles	20,000	19,800	15,000	10,000	7,500

a. $6 \le t \le 48$

$\frac{10{,}000-20{,}000}{48-6}$

$\frac{-10{,}000}{42}$

$\boxed{-238.095 \text{ hair follicles per month}}$

b. $12 \le t \le 72$

$\frac{7{,}500-19{,}800}{72-12}$

$\frac{-12{,}300}{60}$

$\boxed{-205 \text{ hair follicles/month}}$

c. $6 \le t \le 72$

$\frac{7{,}500-20{,}000}{72-6}$

$\frac{-12{,}500}{66}$

$\boxed{-189.3939 \text{ hair follicles/month}}$

Estimate the rate of change of each function at the given point.

6. $f(x) = \frac{1}{3x}$ at $x = 4$

$\frac{f(4.001)-f(4)}{4.001-4}$

$\boxed{-0.0208}$

7. $f(x) = 2x^2 + 1$ at $x = -2$

$\frac{f(-1.999)-f(-2)}{-1.999--2}$

$\boxed{-7.998}$

8. $f(x) = 7\sqrt{x}$ at $x = 2$

$$\frac{f(2.001) - f(2)}{2.001 - 2}$$

$\boxed{2.4745}$

9. $f(x) = \ln(2x)$ at $x = 3$

$$\frac{f(3.001) - f(3)}{3.001 - 3}$$

$\boxed{0.333}$

State whether the situation represents a positive or negative rate of change.

10. A candy company uses pints of chocolate to make candy. The more chocolate they use, the more boxes of candy are produced.

positive

11. The amount of money is Josh's savings account decreases for each semester he attends college.

increase

negative

12. As the number of cats Mr. Sullivan owns increases, the number of mice in his barn decreases.

negative

13. As the amount of water Mr. Brust drinks decreases, the fewer trips to the restroom he needs to make.

positive

1.2 Rates of Change

1.2 Test Prep

14. A continuous function f is defined on the closed interval $-5 < x < 6$ and is shown in the graph below. For how many values of b, $-5 < b < 6$, is the average rate of change of f on the interval $[b, 5]$ equal to 0? Give a reason for your answer.

If the average rate of change equals zero, then it would create a horizonal line. (slope of zero).

Since $f(5) = -2$, we must find other occurrences where $f(b) = -2$. This occurs at two values of b. $b = -4$ and $b = 3$.