

**MULTIPLE CHOICE.** Choose the one alternative that best completes the statement or answers the question.

**Provide an appropriate response.**

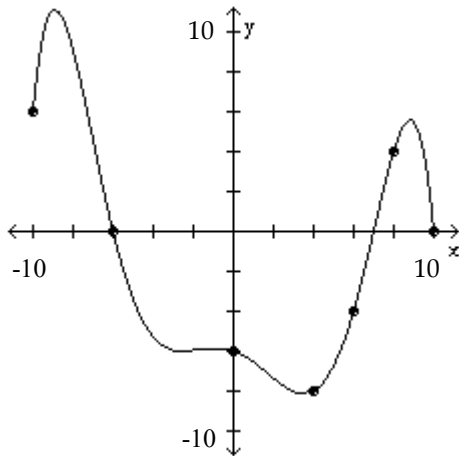
1) Given that  $f(x) = \frac{x}{7-x}$ , find  $f\left(-\frac{4}{5}\right)$ . Express the answer as a simplified fraction.

- A)  $\frac{39}{4}$
- B)  $\frac{4}{39}$
- C)  $-\frac{4}{39}$
- D)  $-\frac{39}{4}$

Answer: C

**The graph of a function  $f$  is given. Use the graph to answer the question.**

2) Use the graph of  $f$  given below to find  $f(-10)$ .

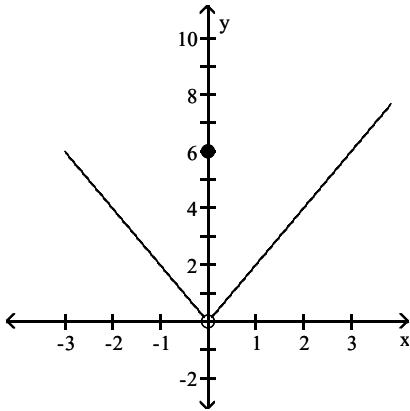


- A) -10
- B) 0
- C) 6
- D) 16

Answer: C

Use the graph to evaluate the indicated limit and function value or state that it does not exist.

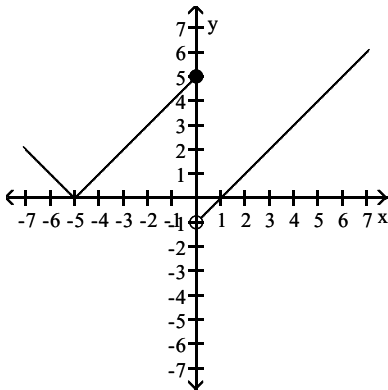
3) Find  $\lim_{x \rightarrow 0} f(x)$  and  $f(0)$ .



- A) 0; 6
- B) 0; does not exist
- C) Does not exist; 6
- D) 6; 0

Answer: A

4) Find  $\lim_{x \rightarrow 0^-} f(x)$  and  $\lim_{x \rightarrow 0^+} f(x)$ .



- A) 5; -1
- B) -1; 5
- C) Does not exist; does not exist
- D) 5; Does not exist

Answer: A

Find the limit, if it exists.

5) Find:  $\lim_{x \rightarrow -1} \frac{6x + 5}{5x - 6}$

- A) 1
- B)  $\frac{1}{11}$
- C) -11
- D)  $-\frac{1}{11}$

Answer: B

6) Given  $\lim_{x \rightarrow 4} f(x) = -2$  and  $\lim_{x \rightarrow 4} g(x) = 5$ , find  $\lim_{x \rightarrow 4} \frac{[g(x) - f(x)]}{-4 f(x)}$ .

A)  $-\frac{3}{8}$

B)  $\frac{7}{8}$

C)  $-\frac{7}{8}$

D)  $\frac{3}{8}$

Answer: B

7) Find:  $\lim_{x \rightarrow -4} \frac{x^2 - 16}{x + 4}$

A) 16

B) 8

C) -8

D) -24

Answer: C

8) Find:  $\lim_{x \rightarrow 5} \frac{x - 5}{|x - 5|}$

A) -1

B) 1

C) 0

D) Does not exist

Answer: D

9) Find:  $\lim_{x \rightarrow 3} \left( \frac{x^2 - 9}{x - 3} + \sqrt{x^2 + 7} \right)$

A) 10

B) 3

C) 2

D) Does not exist

Answer: A

10) Find:  $\lim_{x \rightarrow 3} \frac{x - 3}{x^2 - 3x}$

A)  $\frac{1}{3}$

B)  $-\frac{1}{3}$

C) 0

D) Does not exist

Answer: D

11) Given  $\lim_{x \rightarrow 5} f(x) = 4$  and  $\lim_{x \rightarrow 5} g(x) = -5$ , find  $\lim_{x \rightarrow 5} \frac{2f(x) + 3g(x)}{3f(x)}$ .

A)  $-\frac{7}{12}$

B)  $\frac{7}{12}$

C)  $-\frac{7}{15}$

D)  $\frac{7}{15}$

Answer: A

12) Evaluate the following limit

$$\lim_{x \rightarrow 2^-} \frac{1}{x-2}$$

A)  $\infty$

B) 2

C)  $-\infty$

D) Does not exist

Answer: D

13) Let  $f(x) = \frac{x^2 - 3x - 10}{x + 2}$ . Find  $\lim_{x \rightarrow -2} f(x)$ .

A) -2

B) 5

C) -7

D) Does not exist

Answer: C

$$14) \text{ Let } f(x) = \begin{cases} \frac{x^2 - 16}{x + 4} & \text{if } x > 0 \\ \frac{x^2 - 16}{x - 4} & \text{if } x < 0 \end{cases}$$

Find  $\lim_{x \rightarrow 0^-} f(x)$ .

A) -4

B)  $\infty$

C) 4

D) Does not exist

Answer: C

$$15) \text{ Let } f(x) = \begin{cases} \frac{x^2 - 16}{x + 4} & \text{if } x > 0 \\ \frac{x^2 - 16}{x - 4} & \text{if } x < 0 \end{cases}$$

Find  $\lim_{x \rightarrow 0^+} f(x)$

- A) 0
- B) -4
- C) 4
- D) Does not exist

Answer: B

$$16) \text{ Let } f(x) = \begin{cases} \frac{x^2 - 16}{x + 4} & \text{if } x > 0 \\ \frac{x^2 - 16}{x - 4} & \text{if } x < 0 \end{cases}$$

Find  $\lim_{x \rightarrow 0} f(x)$ .

- A)  $-\infty$
- B) -4
- C) 0
- D) Does not exist

Answer: D

17) Evaluate the following limit.

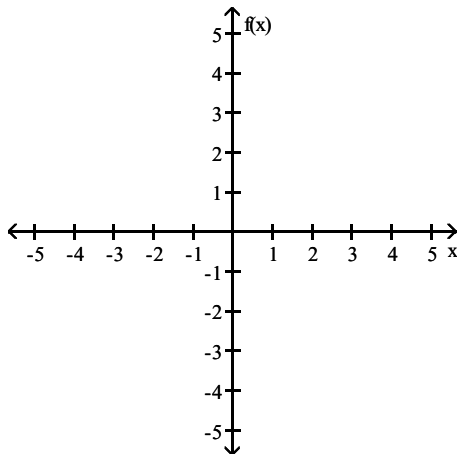
$$\lim_{x \rightarrow 2^+} \frac{1}{x - 2}$$

- A) 2
- B)  $-\infty$
- C)  $\infty$
- D) Does not exist

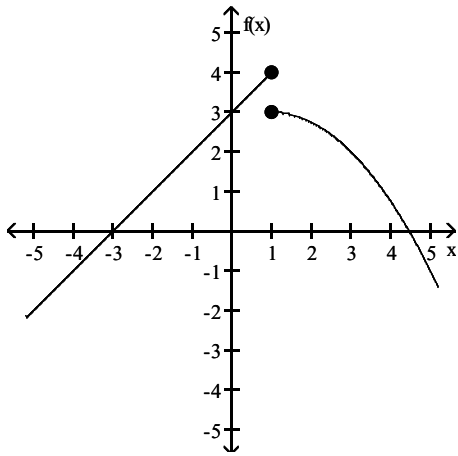
Answer: D

**Sketch a possible graph of a function that satisfies the given conditions.**

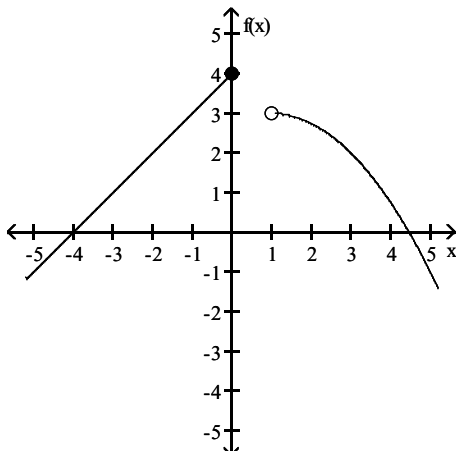
18)  $f(1) = 4$ ;  $\lim_{x \rightarrow 1^-} f(x) = 4$ ;  $\lim_{x \rightarrow 1^+} f(x) = 3$



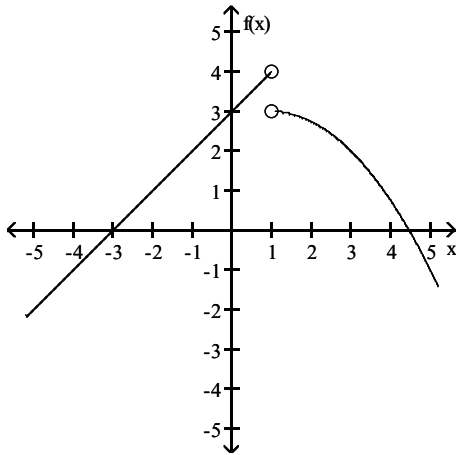
A)



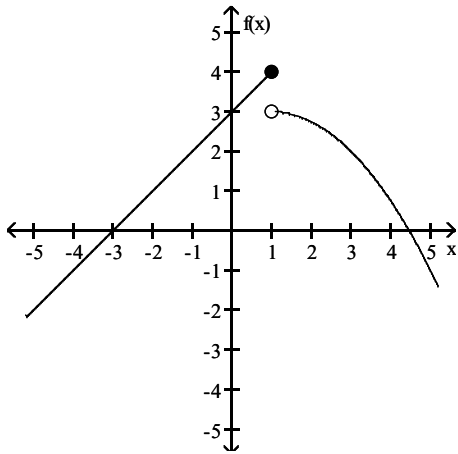
B)



C)

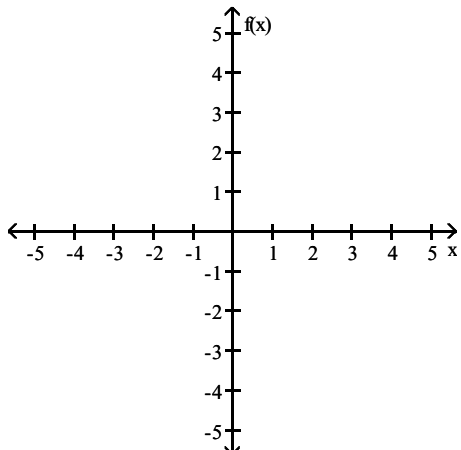


D)

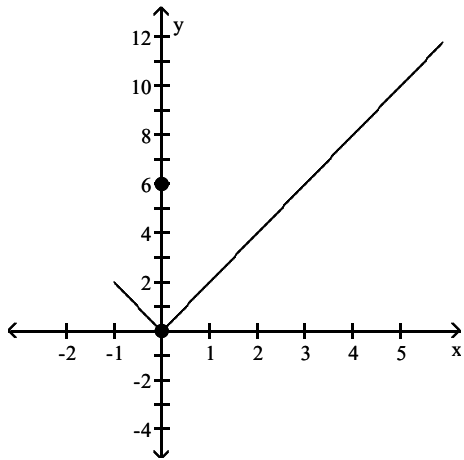


Answer: D

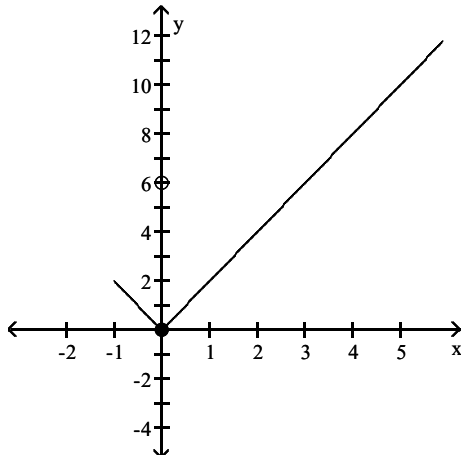
19)  $f(0) = 6$ ;  $\lim_{x \rightarrow 0^-} f(x) = 0$ ;  $\lim_{x \rightarrow 0^+} f(x) = 0$



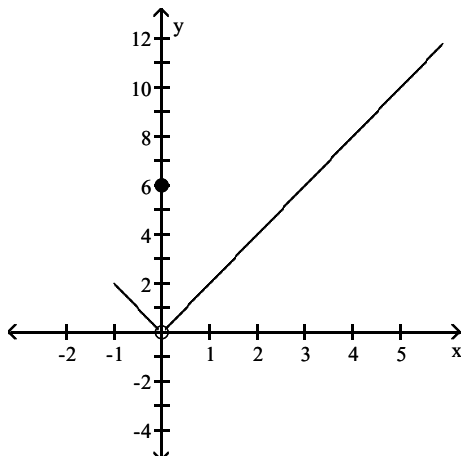
A)



B)

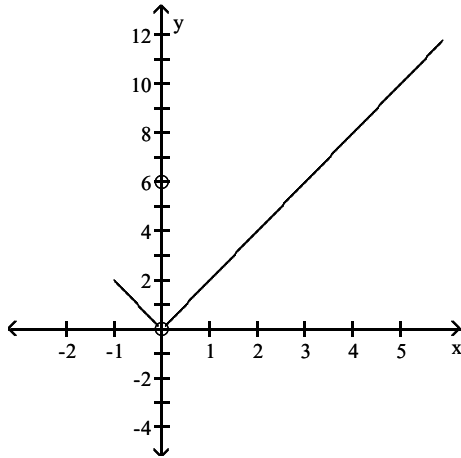


C)





D)



Answer: C

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

20) Find:  $\lim_{h \rightarrow 0} \frac{f(7+h) - f(7)}{h}$  for  $f(x) = -x + 1$ .

- A) 1
- B) -1
- C) 0
- D) Does not exist

Answer: B

**Solve the problem.**

21) A company training program determines that, on average, a new employee can do  $P(x)$  pieces of work per day after  $s$  days of on-the-job training, where  $P(x) = \frac{90 + 60x}{x + 5}$ . Find  $\lim_{x \rightarrow 5} P(x)$ .

- A) 105
- B) 30
- C) 42
- D) Does not exist

Answer: B

22) The cost of manufacturing a particular videotape is  $C(x) = 9000 + 9x$ , where  $x$  is the number of tapes produced.

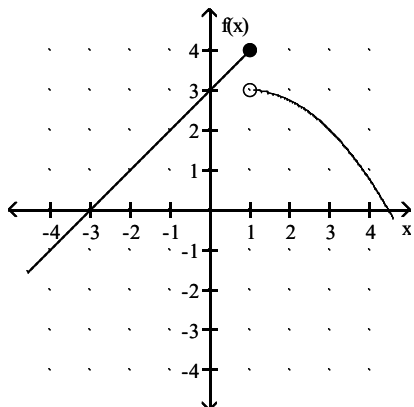
The average cost per tape, denoted by  $\bar{C}(x)$ , is found by dividing  $C(x)$  by  $x$ . Find  $\lim_{x \rightarrow 9000} \bar{C}(x)$ .

- A) 10
- B) 14
- C) 6
- D) Does not exist

Answer: A

Use the given graph to find the indicated limit.

23)

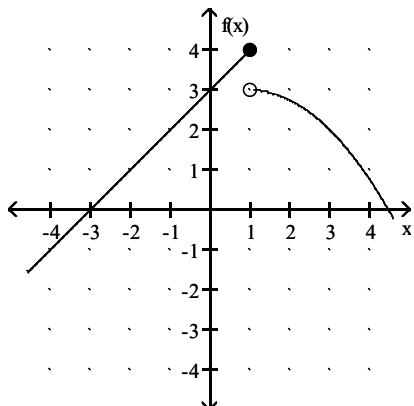


Find  $\lim_{x \rightarrow \infty} f(x)$ .

- A)  $\infty$
- B) 4
- C)  $-\infty$
- D) 3

Answer: C

24)

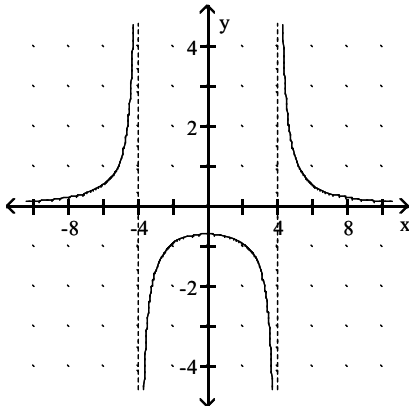


Find  $\lim_{x \rightarrow -\infty} f(x)$ .

- A)  $\infty$
- B)  $-\infty$
- C) 4
- D) 3

Answer: B

25)

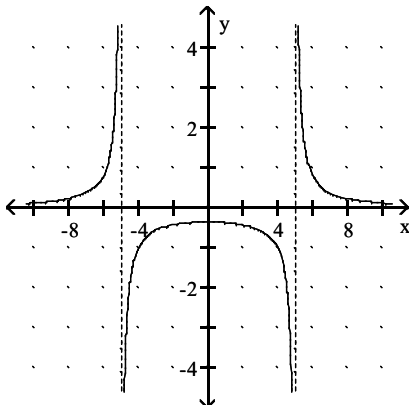


$$\lim_{x \rightarrow 4^+} f(x)$$

- A)  $\infty$
- B)  $-\infty$
- C) 4
- D) 0

Answer: A

26)



$$\lim_{x \rightarrow 5^-} f(x)$$

- A) 5
- B)  $\infty$
- C)  $-\infty$
- D) 0

Answer: C

**Find the limit.**

27) Determine the limit.

$$\lim_{x \rightarrow -10^-} f(x), \text{ where } f(x) = \frac{1}{x + 10}$$

- A)  $-\infty$
- B) 0
- C) -1
- D)  $\infty$

Answer: A

28) Determine the limit.

$$\lim_{x \rightarrow 5^+} f(x), \text{ where } f(x) = \frac{x^2}{(x - 5)^3}$$

- A) -2
- B)  $-\infty$
- C) 5
- D)  $\infty$

Answer: D

**Provide an appropriate response.**

29) If the limit at infinity exists, find the limit.

$$\lim_{x \rightarrow \infty} \frac{5x^2 + 7x - 9}{-6x^2 + 2}$$

- A)  $-\frac{5}{6}$
- B)  $-\frac{2}{9}$
- C)  $\infty$
- D) 0

Answer: A

30) If the limit at infinity exists, find the limit.

$$\lim_{x \rightarrow \infty} \frac{3x^3 + 5x}{4x^4 + 10x^3 + 2}$$

- A) 0
- B)  $\frac{3}{4}$
- C)  $\infty$
- D) 1

Answer: A

Use  $-\infty$  or  $\infty$  where appropriate to describe the behavior at each zero of the denominator and identify all vertical asymptotes.

$$31) g(x) = \frac{x}{6-x}$$

- A)  $\lim_{x \rightarrow 6^-} f(x) = -\infty$ ;  $\lim_{x \rightarrow 6^+} f(x) = \infty$ ;  $x = 6$  is a vertical asymptote
- B)  $\lim_{x \rightarrow 6^-} f(x) = -\infty$ ;  $\lim_{x \rightarrow 6^+} f(x) = -\infty$ ;  $x = 6$  is a vertical asymptote
- C)  $\lim_{x \rightarrow 6^-} f(x) = \infty$ ;  $\lim_{x \rightarrow 6^+} f(x) = -\infty$ ;  $x = 6$  is a vertical asymptote
- D)  $\lim_{x \rightarrow 6^-} f(x) = \infty$ ;  $\lim_{x \rightarrow 6^+} f(x) = -\infty$ ;  $x = 0$  is a vertical asymptote

Answer: C

$$32) f(x) = \frac{x^2 - 16}{x^2 + 16}$$

- A)  $\lim_{x \rightarrow 4^-} f(x) = \infty$ ;  $\lim_{x \rightarrow 4^+} f(x) = -\infty$ ;  $x = 4$  is a vertical asymptote
- B) No zeros of denominator; no vertical asymptotes
- C)  $\lim_{x \rightarrow -4^-} f(x) = \infty$ ;  $\lim_{x \rightarrow -4^+} f(x) = -\infty$ ;  $x = -4$  is a vertical asymptote
- D)  $\lim_{x \rightarrow 4^-} f(x) = \infty$ ;  $\lim_{x \rightarrow 4^+} f(x) = \infty$ ;  $x = 0$  is a vertical asymptote

Answer: B

**Describe the end behavior of the function.**

$$33) f(x) = 5x^4 + 5x + 11$$

- A)  $\lim_{x \rightarrow \infty} f(x) = -\infty$ ;  $\lim_{x \rightarrow -\infty} f(x) = \infty$
- B)  $\lim_{x \rightarrow \infty} f(x) = -\infty$ ;  $\lim_{x \rightarrow -\infty} f(x) = -\infty$
- C)  $\lim_{x \rightarrow \infty} f(x) = \infty$ ;  $\lim_{x \rightarrow -\infty} f(x) = -\infty$
- D)  $\lim_{x \rightarrow \infty} f(x) = \infty$ ;  $\lim_{x \rightarrow -\infty} f(x) = \infty$

Answer: D

**Provide an appropriate response.**

34) Find the vertical asymptote(s) of the graph of the given function.

$$f(x) = \frac{3x - 9}{5x + 30}$$

- A)  $x = -6$
- B)  $y = -3$
- C)  $x = -8$
- D)  $y = 8$

Answer: A

35) Find the vertical asymptote(s) of the graph of the given function.

$$f(x) = \frac{x^2 - 100}{(x - 9)(x + 3)}$$

- A)  $x = 10, x = -10$
- B)  $x = 9, x = -3$
- C)  $y = 9, y = -3$
- D)  $x = -9$

Answer: B

36) Find the horizontal asymptote, if any, of the given function.

$$f(x) = \frac{(x - 3)(x + 4)}{x^2 - 4}$$

- A)  $y = 1$
- B)  $x = 2, x = -2$
- C)  $y = 3, y = -4$
- D) None

Answer: A

37) Find the horizontal asymptote, if any, of the given function.

$$f(x) = \frac{2x^3 - 3x - 9}{9x^3 - 5x + 3}$$

- A)  $y = \frac{3}{5}$
- B)  $y = \frac{2}{9}$
- C)  $y = 0$
- D) None

Answer: B

**Solve the problem.**

38) Suppose that the value  $V$  of a certain product decreases, or depreciates, with time  $t$ , in months, where

$$V(t) = 37 - \frac{16t^2}{(t + 2)^2}.$$

Find  $\lim_{t \rightarrow \infty} V(t)$ .

- A) 16
- B) 21
- C) 37
- D) 33

Answer: B

39) Suppose that the value  $V$  of a certain product decreases, or depreciates, with time  $t$ , in months, where

$$V(t) = 100 - \frac{40t^2}{(t+2)^2}.$$

Find  $\lim_{t \rightarrow \infty} V(t)$ .

- A) 80
- B) 40
- C) 100
- D) 60

Answer: D

40) Suppose that the cost  $C$  of removing  $p\%$  of the pollutants from a chemical dumping site is given by

$$C(p) = \frac{\$40,000}{100 - p}.$$

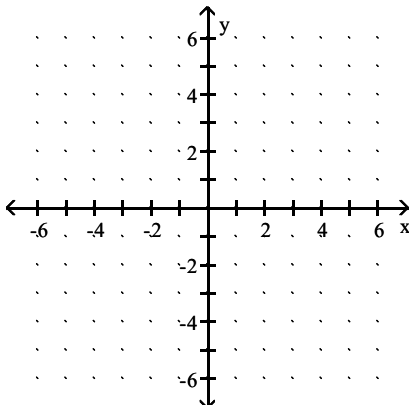
Can a company afford to remove 100% of the pollutants? Explain.

- A) Yes, the cost of removing  $p\%$  of the pollutants is \$40,000, which is certainly affordable.
- B) No, the cost of removing  $p\%$  of the pollutants is \$400, which is a prohibitive amount of money.
- C) Yes, the cost of removing  $p\%$  of the pollutants is \$400, which is certainly affordable.
- D) No, the cost of removing  $p\%$  of the pollutants increases without bound as  $p$  approaches 100.

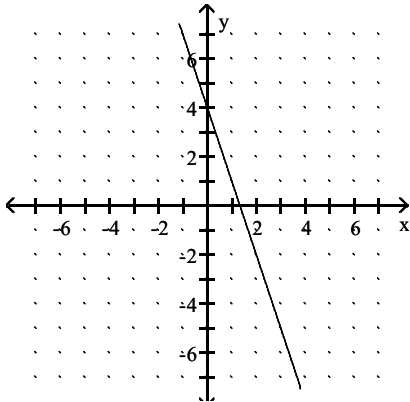
Answer: D

**Sketch a possible graph of a function that satisfies the given conditions.**

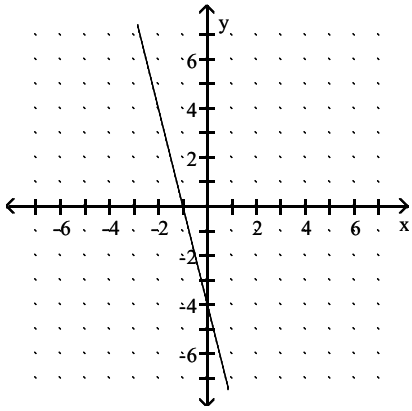
41)  $f(0) = 4$  and  $\lim_{x \rightarrow 0} f(x) = 4$



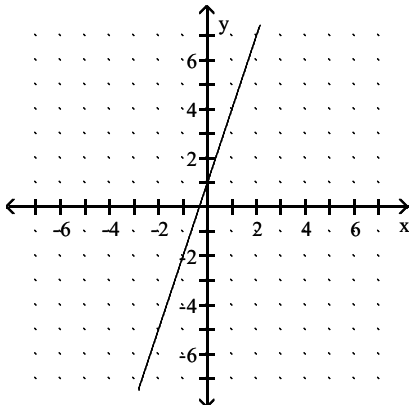
A)



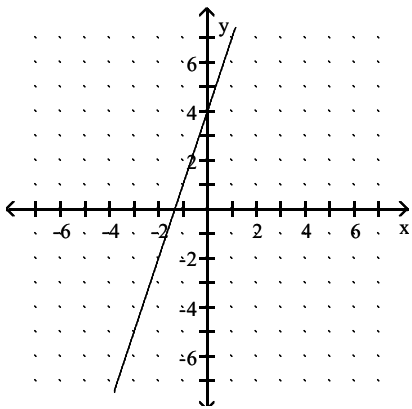
B)



C)



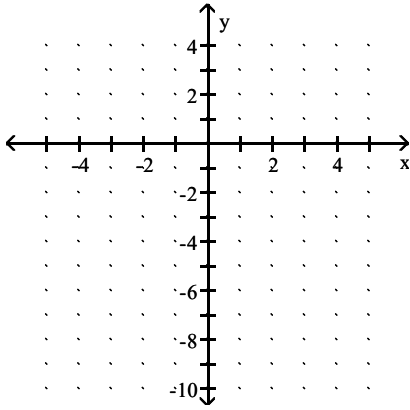
D)



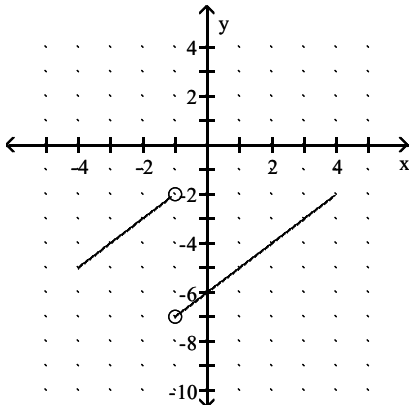
Answer: A



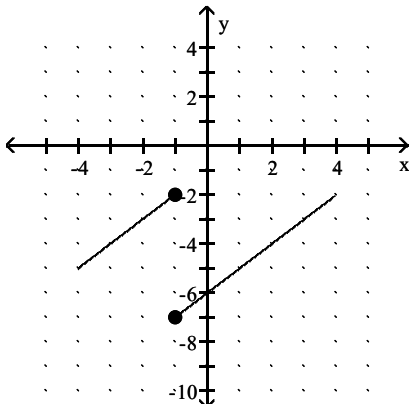
42)  $f(-1) = -7$ ;  $\lim_{x \rightarrow (-1)^-} f(x) = -2$ ;  $\lim_{x \rightarrow (-1)^+} f(x) = -7$



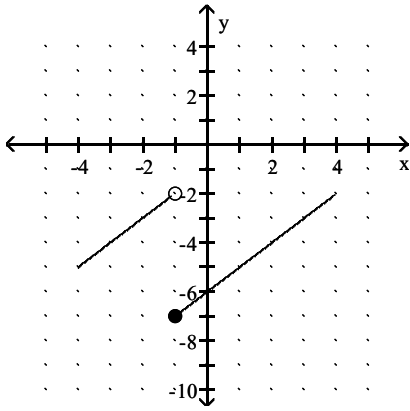
A)



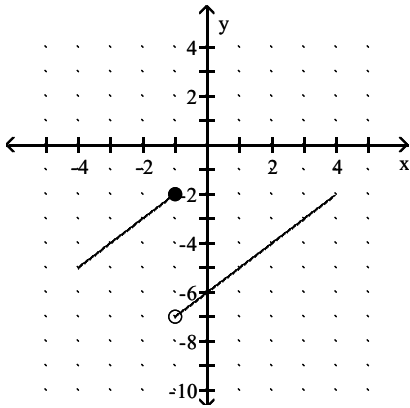
B)



C)



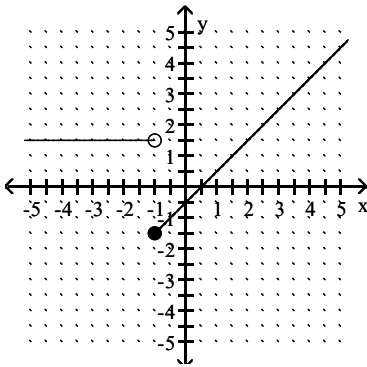
D)



Answer: C

The graph of  $y = f(x)$  is shown. Use the graph to answer the question.

43) Is  $f$  continuous at  $x = -1.5$ ?

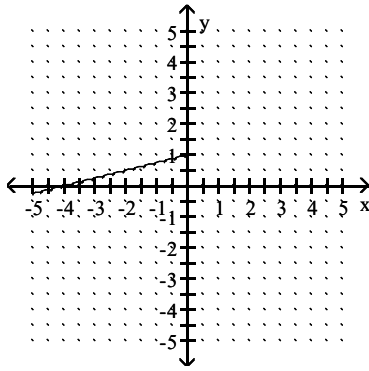


A) No

B) Yes

Answer: B

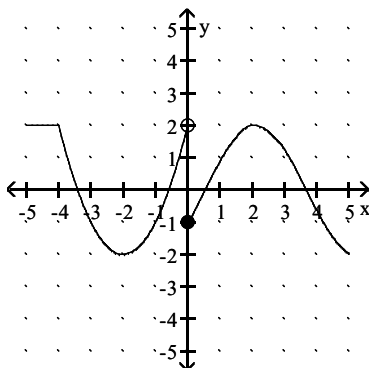
44) Is  $f$  continuous at  $x = 0$ ?



- A) No
- B) Yes

Answer: B

45) Is  $f$  continuous at  $x = 0$ ?



- A) No
- B) Yes

Answer: A

**Provide an appropriate response.**

46) Determine where the function  $H(x) = \frac{x^2 + 7}{x^2 + x - 6}$  is continuous.

- A)  $(-\infty, -3) \cup (-3, 2) \cup (2, \infty)$
- B)  $(-3, 2) \cup (2, \infty)$
- C)  $(-\infty, -3)$
- D)  $(-\infty, -3) \cup (-3, 2)$

Answer: A

47) Determine where the function  $f(x) = \frac{5x}{2x - 3}$  is continuous.

- A)  $\left(\frac{3}{2}, \infty\right)$
- B)  $(-\infty, \infty)$
- C)  $\left(-\infty, \frac{3}{2}\right)$
- D)  $\left(-\infty, \frac{3}{2}\right) \cup \left(\frac{3}{2}, \infty\right)$

Answer: D

48) Determine the points at which the function is discontinuous.

$$h(x) = \begin{cases} x^2 - 4 & \text{for } x < -1 \\ 0 & \text{for } -1 \leq x \leq 1 \\ x^2 + 4 & \text{for } x > 1 \end{cases}$$

- A) 1
- B) -1, 1
- C) -1, 0, 1
- D) None

Answer: B

49) Use a graphing utility to approximate the partition numbers of the function to four decimal places:

$$f(x) = x^4 - 8x^2 - 4x + 1.$$

- A)  $(-\infty, -2.4976)$
- B)  $(-\infty, -2.4976) \cup (0.1832, 3.0347)$
- C)  $(-\infty, -2.4976) \cup (-2.4976, -0.7203)$
- D)  $(-\infty, -2.4976) \cup (-2.4976, -0.7203) \cup (-0.7203, 0.1832) \cup (0.1832, 3.0347)$

Answer: D

50) Use a graphing utility to find the discontinuities of the given rational function.

$$g(x) = \frac{x + 1}{x^3 + 2x^2 + 10x - 13}$$

- A) 3
- B) 1
- C) -1
- D) Continuous at all values of x

Answer: B

51) Use a graphing utility to find the discontinuities of the given rational function.

$$g(x) = \frac{x + 1}{x^3 + 2x^2 + 10x - 13}$$

- A) 3
- B) -1
- C) 1
- D) Continuous at all values of x

Answer: C

52) Use a graphing utility to find the discontinuities of the given rational function.

$$f(x) = \frac{x^2 + 2x + 1}{x^3 + 2x^2 + 5x - 8}$$

- A) 3
- B) -1
- C) 1
- D) Continuous at all values of x

Answer: C

53) Solve the inequality and express the answer in interval notation:  $\frac{x^2 - 4x}{x + 5} > 0$ .

- A) (-5, 0)
- B) (-5, 0)  $\cup$  (4,  $\infty$ )
- C) (-5,  $\infty$ )
- D) (4,  $\infty$ )

Answer: B

54) Use a sign chart to solve the inequality. Express answers in interval notation.

$$x^2 > 16$$

- A) (-4, 4)
- B) (-4,  $\infty$ )
- C) (4,  $\infty$ )
- D)  $(-\infty, -4) \cup (4, \infty)$

Answer: D

55) Use a sign chart to solve the inequality. Express answers in interval notation.

$$x^2 + 6 < 2x$$

- A) {2}
- B)  $\emptyset$
- C) (2,  $\infty$ )
- D)  $(-\infty, -2)$

Answer: B

56) Use a sign chart to solve the inequality. Express answers in interval notation.

$$\frac{-5}{-3x - 4} > 0$$

- A)  $\left(-\frac{4}{3}, \infty\right)$
- B) (0,  $\infty$ )
- C)  $\left(-\infty, -\frac{3}{4}\right)$
- D)  $\left(-\infty, \frac{4}{3}\right)$

Answer: A

**Solve the problem.**

57) The cost of renting a snowblower is \$20 for the first hour (or any fraction thereof) and \$5 for each additional hour (or fraction thereof) up to a maximum rental time of 5 hours. Write a piecewise definition of the cost  $C(x)$  of renting a snowblower for  $x$  hours. Is  $C(x)$  continuous at  $x = 2.5$ ?

$$\text{A) } C(x) = \begin{cases} 20 & \text{if } 0 \leq x \leq 1 \\ 25 & \text{if } 1 < x \leq 2 \\ 30 & \text{if } 2 < x \leq 3; \text{ No} \\ 35 & \text{if } 3 < x \leq 4 \\ 40 & \text{if } 4 < x \leq 5 \end{cases}$$

$$\text{B) } C(x) = \begin{cases} 20 & \text{if } 0 < x \leq 1 \\ 25 & \text{if } 1 < x \leq 2 \\ 30 & \text{if } 2 < x \leq 3; \text{ Yes} \\ 35 & \text{if } 3 < x \leq 4 \\ 40 & \text{if } 4 < x \leq 5 \end{cases}$$

$$\text{C) } C(x) = \begin{cases} 20 & \text{if } 0 < x \leq 1 \\ 25 & \text{if } 1 < x \leq 2 \\ 30 & \text{if } 2 < x \leq 3; \text{ No} \\ 35 & \text{if } 3 < x \leq 4 \\ 40 & \text{if } 4 < x \leq 5 \end{cases}$$

$$\text{D) } C(x) = \begin{cases} 25 & \text{if } 0 < x \leq 1 \\ 30 & \text{if } 1 < x \leq 2 \\ 35 & \text{if } 2 < x \leq 3; \text{ No} \\ 40 & \text{if } 3 < x \leq 4 \\ 45 & \text{if } 4 < x \leq 5 \end{cases}$$

Answer: B

**Find average rate of change for the function over the given interval.**

58)  $y = x^2 + 6x$  between  $x = 5$  and  $x = 9$

A)  $\frac{135}{4}$

B)  $\frac{80}{9}$

C) 15

D) 20

Answer: D

59)  $y = 7x^3 + 7x^2 + 3$  between  $x = -6$  and  $x = -1$

A) 252

B)  $\frac{3}{5}$

C) - 3

D) - 1260

Answer: A

60) Find the average rate of change for  $f(x) = \sqrt{2x}$  if  $x$  changes from 2 to 8.

A) 7

B) 2

C)  $\frac{1}{3}$

D)  $-\frac{3}{10}$

Answer: C

61) Find the average rate of change of  $y$  with respect to  $x$  if  $x$  changes from 3 to 5 in the function  $y = x^2 + 3x$ .

A) 9

B) 11

C) 4

D) 22

Answer: B

**Find the instantaneous rate of change for the function at the value given.**

62) Find the instantaneous rate of change for the function  $x^2 + 4x$  at  $x = 6$ .

A) 16

B) 10

C) 12

D) 60

Answer: A

63) Find the instantaneous rate of change for the function  $f(x) = 5x^2 + x$  at  $x = -4$ .

A) -14

B) -39

C) -41

D) 6

Answer: B

**Provide an appropriate response.**

64) Use the four step process to find  $f'(x)$  for the function  $f(x) = 5x^2 - 3x$ .

A)  $10x - 3$

B)  $5h - 3$

C)  $5h^2 - 3h$

D)  $10x + 5h - 3$

Answer: D

65) Use the four step process to find  $f'(x)$  for the function  $f(x) = \frac{2}{x^2}$ .

A)  $\frac{(h + 2x)}{x^2(x + h)^2}$

B)  $\frac{2(h + x)}{x^2(x + h)^2}$

C)  $-\frac{2(h + 2x)}{x^2(x + h)^2}$

D)  $-\frac{2(h + 2x + xh)}{x^2(x + h)^2}$

Answer: C

66) Use the four step process to find  $f'(x)$  for the function  $f(x) = \frac{x}{6 - x}$ .

A)  $\frac{6}{(x - 6)(x + h - 6)}$

B)  $-\frac{x}{(x - 6)(x + h - 6)}$

C)  $\frac{1}{(x - 6)(x + h - 6)}$

D)  $-\frac{6}{h(x - 6)(x + h - 6)}$

Answer: A

Use the definition  $f'(x) = \lim_{h \rightarrow 0} \frac{f(x + h) - f(x)}{h}$  to find the derivative at  $x$ .

67)  $f(x) = 9x - 16$

A) -9

B) 9

C)  $9x$

D) -7

Answer: B

68)  $f(x) = 10 - 14x^2$

A)  $-28x^2$

B)  $-28x$

C)  $10 - 28x$

D)  $10 - 14x$

Answer: B

69)  $f(x) = 4x + 9x^3$

A)  $4x + 27x^2$

B)  $4x + 27x^3$

C)  $4 + 27x^2$

D)  $4 + 9x^2$

Answer: C



**Provide an appropriate response.**

70) Find the slope of the secant line joining  $(2, f(2))$  and  $(3, f(3))$  for  $f(x) = -3x^2 - 8$ .

- A) -55
- B) 55
- C) 15
- D) -15

Answer: D

71) Find the slope of the graph  $f(x) = -x^2 + 3x$  at the point  $(1, 2)$ .

- A) 1
- B) -1
- C) 2
- D) -2

Answer: A

72) Find the slope of the line tangent to the graph of the function at the given value of  $x$ .

$$y = x^4 + 2x^3 + 2x + 2 \text{ at } x = -3$$

- A) -52
- B) 65
- C) 67
- D) -50

Answer: A

73) Given  $f(x + h) - f(x) = 4xh + 4h + 2h^2$ , find the slope of the tangent line at  $x = 4$ .

- A) 20
- B) 22
- C) 8
- D) 16

Answer: A

**Find the equation of the tangent line to the curve when  $x$  has the given value.**

74)  $f(x) = -4 - x^2$ ;  $x = 4$

- A)  $y = -2x$
- B)  $y = 8x - 12$
- C)  $y = -8x + 12$
- D)  $y = 4x + 12$

Answer: C

75) Find the equation of the tangent line to the graph of the function at the given value of  $x$ .

$$f(x) = x^2 + 5x \text{ at } x = 4$$

- A)  $y = 13x - 16$
- B)  $y = -\frac{4}{25}x + \frac{8}{5}$
- C)  $y = \frac{1}{20}x + \frac{1}{5}$
- D)  $y = -39x - 80$

Answer: A

**Solve the problem.**

76) Suppose an object moves along the y-axis so that its location is  $y = f(x) = x^2 + x$  at time  $x$  ( $y$  is in meters and  $x$  is in seconds). Find the average velocity (the average rate of change of  $y$  with respect to  $x$ ) for  $x$  changing from 2 to 9 seconds.

- A) 84 m/s
- B) 15 m/s
- C) 3 m/s
- D) 12 m/s

Answer: D

77) Suppose an object moves along the y-axis so that its location is  $y = f(x) = x^2 + x$  at time  $x$  ( $y$  is in meters and  $x$  is in seconds). Find the average velocity for  $x$  changing from 3 to  $3 + h$  seconds.

- A)  $12 - h$  m/s
- B)  $12 + h$  m/s
- C)  $7 - h$  m/s
- D)  $7 + h$  m/s

Answer: D

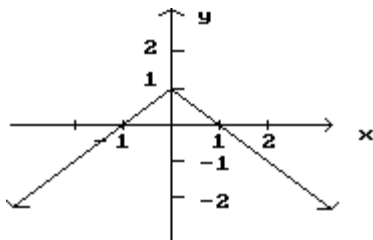
78) Suppose an object moves along the y-axis so that its location is  $y = f(x) = x^2 + x$  at time  $x$  ( $y$  is in meters and  $x$  is in seconds). Find the instantaneous velocity at  $x = 4$  seconds.

- A) 8 m/s
- B) 10 m/s
- C) 9 m/s
- D) 20 m/s

Answer: C

**List the x-values in the graph at which the function is not differentiable.**

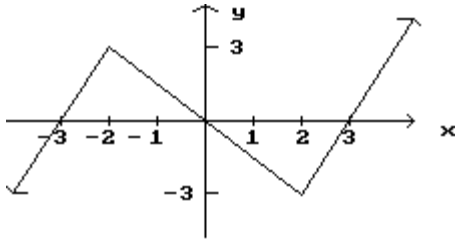
79)



- A)  $x = 1$
- B)  $x = -1$
- C)  $x = 0$
- D)  $x = 2$

Answer: C

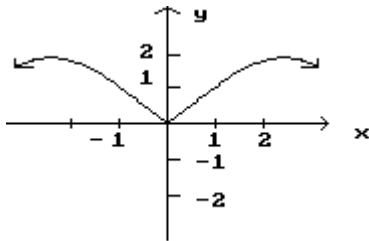
80)



- A)  $x = -2, x = 0, x = 2$
- B)  $x = -3, x = 3$
- C)  $x = -2, x = 2$
- D)  $x = -3, x = 0, x = 3$

Answer: C

81)



- A)  $x = -2, x = 0, x = 2$
- B)  $x = 2$
- C)  $x = 0$
- D)  $x = -2, x = 2$

Answer: C

**Solve the problem.**

82) If an object moves along a line so that it is at  $y = f(x) = 2x^2 - 7x - 6$  at time  $x$  (in seconds), find the instantaneous velocity function  $v = f'(x)$ .

- A)  $2x^2 - 7$
- B)  $4x^2 - 7$
- C)  $4x - 7$
- D)  $2x - 7$

Answer: C

83) If an object moves along a line so that it is at  $y = f(x) = 8x^2$  at time  $x$  (in seconds), find the velocity at  $x = 1$  ( $y$  is measured in feet).

- A) 8 ft / s
- B) 160 ft/s
- C) 6 ft/sec
- D) 16 ft / s

Answer: D

84) The electric power  $p$  (in W) as a function of the current  $i$  (in A) in a certain circuit is given by  $p(i) = 10i^2 + 63i$ .

Find the instantaneous rate of change of  $p$  with respect to  $i$  for  $i = 0.9$  A.

- A) 72 W/A
- B) 81 W/A
- C) 74.7 W/A
- D) 64.8 W/A

Answer: B

**Provide an appropriate response.**

85) Find  $f'(x)$  if  $f(x) = \pi$ .

- A)  $f'(x) = \pi$
- B)  $f'(x) = 0$
- C)  $f'(x) = 1$
- D)  $f'(x) = \pi^2$

Answer: B

86) Find  $y'$  if  $y = \frac{5}{8}$ .

- A) 1
- B)  $\frac{5}{8}x$
- C) 0
- D)  $\frac{5}{8}$

Answer: C

87) Find  $y'$  if  $y = 6x$ .

- A)  $x^2$
- B) 6
- C) 0
- D)  $x$

Answer: B

88) Find  $f'(x)$  for  $f(x) = 2x^5 + 6x^8$ .

- A)  $2x^4 + 6x^7$
- B)  $10x^6 + 48x^9$
- C)  $10x^4 + 48x^7$
- D)  $10x^3 + 48x^2$

Answer: C

89) Find the derivative of  $y = \frac{3x^5 - 7x^2 - 4}{x^2}$ .

- A)  $y' = 9x^2 + 8x^{-3}$
- B)  $y' = 18x^2 + 8x^{-3}$
- C)  $y' = 9x^{-2} + 8x^{-3}$
- D)  $y' = 9x^2 + 8x^3$

Answer: A

90) Let  $f$  and  $g$  be functions that satisfy  $f'(4) = 2$  and  $g'(4) = -3$ . Find  $h'(4)$  for  $h(x) = 3f(x) - g(x) + 2$ .

- A) 9
- B) 11
- C) 5
- D) 2

Answer: A

91) Find  $f'(x)$  if  $f(x) = 3x^4 + 6x^7$ .

- A)  $12x^3 + 42x^6$
- B)  $4x^3 + 7x^6$
- C)  $7x^3 + 13x^6$
- D)  $3x^5 + 7x^8$

Answer: A

92) Find  $f'(x)$  if  $f(x) = 6x^{-2} + 8x^3 + 11x$ .

- A)  $f(x) = -12x^{-1} + 24x^2$
- B)  $f'(x) = -12x^{-1} + 24x^2 + 11$
- C)  $f'(x) = -12x^{-3} + 24x^2$
- D)  $f'(x) = -12x^{-3} + 24x^2 + 11$

Answer: D

93) Find  $f'(x)$  if  $f(x) = 9x^{7/5} - 5x^2 + 10000$ .

- A)  $f'(x) = \frac{63}{5}x^{2/5} - 10x$
- B)  $f'(x) = \frac{63}{5}x^{6/5} - 10x$
- C)  $f'(x) = \frac{63}{5}x^{6/5} - 10x + 4000$
- D)  $f'(x) = \frac{63}{5}x^{2/5} - 10x + 4000$

Answer: A

94) Find:  $\frac{d}{dx} \left( \frac{4}{x^4} - 4\sqrt[5]{x} \right)$

- A)  $-\frac{16}{x^3} - \frac{4}{5}\sqrt[4]{x}$
- B)  $\frac{16}{x^3} - 20\sqrt[4]{x}$
- C)  $-\frac{16}{x^5} - \frac{4}{5\sqrt[5]{x^4}}$
- D)  $\frac{1}{x^3} - \frac{4}{5}\sqrt[4]{x}$

Answer: C

95) Find:  $\frac{dy}{dt}$  if  $y = 3t^{-4} - 5t^{-1}$

A)  $-\frac{12}{t^5} - \frac{5}{t^2}$

B)  $-12t^{-5} - 5t^{-2}$

C)  $-12t^5 - 5t^2$

D)  $-12t^{-5} + 5t^{-2}$

Answer: D

96) Find:  $\frac{d}{dx} \left( \frac{4}{x^4} - 5\sqrt[3]{x} \right)$

A)  $\frac{1}{4x^3} - \frac{5}{3}x^{-2/3}$

B)  $\frac{1}{4}x^{-5} - 15x^{2/3}$

C)  $\frac{1}{x^3} + \frac{5}{3}x^{-4/3}$

D)  $-16x^{-5} - \frac{5}{3}x^{-2/3}$

Answer: D

97) Find  $\frac{d}{dv} (6v^{0.7} - v^{5.8})$

A)  $4.2v^{-0.3} - 5.8v^{4.8}$

B)  $4.2v^{-0.3} - 5.8v^{4.7}$

C)  $4.2v^{-0.3} - 5.8v^{-4.7}$

D)  $4.2v^{-0.3} - 5.8v^{-4.8}$

Answer: A

98) Find  $\frac{dy}{dx}$  for  $y = \frac{1}{3x^3} + \frac{x^7}{10}$ .

A)  $-x^{-2} + \frac{7}{10}x^7$

B)  $\frac{7x^6}{9x^2 + 10}$

C)  $\frac{1}{9x^2} + \frac{7x^6}{10}$

D)  $-x^{-4} + \frac{7}{10}x^6$

Answer: D

- 99) Find the equation of the tangent line at  $x = 7$  for  $f(x) = 6 - x^2$ . Write the answer in the form  $y = mx + b$ .
- A)  $y = -14x + 55$
  - B)  $y = -2x$
  - C)  $y = 7x + 55$
  - D)  $y = 14x - 55$

Answer: A

- 100) Find the equation of the tangent line at  $x = -6$  for  $f(x) = \frac{x^3}{2}$ . Write the answer in the form  $y = mx + b$ .

- A)  $y = 216x + 18$
- B)  $y = 54x + 216$
- C)  $y = 18x + 216$
- D)  $y = 216x + 54$

Answer: B

- 101) Find the values of  $x$  where the tangent line is horizontal for  $f(x) = 3x^3 - 2x^2 - 9$ .

- A)  $x = 0, x = -\frac{4}{9}$
- B)  $x = 0, x = \frac{4}{9}$
- C)  $x = 0, x = -\frac{2}{3}$
- D)  $x = 0, x = \frac{2}{3}$

Answer: B

- 102) Find the equation of the tangent line at  $x = 2$  for  $f(x) = 4 + x - 2x^2 - 3x^3$ . Write the answer in the form  $y = mx + b$ .

- A)  $y = -39x + 52$
- B)  $y = -43x + 60$
- C)  $y = -47x + 68$
- D)  $y = -43x + 48$

Answer: B

**Solve the problem.**

- 103) An object moves along the  $y$ -axis (marked in feet) so that its position at time  $t$  (in seconds) is given by  $f(t) = 9t^3 - 9t^2 + t + 7$ . Find the velocity at three seconds.

- A) 192 feet per second
- B) 197 feet per second
- C) 190 feet per second
- D) 109 feet per second

Answer: C

104) A pen manufacturer determined that the total cost in dollars of producing  $x$  dozen pens in one day is given by:

$$C(x) = 350 + 2x - 0.01x^2, \quad 0 \leq x \leq 100$$

Find the marginal cost at a production level of 70 dozen pens and interpret the result.

- A) The marginal cost is \$0.58/doz. The cost of producing 1 dozen more pens at a production level of 70 dozen pens is approximately \$0.58.
- B) The marginal cost is \$0.60/doz. The cost of producing 1 dozen more pens at a production level of 70 dozen pens is approximately \$0.60.
- C) The marginal cost is \$0.62/doz. The cost of producing 1 dozen more pens at a production level of 70 dozen pens is approximately \$0.62.
- D) The marginal cost is \$0.59/doz. The cost of producing 1 dozen more pens at a production level of 70 dozen pens is approximately \$0.59.

Answer: B

105) According to one theory of learning, the number of items,  $w(t)$ , that a person can learn after  $t$  hours of instruction is given by:

$$w(t) = 15\sqrt[3]{t^2}, \quad 0 \leq t \leq 64$$

Find the rate of learning at the end of eight hours of instruction.

- A) 5 items per hour
- B) 45 items per hour
- C) 20 items per hour
- D) 60 items per hour

Answer: A

**Find  $\Delta y$  for the given values of  $x_1$  and  $x_2$ .**

106)  $y = 2x + 3$ ;  $x = 18$ ,  $\Delta x = 0.5$

- A) 5
- B) 0.1
- C) 0.5
- D) 1

Answer: D

**Find  $dy$ .**

107)  $y = 5x^2 - 7x - 7$

- A)  $10x - 7 dx$
- B)  $10x dx$
- C)  $10x - 14 dx$
- D)  $(10x - 7) dx$

Answer: D



- 108)  $y = x\sqrt{5x+1}$
- A)  $\frac{15x-2}{2\sqrt{5x+1}} dx$
- B)  $\frac{15x-2}{\sqrt{5x+1}} dx$
- C)  $\frac{15x+2}{2\sqrt{5x+1}} dx$
- D)  $\frac{15x+2}{\sqrt{5x+1}} dx$

Answer: C

**Provide an appropriate response.**

- 109) Evaluate  $dy$  and  $\Delta y$  for  $y = f(x) = x^2 - 7x + 5$ ,  $x = 7$ , and  $dx = \Delta x = 0.5$ .
- A)  $dy = 3.5$ ;  $\Delta y = 3.75$
- B)  $dy = 3.5$ ;  $\Delta y = 3.5$
- C)  $dy = 3.75$ ;  $\Delta y = 3.75$
- D)  $dy = 3.75$ ;  $\Delta y = 3.5$

Answer: A

- 110) Evaluate  $dy$  and  $\Delta y$  for  $y = f(x) = 20 + 15x^2 - x^3$ ,  $x = 2$ , and  $dx = \Delta x = 0.3$ .
- A)  $dy = 15.183$ ;  $\Delta y = 14.4$
- B)  $dy = 14.4$ ;  $\Delta y = 15.183$
- C)  $dy = 14.4$ ;  $\Delta y = 14.4$
- D)  $dy = 15.183$ ;  $\Delta y = 15.183$

Answer: B

- 111) A spherical balloon is being inflated. Find the approximate change in volume if the radius increases from 6.2 cm to 6.4 cm. (Recall that  $V = \frac{4}{3}\pi r^3$ .)

- A)  $0.992\pi \text{ cm}^3$
- B)  $153.76\pi \text{ cm}^3$
- C)  $317.77 \text{ cm}^3$
- D)  $30.752\pi \text{ cm}^3$

Answer: D

**Solve the problem.**

- 112) A cube 4 inches on an edge is given a protective coating 0.1 inches thick. About how much coating should a production manager order for 900 cubes?
- A) About  $4320 \text{ in.}^2$
- B) About  $5760 \text{ in.}^3$
- C) About  $1440 \text{ in.}^2$
- D) About  $8640 \text{ in.}^3$

Answer: D

- 113) One hour after  $x$  milligrams of a particular drug are given to a person, the change in body temperature  $T$  (in degrees Fahrenheit) is given by  $T = x^2 \left( 1 - \frac{x}{9} \right)$ , where  $0 \leq x \leq 3$ . Approximate the changes in body temperature produced by changing the drug dosage from 1 to 1.9 milligrams. Round to the nearest hundredth when necessary.
- A)  $0.22^\circ\text{F}$
  - B)  $1.5^\circ\text{F}$
  - C)  $1.67^\circ\text{F}$
  - D)  $3.17^\circ\text{F}$

Answer: B

- 114)  $V = \frac{4}{3}\pi r^3$ , where  $r$  is the radius, in centimeters. By approximately how much does the volume of a sphere increase when the radius is increased from 1.0 cm to 1.1 cm? (Use 3.14 for  $\pi$ .)
- A)  $1.1 \text{ cm}^3$
  - B)  $1.3 \text{ cm}^3$
  - C)  $1.5 \text{ cm}^3$
  - D)  $0.1 \text{ cm}^3$

Answer: B

**Provide an appropriate response.**

- 115) Suppose that the total profit in hundreds of dollars from selling  $x$  items is given by  $P(x) = 4x^2 - 5x + 10$ . Find the marginal profit at  $x = 5$ .
- A) \$32
  - B) \$15
  - C) \$35
  - D) \$45

Answer: C

- 116) The revenue (in thousands of dollars) from producing  $x$  units of an item is modeled by  $R(x) = 5x - 0.0005x^2$ . Find the marginal revenue at  $x = 1000$ .
- A) \$4.50
  - B) \$104.00
  - C) \$10,300.00
  - D) \$4.00

Answer: D

117) Let  $C(x)$  be the cost function and  $R(x)$  the revenue function. Compute the marginal cost, marginal revenue, and the marginal profit functions.

$$C(x) = 0.0004x^3 - 0.036x^2 + 200x + 40,000$$

$$R(x) = 450x$$

A)  $C'(x) = 0.0012x^2 - 0.072x + 200$

$$R'(x) = 450$$

$$P'(x) = -0.0012x^2 + 0.072x + 250$$

B)  $C'(x) = 0.0012x^2 - 0.072x + 200$

$$R'(x) = 450$$

$$P'(x) = 0.0012x^2 - 0.072x - 250$$

C)  $C'(x) = 0.0012x^2 + 0.072x + 200$

$$R'(x) = 450$$

$$P'(x) = 0.0012x^2 + 0.072x + 250$$

Answer: A

118) The total cost to produce  $x$  units of paint is  $C(x) = (5x + 3)(7x + 4)$ . Find the marginal average cost function.

A)  $\bar{C}'(x) = 70x + 41$

B)  $\bar{C}'(x) = 35x + 41 + \frac{12}{x}$

C)  $\bar{C}'(x) = 70 - \frac{41}{x}$

D)  $\bar{C}'(x) = 35 - \frac{12}{x^2}$

Answer: D

119) The total profit from selling  $x$  units of doorknobs is  $P(x) = (6x - 7)(9x - 8)$ . Find the marginal average profit function.

A)  $\bar{P}'(x) = 54 - \frac{56}{x^2}$

B)  $\bar{P}'(x) = 54x - 111$

C)  $\bar{P}'(x) = 54x - 56$

D)  $\bar{P}'(x) = 54 - \frac{111}{x^2}$

Answer: A

120) The total cost in dollars of producing  $x$  lawn mowers is given by  $C(x) = 4,000 + 90x - \frac{x^2}{3}$ . Find the marginal

average cost at  $x = 20$ ,  $\bar{C}'(20)$  and interpret the result.

A)  $-\$13.33$ ; a unit increase in production will decrease the average cost per unit by approximately  $\$13.33$  at a production level of 20 units.

B)  $-\$10.33$ ; a unit increase in production will decrease the average cost per unit by approximately  $\$10.33$  at a production level of 20 units.

C)  $-\$20.33$ ; a unit increase in production will decrease the average cost per unit by approximately  $\$20.33$  at a production level of 20 units.

D)  $-\$1.33$ ; a unit increase in production will decrease the average cost per unit by approximately  $\$1.33$  at a production level of 20 units.

Answer: B

**Solve the problem.**

121) The demand equation for a certain item is  $p = 14 - \frac{x}{1,000}$  and the cost equation is  $C(x) = 7,000 + 4x$ . Find the

marginal profit at a production level of 3,000 and interpret the result.

- A) \$14; at the 3,000 level of production, profit will increase by approximately \$14 for each unit increase in production.
- B) \$16; at the 3,000 level of production, profit will increase by approximately \$16 for each unit increase in production.
- C) \$7; at the 3,000 level of production, profit will increase by approximately \$7 for each unit increase in production.
- D) \$4; at the 3,000 level of production, profit will increase by approximately \$4 for each unit increase in production.

Answer: D

122) A company is planning to manufacture a new blender. After conducting extensive market surveys, the research department estimates a weekly demand of 600 blenders at a price of \$50 per blender and a weekly demand of 800 blenders at a price of \$40 per blender. Assuming the demand equation is linear, use the research department's estimates to find the revenue equation in terms of the demand  $x$ .

- A)  $R(x) = 80x - 20x^2$
- B)  $R(x) = 80x - \frac{x^2}{20}$
- C)  $R(x) = 20x + \frac{x^2}{20}$
- D)  $R(x) = 80x - 20$

Answer: B

123) Suppose the demand for a certain item is given by  $D(p) = -3p^2 + 4p + 8$ , where  $p$  represents the price of the item. Find  $D'(p)$ , the rate of change of demand with respect to price.

- A)  $D'(p) = -3p + 4$
- B)  $D'(p) = -6p + 4$
- C)  $D'(p) = -3p^2 + 4$
- D)  $D'(p) = -6p^2 + 4$

Answer: B