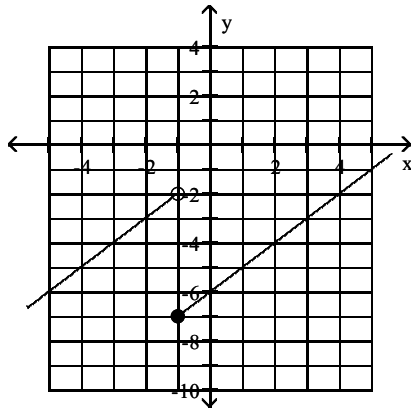
HW 1 Section: _____, Date : _____ Name_____

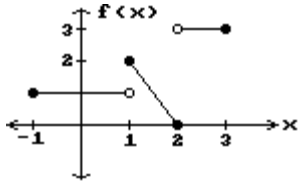
**SHORT ANSWER. Write the word or phrase that best completes each statement or answers the question.**

**Decide whether the limit exists. If it exists, find its value.**

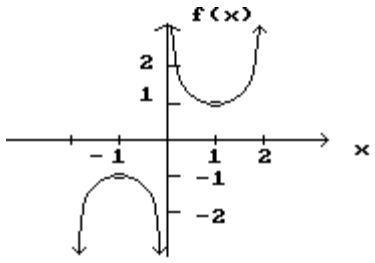
1) Find $\lim_{x \to (-1)^-} f(x)$ and $\lim_{x \to (-1)^+} f(x)$. 1) _____




2) Find $\lim_{x \to 1} f(x)$. 2) _____

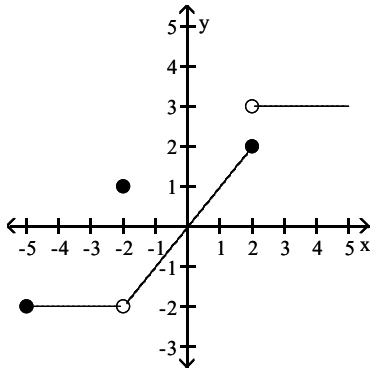



3) Find $\lim_{x \to 1} f(x)$. 3) _____

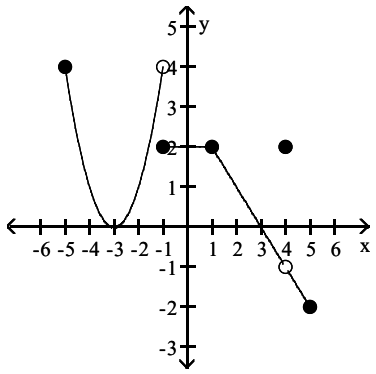


**Use the graph to determine whether each statement is true or false.**

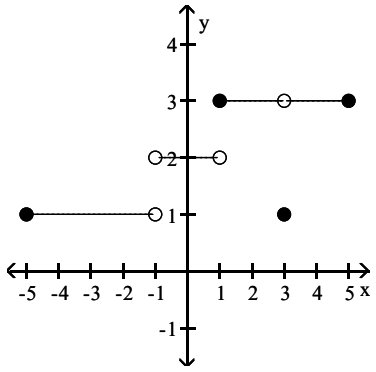
4) $\lim_{x \to -2} f(x)$ exists. 4) _____




5) $\lim_{x \to -1} f(x)$ exists. 5) _____




6) $\lim_{x \to -1^-} f(x) = 1$ 6) _____




**Graph the function and then find the specified limit. When necessary, state that the limit does not exist.**

7) $f(x) = |x - 4|$; $\lim_{x \to 0} f(x)$ 7) _____

8) $f(x) = \frac{1}{x + 3}$; $\lim_{x \to -3} f(x)$ 8) _____

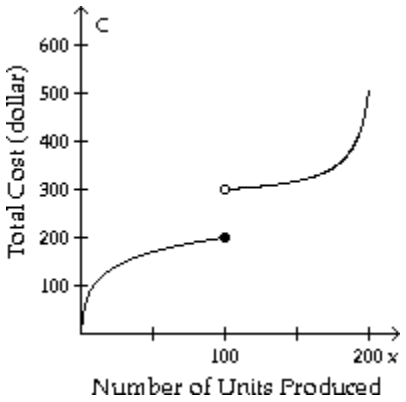
9) $f(x) = \begin{cases} 1 - x, & \text{for } x \le 2, \\ 1 + 3x, & \text{for } x > 2. \end{cases}$; $\lim_{x \to 2^+} f(x)$ 9) _____

10) $y(x) = \begin{cases} 3x + 6, & \text{for } x < 0, \\ 2x^2 - 2, & \text{for } x \ge 0. \end{cases}$; $\lim_{x \to 0} f(x)$ 10) _____

**Solve the problem.**

11) Suppose that the cost, C, of producing x units of a product can be illustrated by the given graph. Find each limit, if it exists: 11) _____

$\lim_{x \to 100^-} p(x)$, $\lim_{x \to 100^+} p(x)$, $\lim_{x \to 100} p(x)$




**Find the limit, if it exists.**

12) $\lim_{x \to -8} \dfrac{x^2 - 64}{x - 8}$ 12) _____

**In the exercise below, the initial substitution of x = a yields the form 0/0. Look for ways to simplify the function algebraically, or use a table and/or graph to determine the limit. When necessary, state that the limit does not exist.**

13) $\lim_{x \to 1} \dfrac{x^2 + 5x - 6}{x^2 - 1}$ 13) _____

**Find a simplified difference quotient for the function.**

14) $f(x) = 6x^2$ 14) _____

15) $f(x) = -3x^2$ 15) _____

16) $f(x) = 3x + 6$ 16) _____

17) $f(x) = x^2 - 5x$ 17) _____

**Complete the table after finding a simplified form of the difference quotient.**

18) For the function $f(x) = -3x + 1$, complete the table below: 18) _____

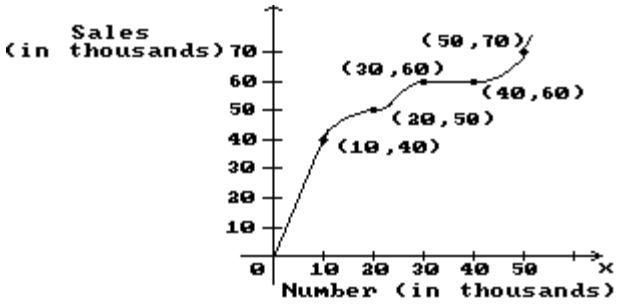
| x | h | $\frac{f(x+h) - f(x)}{h}$ |
|---|---|---|
| 6 | 2 | |
| 6 | 1 | |
| 6 | 0.1 | |
| 6 | 0.01 | |

19) For the function $f(x) = 6x^2$, complete the table below: 19) _____

| x | h | $\frac{f(x+h) - f(x)}{h}$ |
|---|---|---|
| 2 | 2 | |
| 2 | 1 | |
| 2 | 0.1 | |
| 2 | 0.01 | |

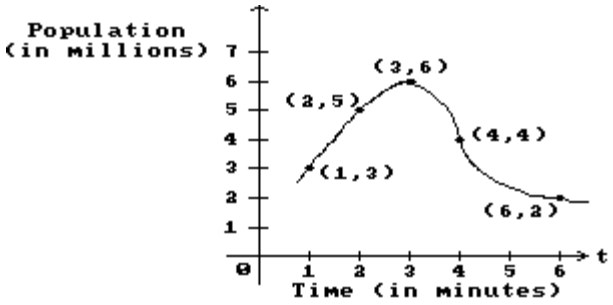
**Solve the problem.**

20) The graph shows the total sales in thousands of dollars from the distribution of x thousand catalogs. Find the average rate of change of sales with respect to the number of catalogs distributed for the change in x. 20) _____




10 to 30

21) The graph shows the population in millions of bacteria t minutes after a bactericide is introduced into a culture. Find the average rate of change of population with respect to time for the time interval. 21) _____




1 to 2

22) The average price of a ticket to a minor league baseball game can be approximated by 22) _____

$p(x) = 0.02x^2 + 0.46x + 6.31$,

where x is the number of years after 1990 and p(x) is in dollars.

(i) Find p(6).

(ii) Find p(13).

(iii) Find p(13) – p(6).

(iv) Find $\frac{p(13) - p(6)}{13 - 6}$, and interpret this result.

23) A car's distance s in miles from its starting point after t hours is given by 23) _____

$$s(t) = 5t^2$$

Find the average rate of change of distance with respect to time (average velocity) as t changes from $t_1 = 4$ to $t_2 = 7$.

**Find the derivative of the function and evaluate the derivative at the given x –value.**

24) $f(x) = 5x + 9$ at $x = 2$ 24) _____

25) $f(x) = 2x^2$ at $x = 1$ 25) _____

26) $f(x) = x^2 + 5x$ at $x = 4$ 26) _____

**Find the derivative.**

27) $y = x^7$ 27) _____

28) $y = 5x^2 - 2.1x$ 28) _____

29) $y = \frac{1}{2}x^8 - \frac{1}{3}x^3$ 29) _____

30) $f(x) = 5x^2 - 7x + 9$ 30) _____

31) $f(x) = 3x^4 + 3x^3 + 9$ 31) _____

32) $y = 11x^{-2} + 7x^3 - 5x$ 32) _____

33) $y = -6\sqrt{x}$ 33) _____

34) $y = \sqrt[9]{x^8}$ 34) _____

35) $y = \frac{3}{x} - \frac{x}{2}$ 35) _____

36) $y = 15x^{-2} - 9x^3 + 14x$ 36) _____

37) $y = -10\sqrt{x}$ 37) _____

38) $y = \sqrt[8]{x^7}$ 38) _____

39) $y = \frac{2}{x} - \frac{x}{3}$ 39) _____

**Evaluate the derivative at the given value of x.**

40) If $f(x) = -4x^2 + 7x - 5$, find $f'(5)$. 40) _____

41) If $y = x^4 + 5x^3 - 2x + 2$, find $\left.\frac{dy}{dx}\right|_{x = -1}$ 41) _____

42) If $y = 4\sqrt{x^3} - 5\sqrt{x}$, find $\left.\frac{dy}{dx}\right|_{x = 16}$ 42) _____

**Find the equation of the line tangent to the graph of the function at the indicated point.**

43) $f(x) = x^2 - 4$ at $(-3, 5)$ 43) _____

44) $f(x) = x^2 + 3$ at $(3, 12)$ 44) _____

45) $f(x) = x^2 - x$ at $(-4, 20)$ 45) _____

46) $f(x) = \frac{36}{x}$ at $(1, 36)$ 46) _____

**For the function, find the interval(s) for which f'(x) is positive.**

47) $f(x) = x^2 - 8x + 9$ 47) _____

48) $f(x) = x^2 + 5x + 8$ 48) _____

49) $f(x) = \frac{1}{3}x^3 - 2x^2 - 5x + 7$ 49) _____

**Find the derivative.**

50) $y = (2x - 5)(4x + 1)$ 50) _____

51) $y = (6x + 4)^2$ 51) _____

**Differentiate.**

52) $f(x) = (4x - 5)(3x + 1)$ 52) _____

53) $f(x) = (2x - 2)(5x^3 - x^2 + 1)$ 53) _____

54) $f(x) = (5x - 3)(\sqrt{x} + 2)$ 54) _____

55) $g(x) = (x^{-5} + 3)(x^{-3} + 5)$ 55) _____

56) $y = \frac{x}{2x - 3}$ 56) _____

57) $y = \frac{2x - 4}{7x^2 + 5}$ 57) _____

58) $y = \frac{x^3}{x - 1}$ 58) _____

59) $y = \frac{7x + 9}{5x - 3}$ 59) _____

**Solve the problem.**

60) A vitamin water maker finds that the revenue, in dollars, from the sale of x bottles of vitamin water is given by $R(x) = 6.5x^{0.8}$. Find the rate at which average revenue is changing when 79 bottles of vitamin water have been produced. Round the answer to four decimal places. 60) _____

**Differentiate.**

61) $f(x) = (4x + 3)^2$ 61) _____

62) $f(x) = (9x - 2)^5$ 62) _____

63) $f(x) = (4x^2 + 9)^5$ 63) _____

64) $f(x) = \sqrt{1 - 10x}$ 64) _____

65) $f(x) = \sqrt[3]{2x^2 - x}$ 65) _____

66) $f(x) = \dfrac{1}{(5x^2 - 7x - 3)^4}$ 66) _____

67) $f(x) = (x^3 - 8)^{2/3}$ 67) _____

68) $f(x) = (2x^2 - 7)^5 - (1 + 4x^3)^5$ 68) _____

**Find $\dfrac{d^2y}{dx^2}$.**

69) $y = 4x + 6$ 69) _____

70) $y = 5x^2 + 9x - 2$ 70) _____

71) $y = 3x^4 - 6x^2 + 5$ 71) _____

72) $y = \sqrt{3x - 7}$ 72) _____

73) $y = (4x + 5)^3$ 73) _____

74) $y = \dfrac{x}{x + 1}$ 74) _____

75) $y = (x^2 + 7x)^{40}$ 75) _____

**Find the indicated derivative of the function.**

76) $\dfrac{d^3y}{dx^3}$ of $y = 2x^3 + 3x^2 - 2x$ 76) _____

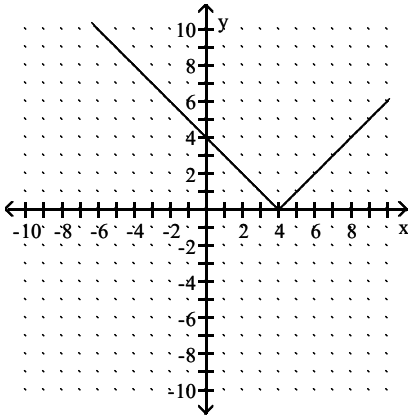
77) $\dfrac{d^4y}{dx^4}$ of $y = 2x^5 - 3x^2 - 5x + 1$ 77) _____

**Solve the problem.**

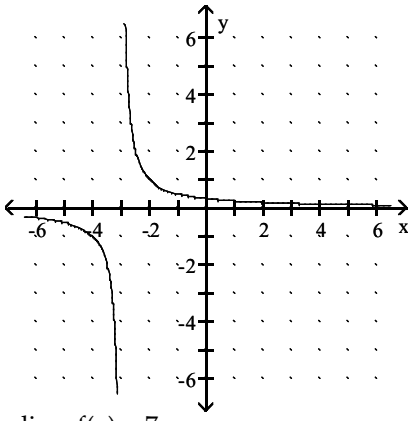
78) If s is a distance given by $s(t) = t^2 + 6t + 20$, find the acceleration, a(t). 78) _____

79) If s is a distance given by $s(t) = 3t^3 + t + 4$, find the acceleration, a(t). 79) _____

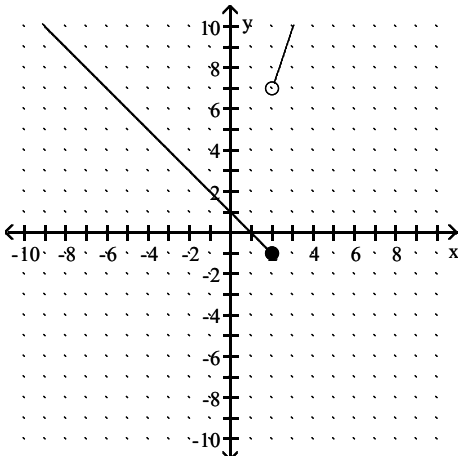
1) –2; –7
2) Does not exist
3) 1
4) True
5) False
6) True
7) $\lim_{x \to 0} f(x) = -4$



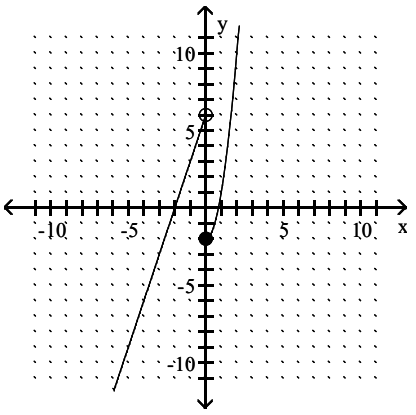

8) $\lim_{x \to -3} f(x)$ does not exist




9) $\lim_{x \to 2^+} f(x) = 7$




10) $\lim_{x \to 0} f(x)$ does not exist




11) 200; 300; does not exist
12) 0
13) $\frac{7}{2}$
14) 12x + 6h
15) –6x – 3h
16) 3
17) 2x + h – 5
18)

| x | h | $\frac{f(x+h)-f(x)}{h}$ |
|---|---|---|
| 6 | 2 | –3 |
| 6 | 1 | –3 |
| 6 | 0.1 | –3 |
| 6 | 0.01 | –3 |

19)

| x | h | $\frac{f(x+h)-f(x)}{h}$ |
|---|---|---|
| 2 | 2 | 36 |
| 2 | 1 | 30 |
| 2 | 0.1 | 24.6 |
| 2 | 0.01 | 24.06 |

20) 1
21) 2
22) (i) \$9.79
(ii) \$15.67
(iii) \$–5.88
(iv) \$–0.84 is the average annual increase in ticket price from the 6th to the 13th year after 1990 (or from 1996 to 2003).
23) 55 miles/hr
24) f'(x) = 5; f'(2) = 5
25) f'(x) = 4x; f'(1) = 4
26) f'(x) = 2x + 5; f'(4) = 13

27) $\frac{dy}{dx} = 7x^6$

28) $\frac{dy}{dx} = 10x - 2.1$

29) $\frac{dy}{dx} = 4x^7 - x^2$

30) $f'(x) = 10x - 7$

31) $f'(x) = 12x^3 + 9x^2$

32) $\frac{dy}{dx} = -22x^{-3} + 21x^2 - 5$

33) $\frac{dy}{dx} = -\frac{3}{\sqrt{x}}$

34) $\frac{dy}{dx} = \frac{8}{9\sqrt[9]{x}}$

35) $\frac{dy}{dx} = -\frac{3}{x^2} - \frac{1}{2}$

36) $\frac{dy}{dx} = -30x^{-3} - 27x^2 + 14$

37) $\frac{dy}{dx} = -\frac{5}{\sqrt{x}}$

38) $\frac{dy}{dx} = \frac{7}{8\sqrt[8]{x}}$

39) $\frac{dy}{dx} = -\frac{2}{x^2} - \frac{1}{3}$

40) –33

41) 9

42) $\frac{187}{8}$

43) $y = -6x - 13$

44) $y = 6x - 6$

45) $y = -9x - 16$

46) $y = -36x + 72$

47) (4, ∞)

48) (–2.5, ∞)

49) (-∞, –1) and (5, ∞)

50) 16x – 18

51) 72x + 48

52) $f'(x) = 24x - 11$

53) $f'(x) = 40x^3 - 36x^2 + 4x + 2$

54) $f'(x) = 7.5x^{1/2} - 1.5x^{-1/2} + 10$

55) $g'(x) = -8x^{-9} - 25x^{-6} - 9x^{-4}$

56) $\frac{dy}{dx} = -\frac{3}{(2x - 3)^2}$

57) $\frac{dy}{dx} = \frac{-14x^2 + 56x + 10}{(7x^2 + 5)^2}$

58) $\frac{dy}{dx} = \frac{2x^3 - 3x^2}{(x - 1)^2}$

59) $\frac{dy}{dx} = -\frac{66}{(5x - 3)^2}$

60) –$0.0069/bottle

61) $f'(x) = 8(4x + 3)$

62) $f'(x) = 45(9x - 2)^4$

63) $f'(x) = 40x(4x^2 + 9)^4$

64) $f'(x) = -\frac{5}{\sqrt{1 - 10x}}$

65) $f'(x) = \frac{4x - 1}{3(2x^2 - x)^{2/3}}$

66) $f'(x) = -\frac{4(10x - 7)}{(5x^2 - 7x - 3)^5}$

67) $f'(x) = \frac{2x^2}{\sqrt[3]{x^3 - 8}}$

68) $f'(x) = 20x(2x^2 - 7)^4 - 60x^2(1 + 4x^3)^4$

69) 0

70) 10

71) $36x^2 - 12$

72) $-\frac{9}{4(3x - 7)^{3/2}}$

73) 384x + 480

74) $-2(x + 1)^{-3}$

75) $40(x^2 + 7x)^{38}(158x^2 + 1106x + 1911)$

76) 12

77) 240x

78) a(t) = 2

79) a(t) = 18t