# Test Bank for Calculus and Its Applications Brief Version 12th Bittinger

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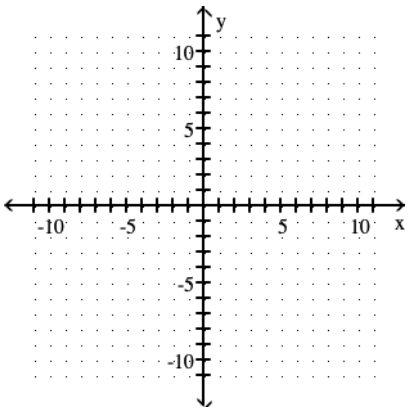
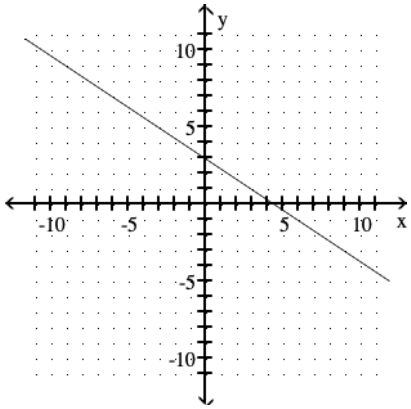
**MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.**

**Graph the equation.**

1) $y = \frac{2}{3}x + 3$




A)

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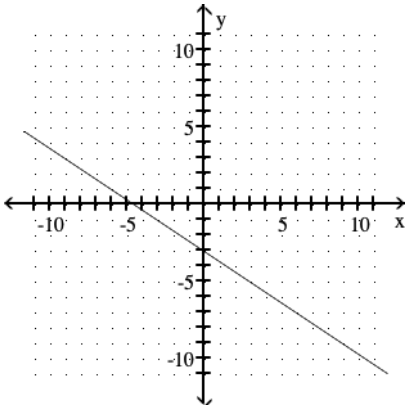
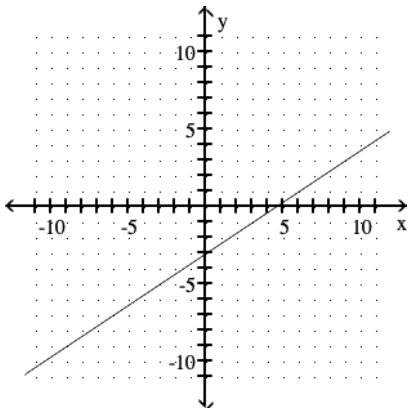
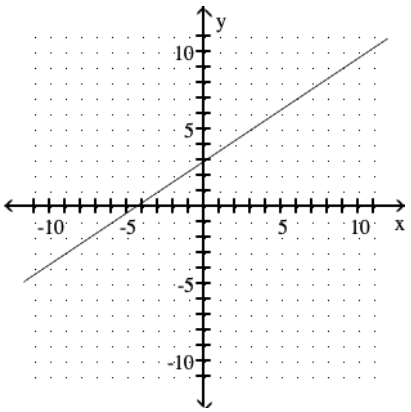



C)




D)




Answer: D



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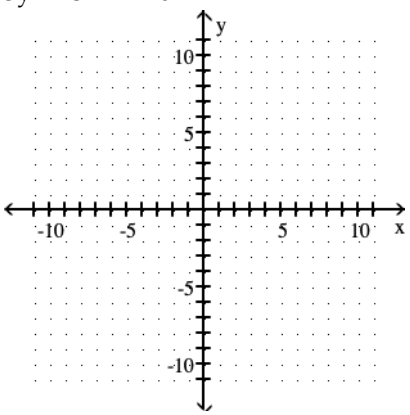
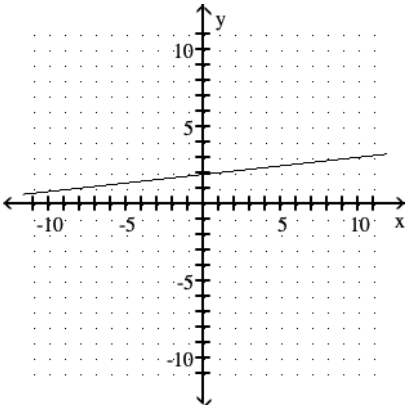
2) $5y + 45x = -10$




A)

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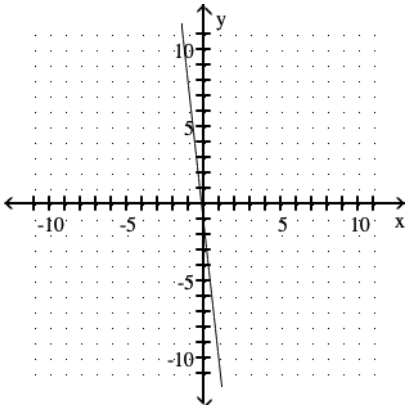


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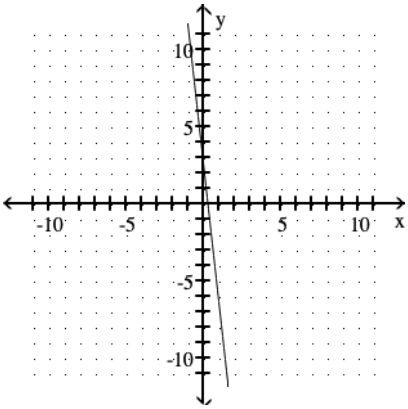


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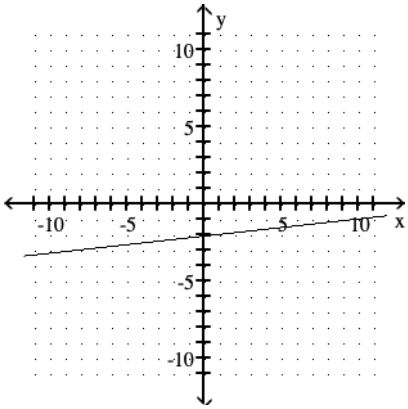


Answer: B



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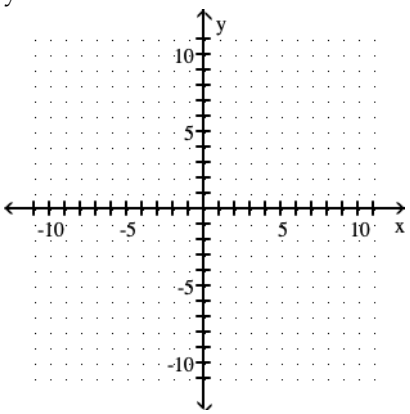
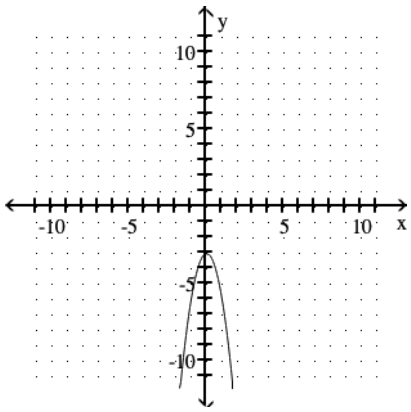
3) $y = -3x^2$




A)

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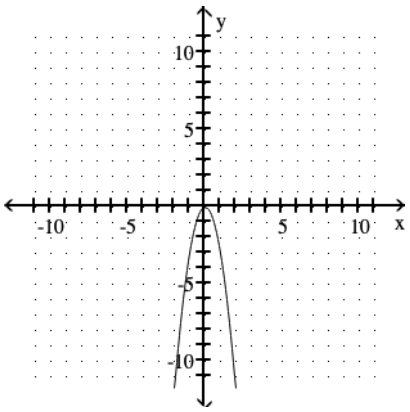


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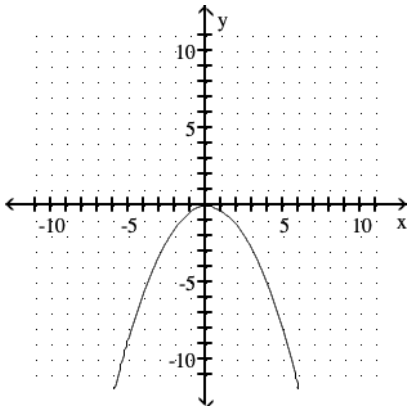


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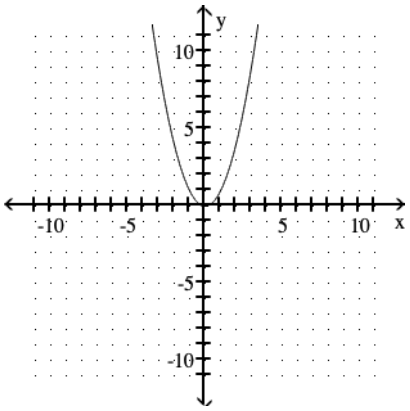


Answer: B



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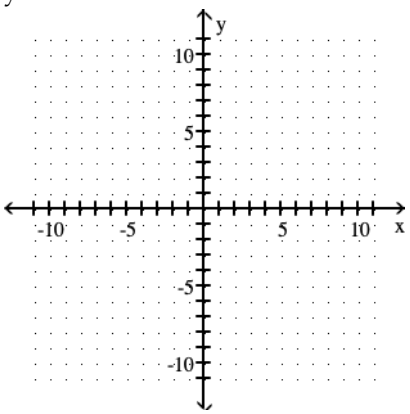
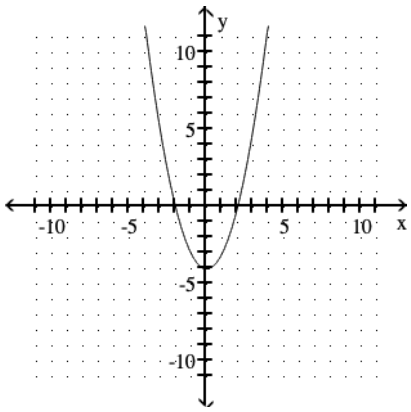
4) $y = x^2 - 4$




A)

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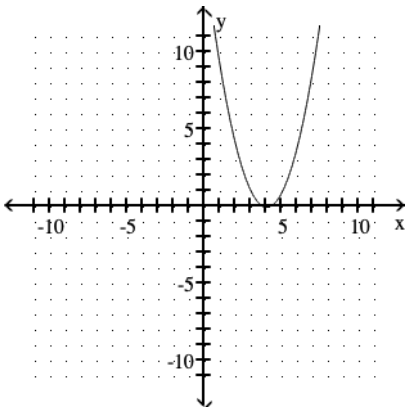


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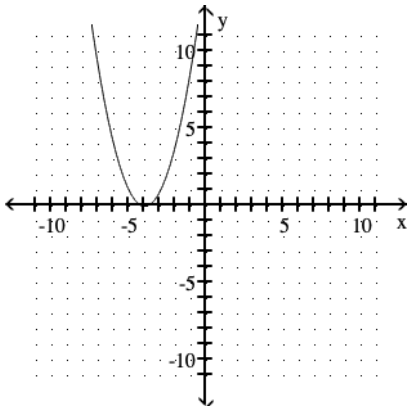


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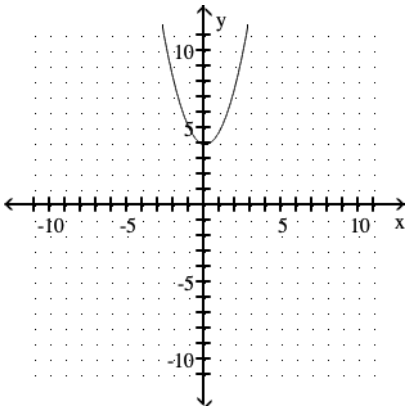


Answer: A



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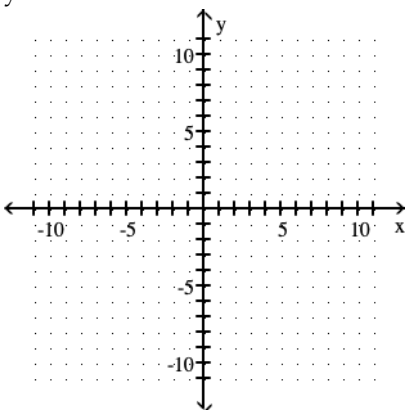
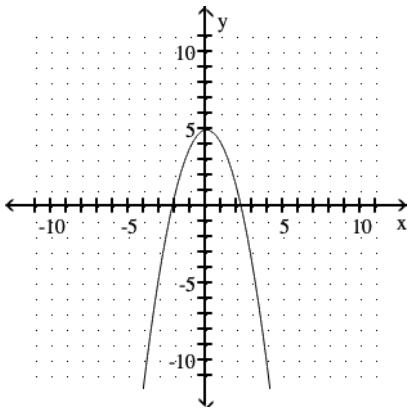
5) $y = -x^2 - 5$




A)

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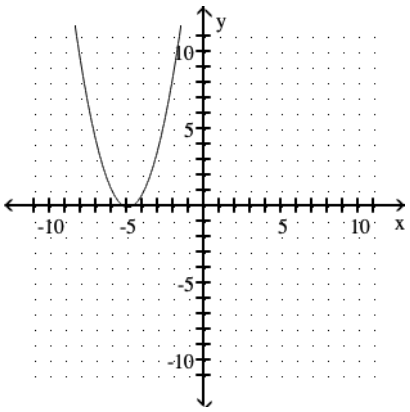


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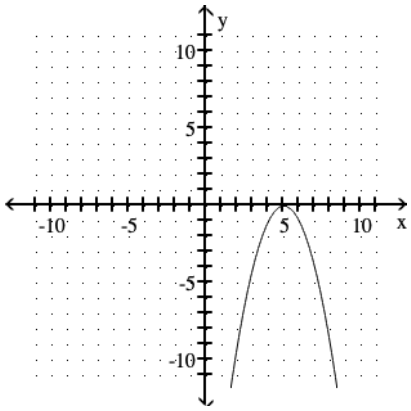


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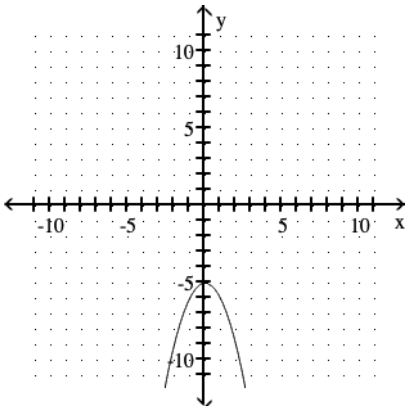


Answer: D



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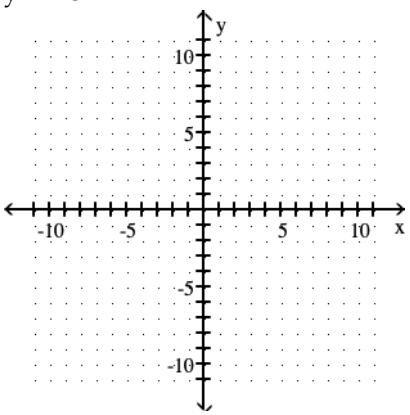
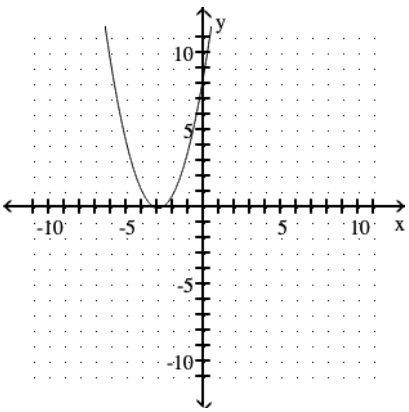
6) y = |–3 – x|




A)

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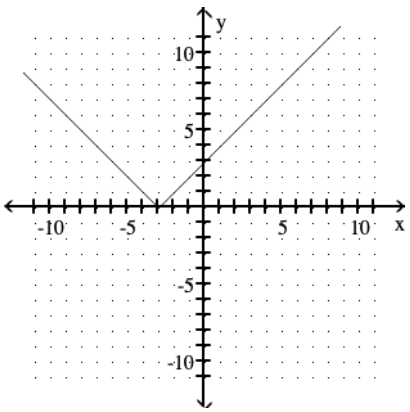
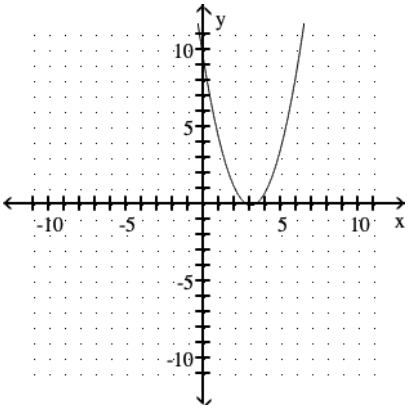



C)

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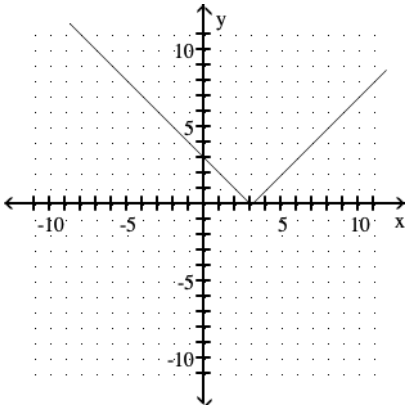


Answer: B



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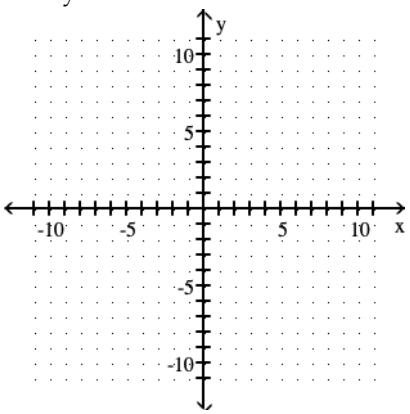
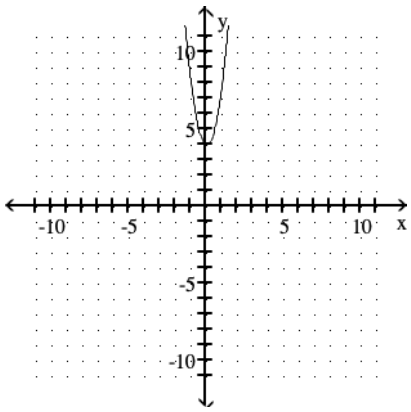
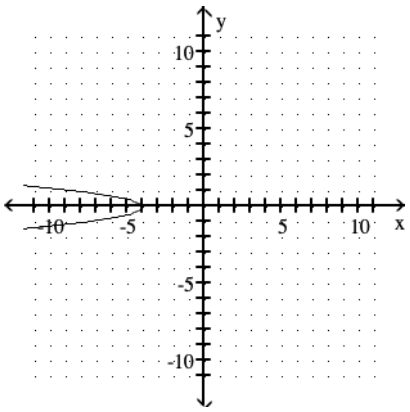
7) $x = 4y^2 + 4$



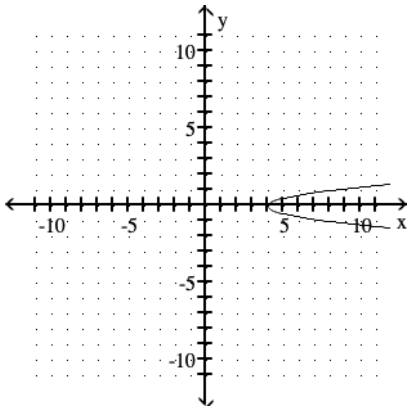

A)



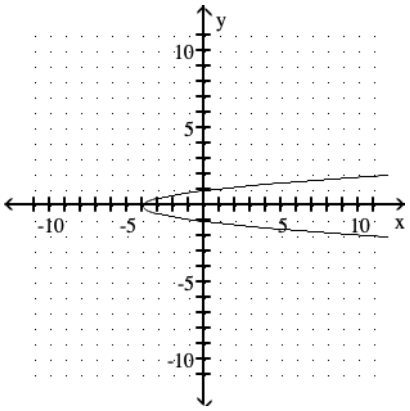

B)




C)




D)




Answer: C



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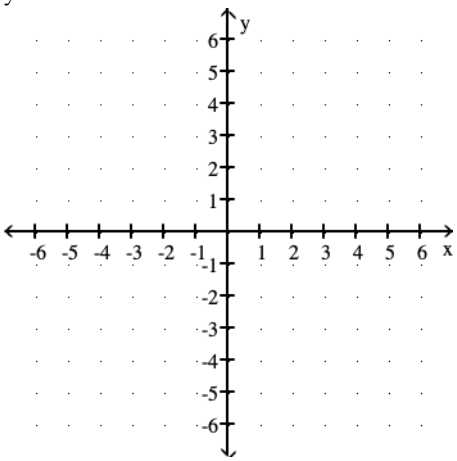
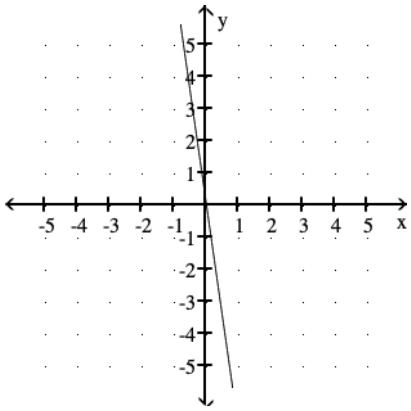
8) y = 7x




A)

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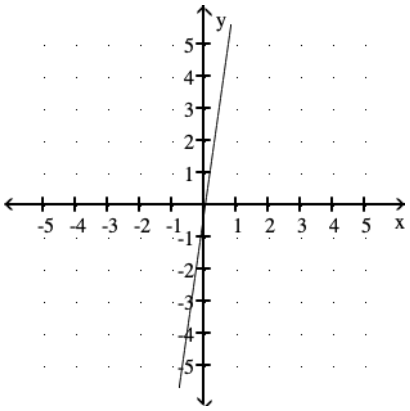


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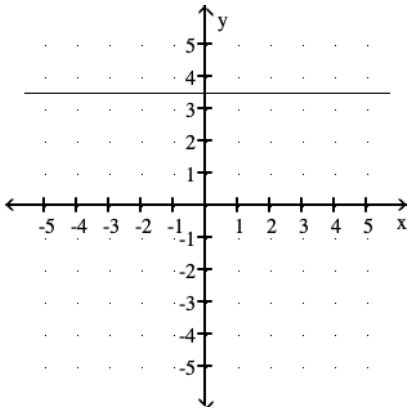


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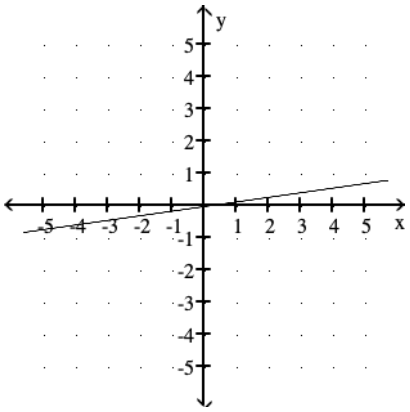


Answer: B



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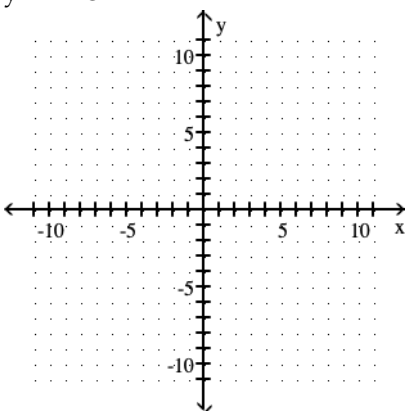
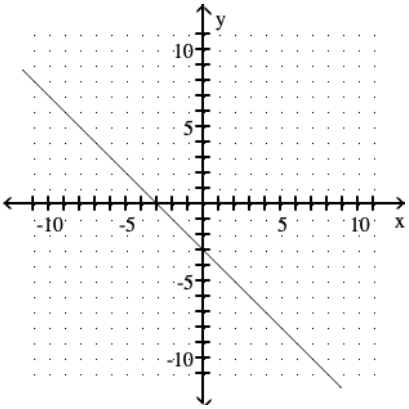
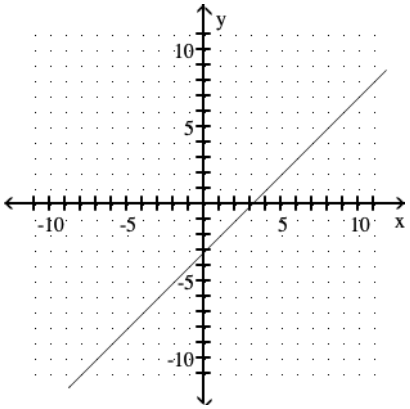
9) $y = x + 3$



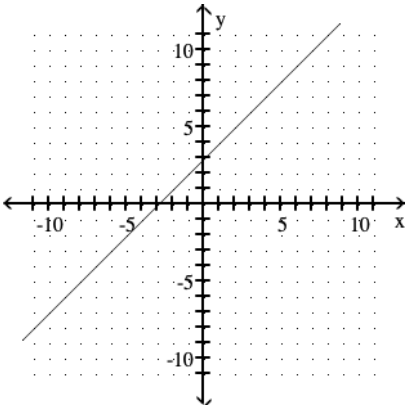

A)



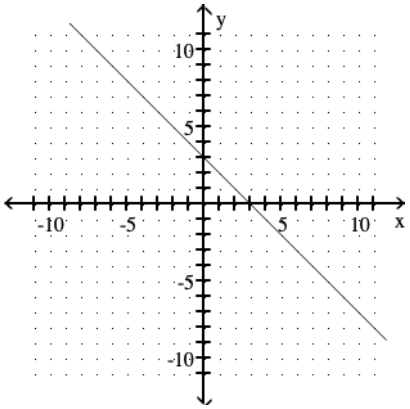

B)




C)




D)




Answer: C



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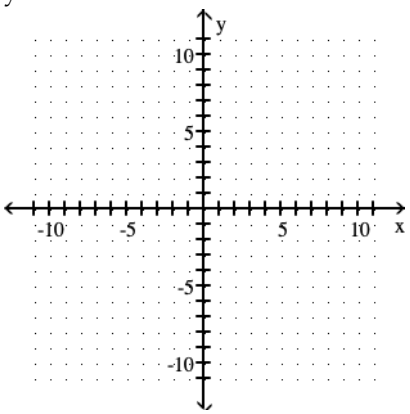
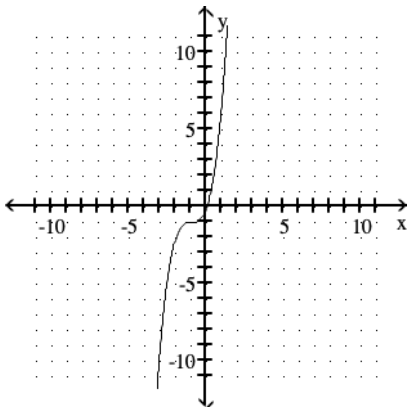
10) $y = x^3 - 1$




A)

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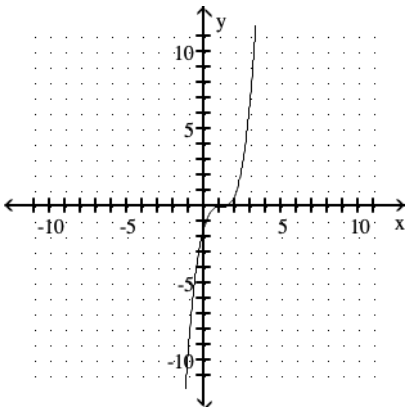
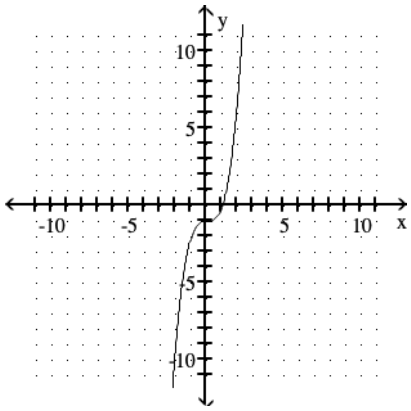
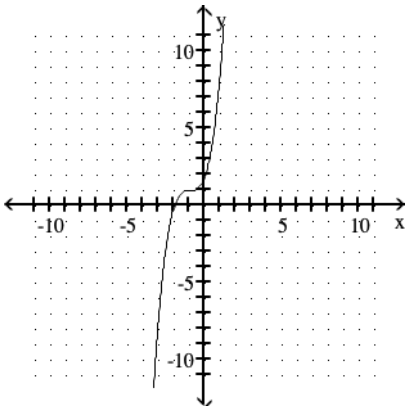



C)




D)




Answer: C

**Use the given information to answer the question.**

11) The height of a baseball that is thrown from ground level with an initial velocity of 80 feet per second can be modeled by $h = -16t^2 + 80t$. Use this model to find the height of the ball after 3.4 seconds.

A) 456.96 ft B) 163.2 ft C) 87.04 ft D) -87.04 ft

Answer: C



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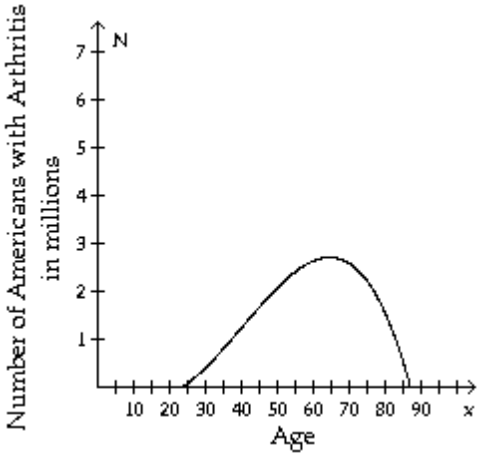
12) The average number of acres on a U.S. farm can be modeled by $A(t) = -0.1283t^2 + 11.0988t + 207.1116$, where A(t) represents the number of acres, and t represents the number of years since 1950. Use this model to find the average number of acres on a U.S farm in 1955.

A) 259.4 acres B) 265.81 acres C) -468,460.54 acres D) 261.32 acres

Answer: A

13) The number N, in millions of Americans of age x with arthritis, is estimated with the following graph.

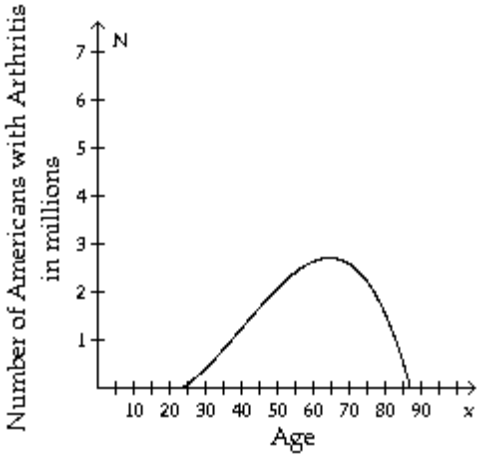



What approximate age (closest integer) has the most arthritic Americans?

A) 65 B) 88 C) 60 D) 21

Answer: A

14) The number N, in millions of Americans of age x with arthritis, is estimated with the following graph.




Approximately how many 70–year–olds have arthritis?

A) 2,900,000 B) 275,000 C) 30,000 D) 3,900,000

Answer: A



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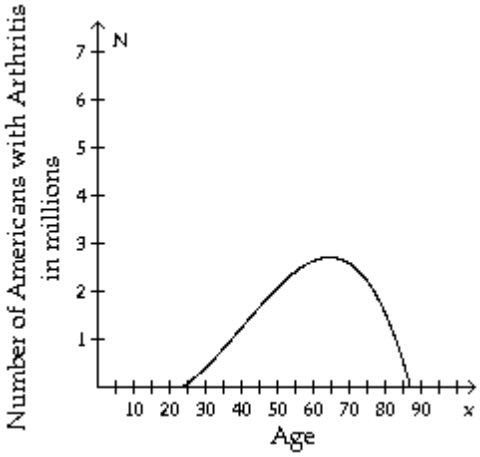
15) The number N, in millions of Americans of age x with arthritis, is estimated with the following graph.

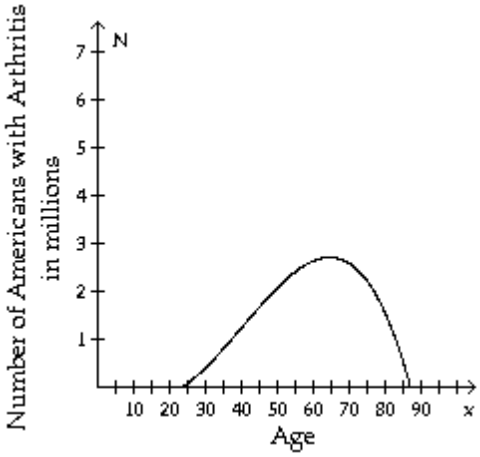



Give the age(s) at which there are 2 million people with arthritis.

A) 46 B) 46 and 80 C) 45 and 65 D) 35 and 80

Answer: B

16) The number N, in millions of Americans of age x with arthritis, is estimated with the following graph.




Approximately how many 40–year–olds and 55–year–olds combined have arthritis?

A) 4,100,000 B) 3,600,000 C) 31,400,000 D) 400,000

Answer: B



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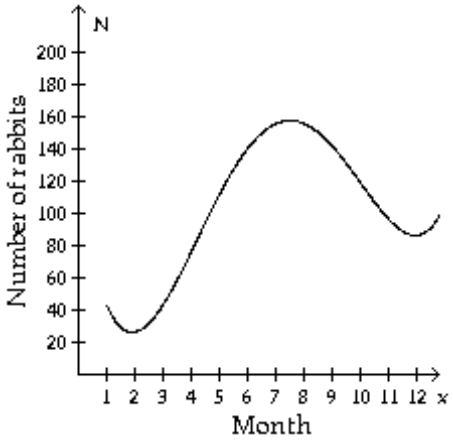
17) The population of rabbits varies with the season due to migration, birth and death. The number, N, of rabbits during month x on a certain midwestern farm can be estimated with the following graph, where x = 1 corresponds to January, x = 2 corresponds to February, and so on.

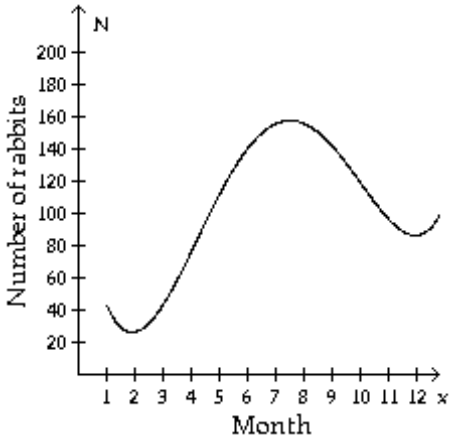



What month has the fewest rabbits?

A) February B) March C) January D) December

Answer: A

18) The population of rabbits varies with the season due to migration, birth and death. The number, N, of rabbits during month x on a certain midwestern farm can be estimated with the following graph, where x = 1 corresponds to January, x = 2 corresponds to February, and so on.




How many rabbits left the area or died between September and October?

A) 119 rabbits B) 23 rabbits C) 14 rabbits D) 28 rabbits

Answer: B



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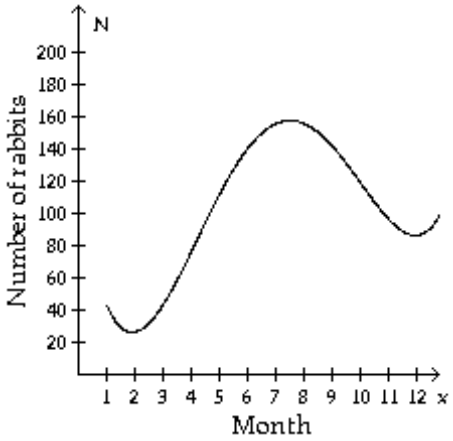
19) The population of rabbits varies with the season due to migration, birth and death. The number, N, of rabbits during month x on a certain midwestern farm can be estimated with the following graph, where x = 1 corresponds to January, x = 2 corresponds to February, and so on.

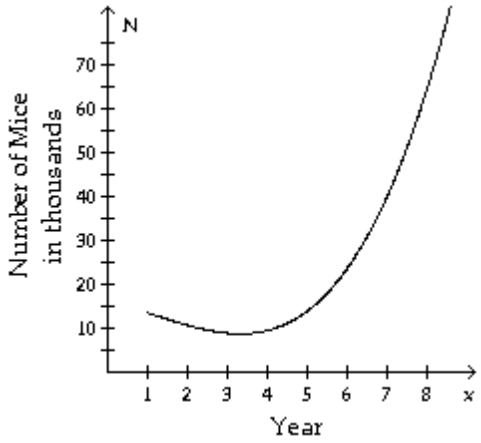



During which months are there approximately 140 rabbits on the farm?

A) July and August
B) May and June
C) August and September
D) June and September

Answer: D

20) The population of a formerly endangered mouse is now on the rise. The population, N, over the last 8 years can be represented with the following graph.




When was the mice population the lowest?

A) Just after the end of the third year
B) At the beginning of the 8 year period
C) During the fifth year
D) Just before the end of the second year

Answer: A

**Solve the problem.**

21) Suppose $2000 is invested at 8%. How much is in the account at the end of 1 year, if interest is compounded quarterly?

A) $2164.86
B) $8640.00
C) $2040.00
D) $2166.00

Answer: A



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22) Suppose \$4000 is invested at $6\frac{1}{2}\%$. How much is in the account at the end of 1 year, if interest is compounded quarterly?

A) \$4266.41 B) \$4065.00 C) \$4267.89 D) \$17,040.00

Answer: A

23) A car loan is \$2200, the interest rate is $6\frac{3}{4}\%$, and the loan period is 5 years. What is the monthly payment?

A) \$447.45 B) \$519.64 C) \$43.30 D) \$190.11

Answer: C

24) A mortgage on a house is \$130,000, the interest rate is $9\frac{1}{2}\%$, and the loan period is 15 years. What is the monthly payment?

A) \$11,398.86 B) \$1357.49 C) \$9225.65 D) \$16,289.91

Answer: B

25) Bob deposits \$5000 at the end of each year into an annuity which earns 10% interest compounded annually. How much is the annuity worth after 15 years?

A) \$179,748.65 B) \$139,874.92 C) \$158,862.41 D) \$153,862.41

Answer: C

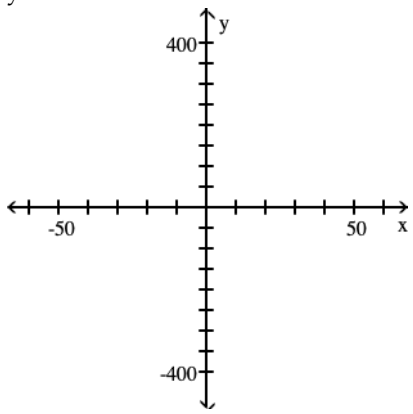
26) Joan wants to start an annuity that will have \$850,000 in it when she retires in 16 years. How much should she invest annually in her annuity to do this if the interest is 12% compounded annually?

A) \$6910.74 B) \$13,941.39 C) \$19,881.52 D) \$19,868.52

Answer: C

**Graph the equation.**

27) $y = x + 280$



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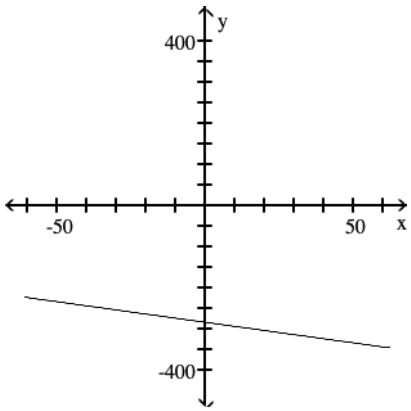
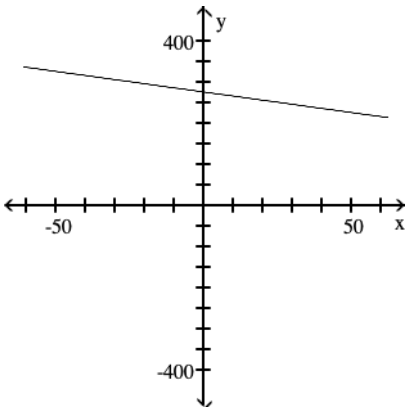
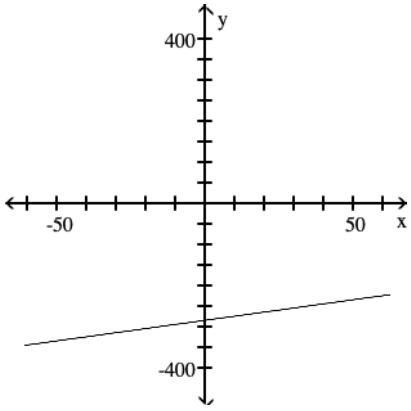
A)



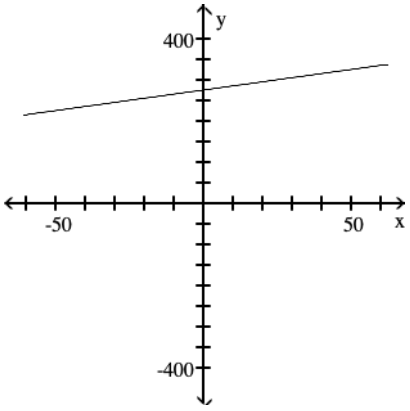

B)




C)

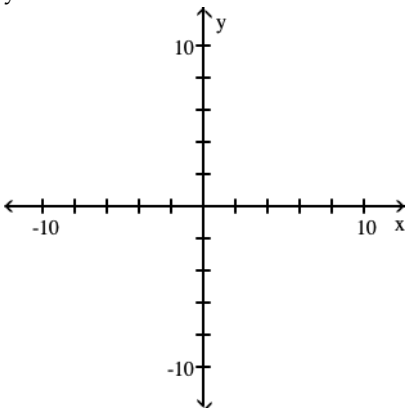



D)




Answer: D

28) $y = |x + 2| - 4$



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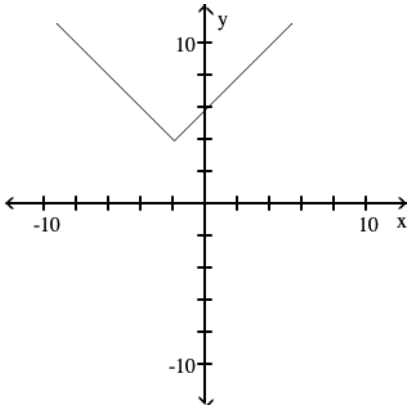
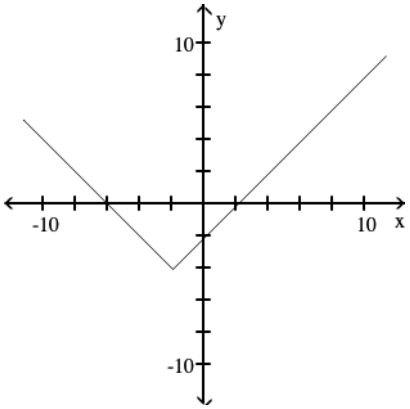
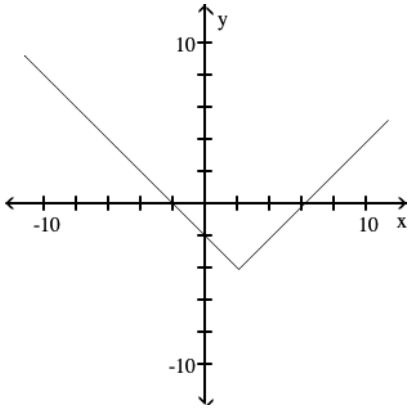
A)



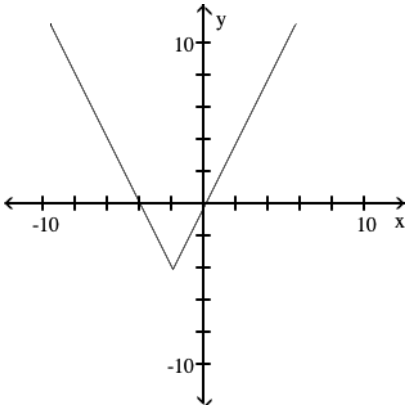

B)




C)

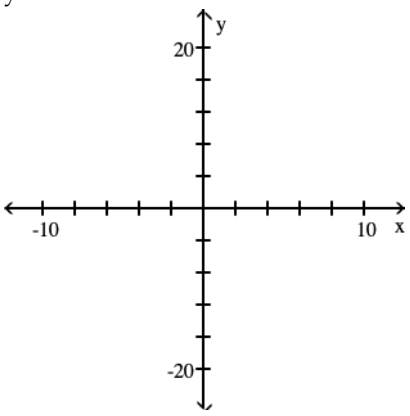



D)




Answer: B

29) $y = 5x^3 - 3x^2 - 8x + 4$



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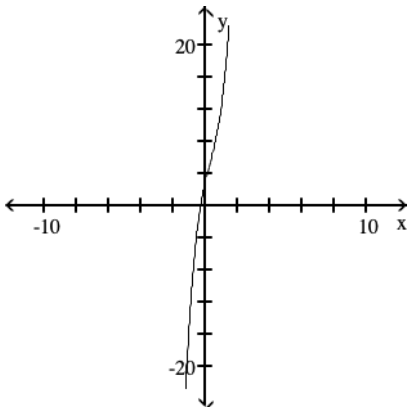
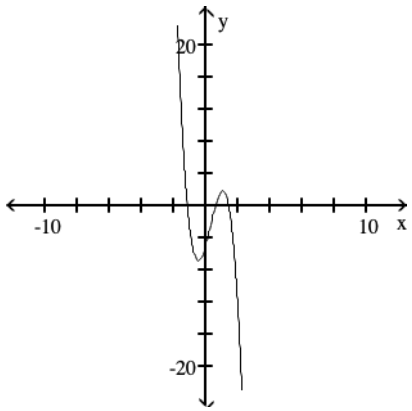
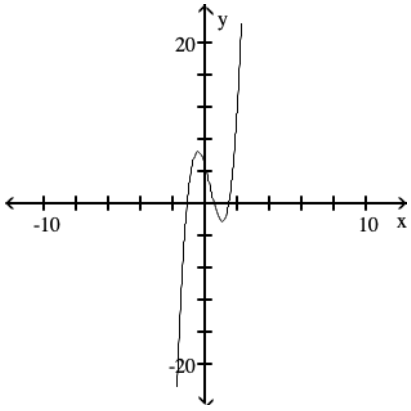
A)



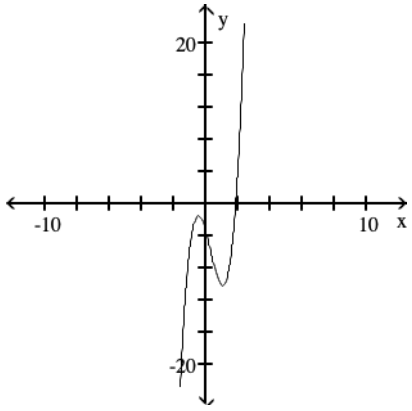

B)




C)

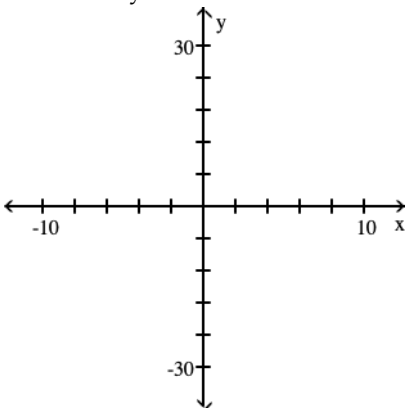



D)




Answer: C

30) −6.0x + 1.7y = −34



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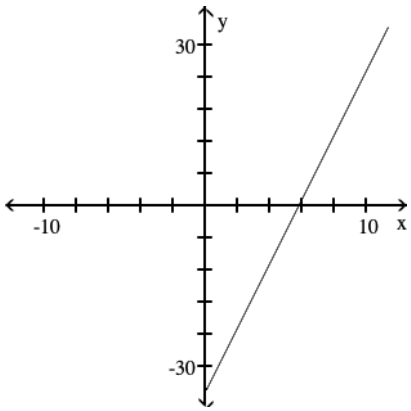
A)

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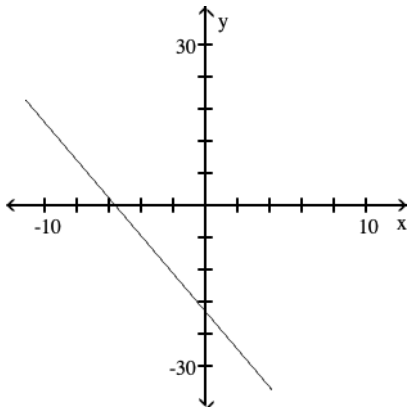
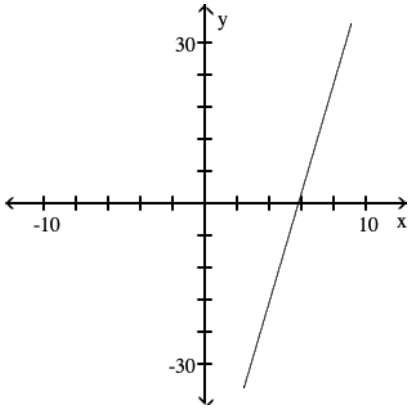
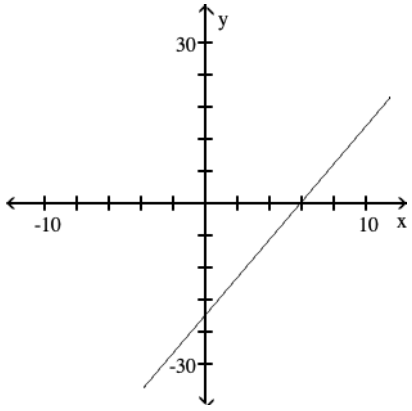



C)

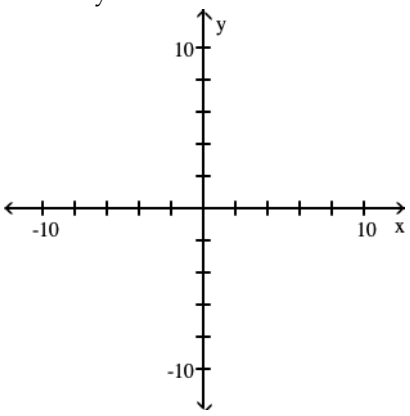



D)




Answer: D

31) $x = 3 + y^2$



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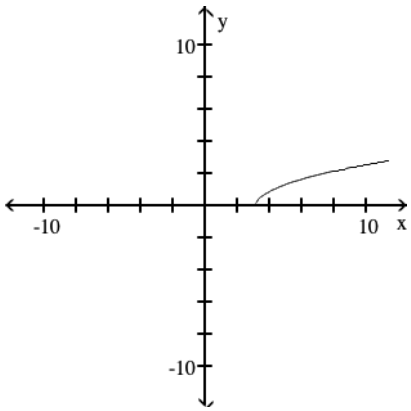
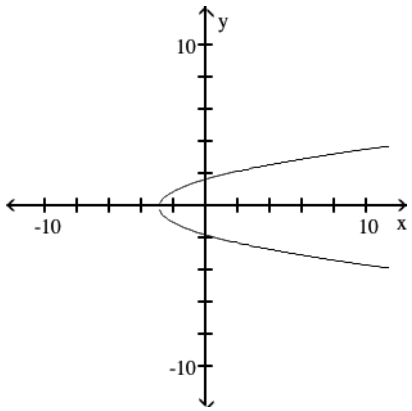
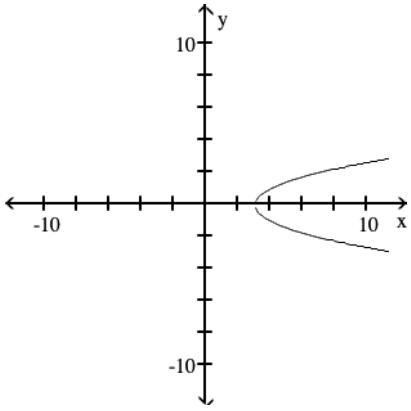
A)



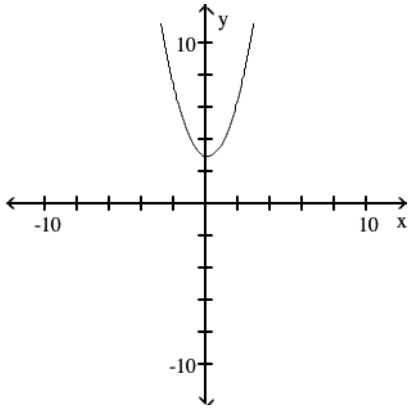

B)




C)

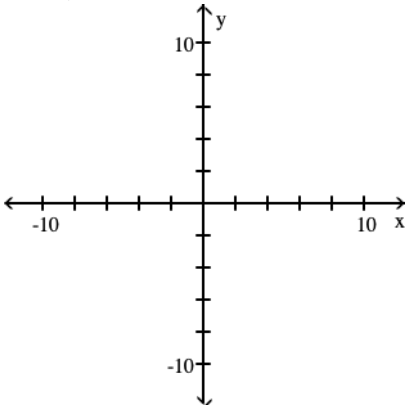



D)




Answer: C

32) $y = \sqrt{4 - \frac{x^2}{1}}$



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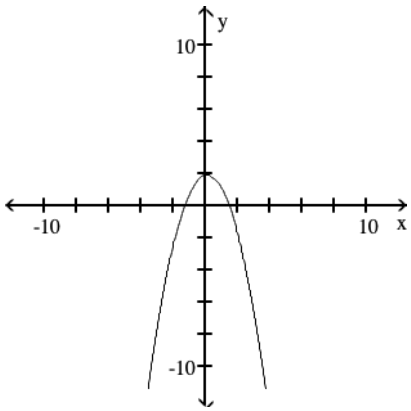
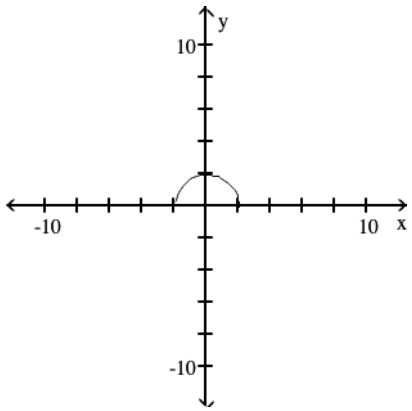
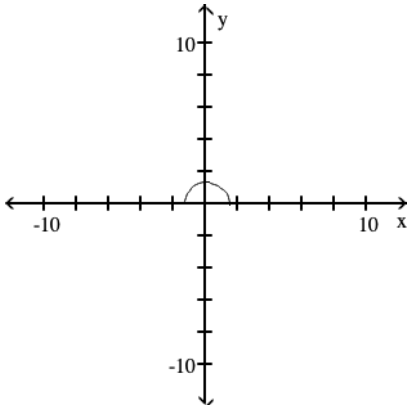
A)



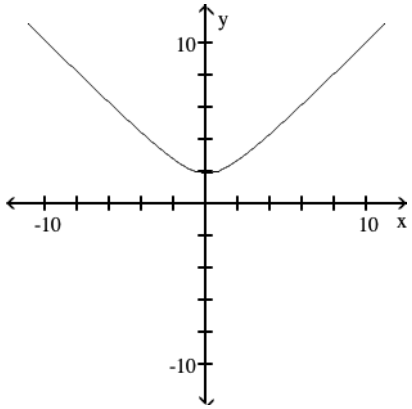

B)




C)

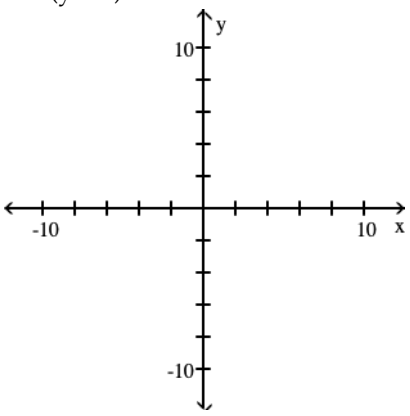



D)




Answer: B

33) $x = (y - 3)^2 - 1$



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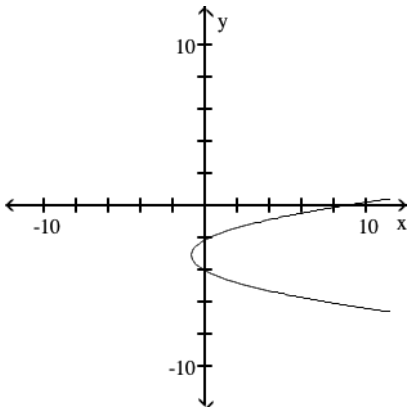
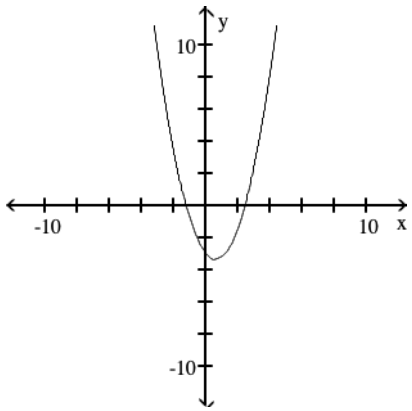
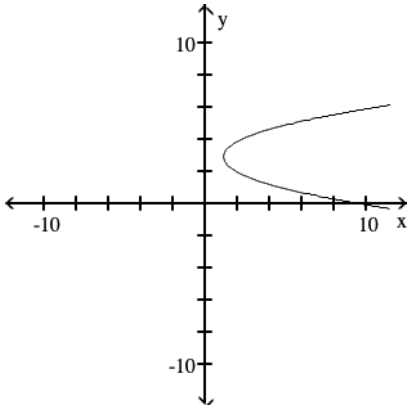
A)



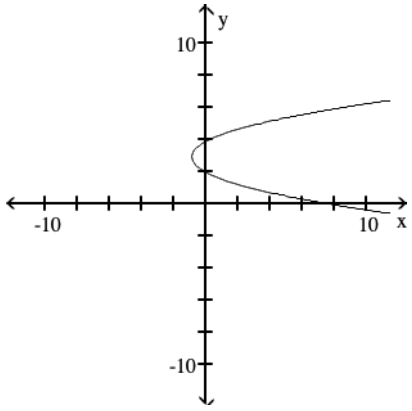

B)




C)



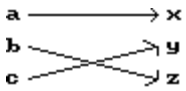

D)




Answer: D

**Is the following correspondence a function?**

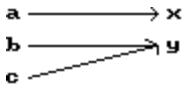
34)




A) Yes B) No

Answer: A

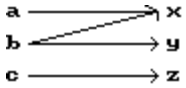
35)




A) Yes B) No

Answer: A

36)




A) Yes B) No

Answer: B



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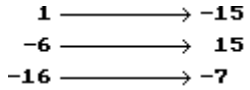
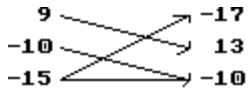
37)




A) Yes B) No

Answer: A

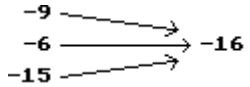
38)




A) Yes B) No

Answer: B

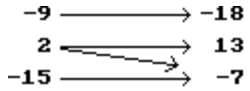
39)




A) Yes B) No

Answer: A

40)




A) Yes B) No

Answer: B

41) Domain: All students attending Laughlin Community College
Correspondence: Each student's Social Security Number
Range: A set of Social Security Numbers

A) Yes B) No

Answer: A

42) Domain: All students attending the University of Ohio
Correspondence: Each student's teachers
Range: A set of teachers

A) Yes B) No

Answer: B

43)

| Name | Test Score |
|---|---|
| Bob L. | 80 |
| Susan H. | 83 |
| Jim H. | 76 |
| Bruce B. | 96 |

A) Yes B) No

Answer: A



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**Evaluate the function.**

44) Given $f(x) = 4x + 0.71$, find $f(-5.6)$.

A) 23.11 B) −15.3 C) −21.69 D) −23.11

Answer: C

45) Given $f(x) = 2x + 3.3$, find $f(6.9)$.

A) 10.5 B) 17.1 C) −10.5 D) 14.13

Answer: B

46) Given $f(x) = x^2 - 3x + 6$, find $f(3)$.

A) 12 B) 24 C) −6 D) 6

Answer: D

47) Given $f(x) = 2x^2 - 4x - 5$, find $f(-4)$.

A) 27 B) 11 C) 53 D) 43

Answer: D

48) Given $f(x) = 2x^2 - 5x + 2$, find $f(k - 1)$.

A) $2k^2 - 9k + 9$ B) $-9k^2 + 2k + 9$ C) $2k^2 - 1k - 1$ D) $2k^2 - 9k - 1$

Answer: A

49) Given $f(x) = \dfrac{x - 10}{x - 7}$, find $f(5)$.

A) $\dfrac{3}{2}$ B) $\dfrac{10}{7}$ C) $\dfrac{5}{2}$ D) $-\dfrac{5}{12}$

Answer: C

50) Given $f(x) = \dfrac{4x}{6x + 9}$, find $f(3)$.

A) $\dfrac{4}{3}$ B) $\dfrac{4}{9}$ C) $\dfrac{4}{15}$ D) $\dfrac{2}{3}$

Answer: B

51) For $f(x) = x^2 + 5x$, find $\dfrac{f(x + h) - f(x)}{h}$.

A) $2xh + h + 5h$ B) $2x + h + 5$ C) $x$ D) $2x + h - 5$

Answer: B

52) For $f(x) = \begin{cases} 3x + 2, & \text{for } x < 2 \\ 11, & \text{for } x = 2 \\ x^2 + 5, & \text{for } x > 2 \end{cases}$, find f(-6) and f(3).

A) f(-6) = -16, f(3) = 14 B) f(-6) = -16, f(3) = 11

C) f(-6) = -20, f(3) = 14 D) f(-6) = 41, f(3) = 11

Answer: A



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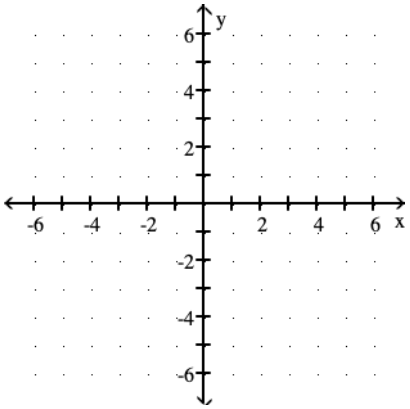
53) For $f(x) = \begin{cases} -3x - 1, & \text{for } x < 0 \\ 12, & \text{for } 0 \le x \le 3 \\ \frac{1}{3}x + 5, & \text{for } x > 3 \end{cases}$, find f(1) and f(9).

A) f(1) = -4, f(9) = 8 B) f(1) = 12, f(9) = 4 C) f(1) = -4, f(9) = 4 D) f(1) = 12, f(9) = 8

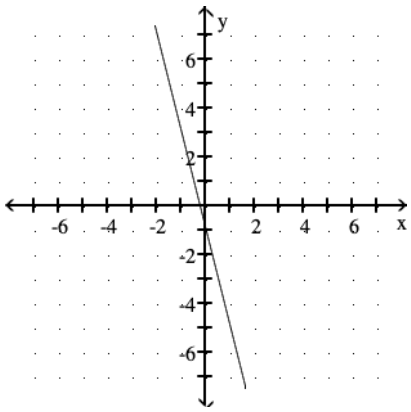
Answer: D

**Graph the function.**

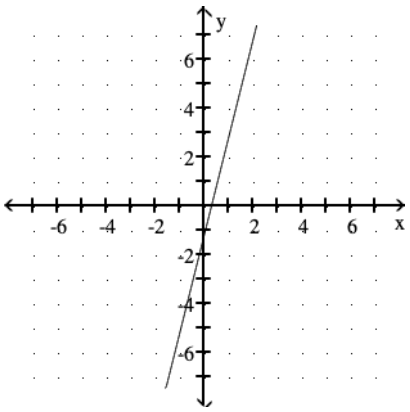
54) f(x) = −4x + 1



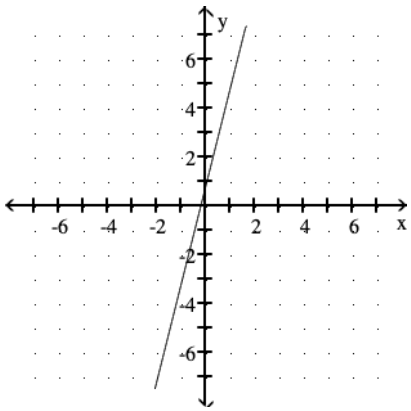

A)



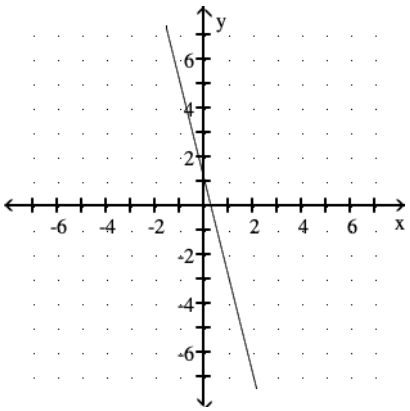

B)




C)




D)




Answer: D



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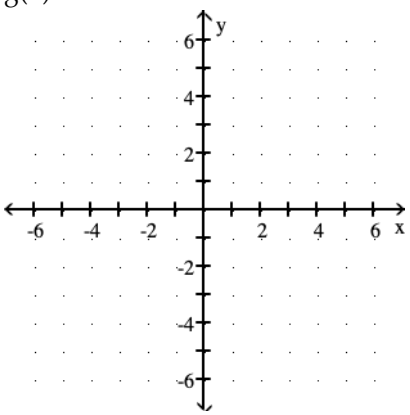
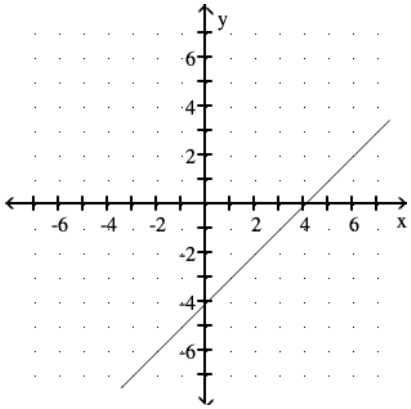
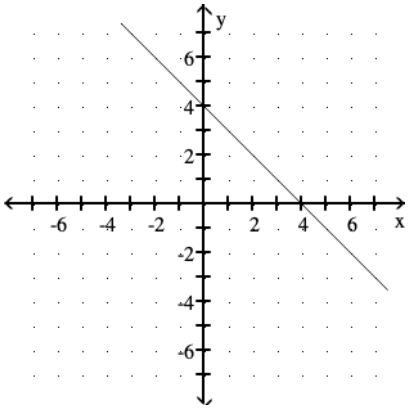
55) g(x) = x – 4



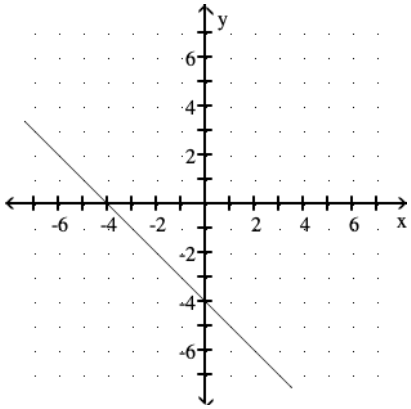

A)



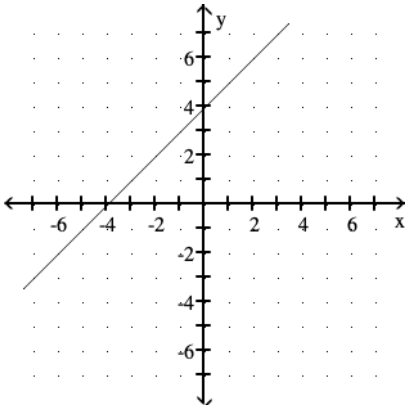

B)




C)




D)




Answer: A



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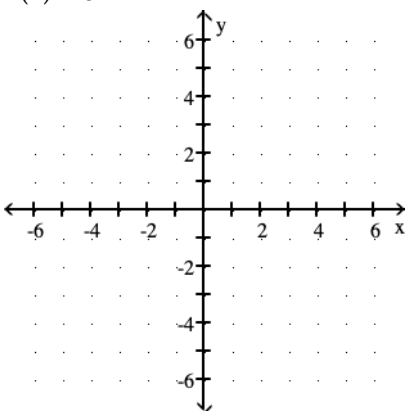
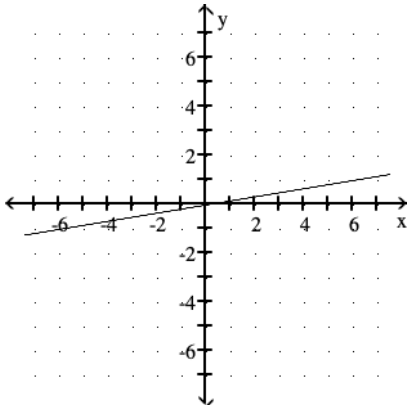
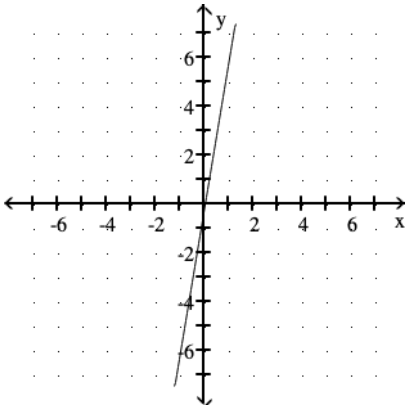
56) h(x) = 6x



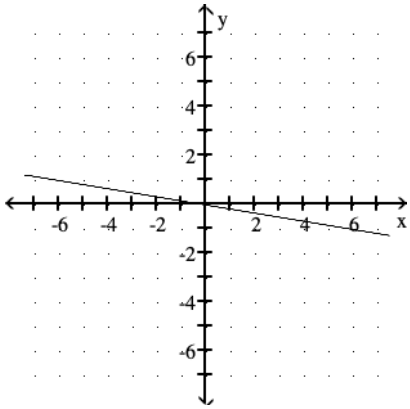

A)



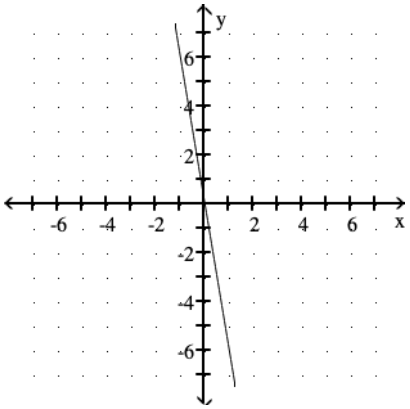

B)




C)




D)




Answer: B



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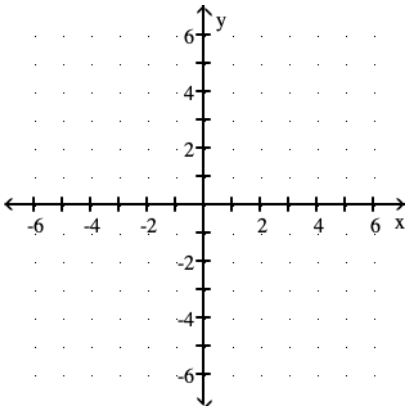
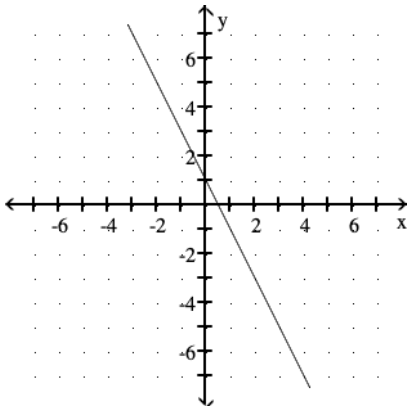
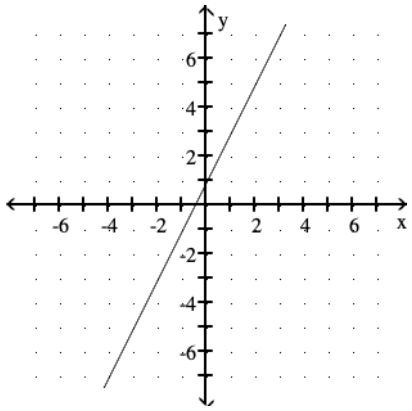
57) $f(x) = \frac{1}{2}x + 1$



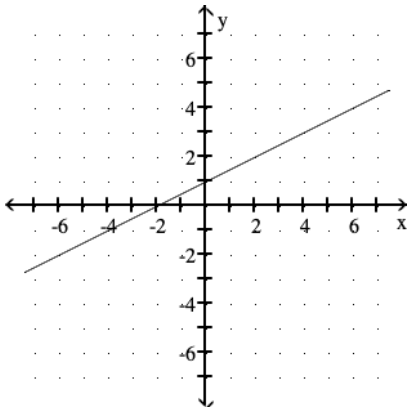

A)



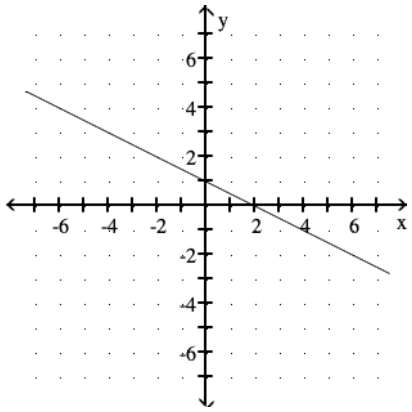

B)




C)




D)




Answer: C



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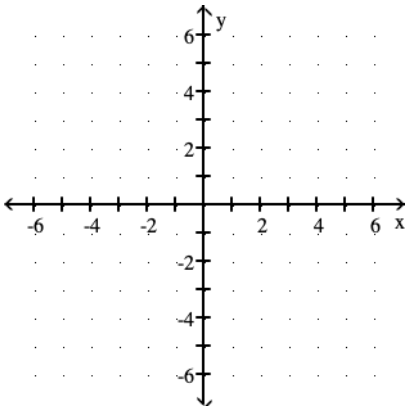
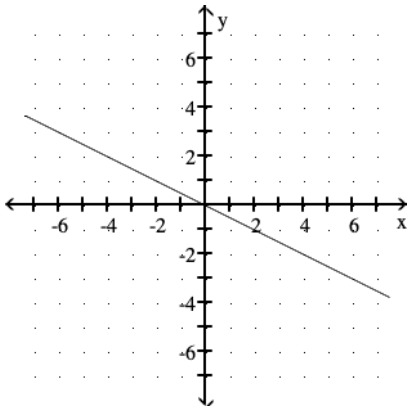
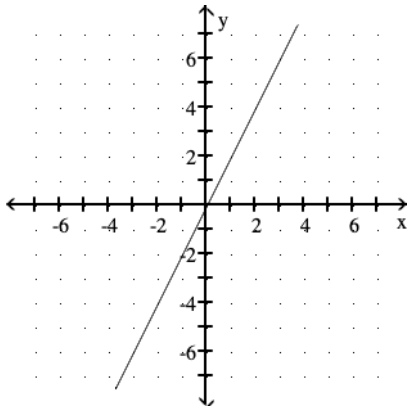
58) $f(x) = \frac{1}{2}x$



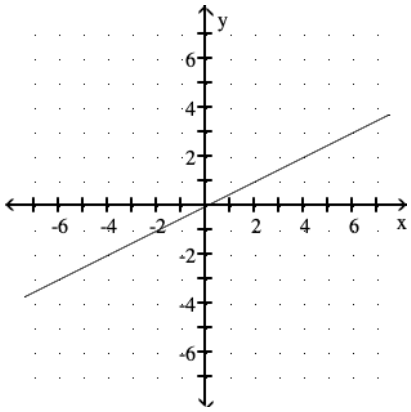

A)



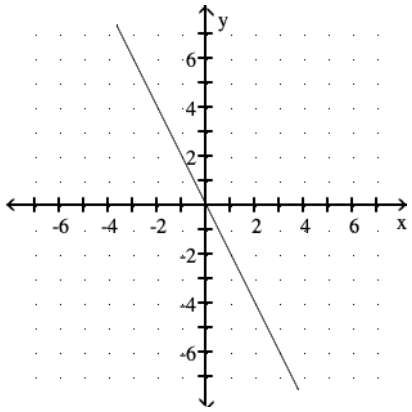

B)




C)




D)




Answer: C



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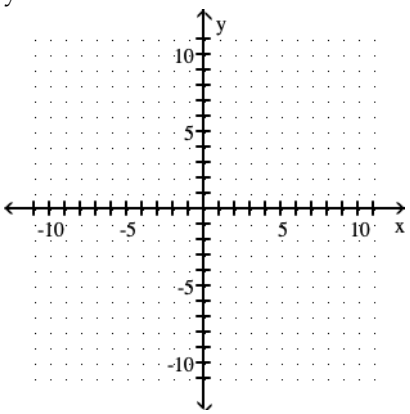
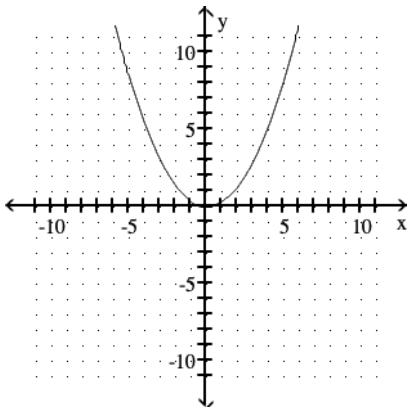
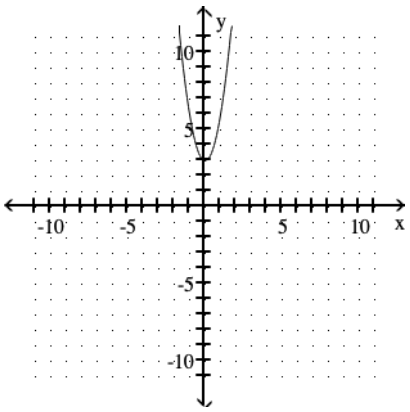
59) $y = 3x^2$



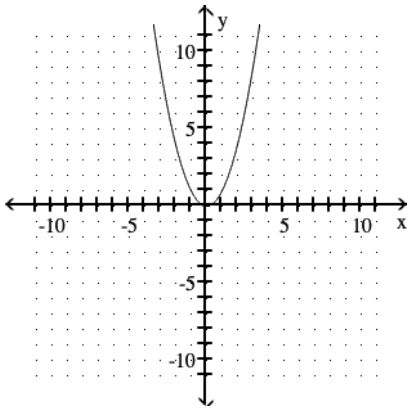

A)



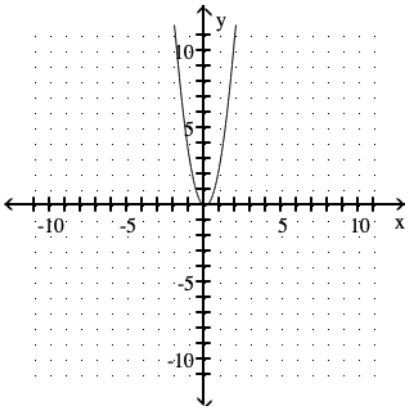

B)




C)




D)




Answer: D



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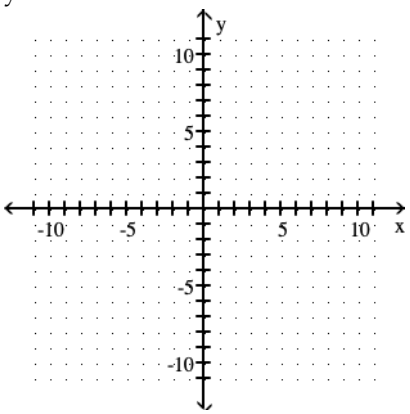
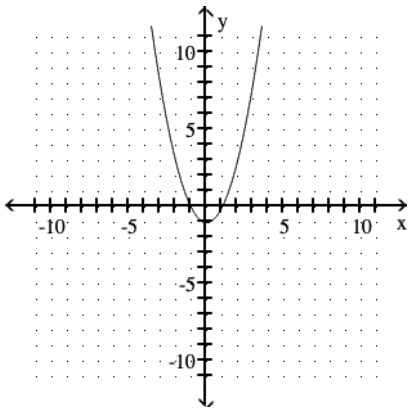
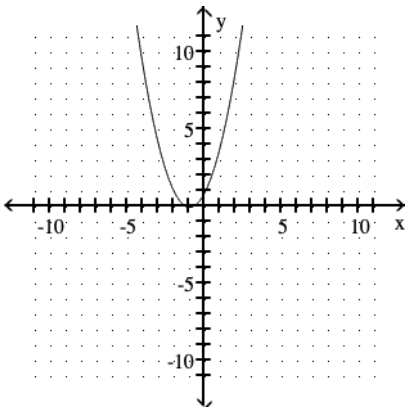
60) $y = x^2 - 1$



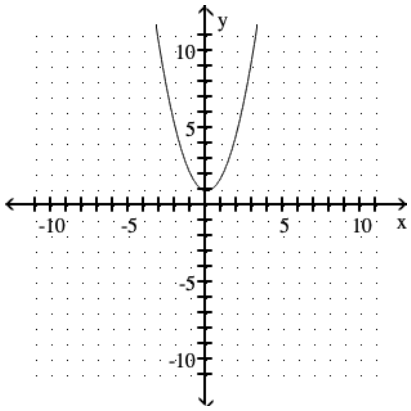

A)



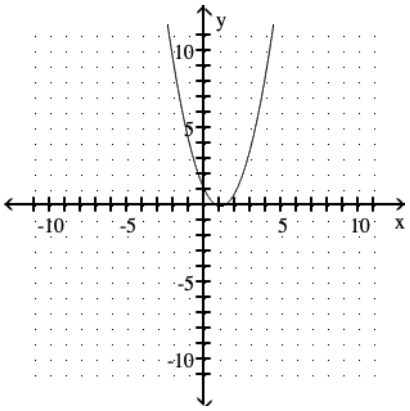

B)




C)




D)




Answer: A



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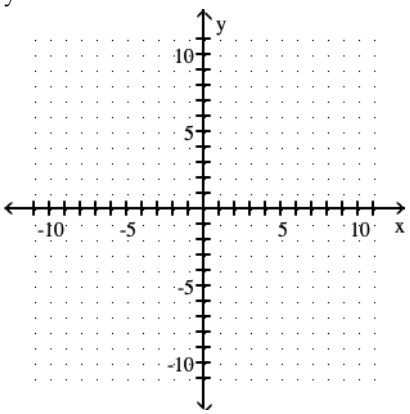
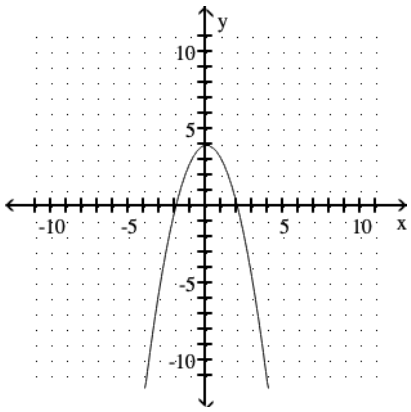
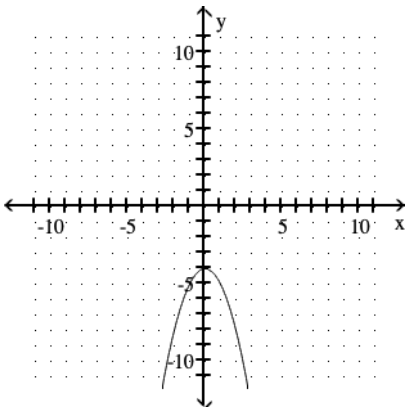
61) $y = -x^2 + 4$



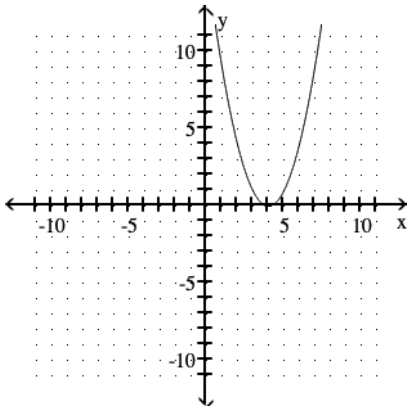

A)



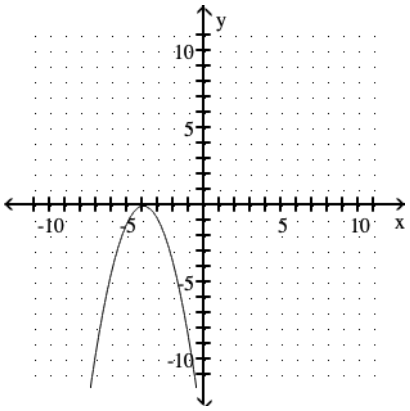

B)




C)




D)




Answer: A



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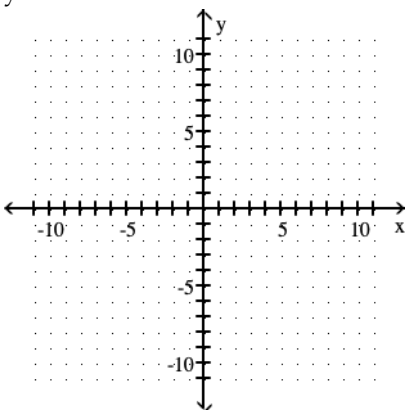
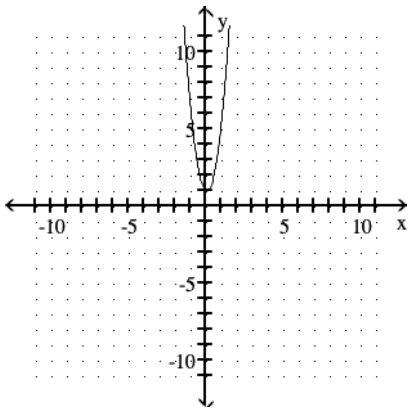
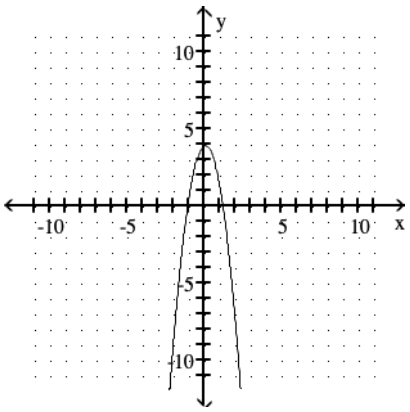
62) $y = 3x^2 + 4$



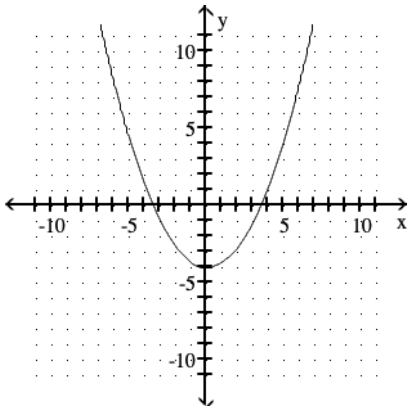

A)



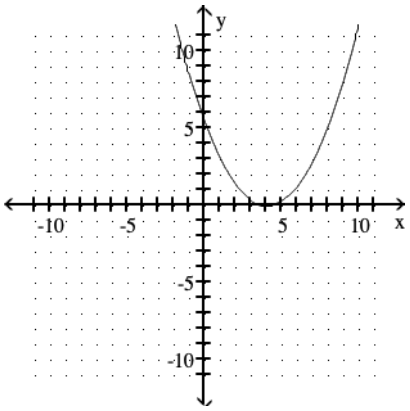

B)




C)




D)




Answer: A



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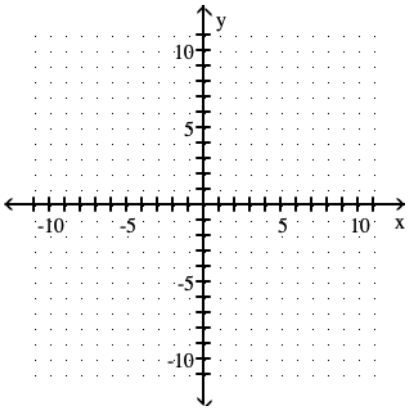
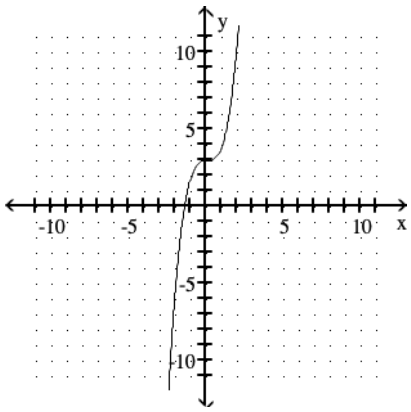
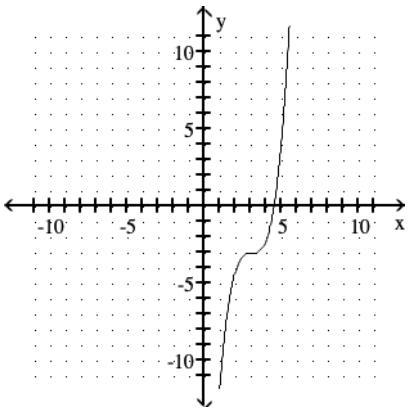
63) $f(x) = x^3 + 3$



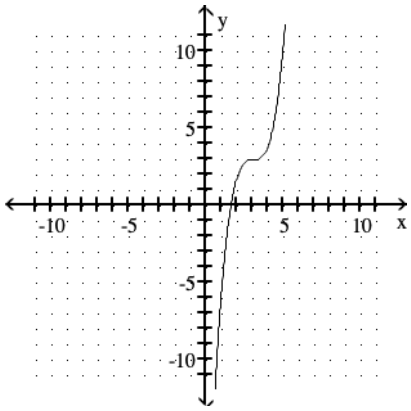

A)



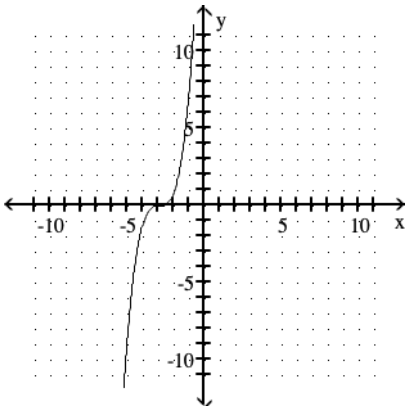

B)




C)




D)




Answer: A



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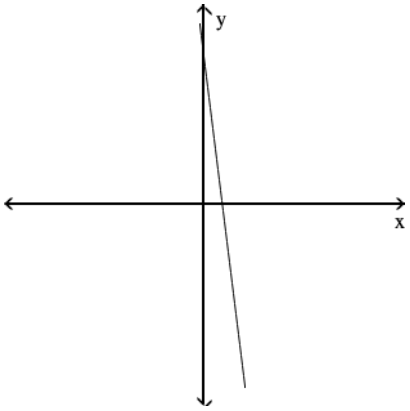
**Use the vertical line test to determine if the graph is a graph of a function.**

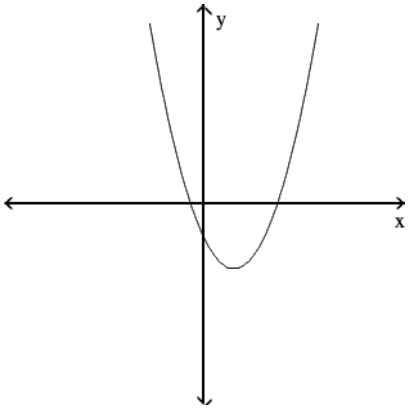
64)




A) Yes B) No

Answer: A

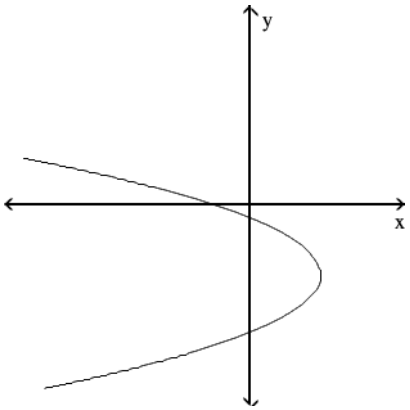
65)




A) Yes B) No

Answer: A

66)




A) Yes B) No

Answer: B



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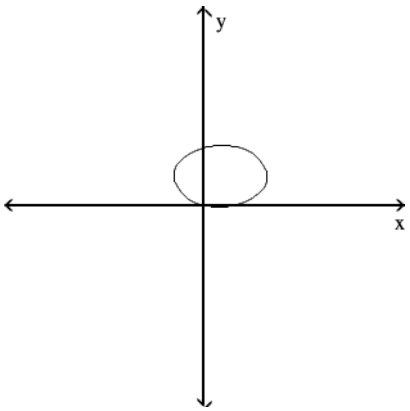
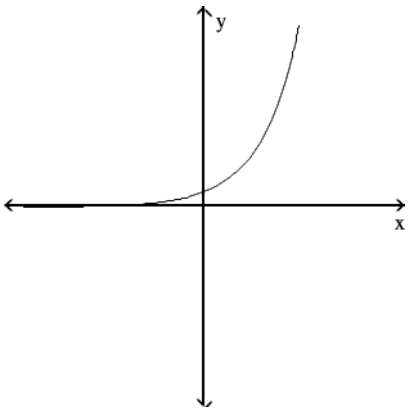
67)




A) Yes B) No

Answer: B

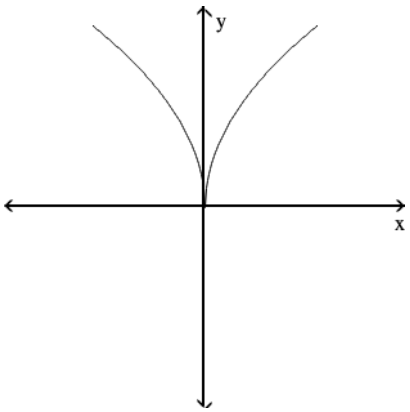
68)




A) Yes B) No

Answer: A

69)




A) Yes B) No

Answer: A



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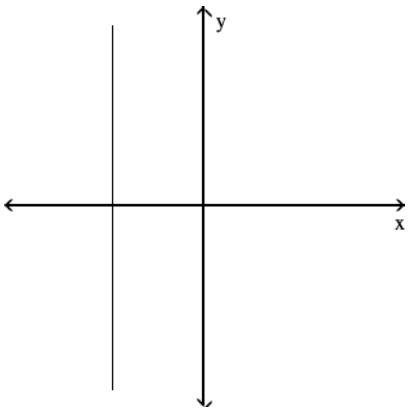
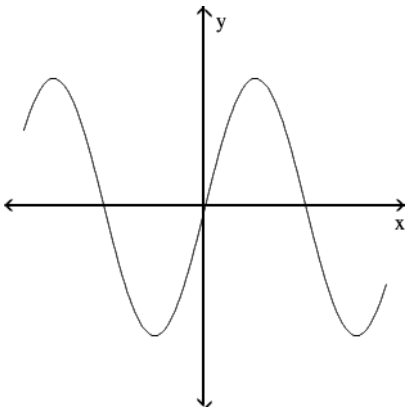
70)




A) Yes B) No

Answer: B

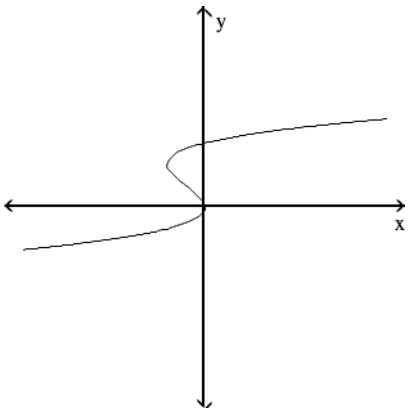
71)




A) Yes B) No

Answer: A

72)




A) Yes B) No

Answer: B



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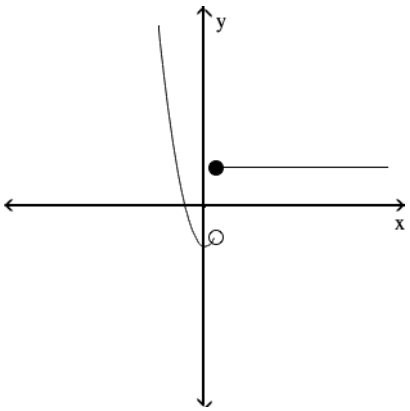
73)




A) Yes B) No

Answer: A

**Determine if the equation represents a function.**

74) $3x = 14 - 3y$

A) Yes B) No

Answer: A

75) $x = y^2 + 3$

A) Yes B) No

Answer: B

76) $y^2 = 5x$

A) Yes B) No

Answer: B

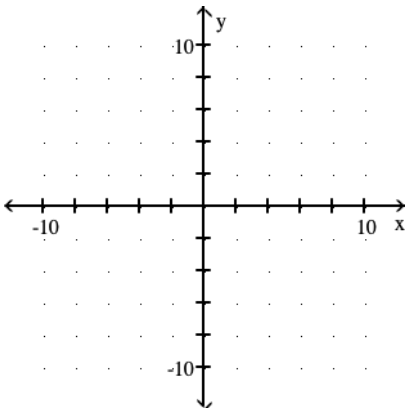
77) $x = y^2$

A) Yes B) No

Answer: B

**Graph the function.**

78) $f(x) = \begin{cases} 6, & \text{for } x \le 5, \\ x+1, & \text{for } x > 5 \end{cases}$



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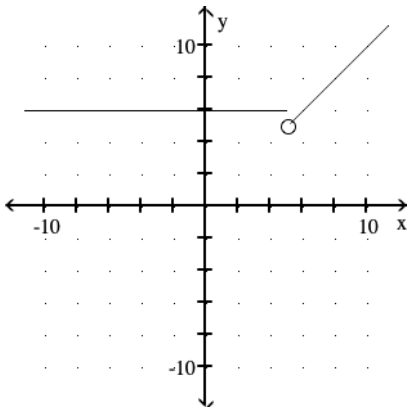
A)

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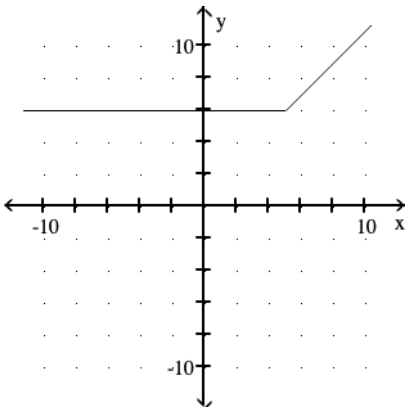
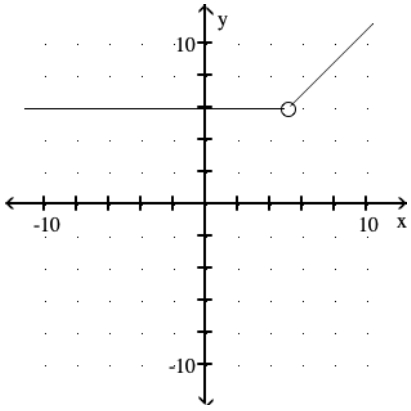
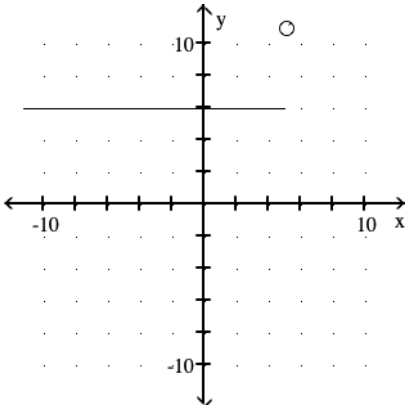



C)

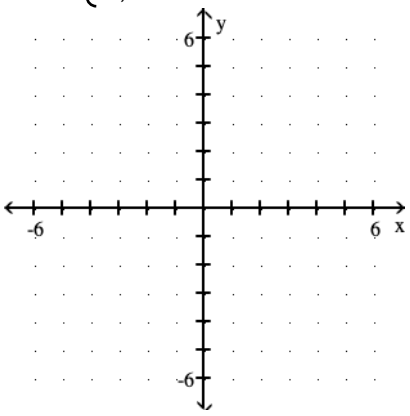



D)




Answer: B

79) $f(x) = \begin{cases} x - 2, & \text{for } x < 1, \\ 4, & \text{for } x \geq 1 \end{cases}$



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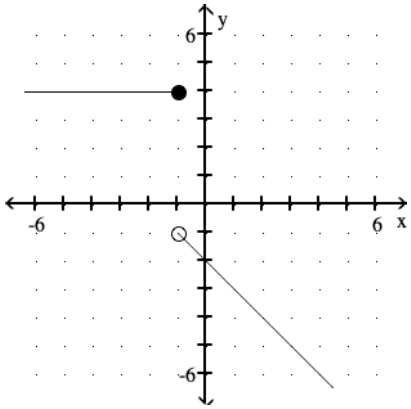
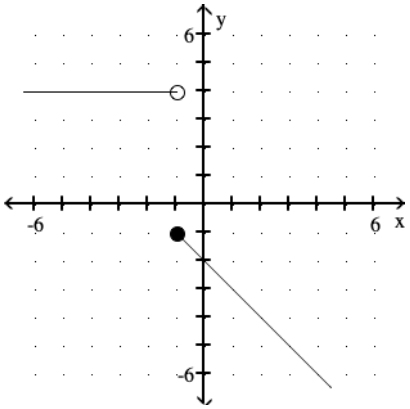
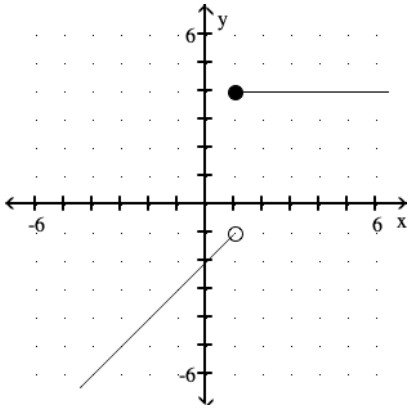
A)



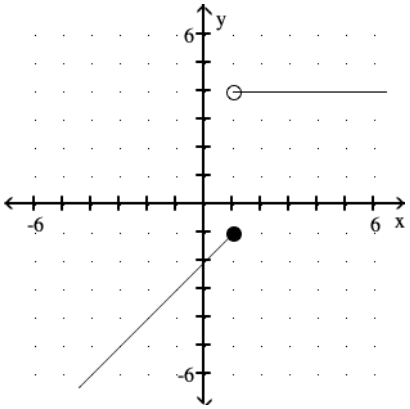

B)




C)

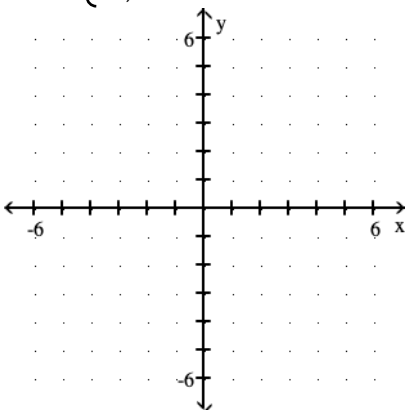



D)




Answer: C

80) $f(x) = \begin{cases} -2 - x, & \text{for } x < 1, \\ -1, & \text{for } x \geq 1 \end{cases}$



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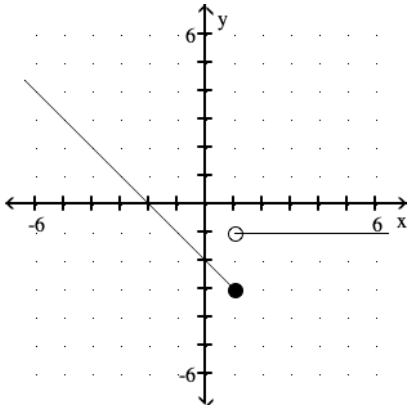
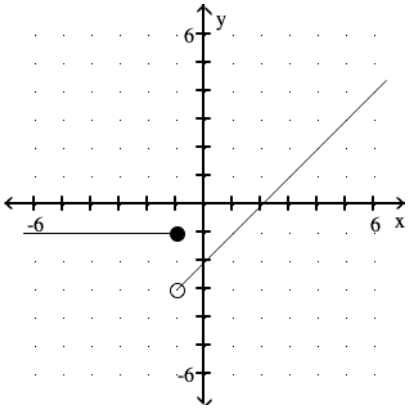
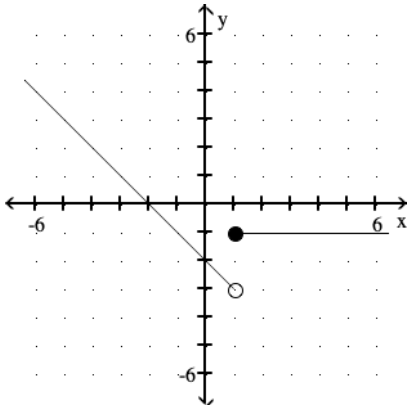
A)



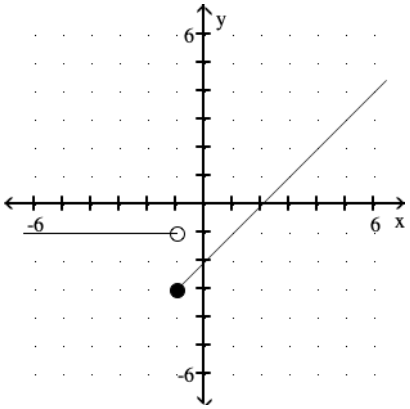

B)




C)

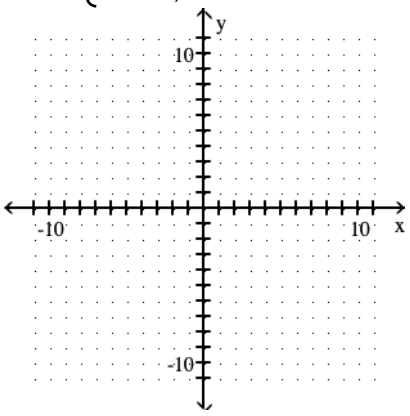



D)




Answer: C

81) $f(x) = \begin{cases} 2 - x, & \text{for } x \le 2, \\ 1 + 3x, & \text{for } x > 2 \end{cases}$



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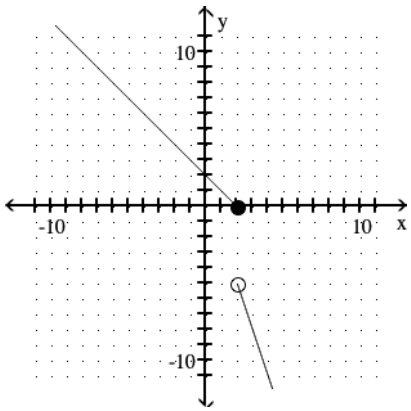
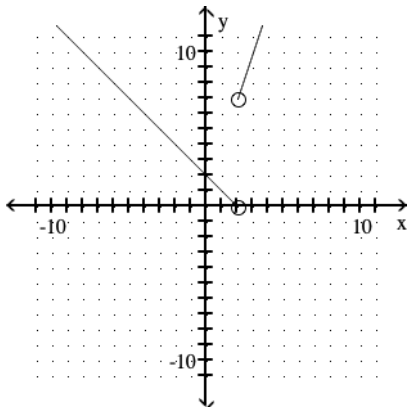
A)




B)

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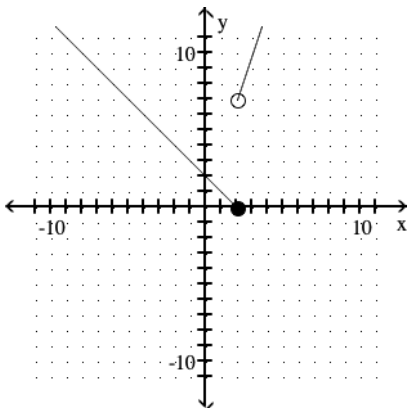
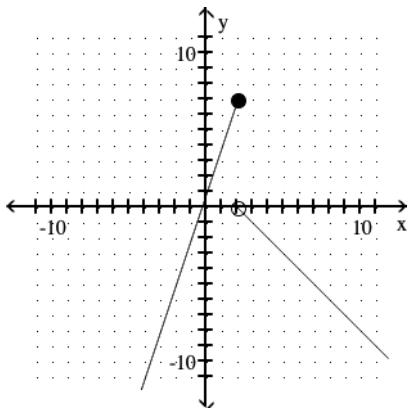
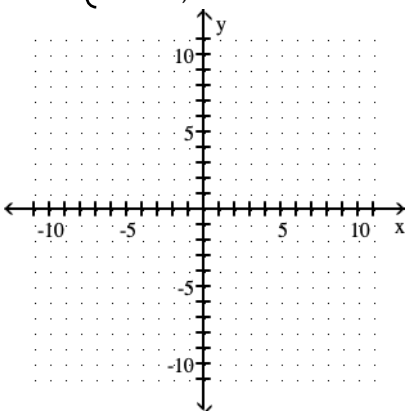



D)




Answer: C

82) $f(x) = \begin{cases} 2x + 8, & \text{for } x < 0, \\ 4x^2 - 1, & \text{for } x \geq 0 \end{cases}$



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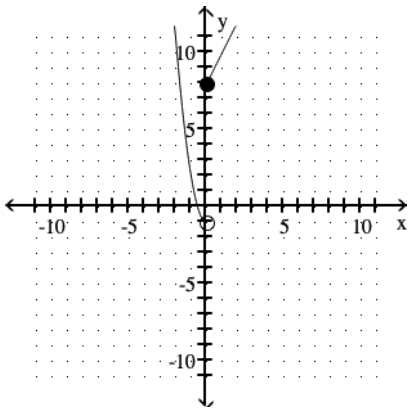
A)

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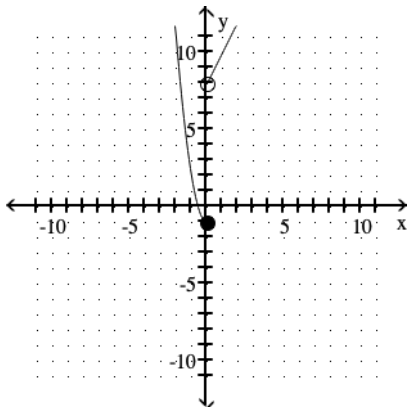
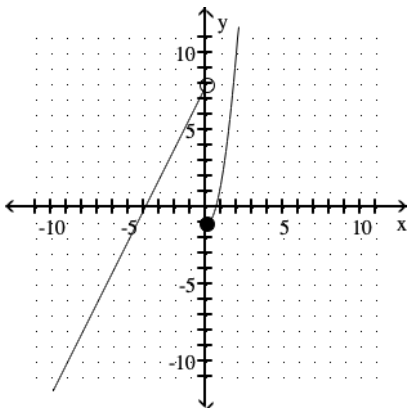
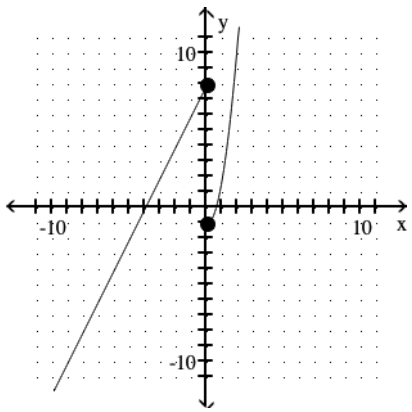



C)

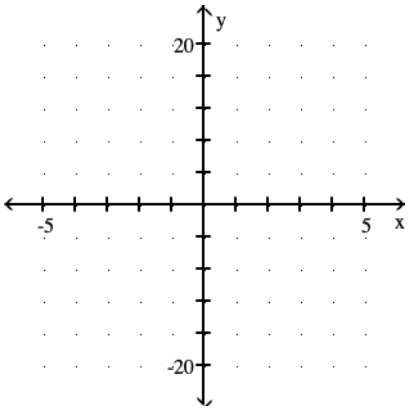



D)




Answer: C

83) $f(x) = \begin{cases} 4x + 2, & \text{for } x < -2, \\ x, & \text{for } -2 \le x \le 3, \\ 3x - 1, & \text{for } x > 3 \end{cases}$



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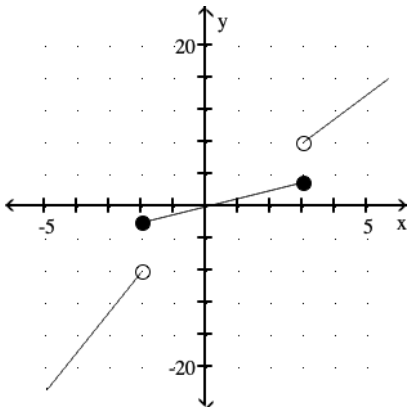
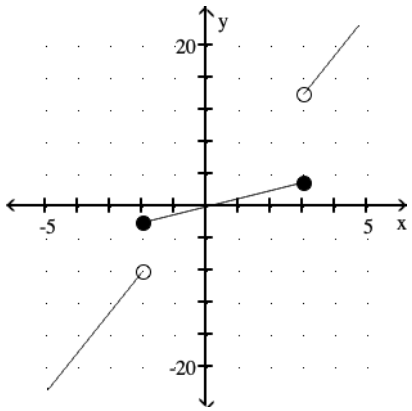
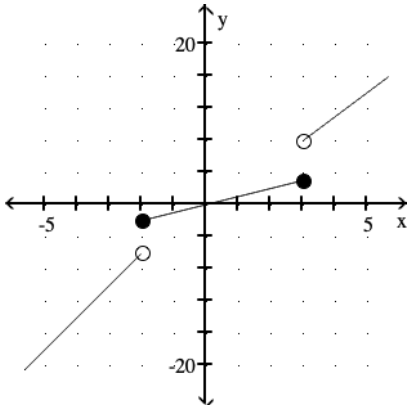
A)



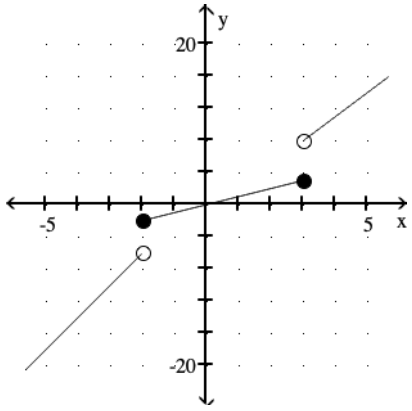

B)




C)

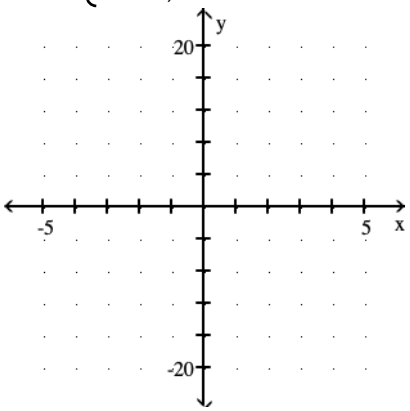



D)




Answer: C

84) $f(x) = \begin{cases} 2x^2, & \text{for } x \le -1, \\ 2, & \text{for } -1 < x \le 1, \\ 2x + 1, & \text{for } x > 1 \end{cases}$



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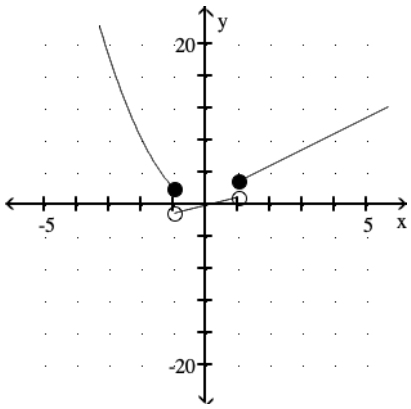
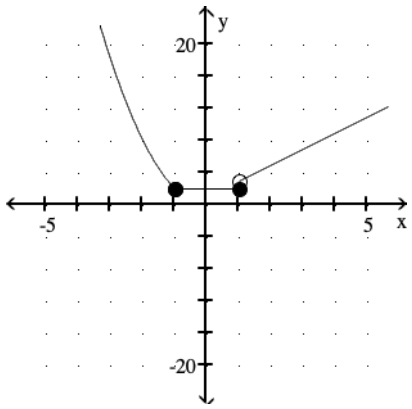
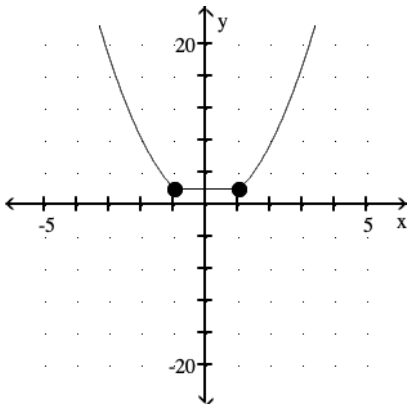
A)



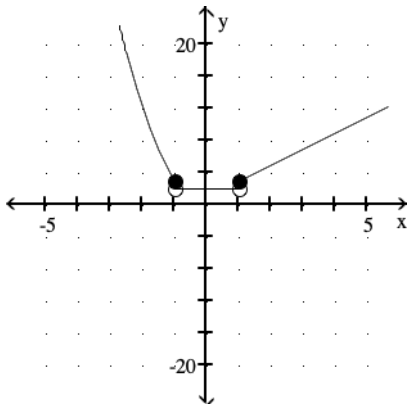

B)




C)




D)




Answer: B

**Solve the problem.**

85) A cellular phone company determines a monthly bill from the x number of minutes of usage. The amount of the bill, B(x), (in dollars) is given by the function:

$B(x) = 29.81 + 0.12x.$

Determine the bill of a customer who uses her cellular phone 32.00 minutes during the month.

A) $32.00 B) $3.84 C) $33.65 D) $957.76

Answer: C

86) A cellular phone company determines a monthly bill from the x number of minutes of usage. The amount of the bill, B(x), (in dollars) is given by the function:

$B(x) = 29.98 + 0.12x.$

How many minutes did Marv use his phone during the month of July if his bill was $38.02?

A) 8 minutes B) 35 minutes C) 287 minutes D) 67 minutes

Answer: D



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87) A small toy company that only makes action figures is owned by its stockholders. The dividend per share of stock is a function of the number of action figures it sells and is defined by

$$D(x) = \frac{\$4.54x - \$270}{3932},$$

where x is the number of action figures sold. What is the dividend for each share of stock if 1350 action figures are sold?

A) –$268.44 B) –$1.49 C) $1.49 D) $1.63

Answer: C

88) A small toy company that only makes action figures is owned by its stockholders. The dividend per share of stock is a function of the number of action figures it sells and is defined by

$$D(x) = \frac{\$4.32x - \$270}{3936},$$

where x is the number of action figures sold. How many action figures were sold if the dividend was $1.42?

A) 63 action figures B) 1564 action figures

C) 1231 action figures D) 1356 action figures

Answer: D

89) The cost of renting a branch chipping machine is a function of the hours it is rented and is defined by

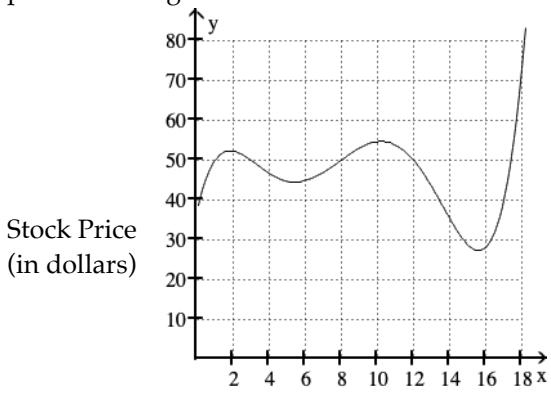
$$C(x) = \begin{cases} \$160, & \text{for } x \le 4, \\ \$160 + 35x, & \text{for } x > 4, \end{cases}$$

x is the number of hours rented. If the rental cost was $492.50, how many hours was the machine rented?

A) 9.5 hours B) 5.5 hours C) 13.5 hours D) 160 hours

Answer: A

90) The following graph shows the stock price of a new internet company over the first 18 months after the initial public offering of its stock.




Stock Price (in dollars)

Month

What was the stock price to the nearest dollar in the fourteenth month?

A) $50 B) $28 C) $35 D) $45

Answer: C



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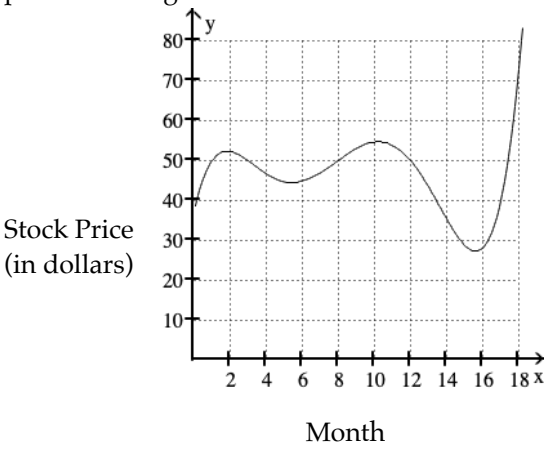
91) The following graph shows the stock price of a new internet company over the first 18 months after the initial public offering of its stock.

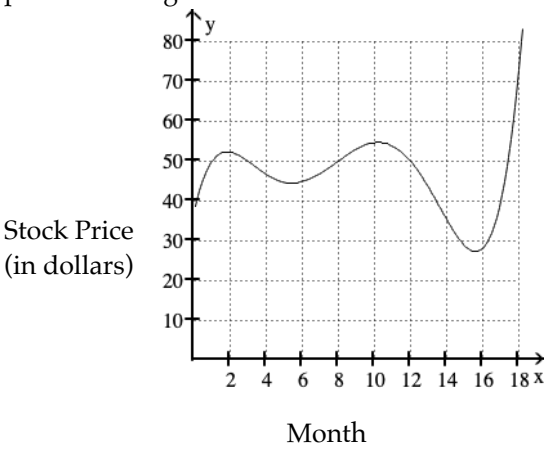



How many months was the stock price $40 during the initial 18 month period?

A) 1 B) 4 C) 2 D) 3

Answer: D

92) The following graph shows the stock price of a new internet company over the first 18 months after the initial public offering of its stock.




Approximately in which month(s) did the stock price reach $60?

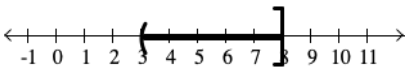
A) The 10th and 18th months B) The price never reached $60.

C) The 2nd and 10th months D) The 18th month

Answer: D

**Write the interval notation for the graph.**

93)




A) (3, 8] B) (3, ∞) C) [3, 8] D) (3, 8)

Answer: A



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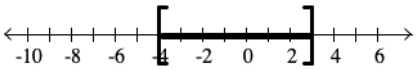
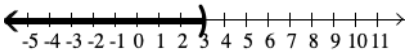
94)




A) [–4, 3] B) –4 ≤ x ≤ 3 C) (–∞, 3) D) [–4, 1]

Answer: A

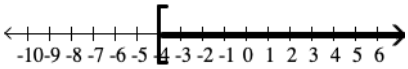
95)




A) (3, ∞) B) [–∞, 3) C) (–∞, 3] D) (–∞, 3)

Answer: D

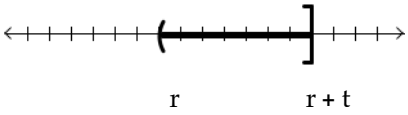
96)




A) [–4, 5) B) (–∞, –4) C) [–4, ∞) D) (–4, ∞)

Answer: C

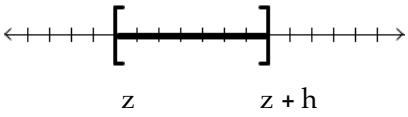
97)




A) (r, r + t) B) (r, ∞) C) (r, r + t] D) (r, t]

Answer: C

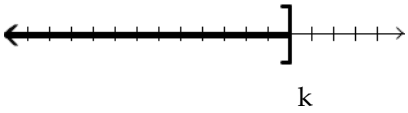
98)




A) (–∞, z + h) B) [z, z + h] C) [z, h] D) (z, z + h)

Answer: B

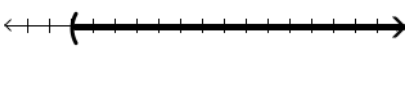
99)




A) [k, ∞) B) [–k, k] C) (–∞, k] D) x ≤ k

Answer: C

100)




A) (r, ∞) B) (–r, r) C) [r, ∞) D) (–r, ∞)

Answer: A



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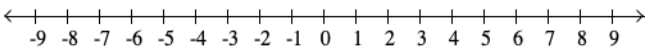
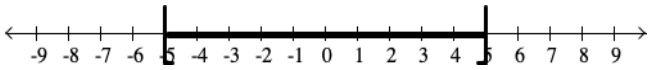
**Write interval notation for the following. Then graph the interval on a number line.**

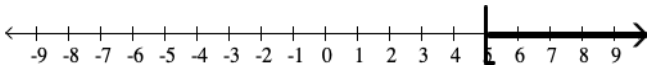
101) The set of all numbers x such that $-5 \le x \le 5$



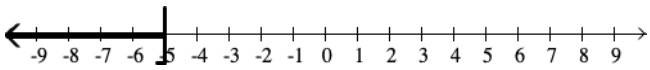

A) [−5, 5]



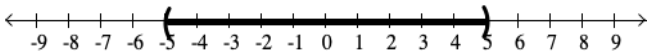

B) [5, ∞)




C) (−∞, −5]

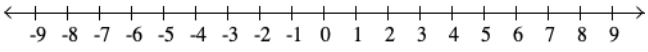



D) (−5, 5)

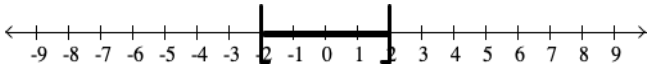



Answer: A

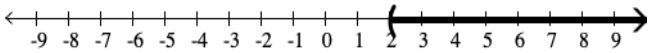
102) The set of all numbers x such that $-2 < x < 2$



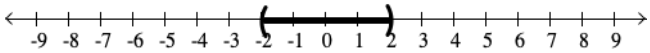

A) [−2, 2]



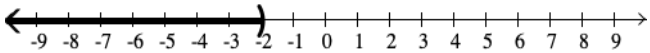

B) (2, ∞)




C) (−2, 2)

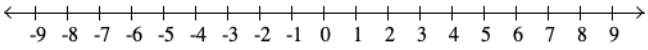



D) (−∞, −2)

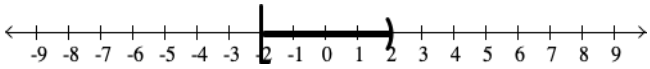



Answer: C

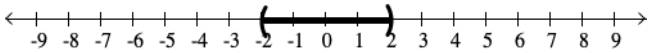
103) {x|−2 ≤ x ≤ 2}



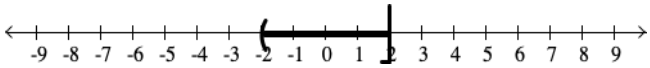

A) [−2, 2)



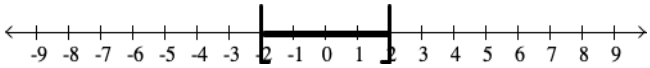

B) (−2, 2)




C) (−2, 2]




D) [−2, 2]




Answer: D



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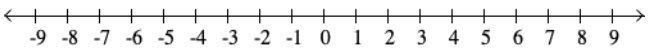
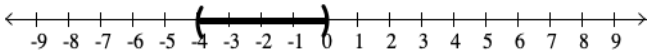
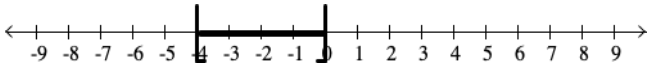
104) {x|−4 ≤ x < 0}



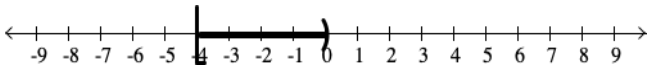

A) (−4, 0)



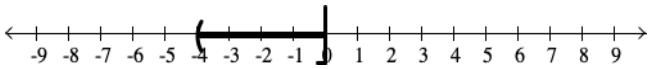

B) [−4, 0]




C) [−4, 0)

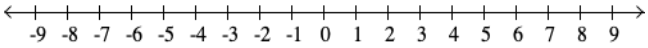



D) (−4, 0]

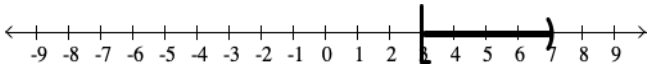



Answer: C

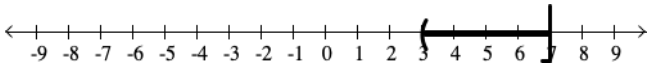
105) {x|3 < x ≤ 7}



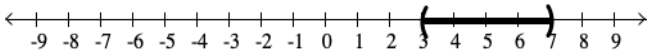

A) [3, 7)



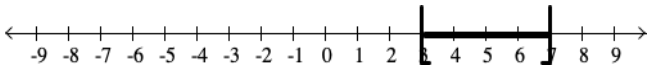

B) (3, 7]




C) (3, 7)

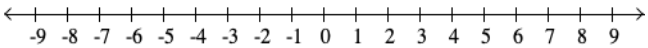



D) [3, 7]

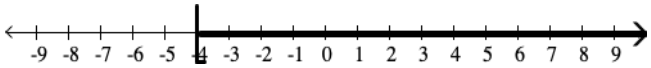



Answer: B

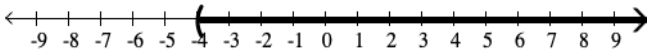
106) {x| x ≥ −4}



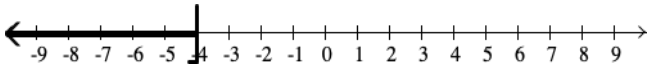

A) [−4, ∞)



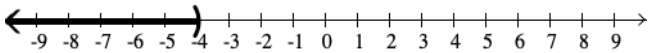

B) (−4, ∞)




C) (−∞, −4]




D) (−∞, −4)




Answer: A



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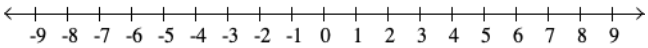
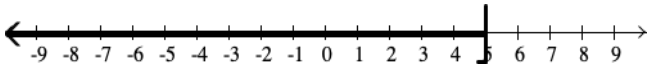
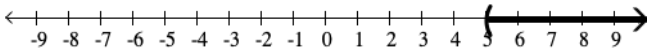
107) {x| x < 5}



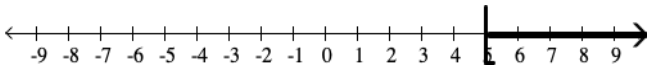

A) (−∞, 5]



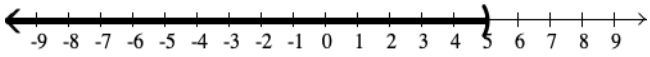

B) (5, ∞)




C) [5, ∞)

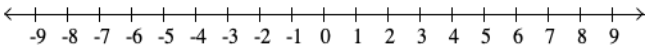



D) (−∞, 5)

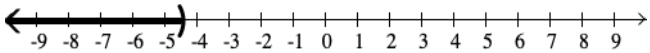



Answer: D

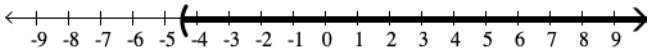
108) {x| x > −4.5}



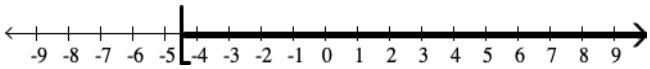

A) (−∞, −4.5)



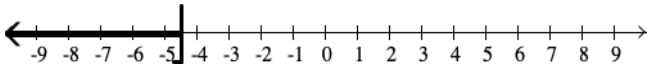

B) (−4.5, ∞)




C) [−4.5, ∞)

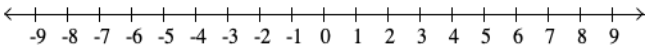



D) (−∞, −4.5]

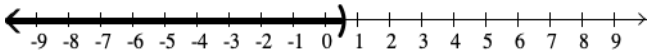



Answer: B

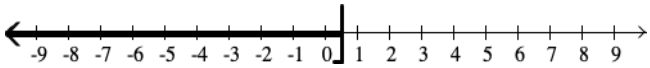
109) {x| x ≤ 0.5}



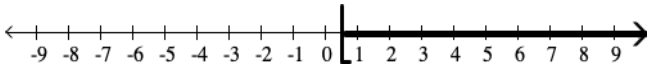

A) (−∞, 0.5)



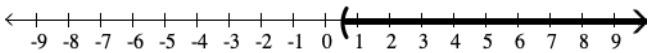

B) (−∞, 0.5]




C) [0.5, ∞)




D) (0.5, ∞)




Answer: B



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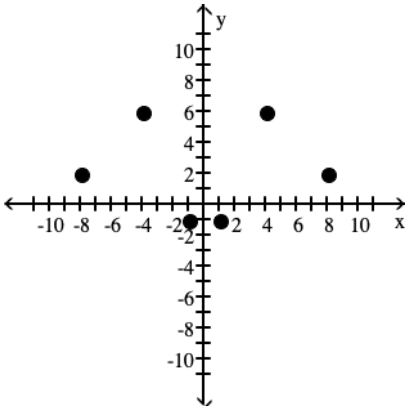
**Find the domain and the range for the function.**

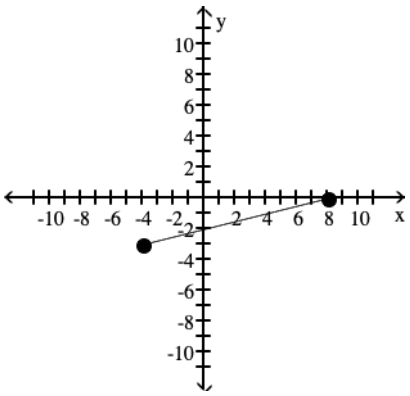
110)




A) Domain: [−8, 8], Range: [−1, 6]
B) Domain: [−1, 6], Range: [−8, 8]
C) Domain: {−8, −4, −1, 1, 4, 8}, Range: {−1, 2, 6}
D) Domain: {−1, 2, 6}, Range: {−8, −4, −1, 1, 4, 8}

Answer: C

111)




A) Domain: (−4, 8), Range: (−3, 0)
B) Domain: (−∞, ∞), Range: (−∞, ∞)
C) Domain: [−4, 8], Range: [−3, 0]
D) Domain: {−4, 8}, Range: {−3, 0}

Answer: C



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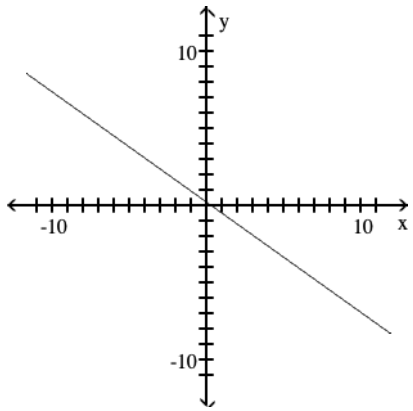
112)




A) Domain: $(-\infty, \infty)$, Range: $(-\infty, \infty)$

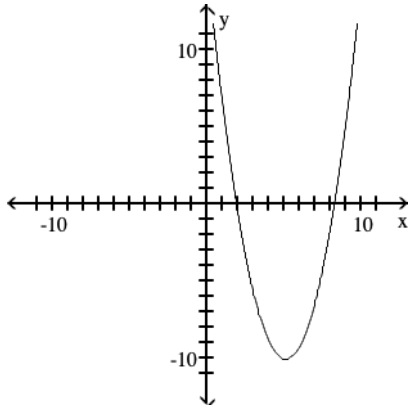
B) Domain: $\left[\frac{2}{5}, \infty\right)$, Range: $[0, \infty)$

C) Domain: $[0, \infty)$, Range: $\left[-\frac{2}{7}, \infty\right)$

D) Domain: $\left(-\infty, \frac{2}{5}\right]$, Range: $(-\infty, 0]$

Answer: A

113)




A) Domain: $(-\infty, 0) \cup (0, \infty)$, Range: $(-\infty, 0) \cup (0, \infty)$

B) Domain: $(0, \infty)$, Range: $[35, \infty)$

C) Domain: $(-\infty, \infty)$, Range: $[-10, \infty)$

D) Domain: $(-\infty, 0)$, Range: $(-\infty, 0)$

Answer: C



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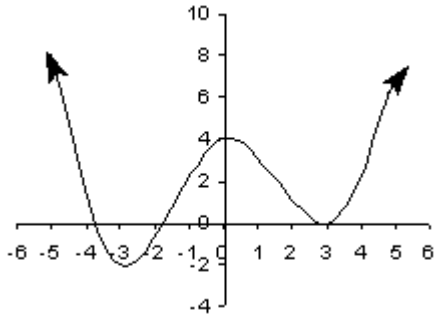
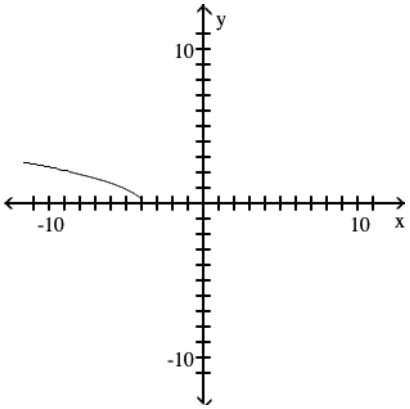
114)




A) Domain: (−∞, ∞), Range: [−2, 4]
B) Domain: (−5, 5), Range: [−2, 8)
C) Domain: (−∞, ∞), Range: [0, ∞)
D) Domain: (−∞, ∞), Range: [−2, ∞)

Answer: D

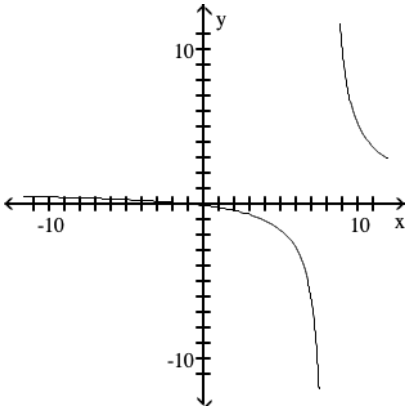
115)




A) Domain: (−∞, −4], Range: [0, ∞)
B) Domain: (−∞, −4) ∪ (−4, ∞), Range: (−∞, 0) ∪ (0, ∞)
C) Domain: $(\sqrt{-4}, \infty)$, Range: (−∞, 0]
D) Domain: (−∞, ∞), Range: [0, ∞)

Answer: A

116)




A) Domain: (0, ∞), Range: (1, ∞)
B) Domain: (−∞, 8) ∪ (8, ∞), Range: (−∞, 1) ∪ (1, ∞)
C) Domain: (−∞, −8) ∪ (−8, ∞), Range: (−∞, ∞)
D) Domain: (−∞, ∞), Range: (−∞, ∞)

Answer: B



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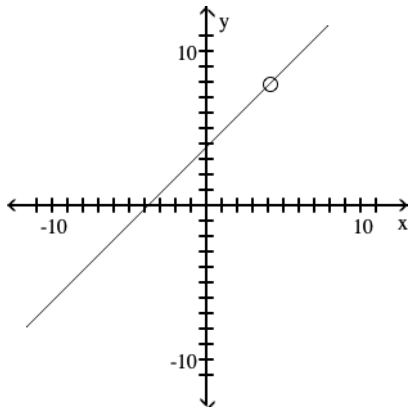
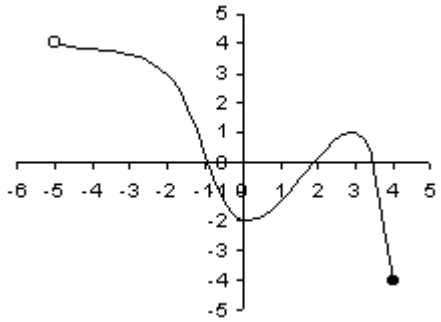
117)




A) Domain: $(-\infty, 4) \cup (4, \infty)$, Range: $(-\infty, 8) \cup (8, \infty)$
B) Domain: $(-\infty, -4) \cup (-4, \infty)$, Range: $(-\infty, -8) \cup (-8, \infty)$
C) Domain: $(-\infty, \infty)$, Range: $(-\infty, \infty)$
D) Domain: $(-\infty, 8) \cup (8, \infty)$, Range: $(-\infty, 4) \cup (4, \infty)$

Answer: A

118)




A) Domain: $[-4, 4)$, Range: $(-5, 4]$
B) Domain: $(-5, 4)$, Range: $[-2, 4)$
C) Domain: $[-5, 4]$, Range: $[-4, 4]$
D) Domain: $(-5, 4]$, Range: $[-4, 4)$

Answer: D



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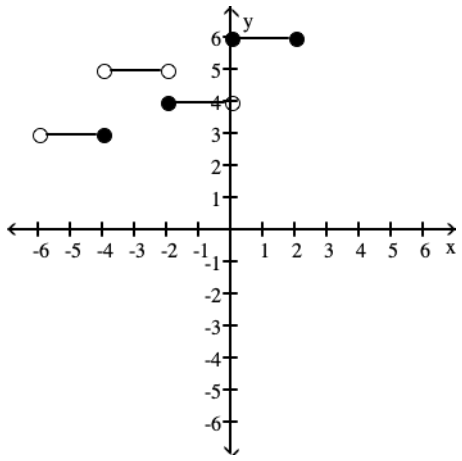
119)




A) Domain: (−6, 2], Range: [3, 6]
B) Domain: (−6, 2], Range: {3, 4, 5, 6}
C) Domain: [−6, 2), Range: {3, 4, 5, 6}
D) Domain: [−6, 2], Range: {3, 4, 5, 6}

Answer: B

**State the domain of the given function.**

120) $f(x) = -4x + 1$

A) {x | x is a real number}
B) {x | x ≥ 0}
C) {x | x ≤ 0}
D) {x | x is a real number and x ≠ 0}

Answer: A

121) $f(x) = 3x^2 + 4x - 3$

A) {x | x > 0}
B) {x | x is a real number and x ≠ 0}
C) {x | x ≥ 0}
D) {x | x is a real number}

Answer: D

122) $f(x) = \dfrac{x}{x - 6}$

A) {x | x > 6}
B) {x | x = 6}
C) {x | x is a real number and x ≠ 6}
D) {x | x is a real number}

Answer: C

123) $f(x) = \dfrac{9}{8x - 2}$

A) $\{x \mid x \text{ is a real number and } x \neq 4\}$
B) $\left\{x \mid x \text{ is a real number and } x \neq \dfrac{1}{4}\right\}$
C) {x | x is a real number}
D) $\left\{x \mid x > \dfrac{1}{4}\right\}$

Answer: B



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124) $f(x) = |\ 3x + 8\ |$

A) $\left\{x \mid x \text{ is a real number and } x \neq -\frac{8}{3}\right\}$ B) {x | x is a real number}

C) {x | x ≥ 0} D) $\{x \mid x \geq -\frac{8}{3}\}$

Answer: B

125) $f(x) = \sqrt{x + 6}$

A) {x | x is a real number and x ≠ −6} B) {x | x ≥ −6}

C) {x | x ≥ 6} D) {x | x > −6}

Answer: B

126) $f(x) = \sqrt{-x - 6}$

A) {x | x ≥ 6} B) {x | x ≥ −6} C) {x | x ≤ 6} D) {x | x ≤ −6}

Answer: D

127) $f(x) = \frac{3x}{x^2 - 81}$

A) {x | x ≥ 81} B) {x|x is a real number}

C) {x | x is a real number and x ≠ 81} D) {x | x is a real number and x ≠ −9, x ≠ 9}

Answer: D

128) $f(x) = \frac{x - 7}{x^2 - 7x - 8}$

A) {x | x is a real number and x ≠ 8} B) {x | x is a real number and x ≠ −8, x ≠ 1}

C) {x | x is a real number and x ≠ −1, x ≠ 8} D) {x | x <−8 ∪ x > 1}

Answer: C

129) $f(x) = \frac{5x - 7}{3x + 18}$

A) {x | x is a real number} B) {x | x is a real number and x ≠ −18}

C) {x | x is a real number and x ≠ −6} D) {x | x is a real number and x ≠ 6}

Answer: C



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**Solve the problem.**

130) Suppose that $2000 is invested at 8% interest, compounded monthly, for t years. The amount A in the account is a function of time. Find an equation for this function and state the domain of the function.

A) $A = 2000\left(1 + \frac{0.02}{12}\right)^{12t}$, Domain: {t | t ≥ 0}

B) $A = 2000\left(1 + \frac{0.02}{12}\right)^{t}$, Domain: {t | t ≥ 0}

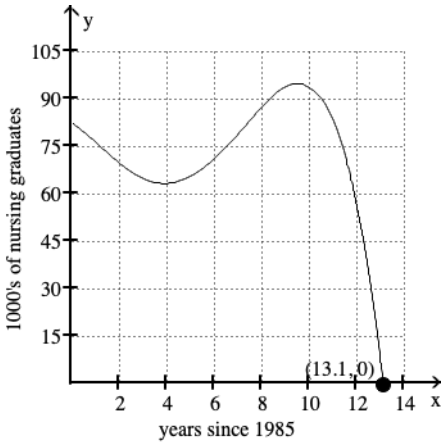
C) $A = 2000\left(1 + \frac{2}{12}\right)^{12t}$, Domain: {t | t ≥ 0}

D) $A = 2000\left(1 + \frac{0.02}{12}\right)^{12t}$, Domain: {t | t is a real number}

Answer: A

131) The following graph approximates the number y, in thousands, of graduates from nursing schools in the U. S. since 1985(Source: Statistical abstract of the US). The equation of this graph is the function given by

$y = -0.036t^4 + 0.605t^3 - 1.87t^2 - 4.67t + 82.5$




Use the graph to approximate the domain and range of the function.

A) Domain: [0, 13.1], Range: (−∞, ∞)

B) Domain: [0, 13.1], Range: [0, 95]

C) Domain: (−∞, ∞), Range: [0, 95]

D) Domain: [0, 95], Range: [0, 13.1]

Answer: B



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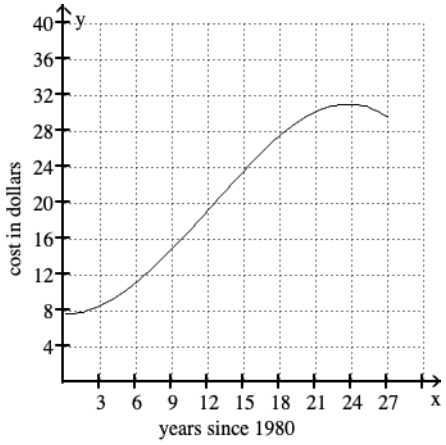
132) The following graph approximates the average monthly cable TV rates, in dollars, since 1980. The equation of this graph is given by

$$R = -0.0036t^3 + 0.13t^2 - 0.073t + 7.7$$



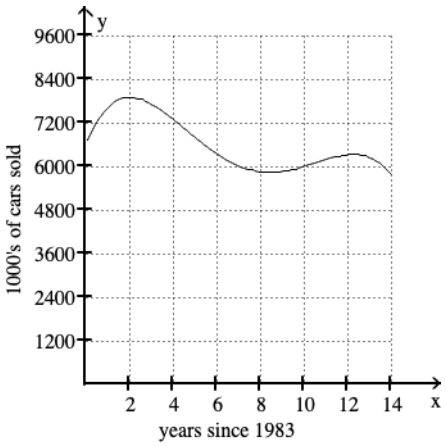

Use the graph to approximate the domain and range of the function.

A) Domain: [0, ∞), Range: [0, 36]
B) Domain: [0, 27], Range: [8, 31]
C) Domain: (−∞, ∞), Range: [0, 32]
D) Domain: [8, 31], Range: [0, 27]

Answer: B

133) The following graph approximates the number C, in thousands, of cars sold that were manufactured in the U.S. since 1983. The equation of this graph is given by

$$C = -1.63t^4 + 49.5t^3 - 476t^2 + 1370t + 6705$$




Use the graph to approximate the domain and range of the function.

A) Domain: [5900, 7900], Range: [0, 14]
B) Domain: [0, 14], Range: [0, 7300]
C) Domain: [0, ∞), Range: [5900, 7900]
D) Domain: [0, 14], Range: [5900, 7900]

Answer: D

**Graph.**



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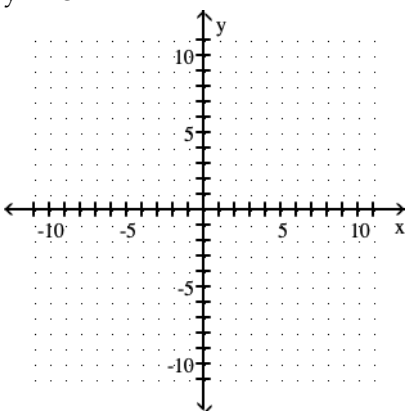
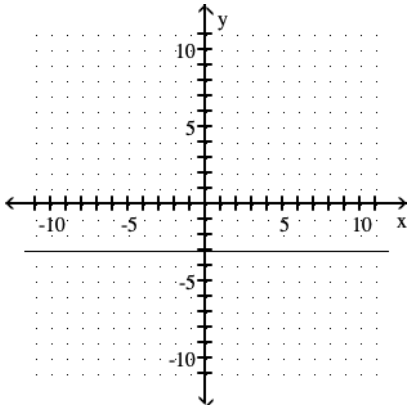
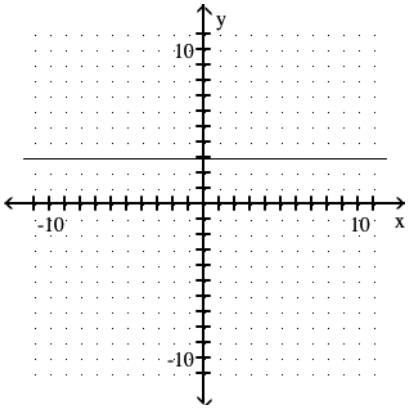
134) y = –3



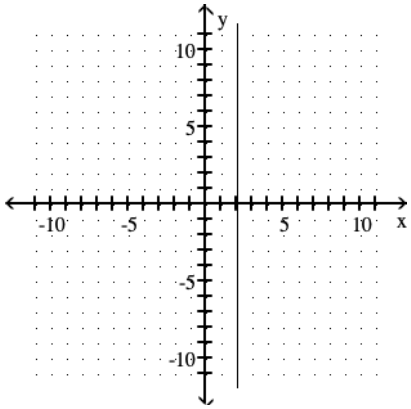

A)



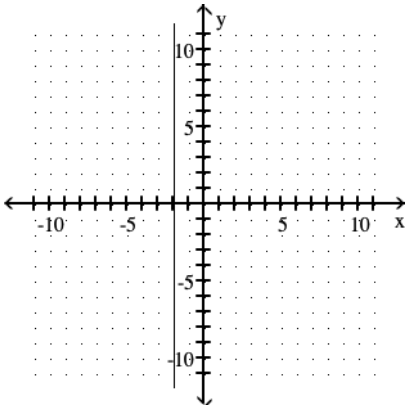

B)




C)




D)




Answer: A



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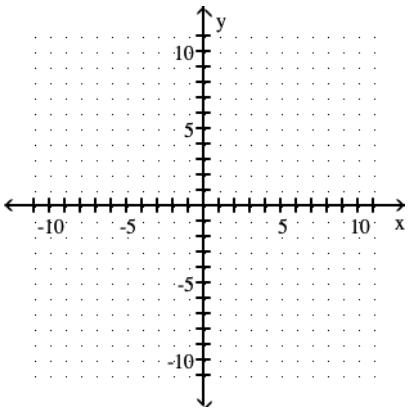
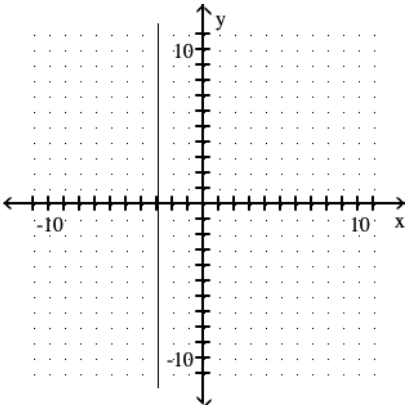
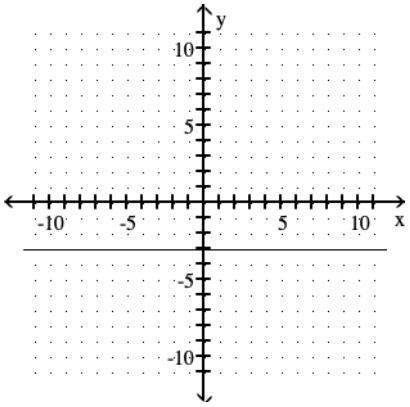
135) x = 3



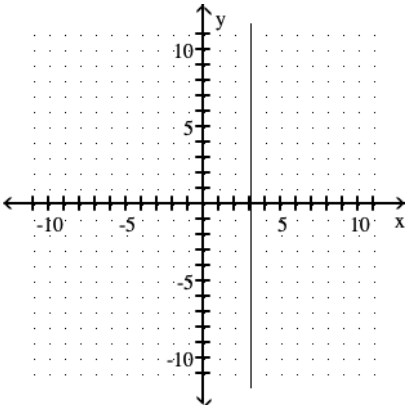

A)



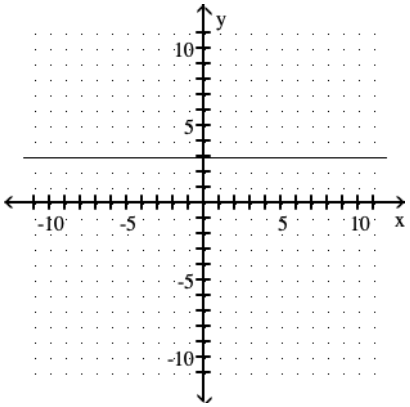

B)




C)




D)




Answer: C



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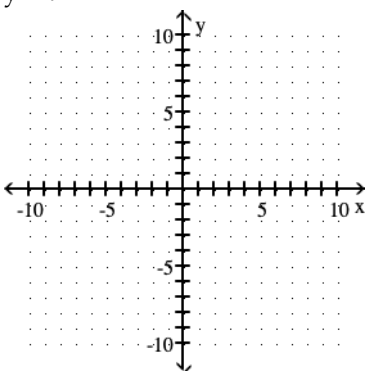
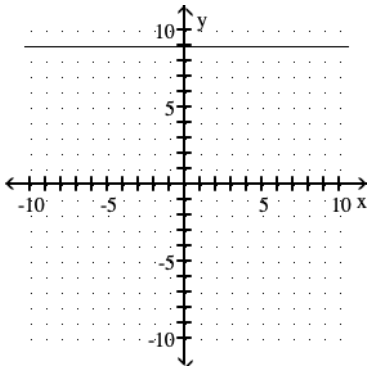
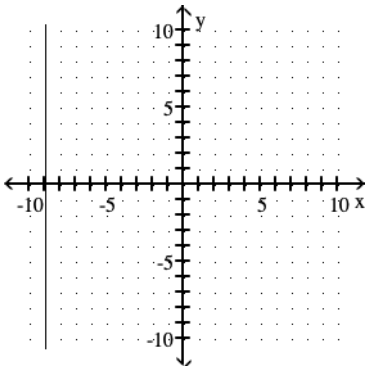
136) y = 9



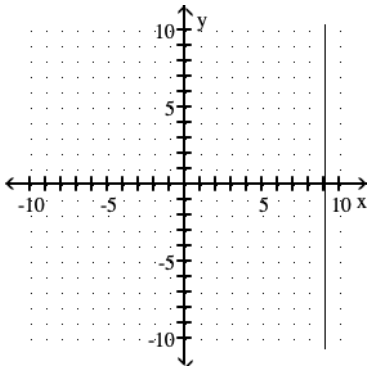

A)



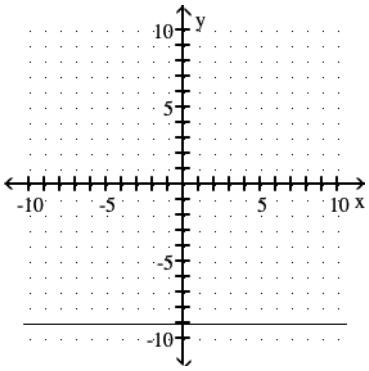

B)




C)




D)




Answer: A



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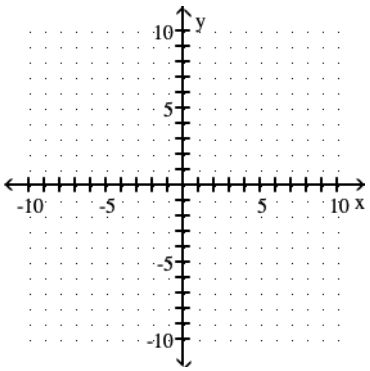
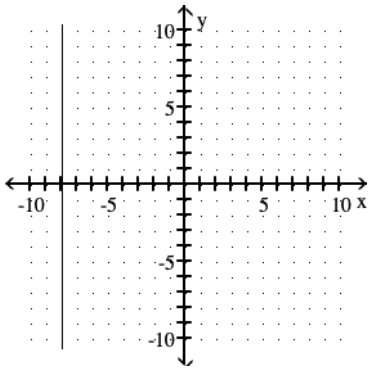
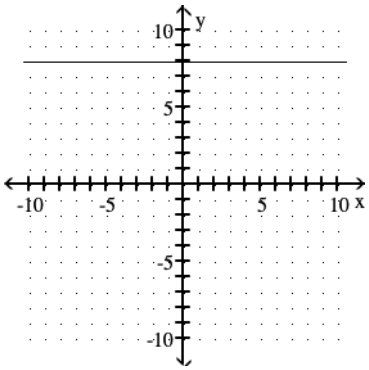
137) x = –8



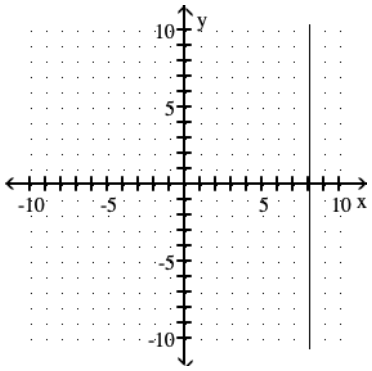

A)



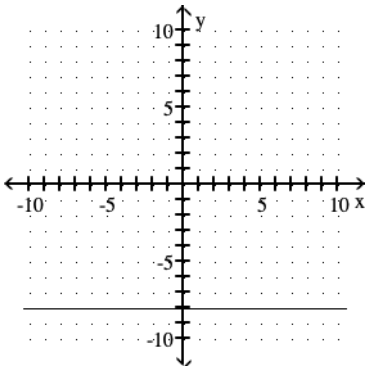

B)




C)




D)




Answer: A



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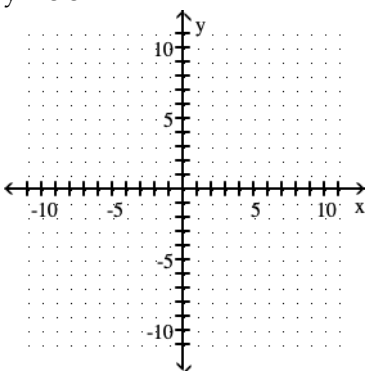
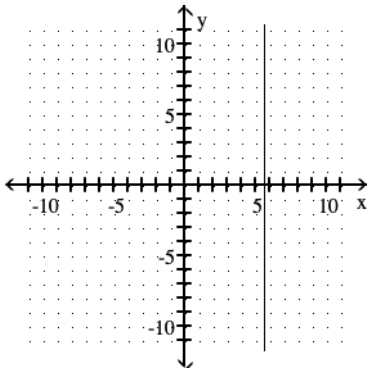
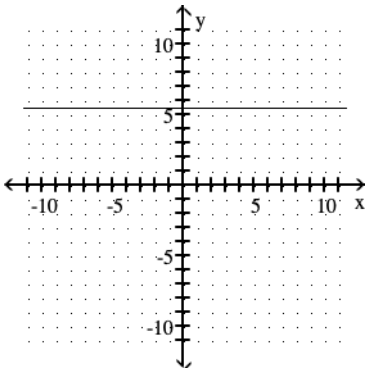
138) y = 5.5



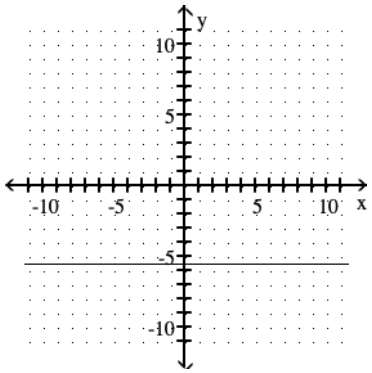

A)



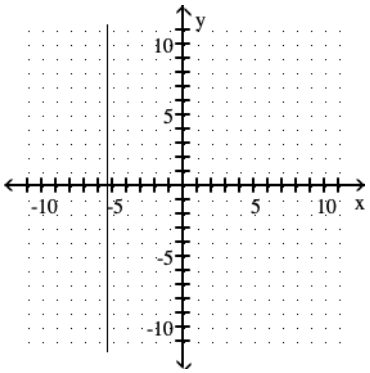

B)




C)




D)




Answer: B



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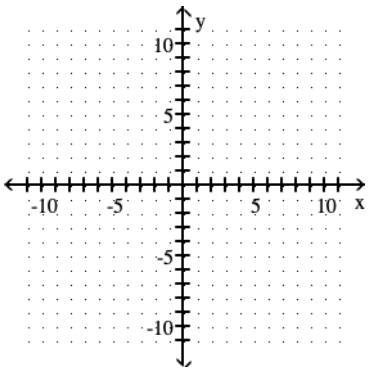
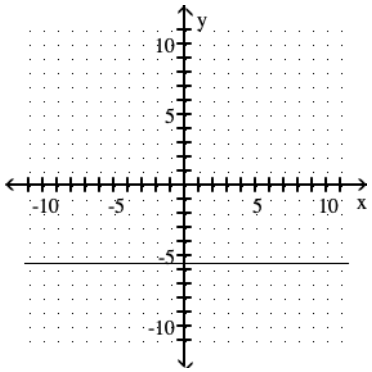
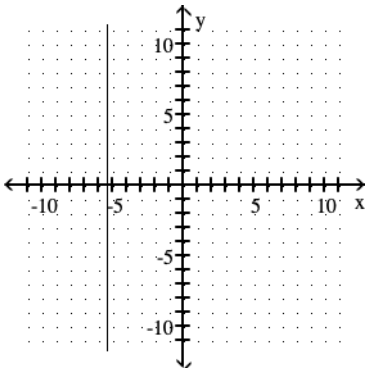
139) x = −5.5



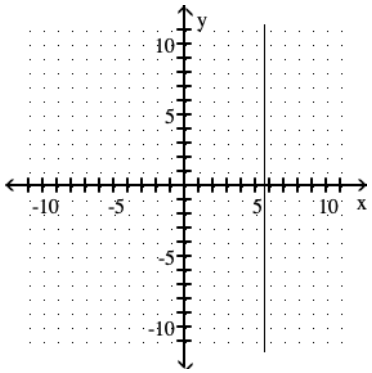

A)



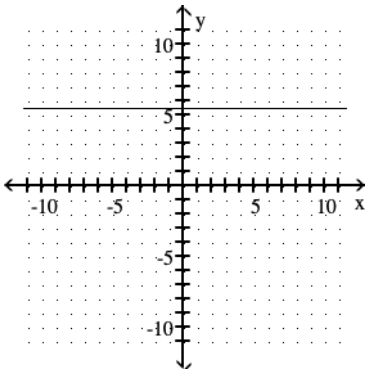

B)




C)




D)




Answer: B



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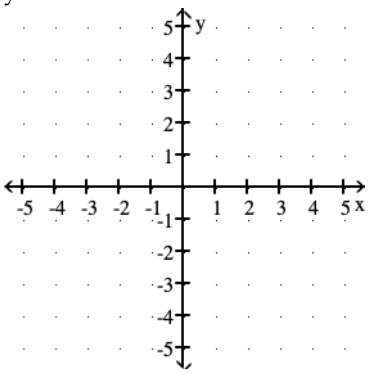
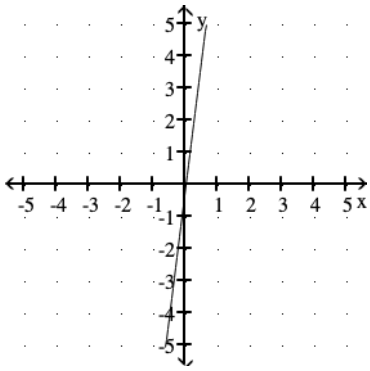
140) y = −8x




A)

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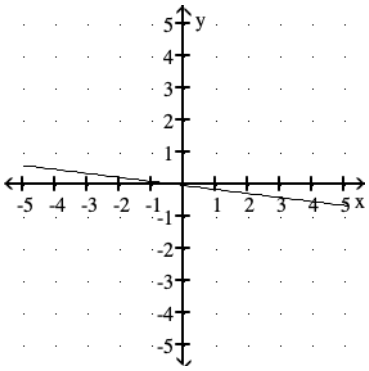
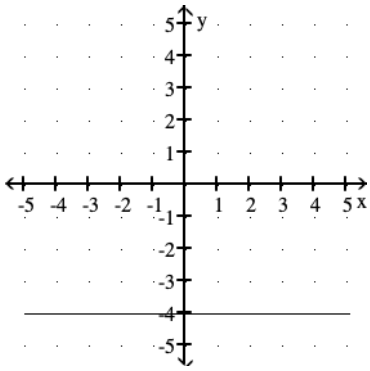
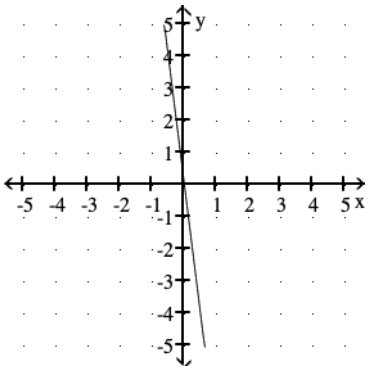



C)

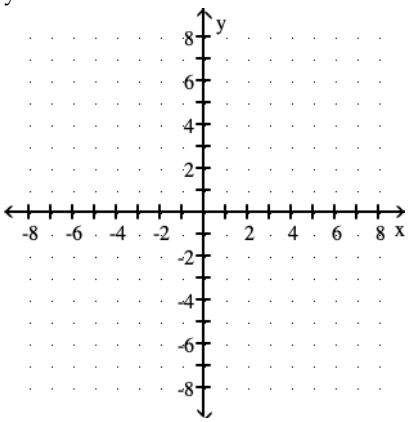



D)




Answer: D

141) y = 4x + 5



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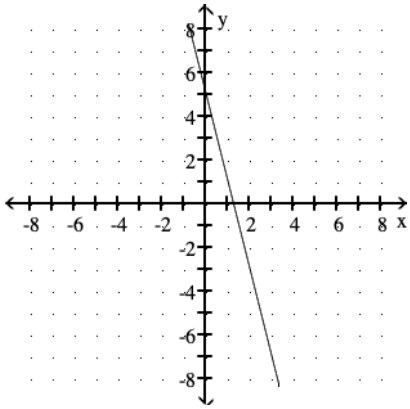
A)

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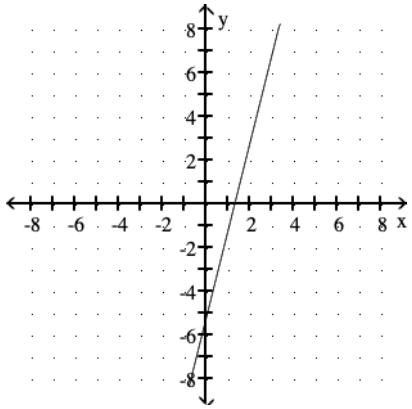


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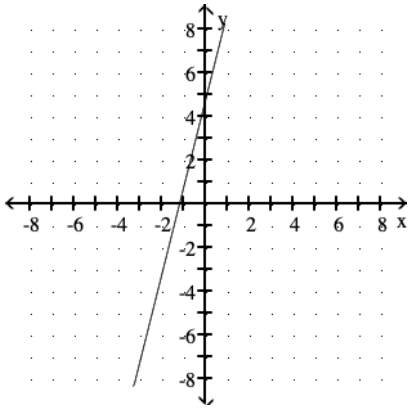
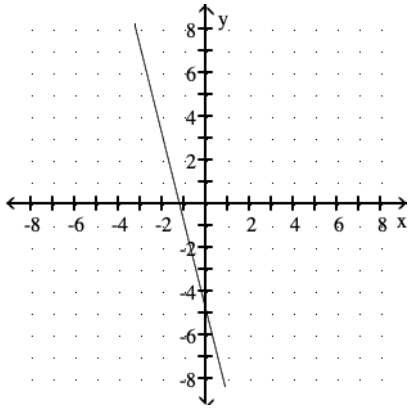
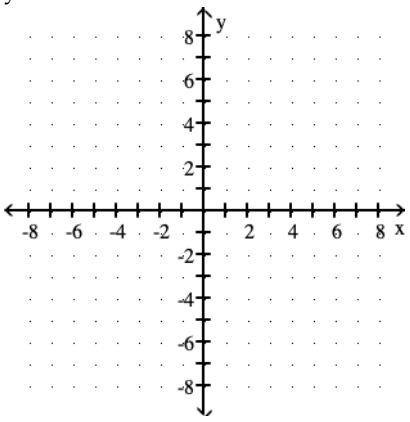



D)




Answer: C

142) $y = 5x - 6$



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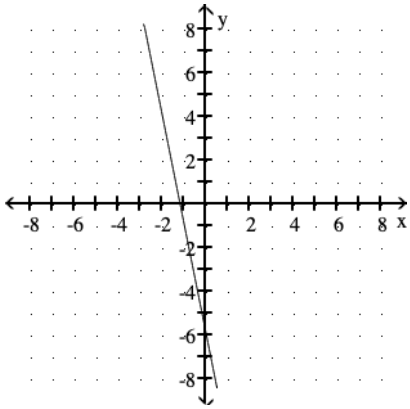
A)

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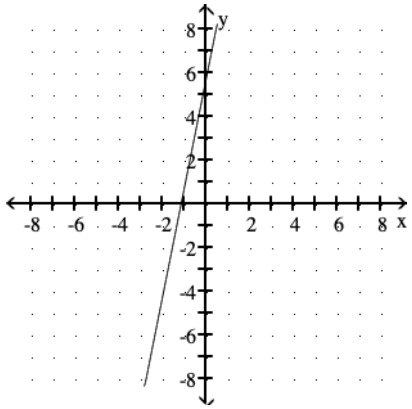


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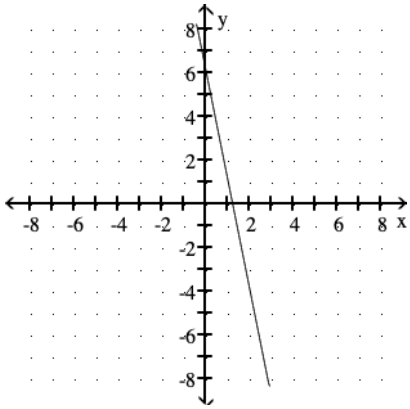
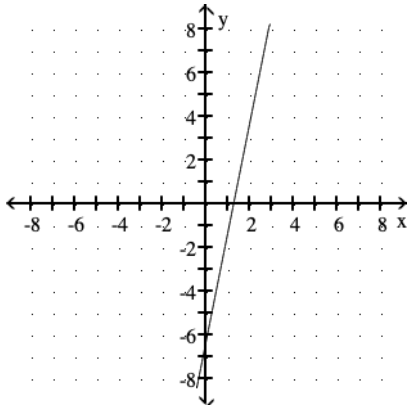
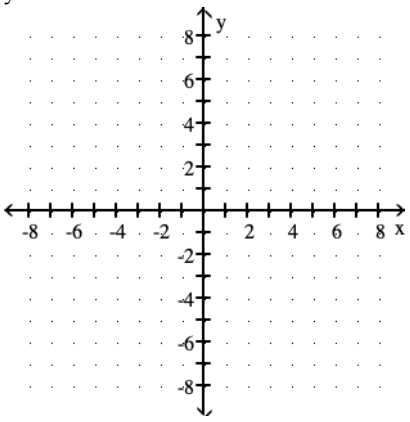



D)




Answer: D

143) $y = -5x + 3$



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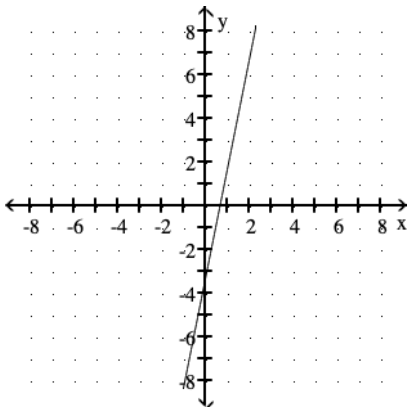
A)

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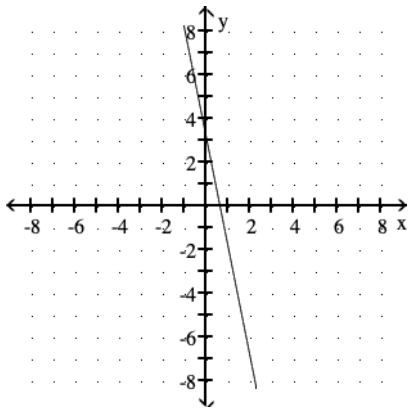


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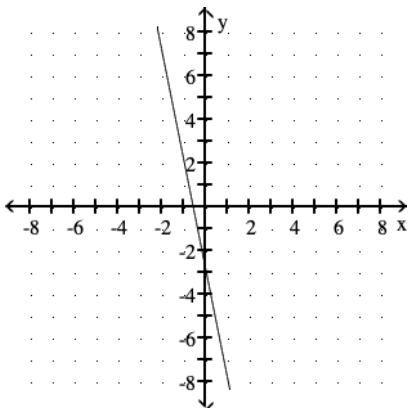
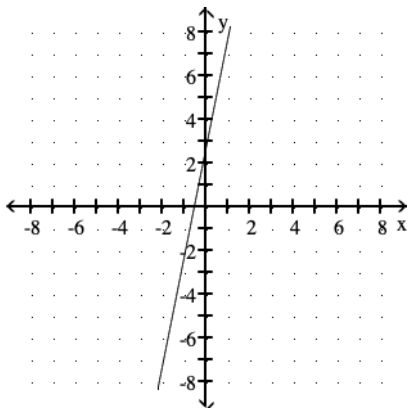
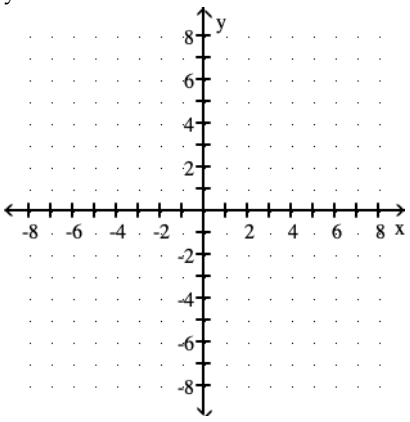



D)




Answer: B

144) $y = -4x - 5$



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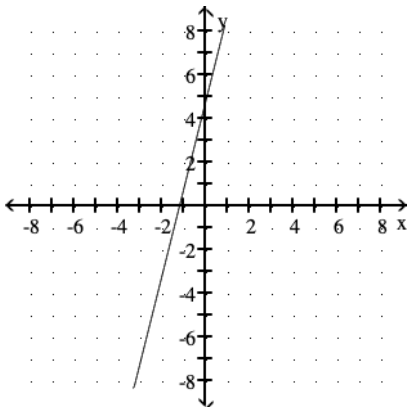
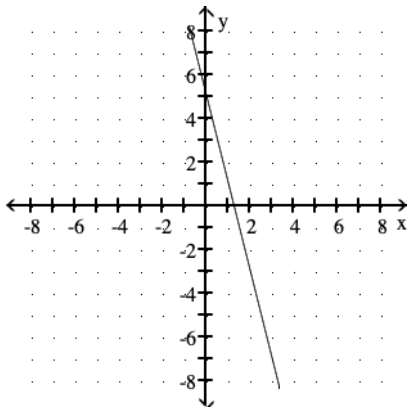
A)




B)

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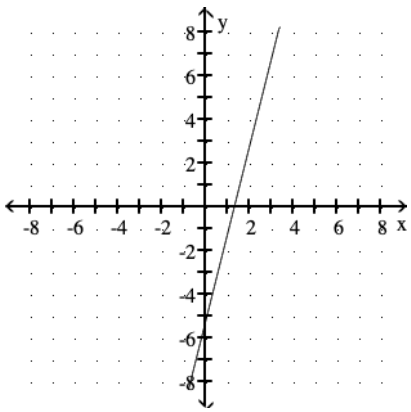
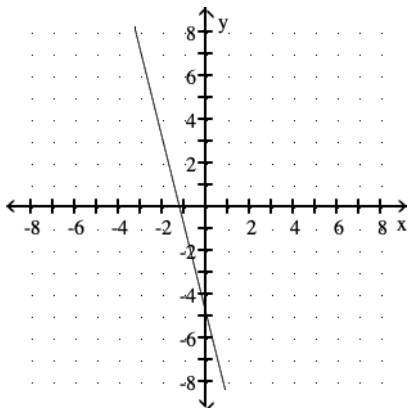
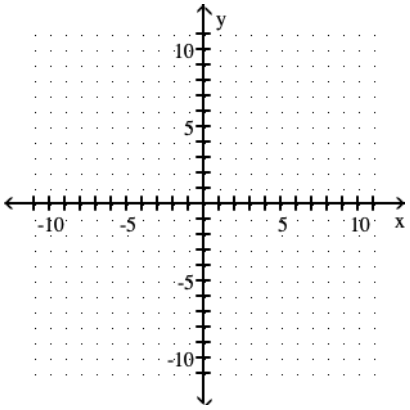



D)




Answer: D

145) f(x) = x – 6



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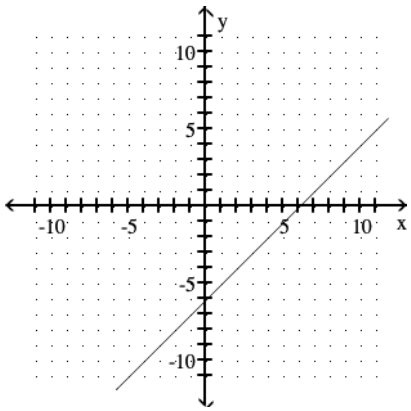
A)

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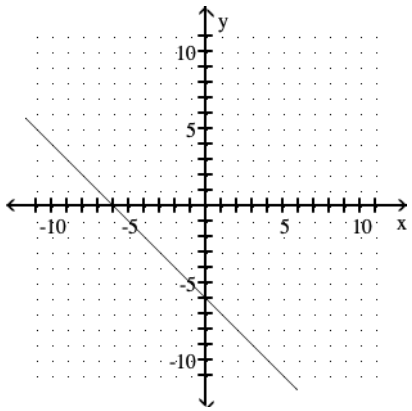


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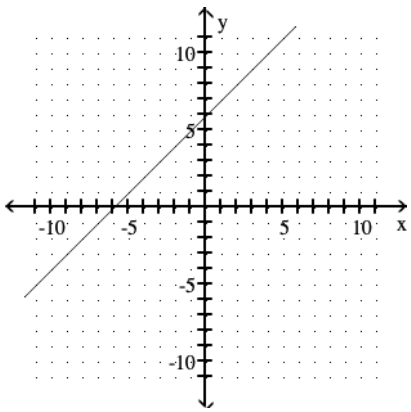
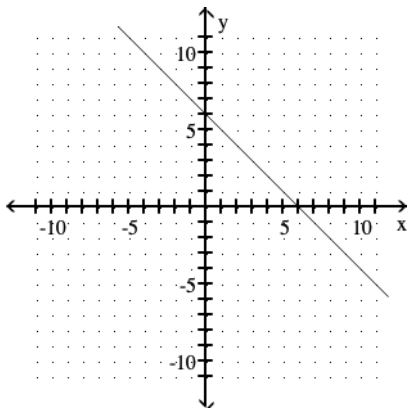
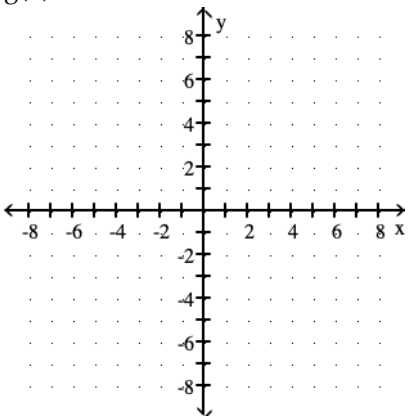



D)




Answer: A

146) g(x) = −0.5x



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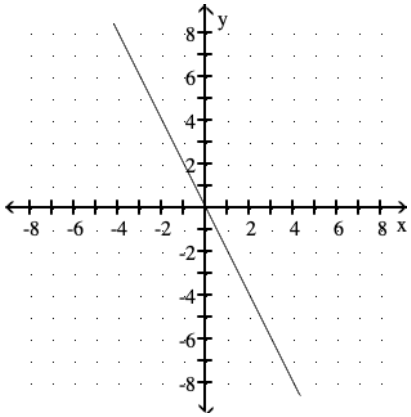
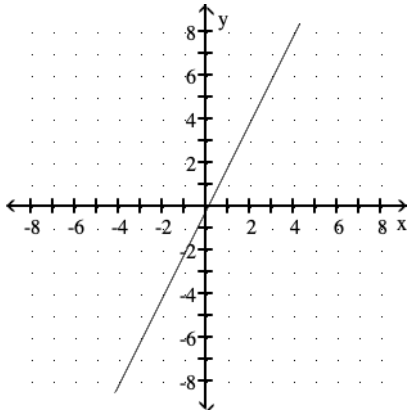
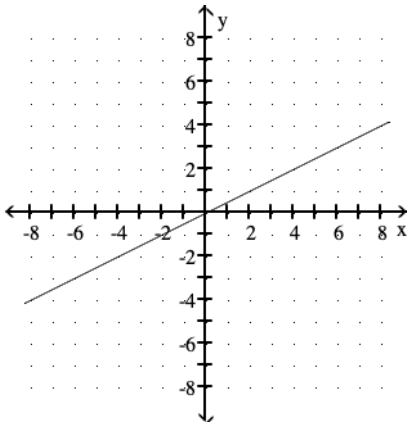
A)



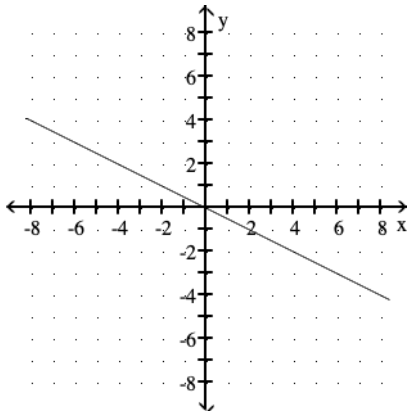

B)




C)

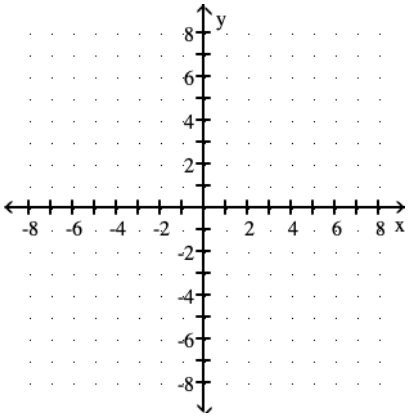



D)




Answer: D

147) f(x) = 0.5x



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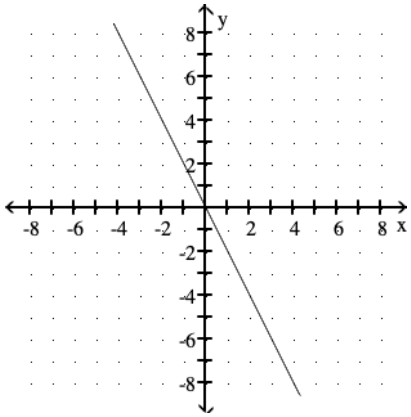
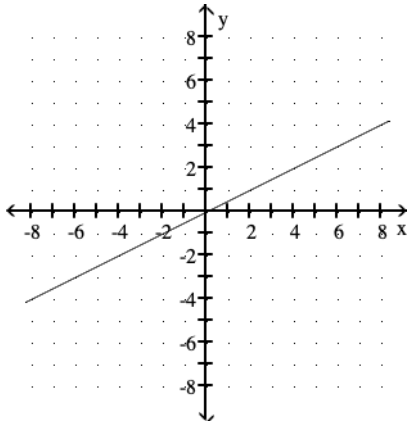
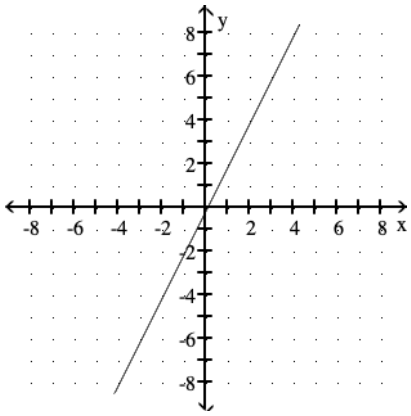
A)



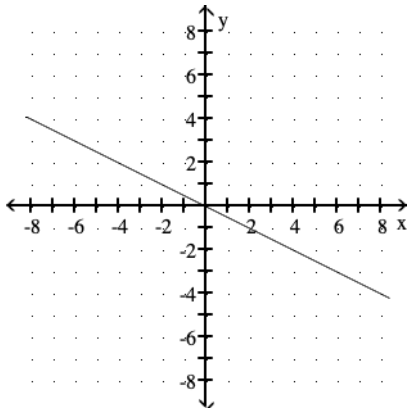

B)




C)




D)




Answer: B

**Find the slope and the y–intercept of the line.**

148) $3x + 5y = 21$

A) $m = -\frac{5}{3}$; y–intercept: (0, 5)

B) $m = -\frac{3}{5}$; y–intercept: $\left(0, \frac{21}{5}\right)$

C) $m = \frac{3}{5}$; y–intercept: (0, 21)

D) $m = \frac{5}{3}$; y–intercept: $\left(0, \frac{21}{5}\right)$

Answer: B

149) $-4y = -2x - 14$

A) $m = -2$; y–intercept: (0, –4)

B) $m = 2$; y–intercept: $\left(0, \frac{7}{2}\right)$

C) $m = \frac{1}{2}$; y–intercept: $\left(0, \frac{7}{2}\right)$

D) $m = -\frac{1}{2}$; y–intercept: (0, –14)

Answer: C



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150) $2x - 5y = 16$

A) $m = \frac{2}{5}$; y–intercept: $\left(0, -\frac{16}{5}\right)$

B) $m = -\frac{5}{2}$; y–intercept: $(0, -5)$

C) $m = \frac{5}{2}$; y–intercept: $\left(0, -\frac{16}{5}\right)$

D) $m = -\frac{2}{5}$; y–intercept: $(0, 16)$

Answer: A

151) $x + 2y = -4$

A) $m = -2$; y–intercept: $(0, 0)$

B) $m = 2$; y–intercept: $(0, -8)$

C) $m = \frac{1}{2}$; y–intercept: $(0, -8)$

D) $m = -\frac{1}{2}$; y–intercept: $(0, -2)$

Answer: D

152) $8x - 4y = -12$

A) $m = 2$; y–intercept: $(0, -12)$

B) $m = -8$; y–intercept: $(0, -3)$

C) $m = 2$; y–intercept: $(0,3)$

D) $m = 0$; y–intercept: $(0, 8)$

Answer: C

153) $6x - y - 5 = 0$

A) $m = 6$, y–intercept: $(0, 5)$

B) $m = -6$, y–intercept: $(0, -5)$

C) $m = -6$, y–intercept: $(0, 5)$

D) $m = 6$, y–intercept: $(0, -5)$

Answer: D

154) $2x + y + 7 = 0$

A) $m = 2$, y–intercept: $(0, 7)$

B) $m = -2$, y–intercept: $(0, -7)$

C) $m = -2$, y–intercept: $(0, 7)$

D) $m = 2$, y–intercept: $(0, -7)$

Answer: B

155) $2x + 2y + 5 = 0$

A) $m = -1$, y–intercept: $\left(0, -\frac{5}{2}\right)$

B) $m = 1$, y–intercept: $(0, 5)$

C) $m = -1$, y–intercept: $(0, -5)$

D) $m = 1$, y–intercept: $\left(0, \frac{5}{2}\right)$

Answer: A

156) $3x - 3y + 4 = 0$

A) $m = -1$, y–intercept: $(0, -4)$

B) $m = -1$, y–intercept: $\left(0, -\frac{4}{3}\right)$

C) $m = 1$, y–intercept: $(0, 4)$

D) $m = 1$, y–intercept: $\left(0, \frac{4}{3}\right)$

Answer: D



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157) $x = 3y - 5$

A) m = –3, y–intercept: (0, 5)

B) m = $-\frac{1}{3}$, y–intercept: $\left(0, -\frac{5}{3}\right)$

C) m = $\frac{1}{3}$, y–intercept: $\left(0, \frac{5}{3}\right)$

D) m = 3, y–intercept: (0, –5)

Answer: C

**Find an equation of the line:**

158) with m = 6, containing (1, 6).

A) $y = \frac{1}{6}x$ B) $y = -6x$ C) $y = 6x$ D) $y = -\frac{1}{6}x$

Answer: C

159) with m = –7, containing (1, –7).

A) $y = -7x$ B) $y = 7x$ C) $y = -\frac{1}{7}x$ D) $y = \frac{1}{7}x$

Answer: A

160) with m = –1, containing (3, 0).

A) $y = x - 3$ B) $y = 3x$ C) $y = -x + 3$ D) $y = -3x$

Answer: C

161) with m = 4, containing (3, –3).

A) $y = -4x - 15$ B) $y = -4x + 9$ C) $y = 4x - 15$ D) $y = 4x + 9$

Answer: C

162) with y–intercept (0, 6) and slope $\frac{7}{6}$.

A) $y = -\frac{7}{6}x + 6$ B) $y = -\frac{7}{6}x - 6$ C) $y = \frac{7}{6}x - 6$ D) $y = \frac{7}{6}x + 6$

Answer: D

163) with y–intercept (0, 3) and slope $-\frac{3}{7}$.

A) $y = -\frac{3}{7}x + 3$ B) $y = \frac{3}{7}x - 3$ C) $y = \frac{3}{7}x + 3$ D) $y = -\frac{3}{7}x - 3$

Answer: A

164) with slope 0, containing (3, 1).

A) x = 3 B) y = 1 C) y = 3 D) x = 1

Answer: B



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**Find the slope of the line containing the given pair of points. If a slope is undefined, state that fact.**

165) (7, 8) and (6, 2)

A) $\frac{10}{13}$ B) – 6 C) $\frac{1}{6}$ D) 6

Answer: D

166) (9, 2) and (–1, –7)

A) $\frac{10}{9}$ B) $\frac{9}{10}$ C) $-\frac{9}{10}$ D) $-\frac{5}{8}$

Answer: B

167) (4, –5) and (4, 8)

A) $-\frac{13}{8}$ B) 0 C) Undefined D) $\frac{3}{8}$

Answer: C

168) (7, –6) and (–1, –6)

A) – 2 B) Undefined C) $\frac{3}{2}$ D) 0

Answer: D

169) (13, –4) and (–5, –9)

A) $\frac{5}{18}$ B) $-\frac{5}{18}$ C) $-\frac{13}{8}$ D) $\frac{18}{5}$

Answer: A

170) $\left(\frac{1}{8}, \frac{1}{2}\right), \left(\frac{1}{4}, \frac{1}{4}\right)$

A) –2 B) 2 C) Undefined D) –1

Answer: A

171) $\left(-\frac{1}{7}, -\frac{2}{7}\right)$ and $\left(\frac{2}{7}, \frac{1}{7}\right)$

A) 0 B) 1 C) $\frac{1}{7}$ D) –1

Answer: B

172) $\left(\frac{2}{7}, \frac{7}{5}\right)$ and $\left(\frac{4}{7}, \frac{8}{5}\right)$

A) $\frac{7}{10}$ B) $\frac{7}{5}$ C) $\frac{5}{14}$ D) $\frac{5}{7}$

Answer: A

173) (x, 3x) and (x + h, 3(x + h))

A) 0 B) 3 C) –3 D) Undefined

Answer: B



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174) $(x, -7x + 5)$ and $(x + h, -7(x + h) + 5)$

A) $-7$ B) 0 C) 7 D) 5

Answer: A

**Find an equation of the line containing the pair of points.**

175) $(4, -3)$ and $(0, 6)$

A) $y = -\frac{7}{6}x + 6$ B) $y = -\frac{9}{4}x + 6$ C) $y = \frac{7}{6}x + 6$ D) $y = \frac{9}{4}x + 6$

Answer: B

176) $(6, 0)$ and $(-4, 3)$

A) $y = -\frac{3}{5}x + \frac{9}{5}$ B) $y = \frac{3}{5}x + \frac{9}{5}$ C) $y = -\frac{3}{10}x + \frac{9}{5}$ D) $y = \frac{3}{10}x + \frac{9}{5}$

Answer: C

177) $(0, 6)$ and $(7, -6)$

A) $y = \frac{12}{7}x + 6$ B) $y = -\frac{6}{7}x + 6$ C) $y = \frac{6}{7}x + 6$ D) $y = -\frac{12}{7}x + 6$

Answer: D

178) $(-9, -7)$ and $(3, 6)$

A) $y = -\frac{1}{6}x + \frac{11}{4}$ B) $y = -\frac{13}{12}x + \frac{11}{4}$ C) $y = \frac{1}{6}x + \frac{11}{4}$ D) $y = \frac{13}{12}x + \frac{11}{4}$

Answer: D

179) $(-4, 4)$ and $(-4, 8)$

A) $y = -2x$ B) $x = -4$ C) $y = -\frac{1}{2}x$ D) $y = 4$

Answer: B

180) $(1, -3)$ and $(-5, -3)$

A) $y = -3$ B) $x = 1$ C) $y = 5x$ D) $y = \frac{1}{5}x$

Answer: A

181) $\left(\frac{7}{8}, \frac{3}{4}\right)$ and $\left(-7, \frac{9}{8}\right)$

A) $y = -\frac{1}{21}x + \frac{19}{24}$ B) $y = -\frac{8}{21}x + \frac{11}{3}$ C) $y = \frac{1}{21}x + \frac{11}{24}$ D) $y = -\frac{1}{21}x$

Answer: A

182) $(x, 4x)$ and $(x + h, 4(x + h))$

A) $y = -4x$ B) $y = x + 4$ C) $y = hx - 4$ D) $y = 4x$

Answer: D



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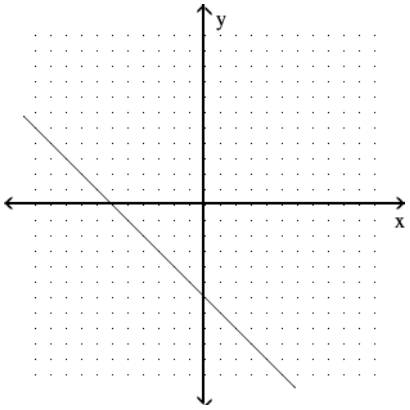
183) $(x, 8x + 5)$ and $(x + h, 8(x + h) + 5)$

A) $y = \frac{8h + 10}{h}x$ B) $y = -8x - 5$ C) $y = 8x + 5$ D) $y = x - 5$

Answer: C

**Use the graph to find the average rate of change.**

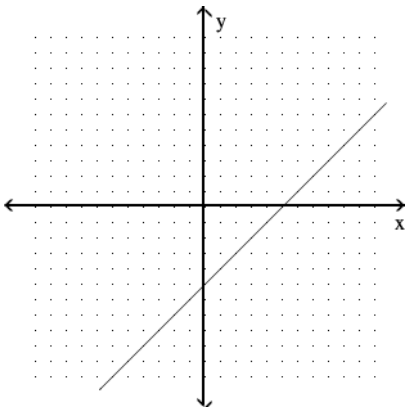
184)




A) 6 B) –6 C) 1 D) –1

Answer: D

185)




A) –5 B) –1 C) 5 D) 1

Answer: D



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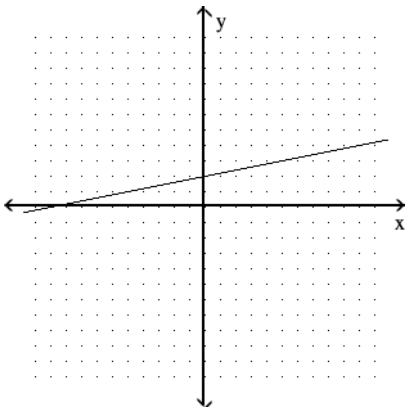
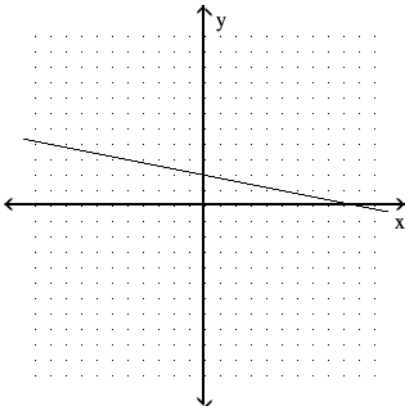
186)




A) $\frac{1}{5}$ B) 5 C) $-\frac{1}{5}$ D) –5

Answer: A

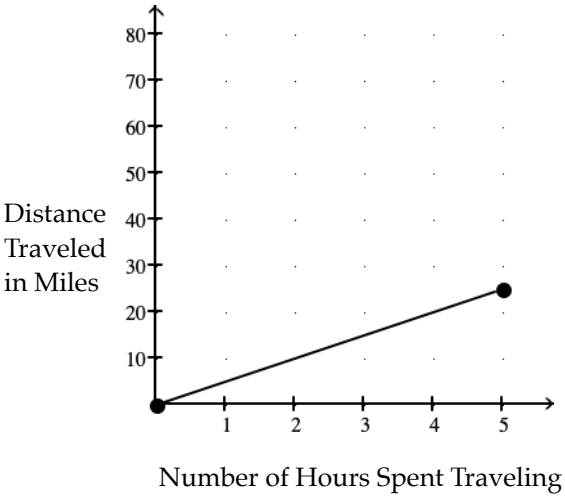
187)




A) 5 B) –5 C) $-\frac{1}{5}$ D) $\frac{1}{5}$

Answer: C

188)




A) 0.2 mph B) 5.0 mph C) 0.3 mph D) 3.0 mph

Answer: B



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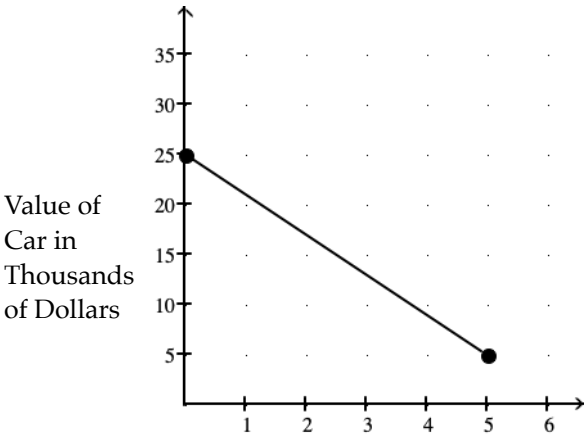
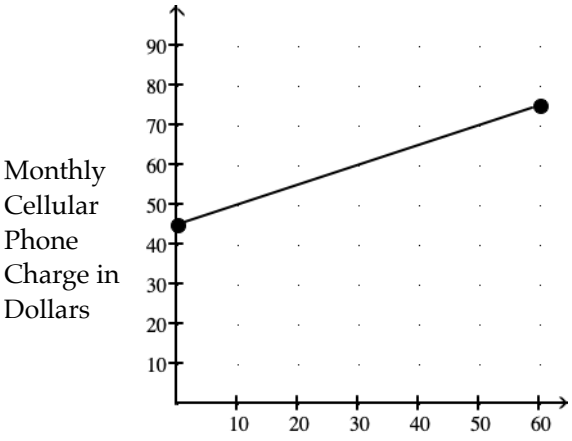
189)




A) $4000.00 per yr B) –$4000.00 per yr C) $5000.00 per yr D) –$5000.00 per yr

Answer: B

190)




A) $2.11 per min B) $0.50 per min C) $0.20 per min D) $2.00 per min

Answer: B



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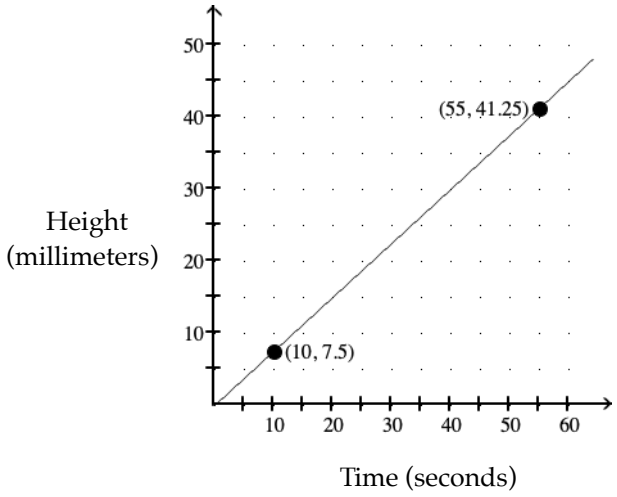
191) The Height of Sand in an Hourglass




A) 1 mm/sec B) 1.3 mm/sec C) 0.85 mm/sec D) 0.75 mm/sec

Answer: D

**Solve the problem.**

192) The shadow cast by an object on a sunny day varies directly as the height of the object. If a person 84 inches tall casts a shadow 78 inches long, how tall is a tree which casts a shadow 33 feet in length?

A) 30.64 ft B) 35.54 ft C) 198.55 ft D) 81 ft

Answer: B

193) A toilet manufacturer has decided to come out with a new and improved toilet. The fixed cost for the production of this new toilet line is $16,600 and the variable costs are $63 per toilet. The company expects to sell the toilets for $160. Formulate a function C(x) for the total cost of producing x new toilets and a function R(x) for the total revenue generated from the sales of x toilets.

A) C(x) = 16600 + 63x; R(x) = 160x B) C(x) = 63x; R(x) = 160x

C) C(x) = 16,663; R(x) = 160 D) C(x) = 16600 + 160x; R(x) = 63x

Answer: A

194) A toilet manufacturer has decided to come out with a new and improved toilet. The fixed cost for the production of this new toilet line is $16,600 and the variable costs are $70 per toilet. The company expects to sell the toilets for $157. Formulate a function P(x) for the total profit from the production and sale of x toilets.

A) P(x) = 87x + 16600 B) P(x) = 157x – 16600

C) P(x) = 87x – 16600 D) P(x) = 87x

Answer: C

195) A shoe company will make a new type of shoe. The fixed cost for the production will be $24,000. The variable cost will be $35 per pair of shoes. The shoes will sell for $105 for each pair. How many pairs of shoes will have to be sold for the company to break even on this new line of shoes?

A) 343 pairs B) 70 pairs C) 686 pairs D) 229 pairs

Answer: A



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196) A shoe company will make a new type of shoe. The fixed cost for the production will be $24,000. The variable cost will be $36 per pair of shoes. The shoes will sell for $109 for each pair. What is the profit if 600 pairs are sold?

A) $43,800 B) $67,800 C) $63,000 D) $19,800

Answer: D

197) A construction company uses the function S(t) = 26,000 – 2000t to determine the salvage value S(t) of their trucks t years after it is purchases. What was the initial value of the truck and how long until it depreciates completely?

A) $28,000; 14 years B) $26,000; 13 years C) $26,000; 26 years D) $20000; 13 years

Answer: B

198) The distance a frog can jump can be estimated from the length of its back legs. The relationship is a linear function D(x) = 11.82x + 1.05, where D(x) is the distance jumped in inches and x is the length of the frog's hind legs in inches. Estimate how far a frog with 2.7 inch hind legs can jump.

A) 14.52 in. B) 15.57 in. C) 32.96 in. D) 12.87 in.

Answer: C

199) The distance D that a spring is stretched by a hanging object is directly proportional to the weight W of the object. If a 2–kg object stretches a spring 76cm, how far will a 21–kg weight stretch the spring?

A) 38 cm B) 99 cm C) 798 cm D) 0.5526 cm

Answer: C

200) According to Ohm's law, the electric current I, in amperes, in a circuit is directly proportional to the voltage V. When 21 volts are applied, the current is 2 amperes. What is the current when 24 volts are applied?

A) 2.29 amperes B) 10.5 amperes C) 252 amperes D) 47 amperes

Answer: A

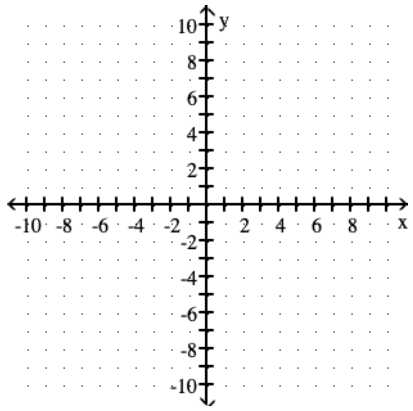
201) The weight W of an object on the Moon is directly proportional to the weight E on earth. A person who weighs 174 lb on earth weighs 34.8 lb on the Moon. How much would a 135–lb person weigh on the Moon?

A) 27 lb B) 343.8 lb C) 675 lb D) 0.2 lb

Answer: A

**Using the same set of axes, graph the pair of equations.**

202) $y = \frac{1}{5}x^2$ and $y = -\frac{1}{5}x^2$



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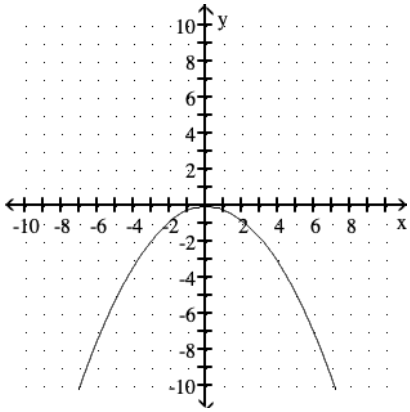
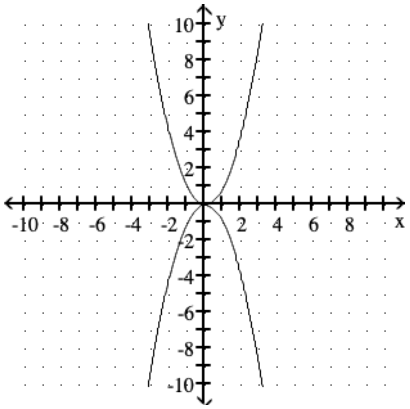
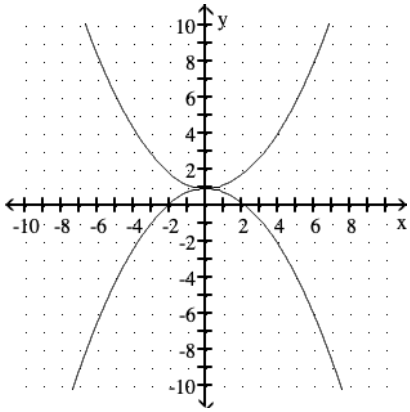
A)



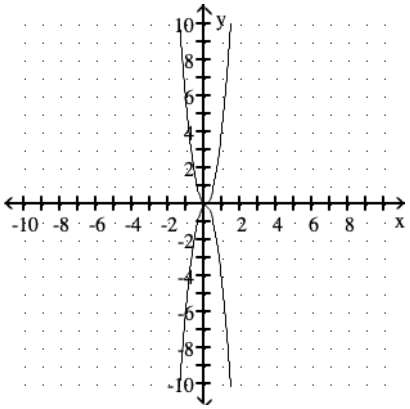

B)




C)

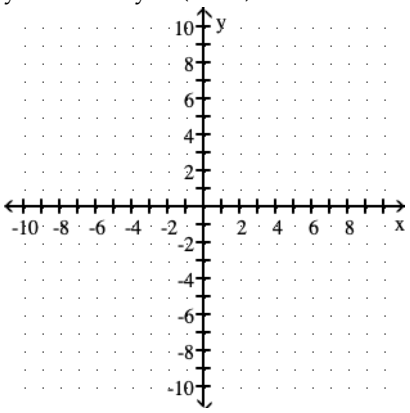



D)




Answer: A

203) $y = x^2$ and $y = (x + 4)^2$



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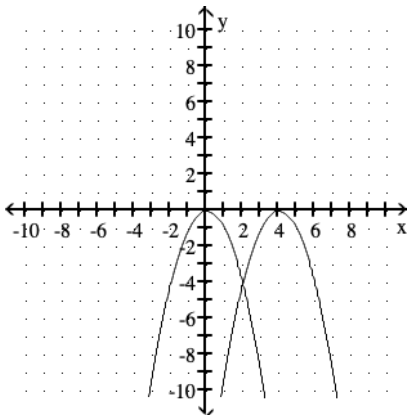
A)

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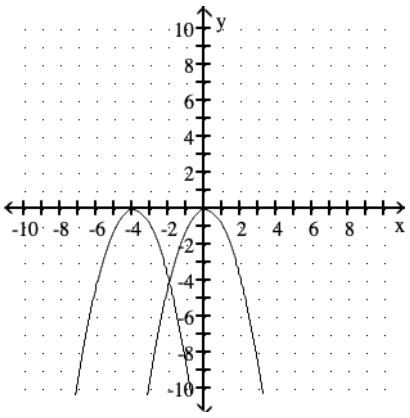


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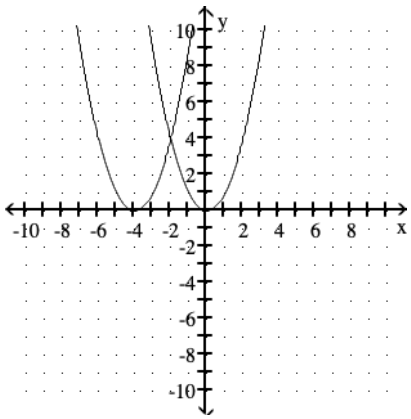
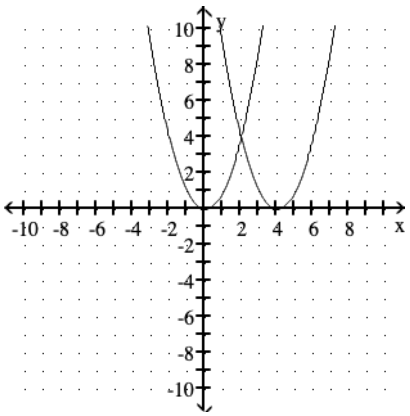
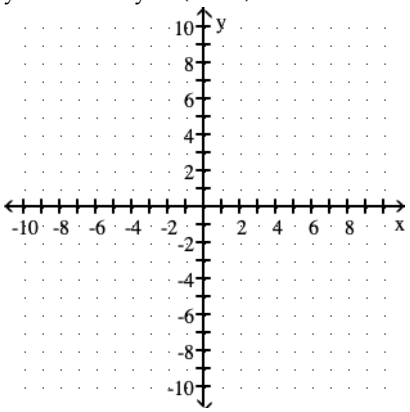



D)




Answer: C

204) $y = x^2$ and $y = (x - 3)^2$



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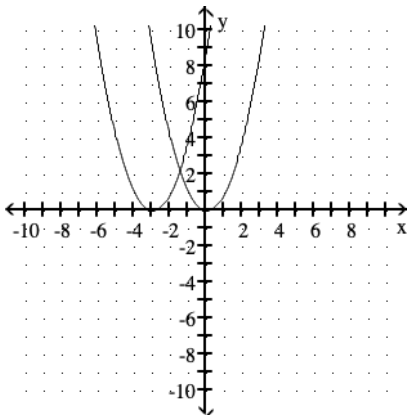
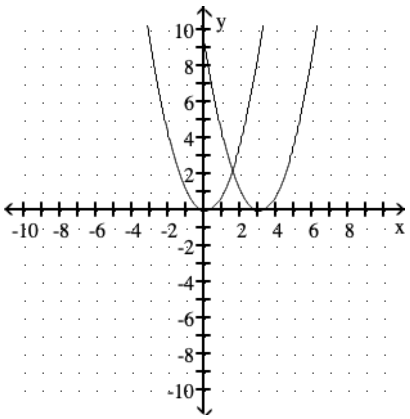
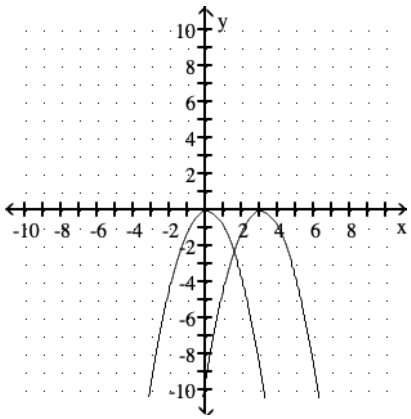
A)



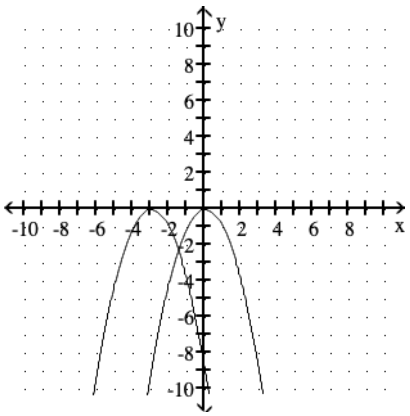

B)




C)

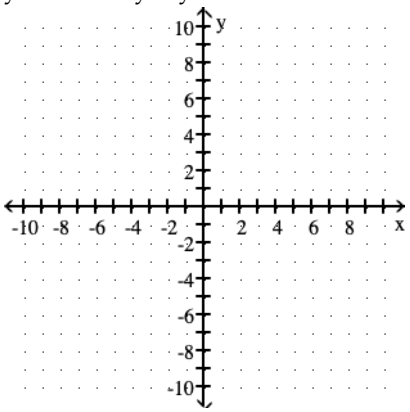



D)




Answer: B

205) $y = x^3$ and $y = y = x^3 - 4$



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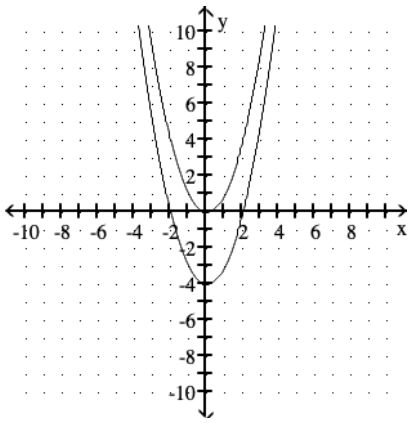
A)

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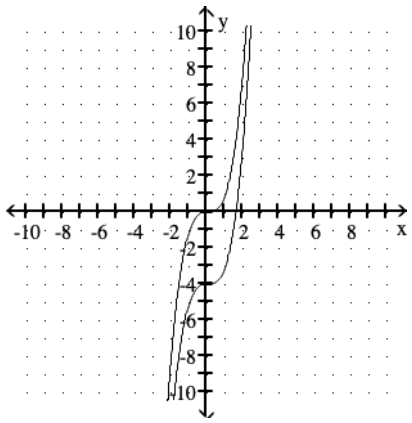
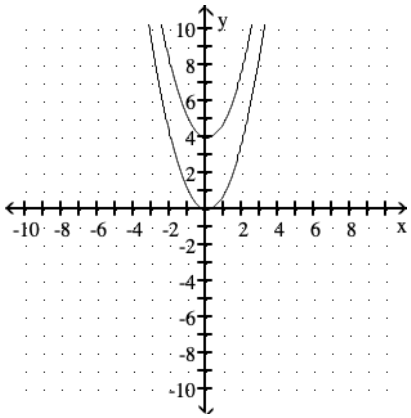
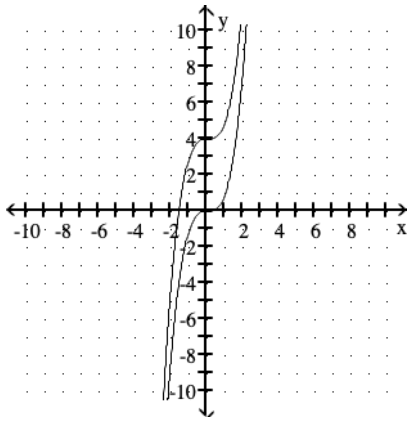



C)

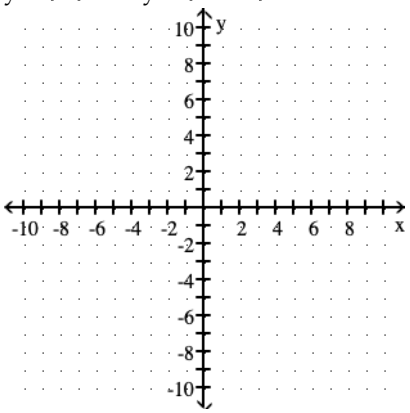



D)




Answer: B

206) $y = |x|$ and $y = |x + 3|$



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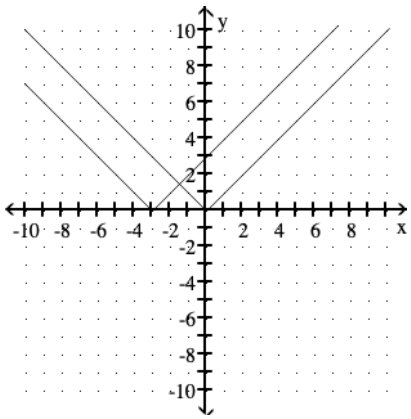
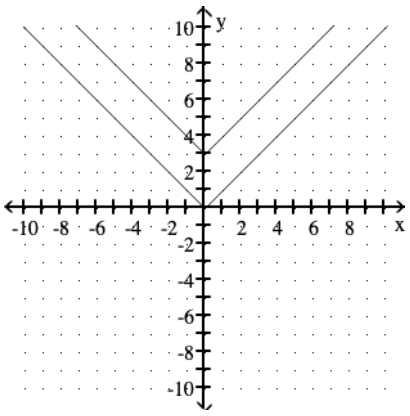
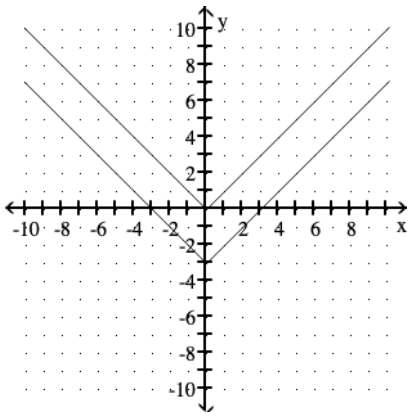
A)



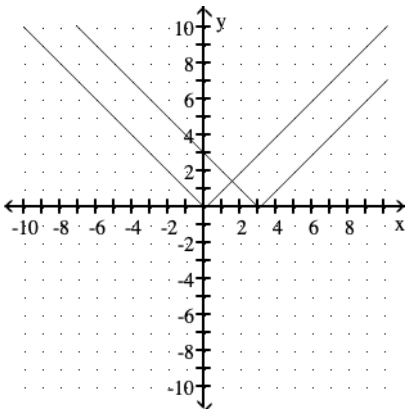

B)




C)

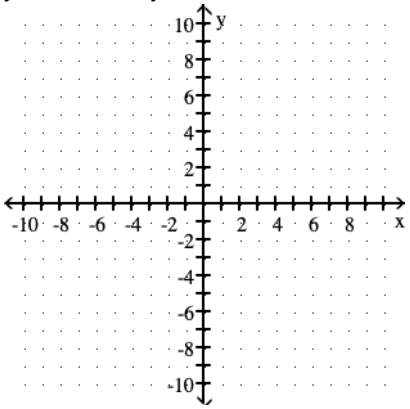



D)




Answer: A

207) $y = \sqrt{x}$ and $y = \sqrt{x + 2}$



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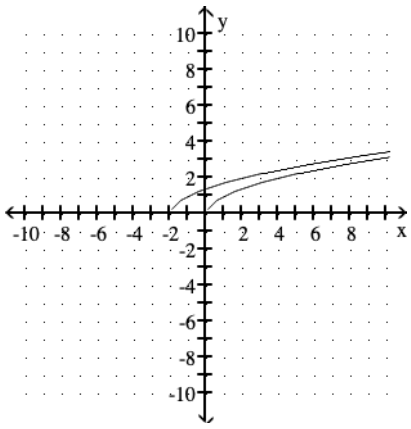
A)

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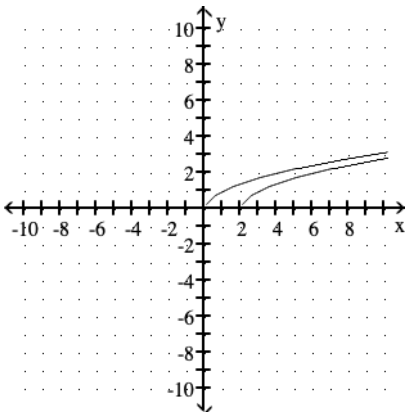
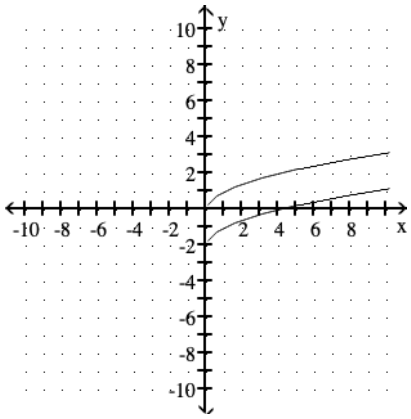
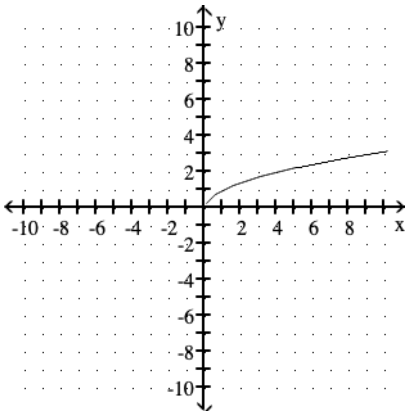



C)

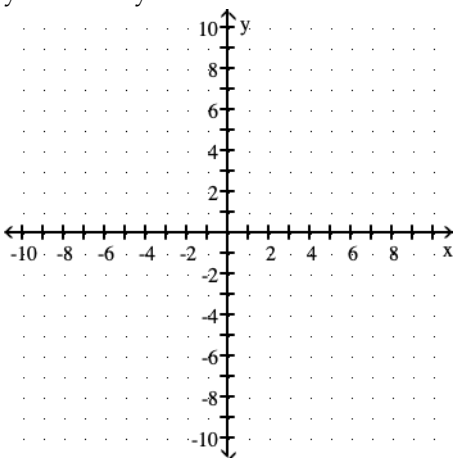



D)




Answer: A

208) $y = x^2$ and $y = x^2 - 4$



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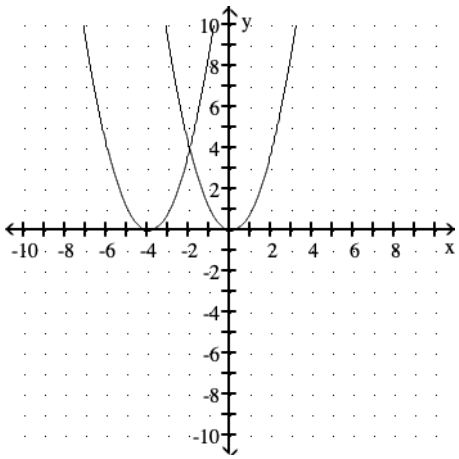
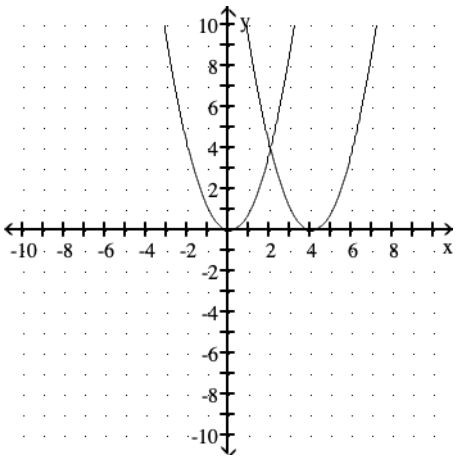
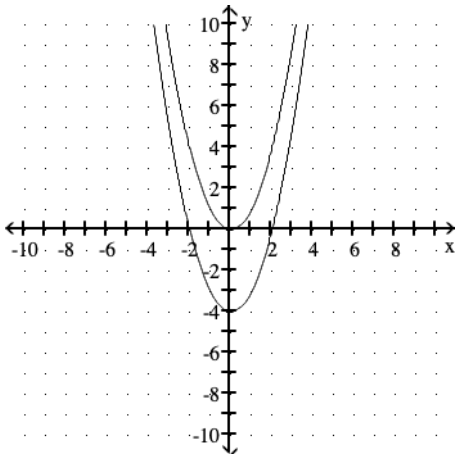
A)



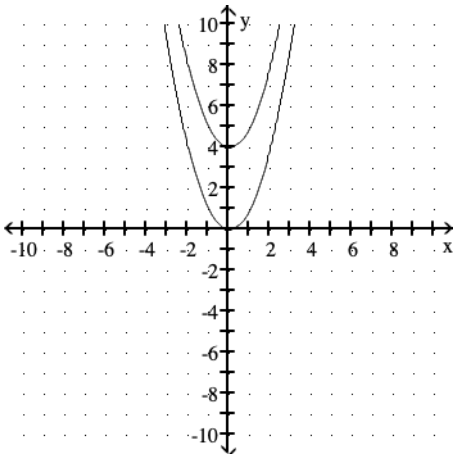

B)




C)

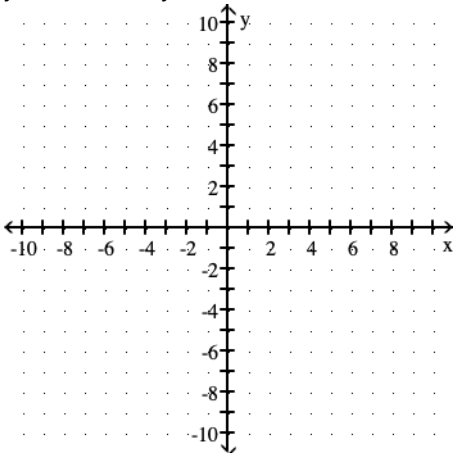



D)




Answer: C

209) $y = -5x^2$ and $y = -5x^2 + 4$



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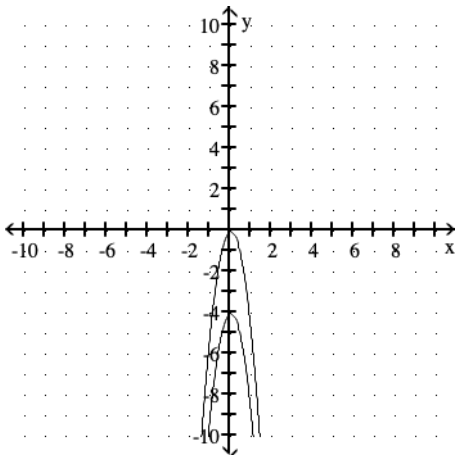
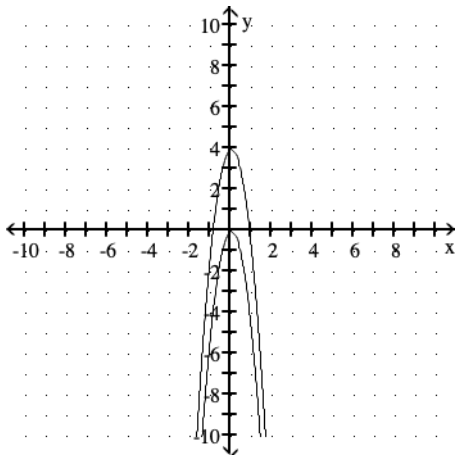
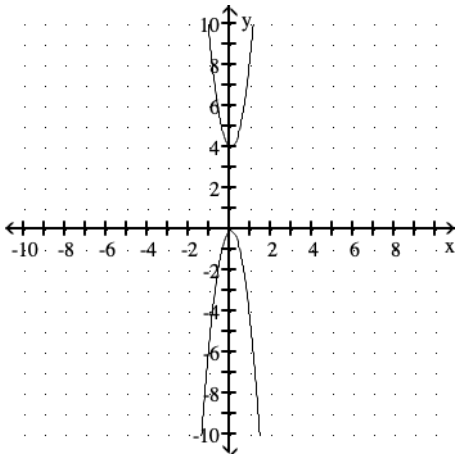
A)



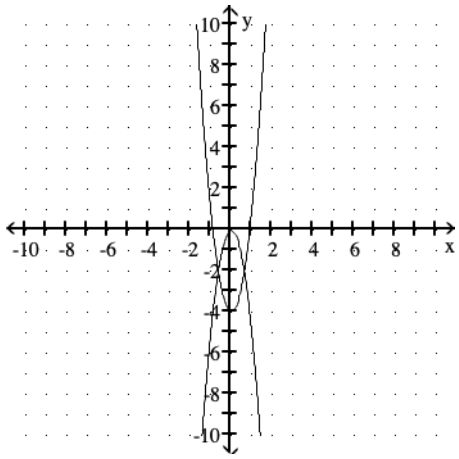

B)




C)




D)




Answer: B

**Determine the vertex of the parabola.**

210) $y = x^2 - 16x + 69$

A) (5, 0) B) (8, 5) C) (5, 8) D) (0, 8)

Answer: B

211) $y = x^2 - 16x + 65$

A) (8, 1) B) (0, 1) C) (1, 8) D) (8, 0)

Answer: A

212) $y = 6x^2 - 84x + 303$

A) (9, 7) B) (7, 9) C) (7, 0) D) (0, 9)

Answer: B

213) $y = 2x^2 - 20x + 46$

A) (−5, 4) B) (4, −5) C) (−4, 5) D) (5, −4)

Answer: D



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214) $y = 3x^2 - 6x + 8$

A) (5, 1) B) (–1, –5) C) (–5, –1) D) (1, 5)

Answer: D

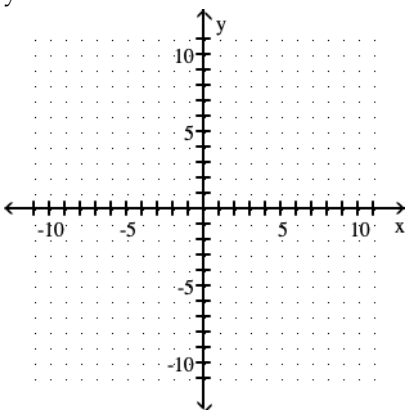
215) $y = 4x^2 + 16x + 15$

A) (–2, –1) B) (1, 2) C) (2, 1) D) (–1, –2)

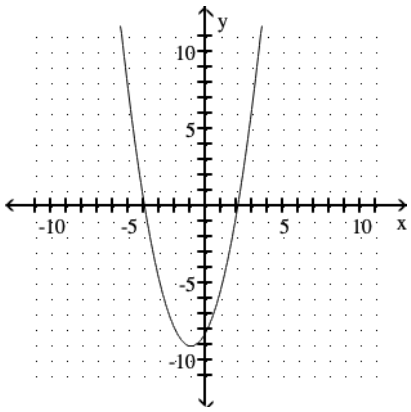
Answer: A

**Graph.**

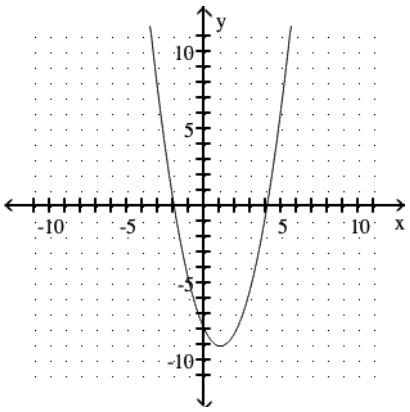
216) $y = x^2 - 2x - 8$



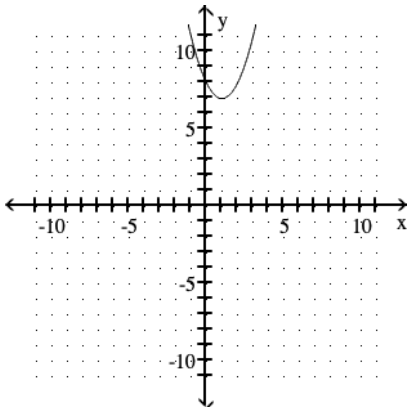

A)



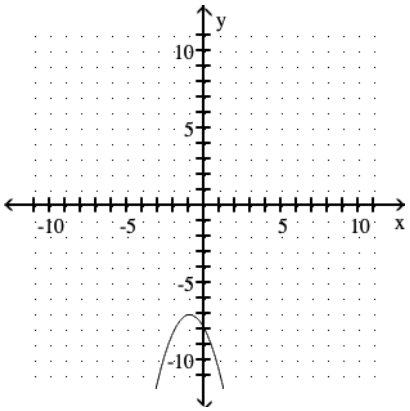

B)




C)




D)




Answer: B



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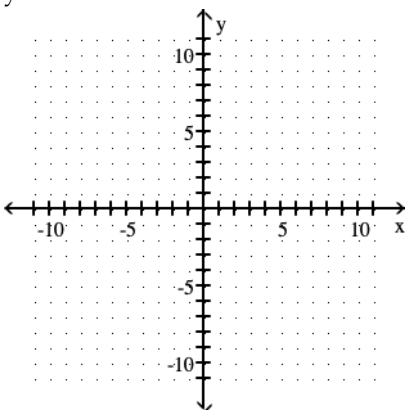
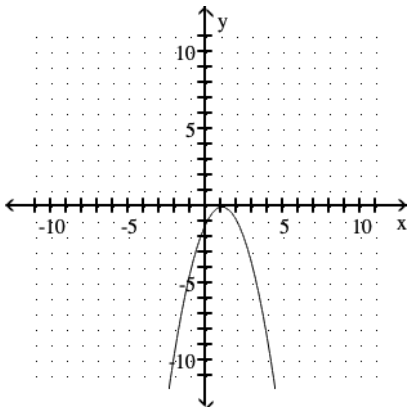
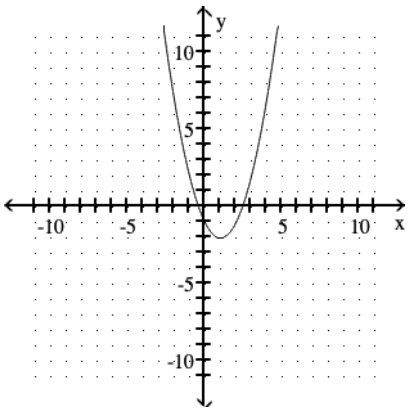
217) $y = -x^2 + 2x - 1$



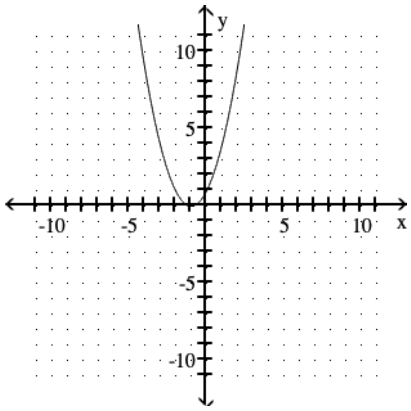

A)



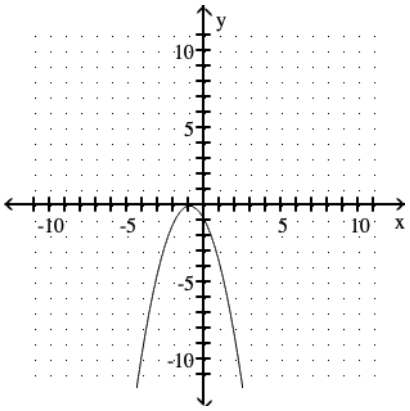

B)




C)




D)




Answer: A



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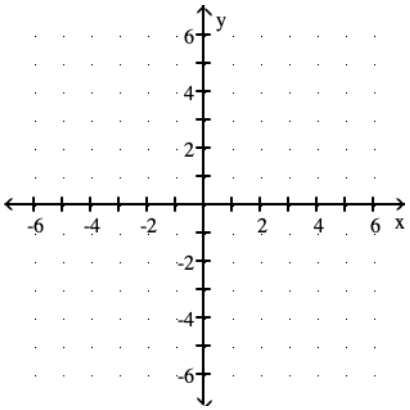
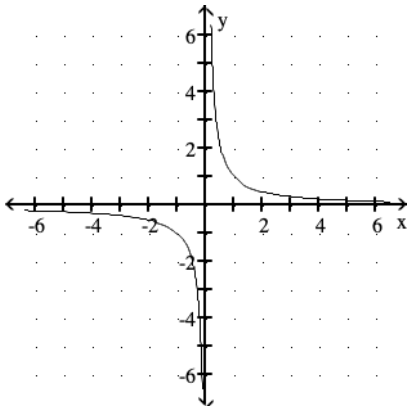
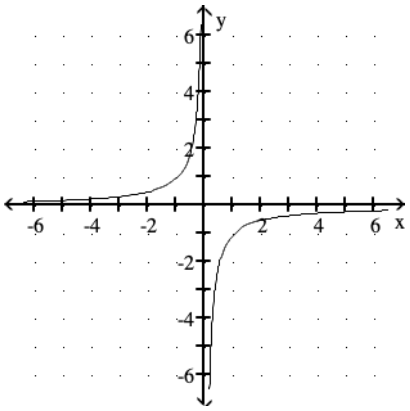
218) $f(x) = \frac{1}{x}$



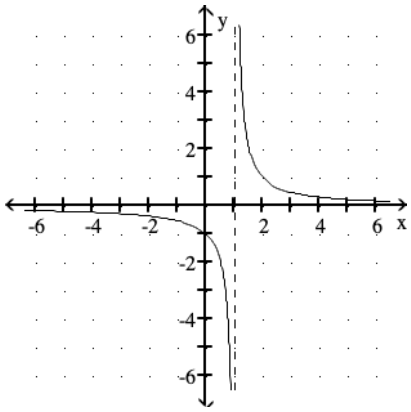

A)



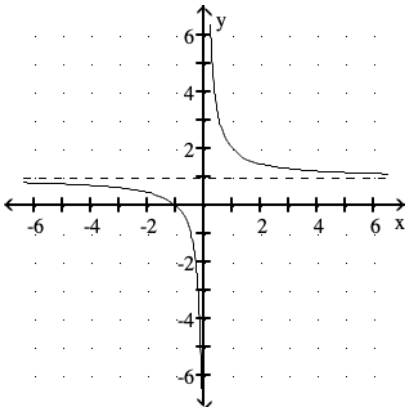

B)




C)




D)




Answer: A



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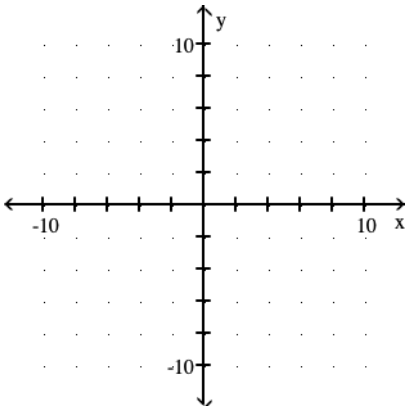
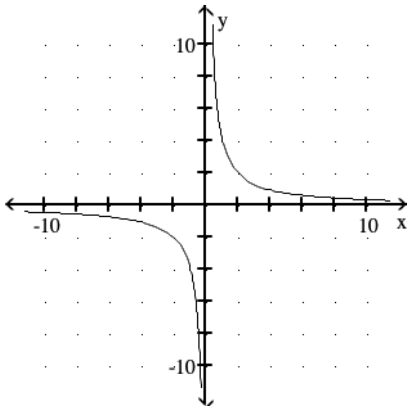
219) $f(x) = -\frac{4}{x}$




A)

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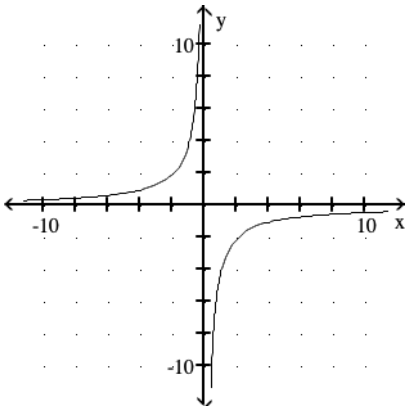
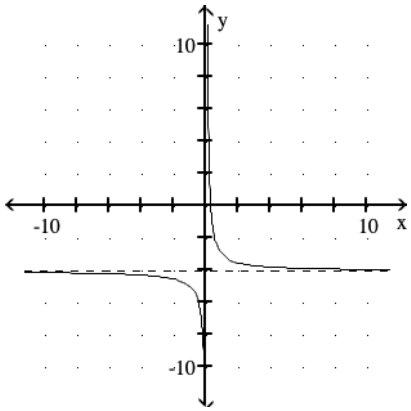
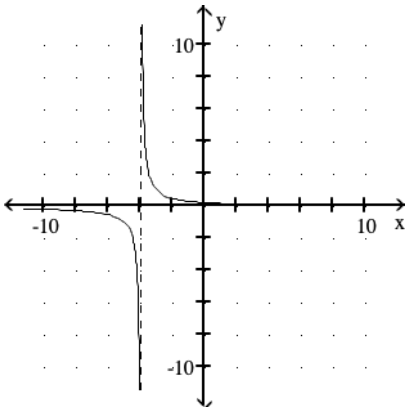



C)




D)




Answer: B



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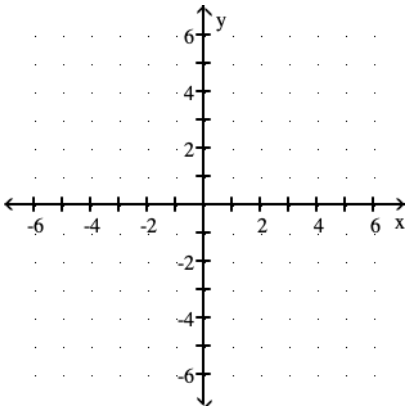
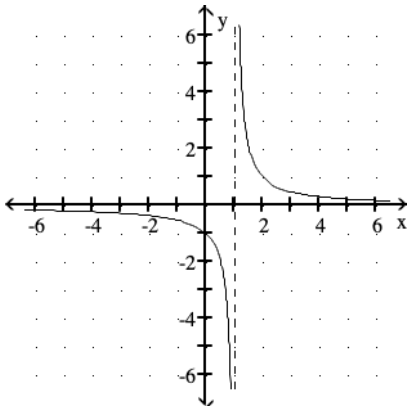
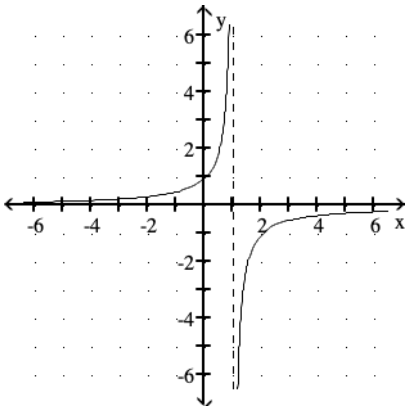
220) $f(x) = \dfrac{1}{x - 1}$



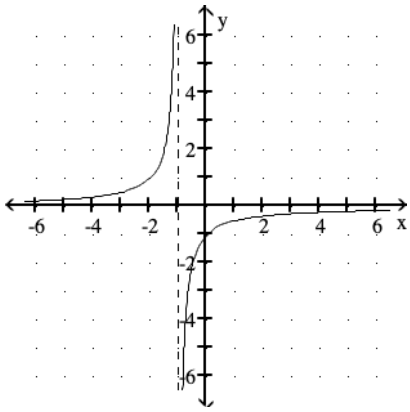

A)



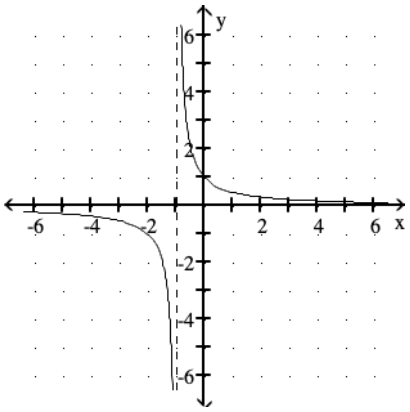

B)




C)




D)




Answer: A



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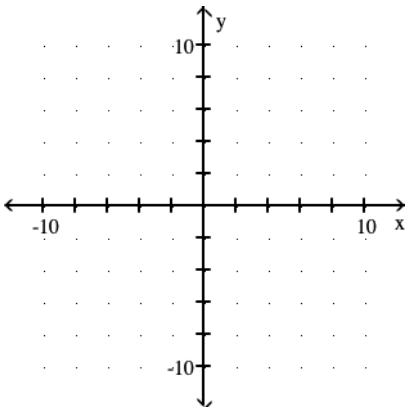
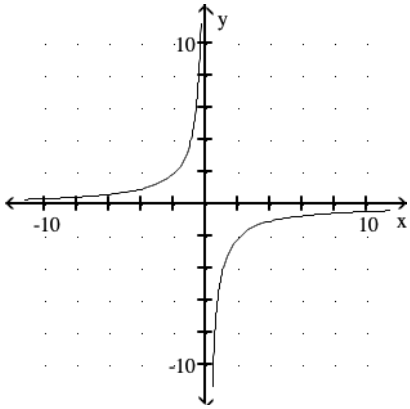
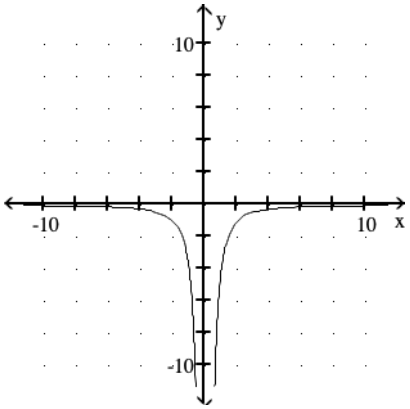
221) $f(x) = \frac{4}{x^2}$



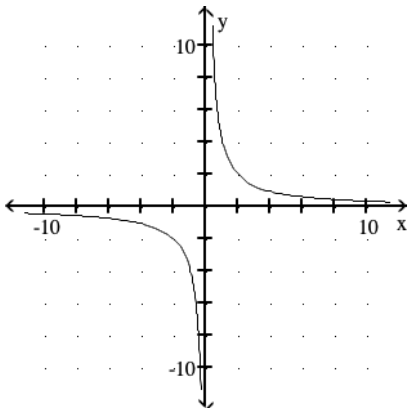

A)



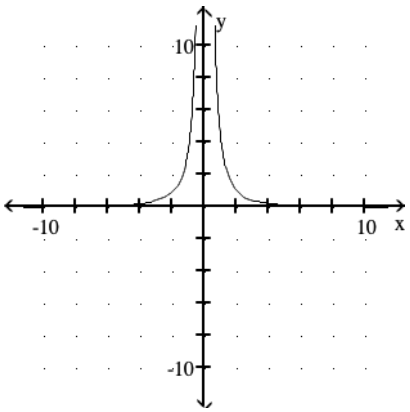

B)




C)




D)




Answer: D



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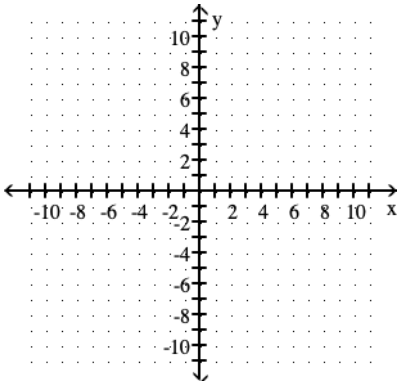
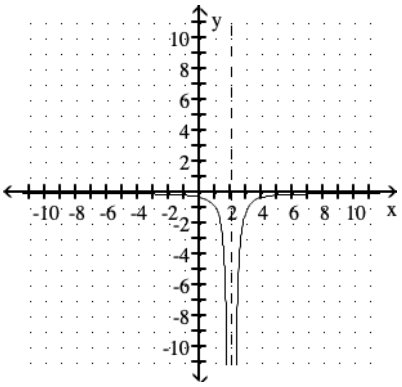
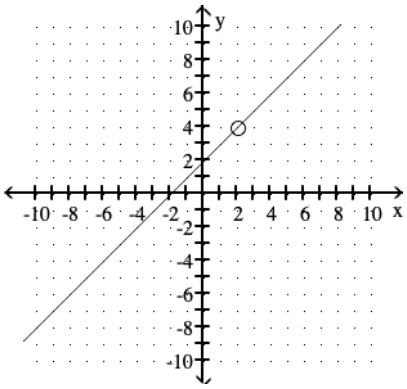
222) $f(x) = \dfrac{x^2 - 4}{x - 2}$



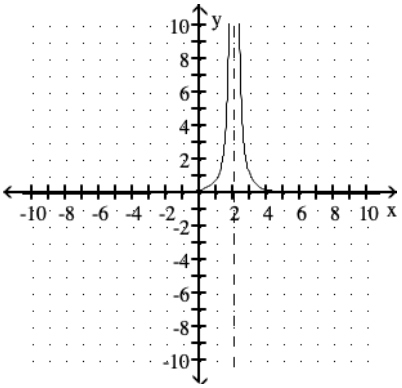

A)



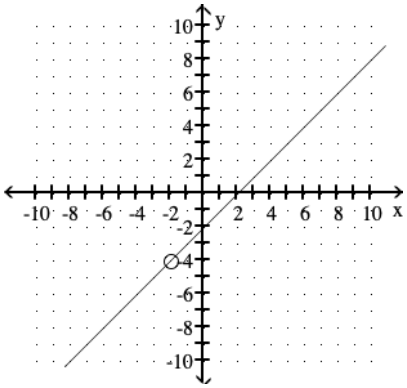

B)




C)




D)




Answer: B



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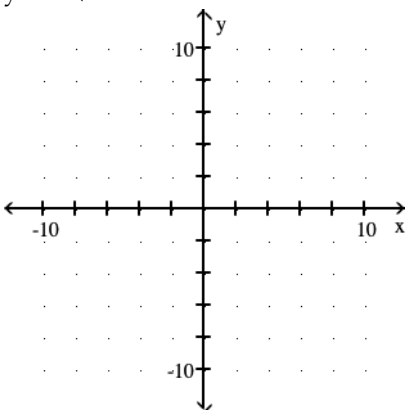
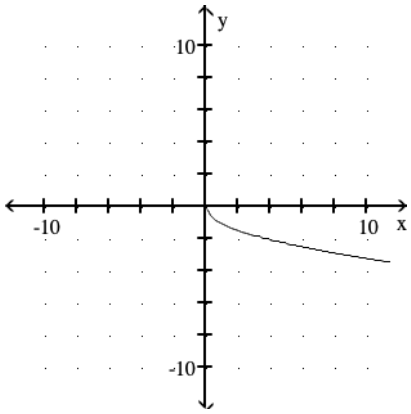
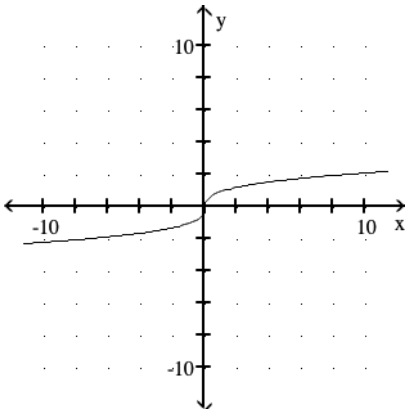
223) $y = -\sqrt[3]{x}$



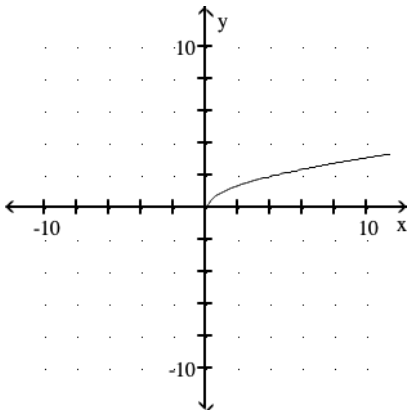

A)



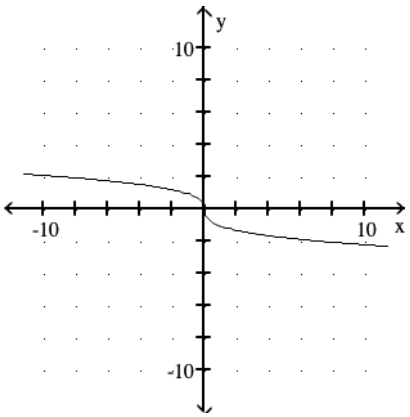

B)




C)




D)




Answer: D



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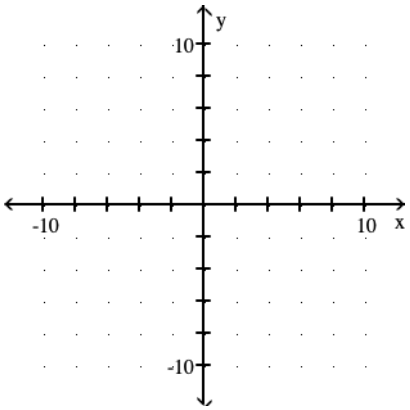
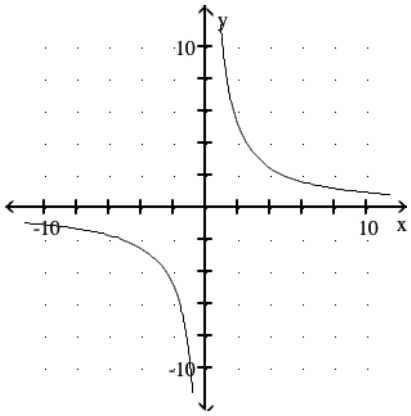
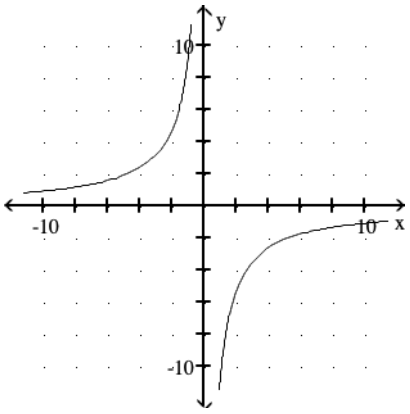
224) $y = \frac{10}{|x|}$



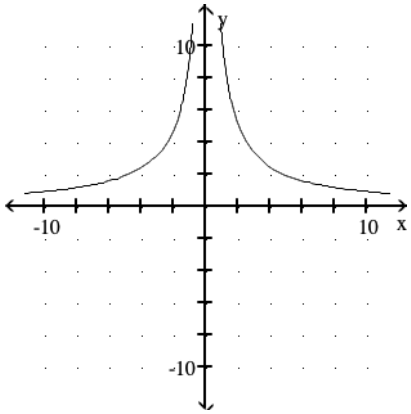

A)



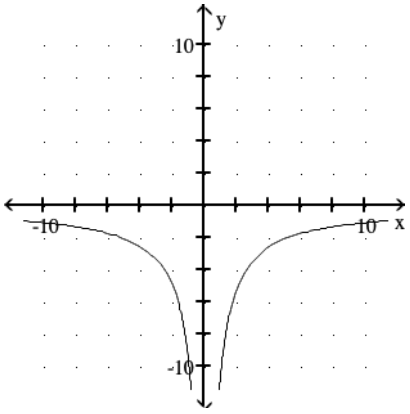

B)




C)




D)




Answer: C

**Solve.**

225) $y^2 + 3y - 9 = 0$

A) $-3 \pm 3\sqrt{5}$ B) $\frac{-3 - 3\sqrt{5}}{2}$ C) $\frac{-3 \pm 3\sqrt{5}}{2}$ D) $\frac{3 + 3\sqrt{5}}{2}$

Answer: C



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226) $x^2 + 4x = 3$

A) $2 + \sqrt{7}$ B) $-1 \pm \sqrt{7}$ C) $-2 \pm \sqrt{7}$ D) $-2 \pm 2\sqrt{7}$

Answer: C

227) $x^2 = 5 - 6x$

A) $3 + \sqrt{14}$ B) $-3 \pm \sqrt{14}$ C) $-3 \pm 2\sqrt{14}$ D) $-1 \pm \sqrt{14}$

Answer: B

228) $y^2 = -5y + 5$

A) $\frac{5 + 3\sqrt{5}}{2}$ B) $-5 \pm 3\sqrt{5}$ C) $\frac{-5 \pm 3\sqrt{5}}{2}$ D) $\frac{-5 - 3\sqrt{5}}{2}$

Answer: C

229) $q^2 + 4q - 7 = 0$

A) $-2 \pm 2\sqrt{11}$ B) $2 + \sqrt{11}$ C) $-2 \pm \sqrt{11}$ D) $-1 \pm \sqrt{11}$

Answer: C

230) $p^2 + 5p - 5 = 0$

A) $\frac{-5 \pm 3\sqrt{5}}{2}$ B) $-5 \pm 3\sqrt{5}$ C) $\frac{-5 - 3\sqrt{5}}{2}$ D) $\frac{5 + 3\sqrt{5}}{2}$

Answer: A

231) $r^2 + 3r = 9$

A) $-3 \pm 3\sqrt{5}$ B) $\frac{3 + 3\sqrt{5}}{2}$ C) $\frac{-3 \pm 3\sqrt{5}}{2}$ D) $\frac{-3 - 3\sqrt{5}}{2}$

Answer: C

232) $y^2 + 8y = 7$

A) $-1 \pm \sqrt{23}$ B) $4 + \sqrt{23}$ C) $-4 \pm 2\sqrt{23}$ D) $-4 \pm \sqrt{23}$

Answer: D

233) $1 - \frac{5}{x} - \frac{14}{x^2} = 0$

A) $-7, -2$ B) $7, -2$ C) $7, 2$ D) $-7, 2$

Answer: B

**Convert to an expression with a rational exponent.**

234) $\sqrt{t^4}$

A) $t^4$ B) $t^2$ C) $t^{1/2}$ D) $t^{3/2}$

Answer: B



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235) $\sqrt[10]{b^3}$

A) $b^{13}$ B) $\frac{b^3}{10}$ C) $b^{10/3}$ D) $b^{3/10}$

Answer: D

236) $\sqrt[6]{c^8}$

A) $c^{4/3}$ B) $c^{3/4}$ C) $c^2$ D) $\frac{c^8}{6}$

Answer: A

237) $\sqrt[11]{t^6}$

A) $\frac{t^6}{11}$ B) $t^{-5}$ C) $t^{11/6}$ D) $t^{6/11}$

Answer: D

238) $\frac{1}{\sqrt[3]{a^{11}}}$

A) $a^{-11/3}$ B) $a^8$ C) $a^{-8}$ D) $a^{-3/11}$

Answer: A

239) $\frac{1}{\sqrt[3]{b^9}}$

A) $\frac{b^9}{3}$ B) $b^{-6}$ C) $b^{-3}$ D) $b^{-1/3}$

Answer: C

240) $\frac{1}{\sqrt{s^6}}$

A) $b^{-1/3}$ B) $s^{-4}$ C) $s^{-3}$ D) $s^{-6}$

Answer: C

241) $\frac{2}{\sqrt{t^9}}$

A) $t^{-9}$ B) $2t^{-9/2}$ C) $\frac{1}{2}t^{-9}$ D) $2t^{-2/9}$

Answer: B



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242) $\frac{1}{\sqrt{x^3 + b}}$

A) $(x^3 + b)^{-1/2}$ B) $(x^3 + b)^{1/2}$ C) $\frac{x^2 + b}{2}$ D) $x^{-3/2} + b^{-1/2}$

Answer: A

243) $\sqrt{(x + 2)^3}$

A) $x + 2$ B) $(x + 2)^{-3/2}$ C) $(x + 2)^{2/3}$ D) $(x + 2)^{3/2}$

Answer: D

**Convert to an expression using radical notation.**

244) $x^{1/3}$

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

Answer: C

245) $b^{2/7}$

A) $\sqrt[9]{b^2}$ B) $\sqrt{b^2}$ C) $\sqrt{b^7}$ D) $\sqrt[7]{b^2}$

Answer: D

246) $t^{11/3}$

A) $\sqrt[3]{t^{11}}$ B) $\frac{1}{\sqrt[3]{t^{11}}}$ C) $\sqrt[11]{t^3}$ D) $\sqrt{t^{11}}$

Answer: A

247) $\frac{1}{y^{-13/5}}$

A) $\sqrt{y^{13}}$ B) $\frac{1}{\sqrt[5]{y^{13}}}$ C) $\sqrt[13]{y^5}$ D) $\sqrt[5]{y^{13}}$

Answer: D

248) $r^{-3/14}$

A) $\frac{1}{\sqrt[3]{r^{14}}}$ B) $\sqrt[14]{r^3}$ C) $\frac{-1}{\sqrt[14]{r^3}}$ D) $\frac{1}{\sqrt[14]{r^3}}$

Answer: D



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249) $\frac{1}{s^{1/2}}$

A) $\frac{1}{\sqrt{s^2}}$ B) $\frac{1}{\sqrt{s}}$ C) $\sqrt{s}$ D) $\frac{-1}{\sqrt{s}}$

Answer: B

250) $(x^2 - 13)^{-1/2}$

A) $\frac{\sqrt{13}}{x}$ B) $\frac{1}{\sqrt{x^2 - 13}}$ C) $\frac{1}{x^2 - 13}$ D) $-\sqrt{x^2 - 13}$

Answer: B

251) $(y^2 - 3)^{1/4}$

A) $\frac{1}{\sqrt[4]{y^2 - 3}}$ B) $\sqrt{y^2 - 3}$ C) $\sqrt[4]{y^2 - 3}$ D) $\frac{1}{y^2 - 8}$

Answer: C

252) $w^{-1/6}$

A) $\frac{1}{\sqrt[6]{w}}$ B) $\sqrt{w^6}$ C) $\sqrt[6]{w}$ D) $w^{-6}$

Answer: A

253) $(x^2 + 5)^{-1/2}$

A) $-\sqrt{x^2 + 5}$ B) $\frac{\sqrt{5}}{x}$ C) $\frac{1}{\sqrt{x^2 + 5}}$ D) $\frac{1}{x^2 + 5}$

Answer: C

**Evaluate the expression.**

254) $361^{1/2}$

A) 19 B) 9.5 C) 76 D) 38

Answer: A

255) $8^{1/3}$

A) 2 B) 16 C) 6 D) 48

Answer: A

256) $1296^{1/4}$

A) 6 B) 144 C) 24 D) 7776

Answer: A



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257) $-32^{1/5}$

A) –2 B) 16 C) –8 D) 32

Answer: A

258) $\left(\frac{16}{49}\right)^{1/2}$

A) $\frac{3}{8}$ B) $\frac{4}{8}$ C) $\frac{3}{7}$ D) $\frac{4}{7}$

Answer: D

259) $125^{4/3}$

A) 625 B) 15,625 C) 78,125 D) 3125

Answer: A

260) $625^{5/4}$

A) 3125 B) 78,125 C) 390,625 D) 1,953,125

Answer: A

261) $1024^{4/5}$

A) 262,144 B) 256 C) 65,536 D) 16,384

Answer: B

**Determine the domain of the function.**

262) $f(x) = \sqrt{2x + 14}$

A) $\{x \mid x \geq 0\}$ B) $\{x \mid x \geq 7\}$ C) $\{x \mid x \geq -7\}$ D) $\{x \mid x \leq 7\}$

Answer: C

263) $f(x)=\sqrt{3x - 10}$

A) $\left\{x \mid x \leq \frac{10}{3}\right\}$ B) $\left\{x \mid x \geq -\frac{10}{3}\right\}$ C) $\{x \mid x \geq 0\}$ D) $\left\{x \mid x \geq \frac{10}{3}\right\}$

Answer: D

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

A) {x| x ≠ 2, x ≠ –2} B) {x| x is a real number}
C) {x| x ≠ –2} D) {x| x ≠ 2}

Answer: D

265) $f(x) = \frac{x^2 - 36}{x + 6}$

A) {x| x ≠ –6} B) {x| x is a real number}
C) {x| x ≠ 6, x ≠ –6} D) {x| x ≠ 6}

Answer: A



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266) $f(x) = \dfrac{x^3}{x^2 - 8x + 12}$

A) {x| x ≠ 0, x ≠ 2, x ≠ 6}
B) {x| x ≠ 2, x ≠ 6}
C) {x| x ≠ −2, x ≠ −6}
D) {x| x ≠ −2, x ≠ −6, x ≠ 0}

Answer: B

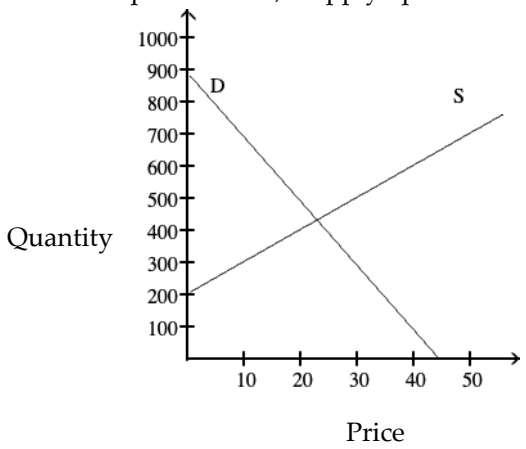
267) $f(x) = \dfrac{x^4 + 7}{x^2 - 3x - 54}$

A) {x| x ≠ −6, x ≠ −9}
B) {x| x ≠ −9, x ≠ 6}
C) {x| x ≠ −6, x ≠ 9}
D) {x| x ≠ 6, x ≠ 9}

Answer: C

**Find the equilibrium point for the supply and demand curves. Round answers to two decimal places.**

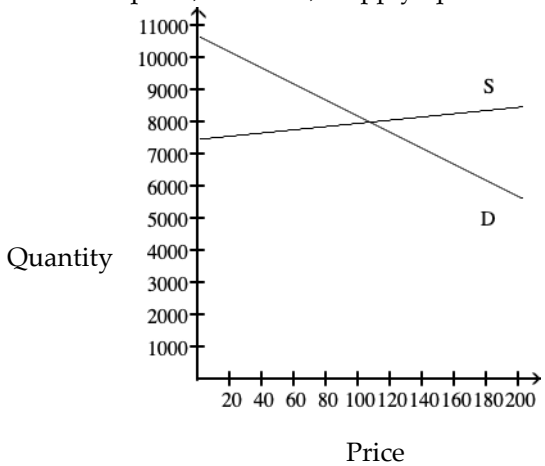
268) Demand: q = 890 − 20x, Supply: q = 210 + 10x




A) (22.67, 436.67)
B) (68.00, −470.00)
C) (−68.00, 2250.00)
D) (36.67, 156.67)

Answer: A

269) Demand: q = 10,700 − 25x, Supply: q = 7500 + 5x




A) (160.00, 6700)
B) (−160.00, 14,700)
C) (106.67, 8033)
D) (606.67, −4467)

Answer: C



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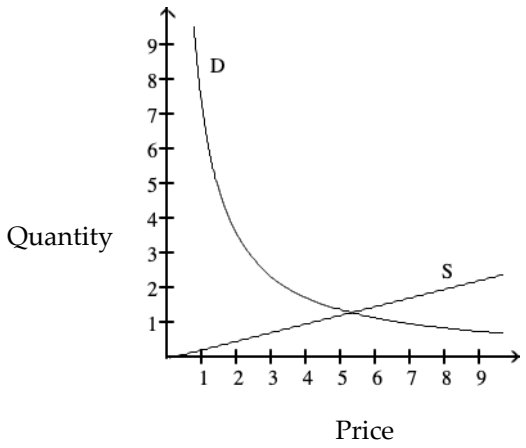
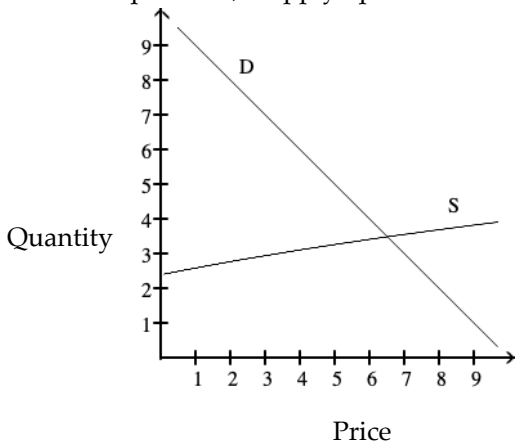
270) Demand: $q = \frac{7}{x}$, Supply: $q = \frac{x}{4}$




A) (5.29, 1.32) B) (1.32, 5.29) C) (5.29, 5.29) D) (14.00, 0.50)

Answer: A

271) Demand: $q = 10 - x$, Supply: $q = \sqrt{x + 6}$




A) (6.01, 4.21) B) (8.44, 1.56) C) (4.69, 5.30) D) (6.46, 3.53)

Answer: D

**Solve the problem.**

272) When the leaves fall off maple trees in the fall, we can estimate the number of leaves per square foot under the tree with the following function:

$$y = 5.5x^{5/9} - 2.0,$$

where x is the number of days after October 10. Predict the density of the leaves on November 10.

A) 5 leaves per square foot B) 17,495,590 leaves per square foot

C) 39 leaves per square foot D) 35 leaves per square foot

Answer: D



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273) The number of people present at a stadium for a big rock concert can be estimated with the following function:

$$y = 13252x^{0.75} + 0.46x + 102,$$

where y is the number of people present and x is the amount of time after 3:00 P.M. on the day of the concert. Predict the number of people present at 7:00PM.

A) 37,586 people B) 39,860 people C) 37,596 people D) 57,135 people

Answer: A

274) When pouring water from one five gallon bucket to another, one tends to pour at a faster rate initially and then slow down in order not to spill. The following function will estimate how much water is left in the bucket from which one is pouring:

$$y = 5 - 0.78t^{0.61},$$

where y is volume in gallons left in the original bucket and t is the time spent pouring in seconds. Predict the amount of water left in the original bucket and the amount in the new bucket after 6 seconds of pouring.

A) 4.39 gallons in the original bucket and 0.61 gallons in the new bucket
B) 2.33 gallons in the original bucket and 2.67 gallons in the new bucket
C) 4.22 gallons in the original bucket and 0.78 gallons in the new bucket
D) 2.67 gallons in the original bucket and 2.33 gallons in the new bucket

Answer: D

275) The distance an object is from the ground after being tossed from a hot air balloon 810 feet in the air is a function of time:

$$y = -16.1t^2 + 6.2t + 810,$$

where y is height and t is the amount of time the object has been in the air. Predict the height of the object after 5.5 seconds.

A) 0 feet B) 288.88 feet C) 357.08 feet D) 755.55 feet

Answer: C

276) The number of mice in an old barn after the cats are removed can be roughly estimated with the following function:

$$y = 2.325x^{0.72} + 0.29x + 1,$$

where y is the number of mice and x is the number of weeks since a cat lived in the barn. Predict the number of mice there will be in ten weeks if you get rid of the cat in the barn.

A) 14 mice B) 15 mice C) 16 mice D) 21 mice

Answer: C



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277) The speed of a vehicle is inversely proportional to the time it takes to travel a fixed distance. If a vehicle travels a fixed distance at 35 miles per hour in 40 minutes, how fast must it travel to cover the same distance in 25 minutes?

A) 56 miles per hour

B) $\frac{175}{8}$ miles per hour

C) $\frac{8}{175}$ miles per hour

D) $\frac{200}{7}$ miles per hour

Answer: A

278) The pitch P of a musical tone is inversely proportional to its wavelength W. One tone has a pitch of 217 vibrations per second and a wavelength of 14.1 ft. Find the wavelength of another tone that has a pitch of 302 vibrations per second. Round to the nearest tenth.

A) 10.1 ft B) 4647.8 ft C) 0.000215 ft D) 0.1 ft

Answer: A

279) The current I in an electrical conductor is inversely proportional to the resistance R of the conductor. The current is 2 amperes when the resistance is 690 ohms. What is the current when the resistance is 411 ohms? Round to the nearest tenth.

A) 3.4 amperes B) 0.3 amperes C) 0.84 amperes D) 1.2 amperes

Answer: A

**Use the ZERO or the INTERSECT feature on your calculator to approximate all the zeros of the function to three decimal places.**

280) $f(x) = 3x^3 + x^2 - x - 1$

A) –1 B) 0.736 C) 0.705 D) 0.469

Answer: B

281) $f(x) = 4x^4 - 1.3x^3 + 0.5x^2 - 2x - 1$

A) –0.383, 0.981 B) 0.981 C) 0.383, –0.981 D) –0.245, 3.266

Answer: A

282) $f(x) = 0.5|x + 2| - 0.25|x - 3| - 1$

A) –11, 1 B) –2.474, –1.571 C) –2, 3 D) –7, –0.333

Answer: A

283) $f(x) = |x + 1| - 3|x - 3| + 5$

A) 0, 7.5 B) –1, 3 C) 0.75, 7.5 D) 1, 8

Answer: C

284) $f(x) = \sqrt{8 + x^3} - 4$

A) 4 B) –2 C) 2 D) 1.896

Answer: C

285) $f(x) = 0.9x^3 - 5x^2 + 6x + 1.23$

A) –0.25, 2, 3.6 B) –0.178, 2.137, 3.596

C) –0.251, –1.334, –4.045 D) –0.178, 2.137

Answer: B



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286) $f(x) = (x - 20)^3 + 2x$

A) 16.775 B) 20

C) 23.615 D) There are no real roots.

Answer: A

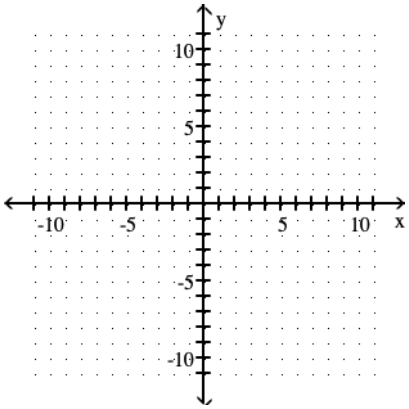
287) $f(x) = \frac{1}{2}|x + 2| - \frac{1}{4}|x - 3| - 1$

A) –11, 1 B) –2.474, –1.571 C) –2, 3 D) –7, –0.333

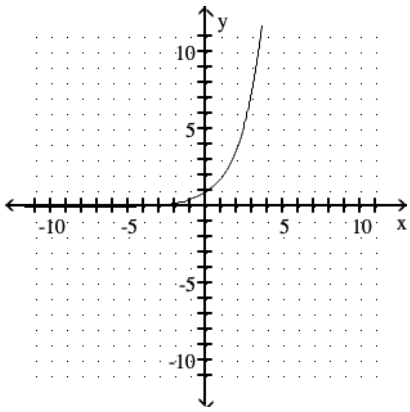
Answer: A

**Graph the exponential function.**

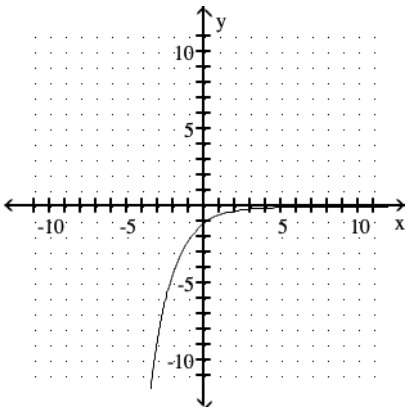
288) $f(x) = 2^x$



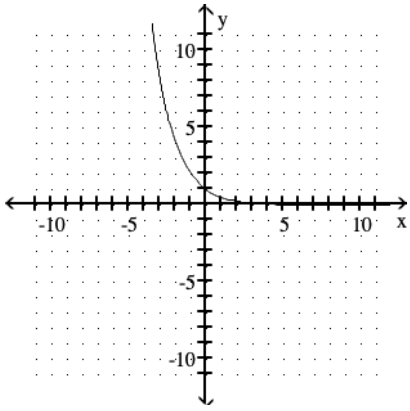

A)



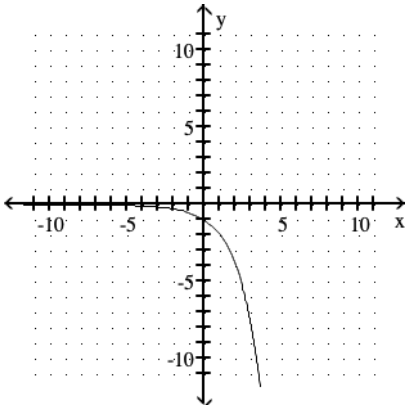

B)




C)




D)




Answer: A



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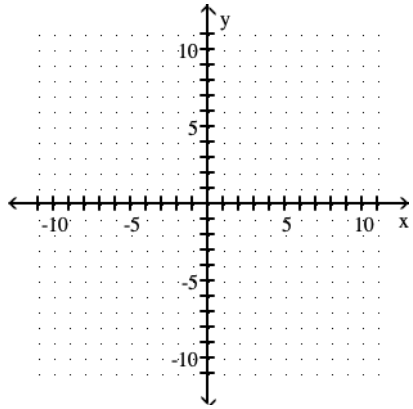
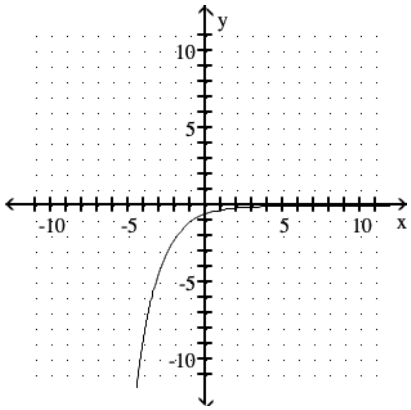
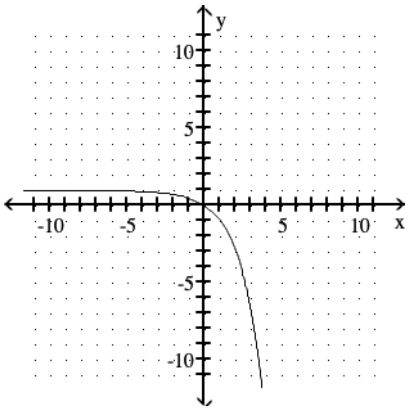
289) $f(x) = 2^x + 1$



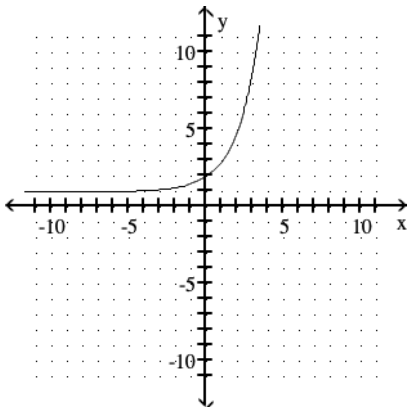

A)



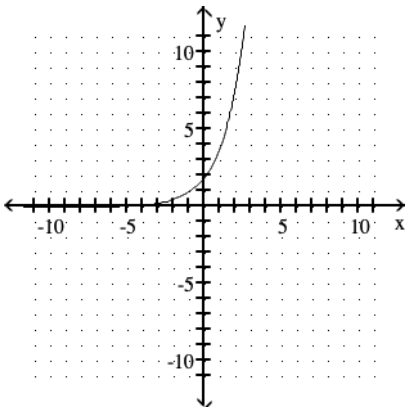

B)




C)




D)




Answer: C



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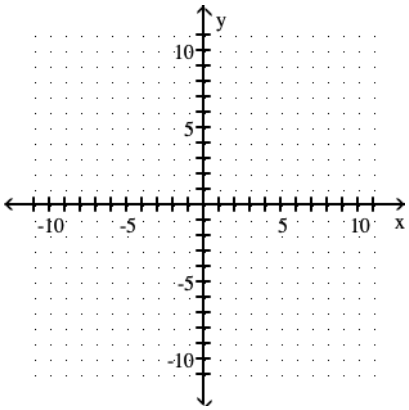
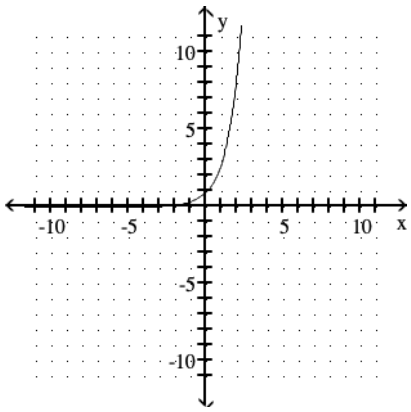
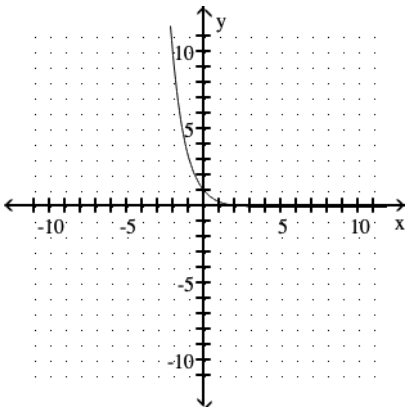
290) $f(x) = \left(\frac{1}{3}\right)^x$



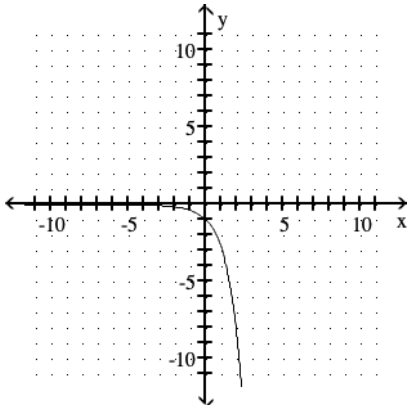

A)



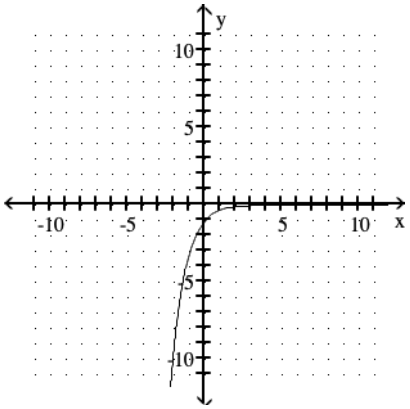

B)




C)




D)




Answer: B



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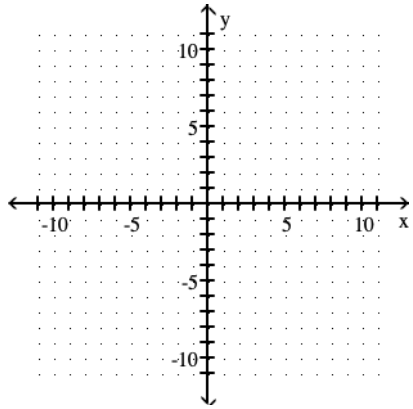
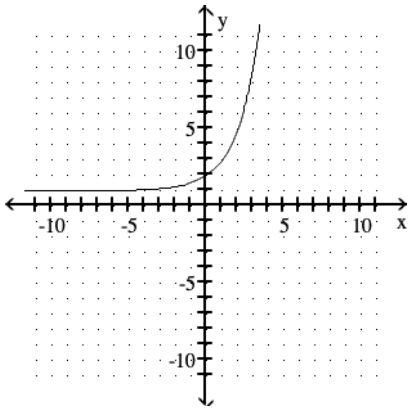
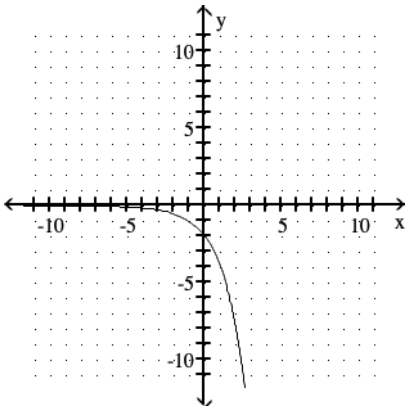
291) $f(x) = 2^{x+1}$



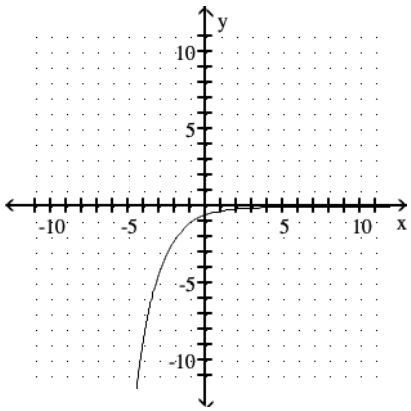

A)



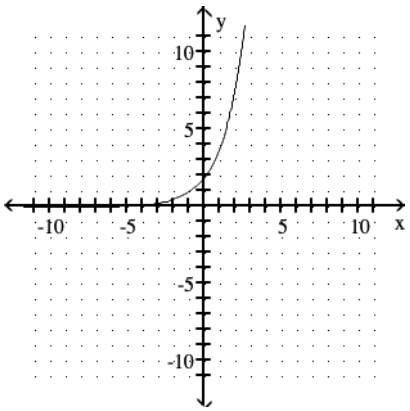

B)




C)




D)




Answer: D



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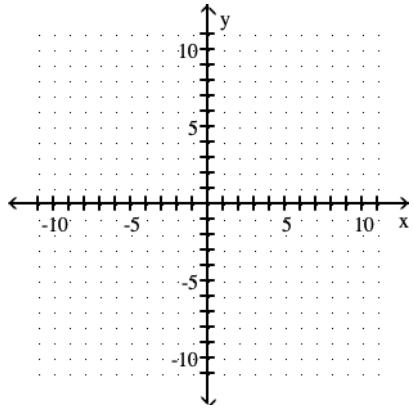
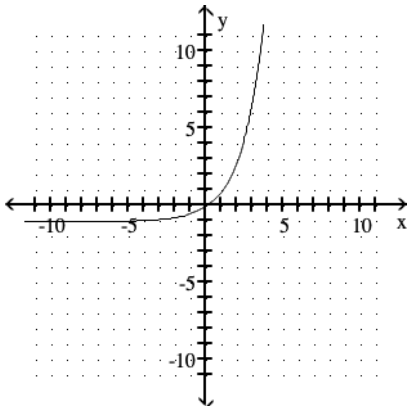
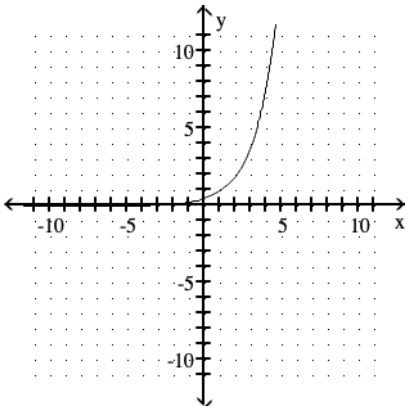
292) $f(x) = 2^{x-1}$



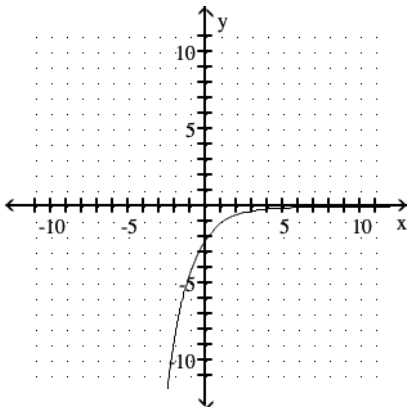

A)



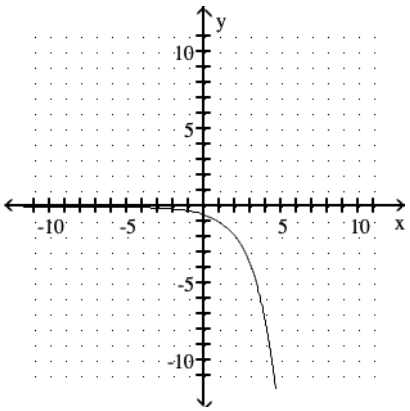

B)




C)




D)




Answer: B



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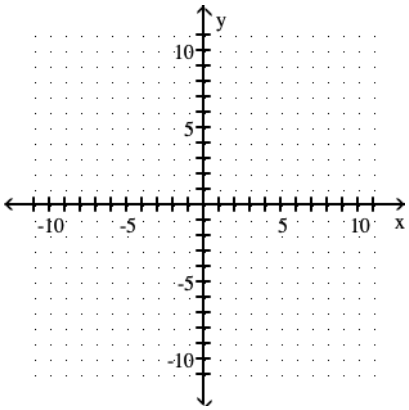
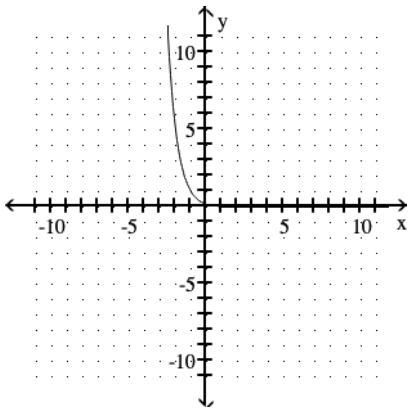
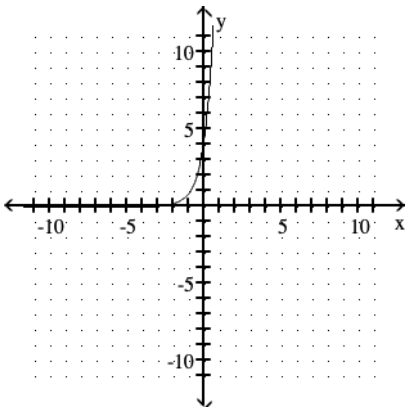
293) $f(x) = \left(\frac{1}{5}\right)^{x+1}$



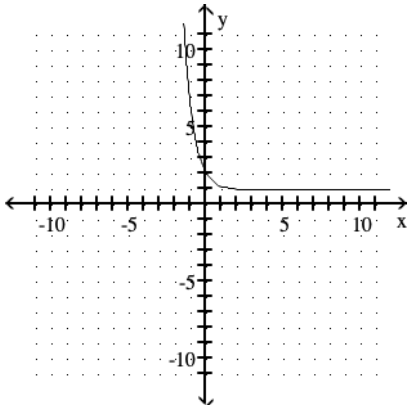

A)



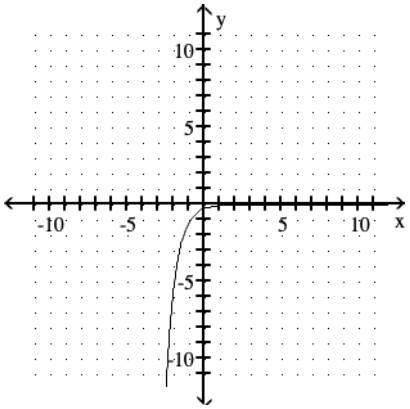

B)




C)




D)




Answer: A



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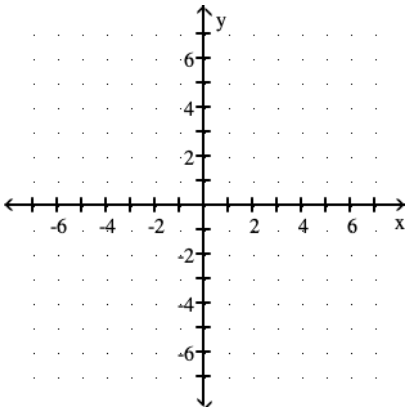
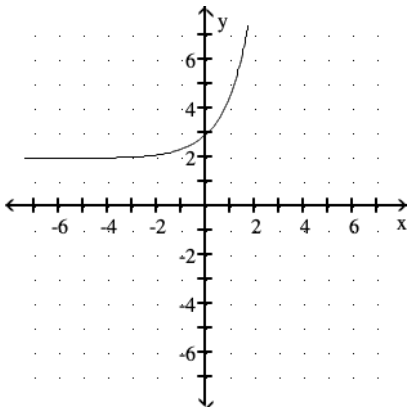
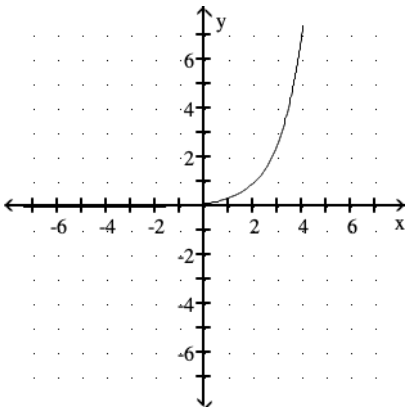
294) $f(x) = e^{x+2}$



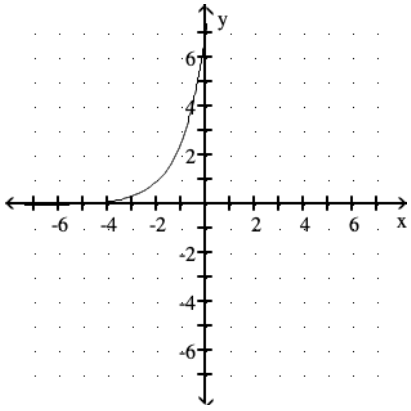

A)



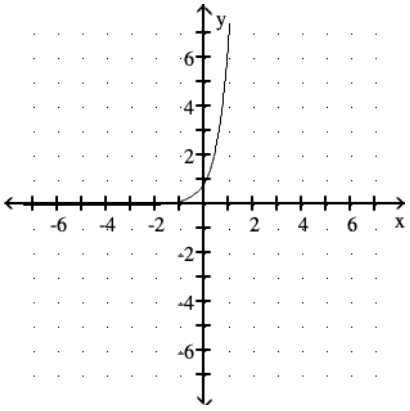

B)




C)




D)




Answer: C



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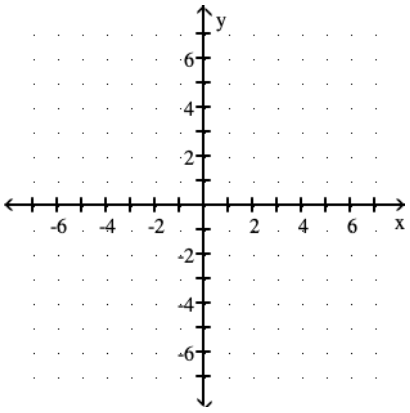
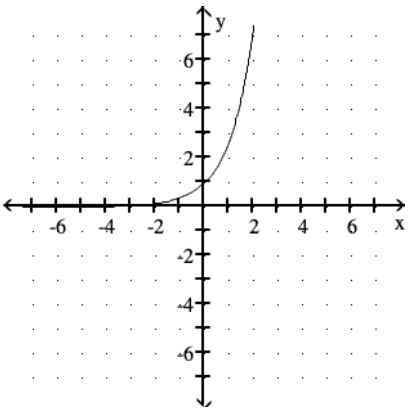
295) $f(x) = e^x$




A)

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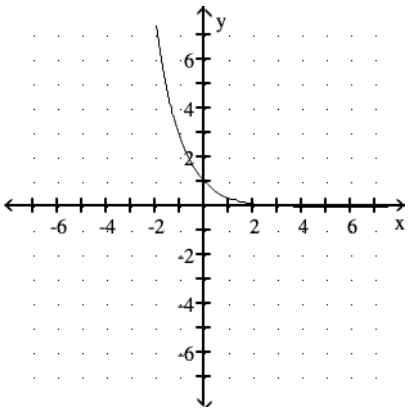
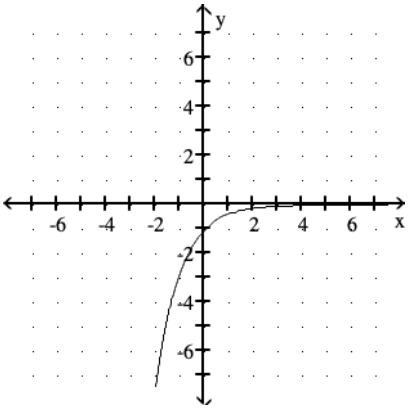
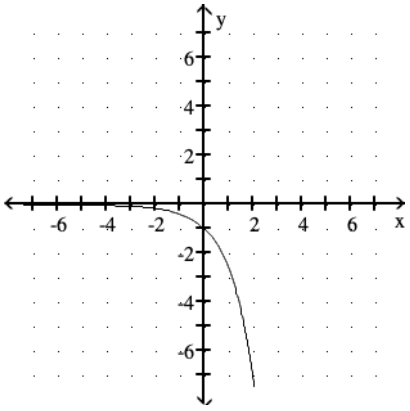



C)




D)




Answer: A

**Convert to a logarithmic equation.**

296) $5^2 = 25$

A) $5 = \log_2 25$ B) $2 = \log_{25} 5$ C) $25 = \log_5 2$ D) $2 = \log_5 25$

Answer: D

297) $4^3 = 64$

A) $3 = \log_4 64$ B) $4 = \log_3 64$ C) $3 = \log_{64} 4$ D) $64 = \log_4 3$

Answer: A



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298) $5^{-2} = \frac{1}{25}$

A) $-2 = \log_5 \frac{1}{25}$ B) $5 = \log_{-2} \frac{1}{25}$ C) $-2 = \log_{1/25} 5$ D) $\frac{1}{25} = \log_5 -2$

Answer: A

299) $32^{1/5} = 2$

A) $\frac{1}{5} = \log_{32} 2$ B) $2 = \log_{1/5} 32$ C) $\frac{1}{5} = \log_2 32$ D) $2 = \log_{32} \frac{1}{5}$

Answer: A

300) $e^{-6} = 0.002479$

A) $0.002479 = \log_{-6} e$ B) $0.002479 = \log_e -6$

C) $-6 = \log_e 0.002479$ D) $e = \log_{-6} 0.002479$

Answer: C

**Convert to an exponential equation.**

301) $\log_9 729 = 3$

A) $3^9 = 729$ B) $9^{729} = 3$ C) $729^3 = 9$ D) $9^3 = 729$

Answer: D

302) $\log_9 \frac{1}{729} = -3$

A) $(\frac{1}{729})^3 = 9$ B) $9^{729} = 3$ C) $9^{-3} = \frac{1}{729}$ D) $3^9 = \frac{1}{729}$

Answer: C

303) $\log_3 1 = 0$

A) $0^3 = 1$ B) $3^1 = 0$ C) $1^0 = 3$ D) $3^0 = 1$

Answer: D

304) $\log_w Q = 13$

A) $13^w = Q$ B) $Q^{13} = w$ C) $Q^w = 13$ D) $w^{13} = Q$

Answer: D

305) $\log_{10} 0 = -10$

A) $-10^{10} = 0$ B) $10^{-10} = 0$ C) $0^{-10} = 10$ D) $0^{10} = -10$

Answer: B

306) $\log_e 21 = 3.045$

A) $e^{3.045} = 21$ B) $21^{3.045} = e$ C) $21^e = 3.045$ D) $e^{21} = 3.045$

Answer: A



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**Solve.**

307) $\log_3 9 = x$

A) 3 B) 27 C) 12 D) 2

Answer: D

308) $\log_2 \frac{1}{8} = x$

A) 3 B) $\frac{1}{4}$ C) $\frac{1}{16}$ D) –3

Answer: D

309) $\log_3 x = 2$

A) 5 B) 6 C) 8 D) 9

Answer: D

310) $\log_2 x = -3$

A) –6 B) –1 C) $\frac{1}{8}$ D) $\frac{1}{9}$

Answer: C

311) $\log_4 1 = x$

A) 16 B) 4 C) 0 D) 1

Answer: C

312) $\log_x 9 = 2$

A) 2 B) 2 or –2 C) 3 or –3 D) 3

Answer: D

313) $\log_5 x = -4$

A) 1024 B) $\frac{1}{625}$ C) –625 D) –20

Answer: B

314) $\log_{27} x = \frac{2}{3}$

A) 9 B) 3 C) 18 D) 27

Answer: A

315) $\log_{30} x = 0$

A) 1 B) 30 C) –1 D) 0

Answer: A



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316) $\log_{81} x = \frac{1}{4}$

A) $\frac{1}{3}$ B) 9 C) –3 D) 3

Answer: D

**Find the logarithm to four decimal places.**

317) log 89.36

A) 4.9927 B) 4.4927 C) 1.4511 D) 1.9511

Answer: D

318) log 3695

A) 8.7147 B) 8.2147 C) 3.5676 D) 3.0676

Answer: C

319) log 49

A) 4.3918 B) 1.1902 C) 1.6902 D) 3.8918

Answer: C

320) log 0.57

A) –0.7441 B) –0.5621 C) –0.2441 D) –0.0621

Answer: C

**Determine the value of the logarithm. Round to the nearest hundredth.**

321) $\log_5 55$

A) 2.40 B) 0.40 C) 2.49 D) 6.45

Answer: C

322) $\log_5 9.6$

A) 0.71 B) 1.41 C) 3.64 D) 0.65

Answer: B

323) $\log_4 0.7$

A) –3.89 B) –0.49 C) –0.26 D) –1.74

Answer: C

**Solve the equation.**

324) $5^x = 125$

A) 4 B) 25 C) 2 D) 3

Answer: D

325) $4^{-x} = \frac{1}{256}$

A) 4 B) $\frac{1}{64}$ C) $\frac{1}{4}$ D) –4

Answer: A



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326) $2^{(12 - 2x)} = 16$

A) –4 B) 8 C) 6 D) 4

Answer: D

327) $3^{(1 + 2x)} = 27$

A) 1 B) –1 C) 3 D) 9

Answer: A

328) $2^{(5 - 3x)} = \frac{1}{16}$

A) 8 B) $\frac{1}{8}$ C) 3 D) –3

Answer: C

329) $4^{x} = \frac{1}{64}$

A) $\frac{1}{16}$ B) –3 C) 3 D) $\frac{1}{3}$

Answer: B

330) $2^{(7 + 3x)} = \frac{1}{4}$

A) 3 B) –3 C) 1 D) $\frac{1}{2}$

Answer: B

331) $e^{-4x} = (e^{7})^{2 - x}$

A) $-\frac{14}{3}$ B) 0 C) $\frac{2}{3}$ D) $\frac{14}{3}$

Answer: D

332) $4^{-|x|} = \frac{1}{16}$

A) 1, –1 B) 4, –4 C) 2, –2 D) 2

Answer: C

**Solve.**

333) Given $\log_{10} 2 = 0.3010$ and $\log_{10} 3 = 0.4771$, evaluate $\log_{10} 6$.

A) 0.9030 B) 0.9542 C) 0.1436 D) 0.7781

Answer: D

334) Given $\log_{10} 2 = 0.3010$ and $\log_{10} 3 = 0.4771$, evaluate $\log_{10} 72$.

A) 0.2549 B) 2.0333 C) 0.8616 D) 1.8572

Answer: D



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335) Given $\log_{10} 2 = 0.3010$ and $\log_{10} 3 = 0.4771$, evaluate $\log_{10} 12$.

A) 0.5677 B) 1.2552 C) 1.0791 D) 0.2872

Answer: C

336) Let $\log_b A = 1.963$ and $\log_b B = 0.138$. Find $\log_b AB$.

A) 1.825 B) 2.101 C) 0.271 D) 14.225

Answer: B

337) Let $\log_b A = 3.878$ and $\log_b B = 0.376$. Find $\log_b \frac{A}{B}$.

A) 3.502 B) 4.254 C) 3.878 D) 1.458

Answer: A

338) Given $\log_b 5 = 1.035$ and $\log_b 10 = 1.481$, evaluate $\log_b 2$.

A) 1.431
B) 2.516
C) 0.446
D) cannot be found using the properties of logarithms

Answer: C

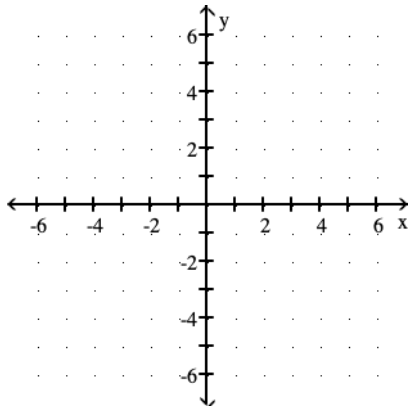
339) Given $\log_b 3 = 1.241$ and $\log_b 10 = 1.357$, evaluate $\log_b 7$.

A) 30
B) 3.333
C) cannot be found using the properties of logarithms
D) 13

Answer: C

**Graph.**

340) $f(x) = \log_2 x$



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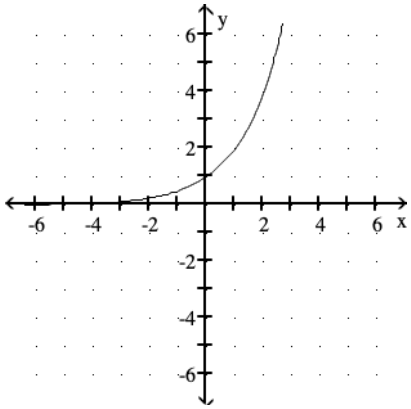
A)

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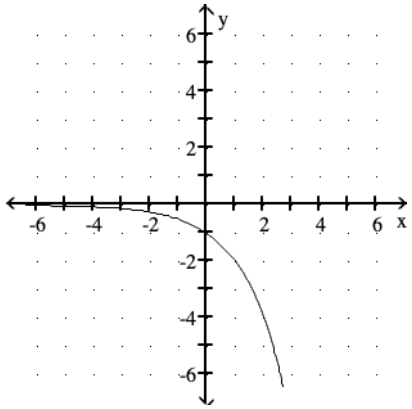


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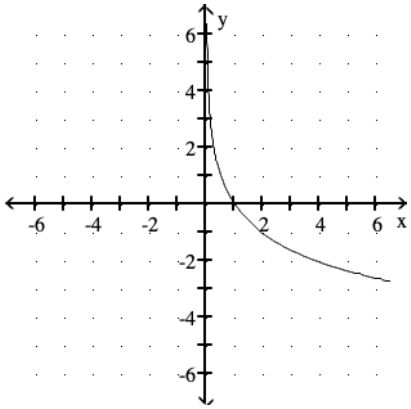
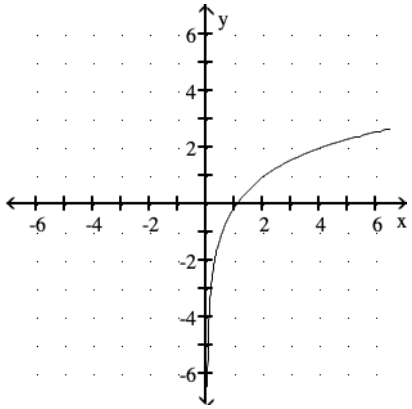
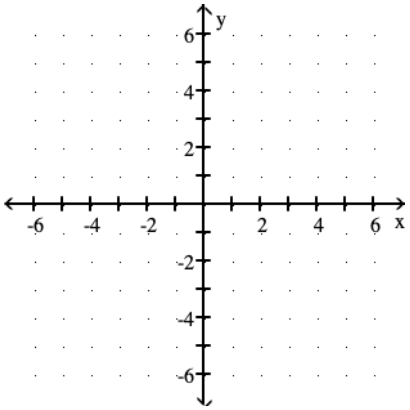



D)




Answer: D

341) $f(x) = \log_{1/3} x$



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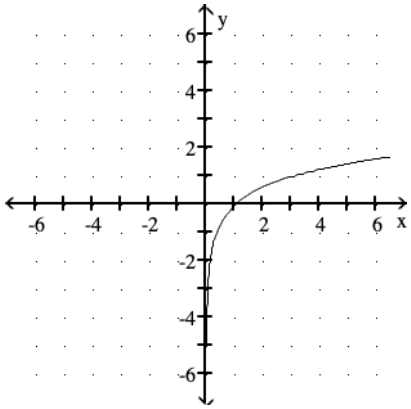
A)

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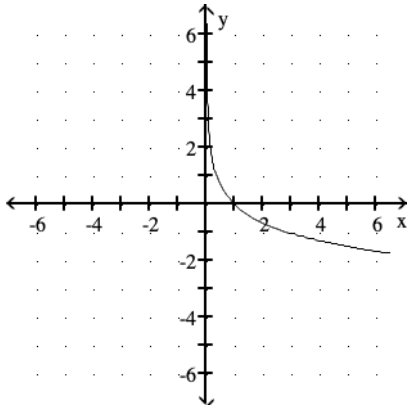
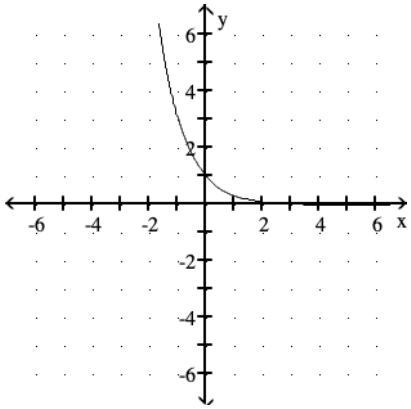
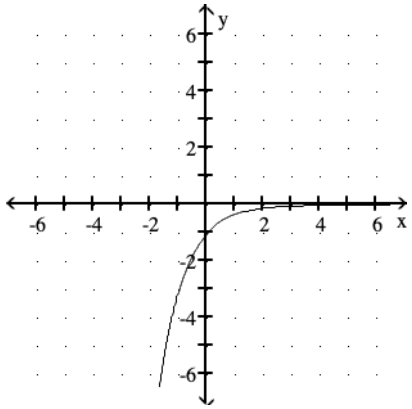



C)




D)




Answer: B

**Solve the problem.**

342) Find the amount of interest earned on the following deposit: $1000 at 8% compounded annually for 11 years

A) $1518.17 B) $1158.92 C) $1331.64 D) $2331.64

Answer: C

343) An economist predicts that the buying power B(x) of a dollar x years from now will decrease according to the formula $B(x) = 0.41^x$. How much will today's dollar be worth in 3 years? Round to the nearest cent.

A) $0.07 B) $0.77 C) $1.23 D) $1.57

Answer: A

344) Suppose that the number of bacteria in a culture after x hours is given by $f(x) = 1000 \cdot 3^{0.25x}$. How many bacteria are in the culture after 6 hours?

A) 7 bacteria B) 42,128 bacteria C) 4311 bacteria D) 5196 bacteria

Answer: D

345) The number of books in a small library increases according to the function $B = 5400e^{0.02t}$, where t is measured in years. How many books will the library have after 5 years?

A) 12,434 books B) 6798 books C) 5968 books D) 5400 books

Answer: C



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346) Sonja and Chris both accept new jobs on March 1, 2001. Sonja starts at $43,000 with a raise each March 1 of 4%. Chris starts at $31,000 with a raise on March 1 of each year of 7%. In what year will Chris' salary exceed Sonja's?

A) 2013 B) 2014 C) 2011 D) 2012

Answer: B

347) A college student invests $11,000 in an account paying 3% per year compounded annually. In how many years will the amount at least triple? Round to the nearest tenth when necessary.

A) 37.2 yr B) 42.4 yr C) 46.9 yr D) 50.9 yr

Answer: A

348) How long will it take for prices in the economy to double at a 5% annual inflation rate? Round to the nearest hundredth when necessary.

A) 11.9 yr B) 23.45 yr C) 22.52 yr D) 14.21 yr

Answer: D

349) The magnitude of an earthquake, measured on the Richter scale, is given by $R(I) = \log\frac{I}{I_0}$, where I is the amplitude registered on a seismograph located 100 km from the epicenter of the earthquake, and $I_0$ is the amplitude of a certain small size earthquake. Find the Richter scale rating of an earthquake with an amplitude of 5,011,872 $I_0$.

A) 0.67 B) 5.7 C) 15.4 D) 6.7

Answer: D

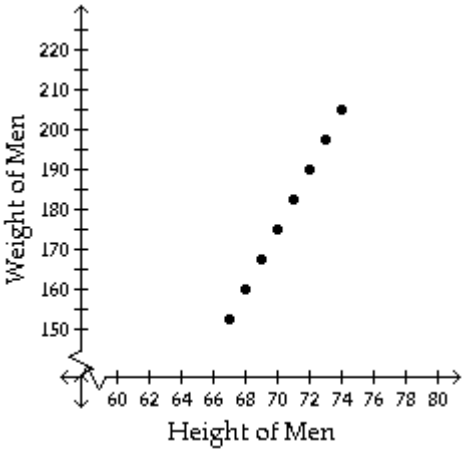
350) A certain noise has intensity $1.06 \times 10^8 I_0$. What is the decibel rating of this sound? Use the formula $D = 10 \log I_0$, where $I_0$ is a faint threshold sound, and I is the intensity of the sound."

A) 185 decibels B) 8 decibels C) 70 decibels D) 80 decibels

Answer: D

**Determine what kind of function might be used as a model for the data.**

351)




A) Quadratic: $f(x) = ax^2 + bx + c$, $a > 0$ B) Quadratic: $f(x) = ax^2 + bx + c$, $a < 0$

C) Linear: $f(x) = mx + b$ D) Polynomial, but neither quadratic nor linear

Answer: C



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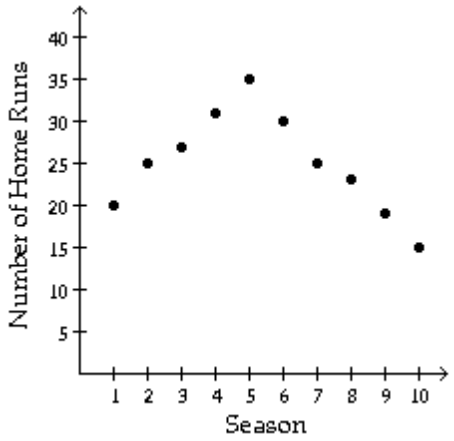
352)




A) Quadratic: $f(x) = ax^2 + bx + c$, $a > 0$

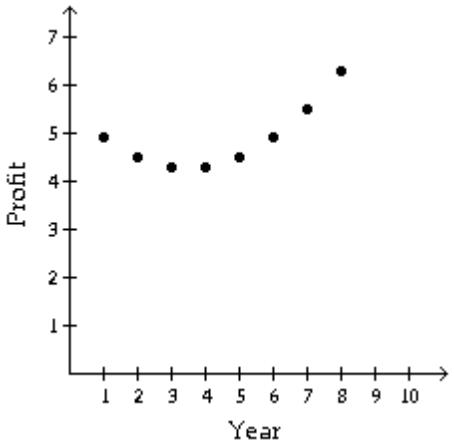
B) Polynomial, but neither quadratic nor linear

C) Quadratic: $f(x) = ax^2 + bx + c$, $a < 0$

D) Linear: $f(x) = mx + b$

Answer: C

353)




A) Polynomial, but neither quadratic nor linear

B) Quadratic: $f(x) = ax^2 + bx + c$, $a > 0$

C) Quadratic: $f(x) = ax^2 + bx + c$, $a < 0$

D) Linear: $f(x) = mx + b$

Answer: B



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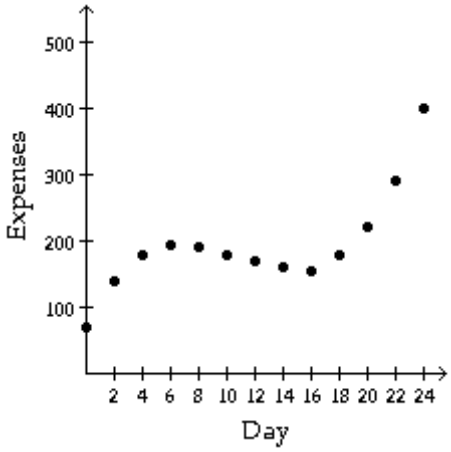
354)




A) Quadratic: $f(x) = ax^2 + bx + c$, $a > 0$

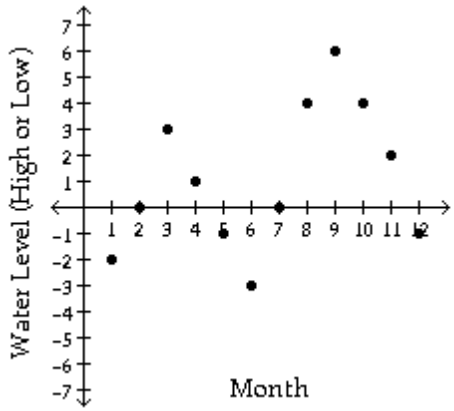
B) Polynomial, but neither quadratic nor linear

C) Quadratic: $f(x) = ax^2 + bx + c$, $a < 0$

D) Linear: $f(x) = mx + b$

Answer: B

355)




A) Polynomial, but neither quadratic nor linear

B) Quadratic: $f(x) = ax^2 + bx + c$, $a > 0$

C) Linear: $f(x) = mx + b$

D) Quadratic: $f(x) = ax^2 + bx + c$, $a < 0$

Answer: A



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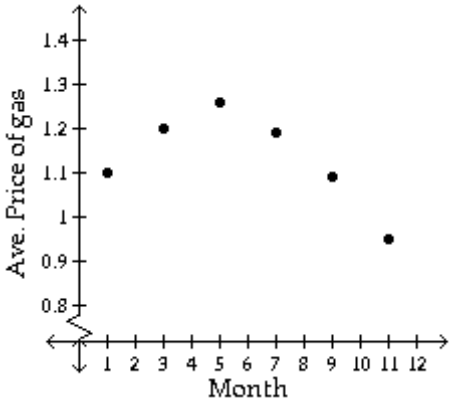
356)




A) Linear: $f(x) = mx + b$

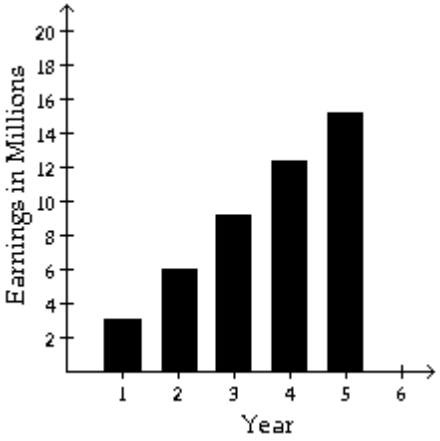
B) Quadratic: $f(x) = ax^2 + bx + c$, $a > 0$

C) Polynomial, but neither quadratic nor linear

D) Quadratic: $f(x) = ax^2 + bx + c$, $a < 0$

Answer: D

357)




A) Polynomial, but neither quadratic nor linear

B) Quadratic: $f(x) = ax^2 + bx + c$, $a < 0$

C) Quadratic: $f(x) = ax^2 + bx + c$, $a > 0$

D) Linear: $f(x) = mx + b$

Answer: D



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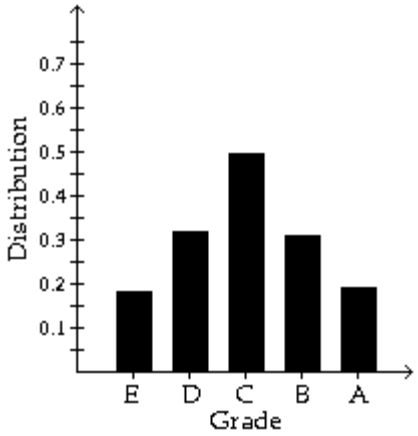
358)




A) Polynomial, but neither quadratic nor linear

B) Quadratic: $f(x) = ax^2 + bx + c$, $a > 0$

C) Linear: $f(x) = mx + b$

D) Quadratic: $f(x) = ax^2 + bx + c$, $a < 0$

Answer: D

**Solve the problem.**

359)

| | | | |
|---|---|---|---|
| Degrees Fahrenheit | 32 | 68 | 113 |
| Degrees Celsius | 0 | 20 | 45 |

Choose any two data points and use them to construct a linear equation that models the data, with x being Fahrenheit and y Celsius. Then use the equation to find the Celsius temperature corresponding to 104° Fahrenheit.

A) $y = \frac{5}{9}(x + 32)$; 76° Celsius

B) $y = \frac{9}{5}(x - 32)$; 130° Celsius

C) $y = \frac{5}{9}(x - 32)$; 40° Celsius

D) $y = \frac{9}{5}(x + 32)$; 245° Celsius

Answer: C

360)

| | | | |
|---|---|---|---|
| Degrees Fahrenheit | 32 | 77 | 221 |
| Degrees Celsius | 0 | 25 | 105 |

Choose any two data points and use them to construct a linear equation that models the data, with x being Celsius and y Fahrenheit. Then use the equation to find the Fahrenheit temperature corresponding to 60° Celsius.

A) $y = \frac{5}{9}x + 32$; 51° Fahrenheit

B) $y = \frac{9}{5}x + 32$; 50° Fahrenheit

C) $y = \frac{9}{5}x + 32$; 140° Fahrenheit

D) $y = \frac{5}{9}x + 32$; 16° Fahrenheit

Answer: C



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361) The information in the chart gives the salary of a person for the stated years. Model the data with a linear function using the points (1, 24,600) and (3, 26,200).

| Year, x | Salary, y |
|---|---|
| 1990, 0 | $23,500 |
| 1991, 1 | $24,600 |
| 1992, 2 | $25,200 |
| 1993, 3 | $26,200 |
| 1994, 4 | $27,200 |

A) $y = 800x + 23{,}500$ B) $y = 800x$

C) $y = 27.8x + 23{,}500$ D) $y = -1046x + 23{,}500$

Answer: A

362) The information in the chart below gives the salary of a person for the stated years. Model the data with a linear function using the points (1, 24,100) and (3, 26,400). Then use this function to predict the salary for the year 2002.

| Year, x | Salary, y |
|---|---|
| 1990, 0 | $23,500 |
| 1991, 1 | $24,100 |
| 1992, 2 | $25,200 |
| 1993, 3 | $26,400 |
| 1994, 4 | $27,200 |

A) $37,300 B) $37,320 C) $37,280 D) $37,340

Answer: A

363) The height of an object dropped from a tall building is given by the table, where t is the elapsed time in seconds and h is the height in feet.

| t | 0 | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|---|
| h | 600 | 584 | 536 | 456 | 344 | 200 |

Find a quadratic function that fits the data.

A) $h(t) = -16t^2 - 600$ B) $h(t) = -16t^2 + 600$ C) $h(t) = 600t^2 - 16$ D) $h(t) = 16t^2 - 600$

Answer: B

364) The population of a small town is given by the table.

| Year | 1960 | 1970 | 1980 | 1990 |
|---|---|---|---|---|
| p | 2500 | 2513 | 2552 | 2617 |

If t = 0 corresponds to the year 1960 and t = 1 corresponds to the year 1970, find a quadratic function that fits the data.

A) $p(t) = 15t^2 + 2500$ B) $p(t) = 13t^2 + 2500$ C) $p(t) = 30t^2 + 2500$ D) $p(t) = 26t^2 + 2500$

Answer: B

365) The height of a projectile moving vertically is given by the table, where t is the elapsed time in seconds and h is the height in feet.

| t | 0 | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|---|
| h | 500 | 1384 | 2236 | 3056 | 3844 | 4600 |

Find a quadratic function to model the height of the projectile.

A) $h(t) = -16t^2 + 1800t + 500$ B) $h(t) = 16t^2 + 900t$

C) $h(t) = -16t^2 + 1400t + 500$ D) $h(t) = -16t^2 + 900t + 500$

Answer: D



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366) The table lists the distance traveled by a falling object, where t is the elapsed time in seconds and d is the distance in meters.

| t | 0 | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|---|
| d | 0 | 4.9 | 19.6 | 44.1 | 78.4 | 122.5 |

Find a quadratic function that fits the data and use it to find the distance traveled after 6 seconds.

A) 144 meters B) 176.4 meters C) 576 meters D) 864.36 meters

Answer: B

367) The table lists the amount of emissions of a certain pollutant in millions of tons.

| Year | 1980 | 1985 | 1990 | 1995 |
|---|---|---|---|---|
| P | 18.8 | 22.6 | 26.0 | 29.0 |

If t = 0 corresponds to 1980, and t = 5 corresponds to 1985, find a quadratic function that fits the data. Use the function to estimate the amount of emissions in the year 2060.

A) 34.7 million tons B) 27.0 million tons C) 31.6 million tons D) 36.8 million tons

Answer: C

368) A furniture manufacturer decides to make a new line of desks. The table shows the profit, in thousands of dollars, for various levels of production.

| Number of Desks Produced | 120 | 350 | 500 | 650 | 750 |
|---|---|---|---|---|---|
| Profit (Thousands) | 13 | 37 | 44 | 34 | 25 |

Find a quadratic function to model the data, and use the model to predict the profit if 450 desks are made.

A) Just under $45,000 B) Almost $42,000
C) Just over $40,000 D) Almost $44,000

Answer: B

369) Use linear regression to find a line representing weight, in pounds, as a function of height, in inches, of men. Then, predict the weight of a man who is 68 inches tall to the nearest tenth of a pound. The following data are the (height, weight) pairs for 8 men: (66, 150), (68, 160), (69, 166), (70, 175), (71, 181), (73, 198), (74, 206).

A) 151.4 lb B) 165.1 lb C) 160.0 lb D) 161.2 lb

Answer: D

370) Use linear regression to find a line representing weight, in pounds, as a function of height, in inches, of men. Then, predict the height of a man who is 145 pounds to the nearest tenth of an inch. The following data are the (height, weight) pairs for 8 men: (66, 150), (68, 160), (69, 166), (70, 175), (71, 181), (72, 191), (73, 198), (74, 206).

A) 63.2 in. B) 65.7 in. C) 64.6 in. D) 68.2 in.

Answer: B

371) The following points form a quadratic relationship: (1, 5.0), (2, 4.4), (3, 4.3), (4, 4.2), (5, 4.6), (6, 4.8), (7, 5.4), (8, 6.2). The x-coordinates are the years a particular company has been in operation and the y-coordinates are the profit, in millions, for that year. Use quadratic regression to estimate the profit in the ninth year.

A) 7.38 million B) 4.47 million C) 7.19 million D) 6.48 million

Answer: C

372) The following points form a quadratic relationship: (1, 5.0), (2, 4.4), (3, 4.3), (4, 4.2), (5, 4.6), (6, 4.8), (7, 5.4), (8, 6.2). The x-coordinates are the years a particular company has been in operation and the y-coordinates are the profit, in millions, for that year. Use quadratic regression to determine the profit in the fourth year.

A) 4.35 million B) 4.27 million C) 4.20 million D) 6.5 million

Answer: B



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373) For some reason the quality of production decreases as the year progresses at a light bulb manufacturing plant. The following data represent the percentage of defective light bulbs produced at a light bulb manufacturing plant in the corresponding month of the year.

| Month | 2 | 3 | 5 | 7 | 8 | 9 | 12 |
|---|---|---|---|---|---|---|---|
| % defective | 1.3 | 1.6 | 2.0 | 2.4 | 2.6 | 2.8 | 3.1 |

Use linear regression to predict the percentage of defective bulbs in June.

A) 2.20% B) 2.3% C) 2.15% D) 2.0%

Answer: C

374) For some reason the quality of production decreases as the year progresses at a light bulb manufacturing plant. The following data represent the percentage of defective light bulbs produced at a light bulb manufacturing plant in the corresponding month of the year.

| Month | 2 | 3 | 5 | 7 | 8 | 9 | 12 |
|---|---|---|---|---|---|---|---|
| % defective | 1.3 | 1.6 | 2.0 | 2.4 | 2.6 | 2.8 | 3.1 |

Use linear regression to predict in which month the percentage of defective light bulbs would be 1.83%.

A) May B) March C) February D) April

Answer: D

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

**Provide a short answer.**

375) Suppose the population of deer fluctuates over time. The population increases in the summer and decreases in the winter. It also varies over many years as well. If you looked at the graph of population versus time, would this relation be a function? Why or why not?

Answer: This would be a function because at any given time there is only one possible population. Despite the fact that the population can reach the same level several times this is still a function, but for each point in time, there can be no more than one population.

376) Consider the linear function $f(x) = 5x + 20$. What is the domain and range of this function? Now, suppose the function represents the relationship between studying time and grades on an exam. The variable x represents the number of hours spent studying and f(x) represents the grade on the exam. Does this change the domain and range? If so, what is the new domain and range and why is it different?

Answer: The domain is all real numbers and the range is the set of all real numbers. In the context of exam grades, the domain and range both become the set of nonegative real numbers. In this context, times and grades less than zero do not make sense.

377) If a company decides to make a new product, there are fixed costs and variable costs associated with this new product. Explain the differences of the two types of costs and why they occur. Use an example to illustrate your point.

Answer: Fixed costs occur only once. These costs may be startup costs related to the production of the new product. Variable costs depend on how much product is made. These costs may consist of labor, material, and maintenance.

For example, a company decided to make oak filing cabinets. Fixed costs would include the costs of purchasing and renovating plant space and the cost of manufacturing equipment. Variable costs would include the cost labor and the cost of materials.



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378) Suppose you have to develop a model to predict snowfall for the upcoming winter based on data from previous winters. Consider the table of annual snowfall over the last five years:

| Snowfall (y) (in inches) | 180 | 168 | 163 | 155 | 165 |
|---|---|---|---|---|---|
| year (x) | 1994 | 1995 | 1996 | 1997 | 1998 |

Would it be possible to come up with one model that predicted very low amounts of snowfall and another that predicted very high amounts of snowfall? How so? If you were employed by a ski resort to come up with a model, what type of model would you use? What could be done to try to reduce the chance of coming up with such different models?

Answer: Linear Regression would provide a low snowfall prediction, and quadratic regression would provide a high snowfall prediction. Because ski resorts depend on snowfall, a model that predicts a greater amount of snow would be more useful for advertising purposes. Considering the pattern of snowfall over a longer period of time would provide a more accurate prediction than simply considering a five year period and hence would reduce the potential for finding conflicting models.



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1) D
2) B
3) B
4) A
5) D
6) B
7) C
8) B
9) C
10) C
11) C
12) A
13) A
14) A
15) B
16) B
17) A
18) B
19) D
20) A
21) A
22) A
23) C
24) B
25) C
26) C
27) D
28) B
29) C
30) D
31) C
32) B
33) D
34) A
35) A
36) B
37) A
38) B
39) A
40) B
41) A
42) B
43) A
44) C
45) B
46) D
47) D
48) A
49) C



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50) B
51) B
52) A
53) D
54) D
55) A
56) B
57) C
58) C
59) D
60) A
61) A
62) A
63) A
64) A
65) A
66) B
67) B
68) A
69) A
70) B
71) A
72) B
73) A
74) A
75) B
76) B
77) B
78) B
79) C
80) C
81) C
82) C
83) C
84) B
85) C
86) D
87) C
88) D
89) A
90) C
91) D
92) D
93) A
94) A
95) D
96) C
97) C
98) B



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99) C
100) A
101) A
102) C
103) D
104) C
105) B
106) A
107) D
108) B
109) B
110) C
111) C
112) A
113) C
114) D
115) A
116) B
117) A
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125) B
126) D
127) D
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134) A
135) C
136) A
137) A
138) B
139) B
140) D
141) C
142) D
143) B
144) D
145) A
146) D
147) B



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148) B
149) C
150) A
151) D
152) C
153) D
154) B
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156) D
157) C
158) C
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182) D
183) C
184) D
185) D
186) A
187) C
188) B
189) B
190) B
191) D
192) B
193) A
194) C
195) A
196) D



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197) B
198) C
199) C
200) A
201) A
202) A
203) C
204) B
205) B
206) A
207) A
208) C
209) B
210) B
211) A
212) B
213) D
214) D
215) A
216) B
217) A
218) A
219) B
220) A
221) D
222) B
223) D
224) C
225) C
226) C
227) B
228) C
229) C
230) A
231) C
232) D
233) B
234) B
235) D
236) A
237) D
238) A
239) C
240) C
241) B
242) A
243) D
244) C
245) D



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246) A
247) D
248) D
249) B
250) B
251) C
252) A
253) C
254) A
255) A
256) A
257) A
258) D
259) A
260) A
261) B
262) C
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283) C
284) C
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289) C
290) B
291) D
292) B
293) A
294) C



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295) A
296) D
297) A
298) A
299) A
300) C
301) D
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303) D
304) D
305) B
306) A
307) D
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322) B
323) C
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325) A
326) D
327) A
328) C
329) B
330) B
331) D
332) C
333) D
334) D
335) C
336) B
337) A
338) C
339) C
340) D
341) B
342) C
343) A



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344) D
345) C
346) B
347) A
348) D
349) D
350) D
351) C
352) C
353) B
354) B
355) A
356) D
357) D
358) D
359) C
360) C
361) A
362) A
363) B
364) B
365) D
366) B
367) C
368) B
369) D
370) B
371) C
372) B
373) C
374) D
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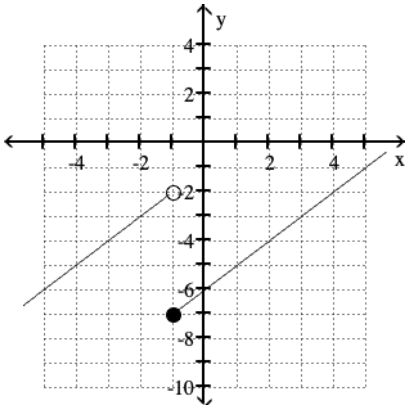
**MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.**

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

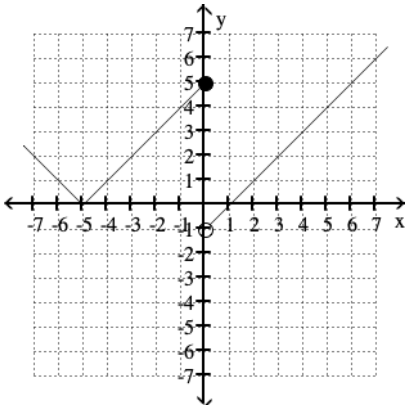
1) Find $\lim_{x\to(-1)^-} f(x)$ and $\lim_{x\to(-1)^+} f(x)$.




A) –7; –5 B) –5; –2 C) –7; –2 D) –2; –7

Answer: D

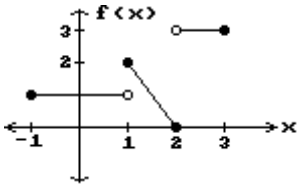
2) Find $\lim_{x\to0^-} f(x)$ and $\lim_{x\to0^+} f(x)$.




A) 5; –1 B) –5; –1 C) –1; 5 D) 5; 1

Answer: A

3) Find $\lim_{x\to1} f(x)$.




A) 0 B) 2 C) Does not exist D) 1

Answer: C



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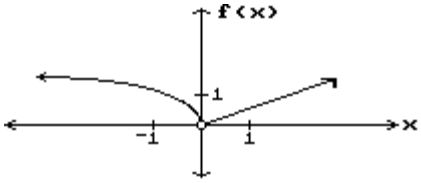
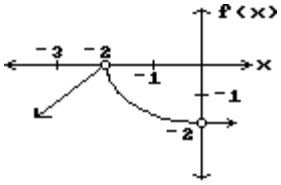
4) Find $\lim_{x \to 0}$ f(x).




A) –1 B) 0 C) 1 D) Does not exist

Answer: B

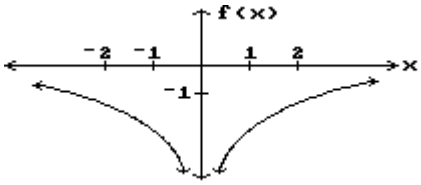
5) Find $\lim_{x \to 0}$ f(x).




A) Does not exist B) –2 C) 0 D) –1

Answer: B

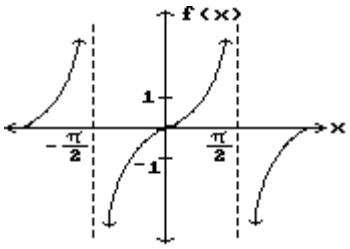
6) Find $\lim_{x \to 0}$ f(x).




A) –2 B) 2 C) $-\infty$ D) 0

Answer: C

7) Find $\lim_{x \to \pi/2}$ f(x).




A) 1 B) Does not exist C) 0 D) $\frac{\pi}{2}$

Answer: B



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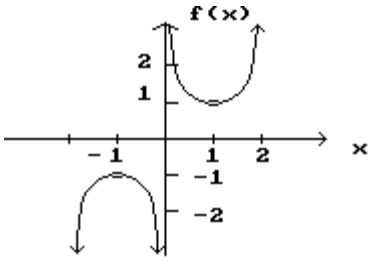
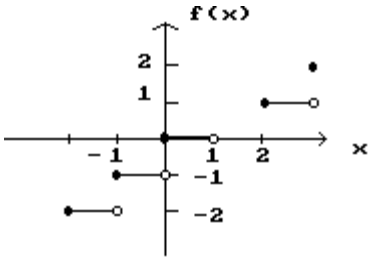
8) Find $\lim_{x \to 1} f(x)$.




A) 0 B) –1 C) Does not exist D) 1

Answer: D

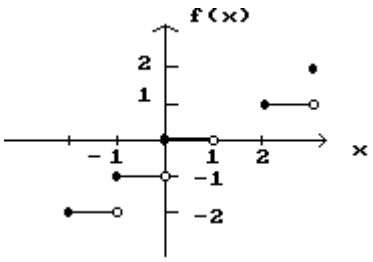
9) Find $\lim_{x \to -1} f(x)$.




A) 0 B) –2 C) –1 D) Does not exist

Answer: D

10) Find $\lim_{x \to -1/2} f(x)$.




A) Does not exist B) –1 C) 0 D) –2

Answer: B



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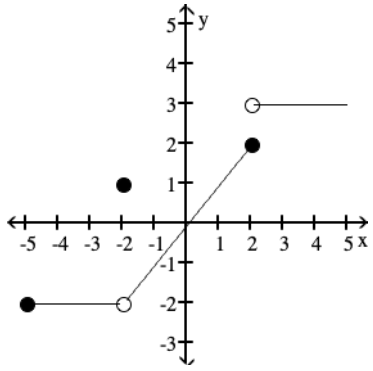
**Use the graph to determine whether each statement is true or false.**

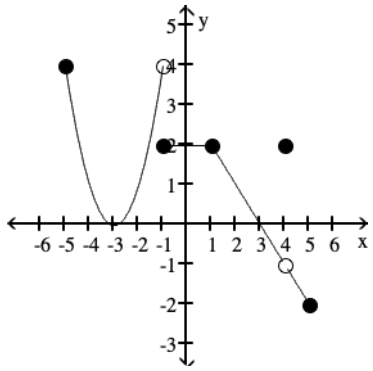
11) $\lim_{x \to -2^+} f(x) = -2$




A) False B) True

Answer: B

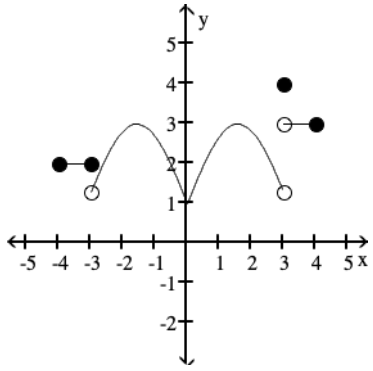
12) $\lim_{x \to -1^+} f(x) = 2$




A) False B) True

Answer: B

13) $\lim_{x \to -3} f(x)$ exists.




A) True B) False

Answer: B



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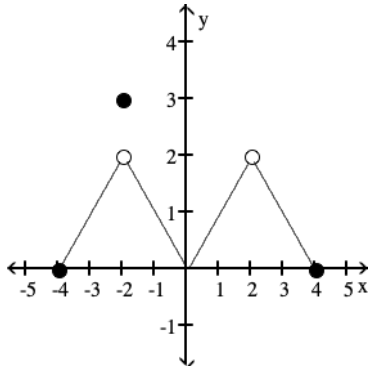
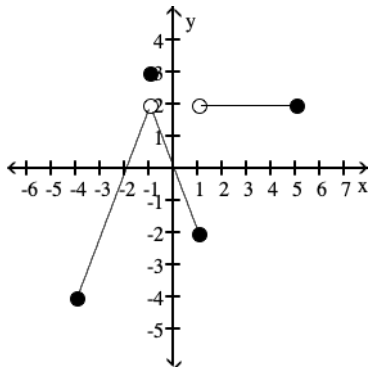
14) $\lim_{x \to 2} f(x) = 2$




A) True B) False

Answer: B

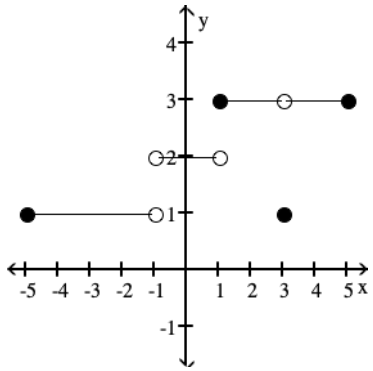
15) $f(-1) = 3$




A) True B) False

Answer: A

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




A) True B) False

Answer: B



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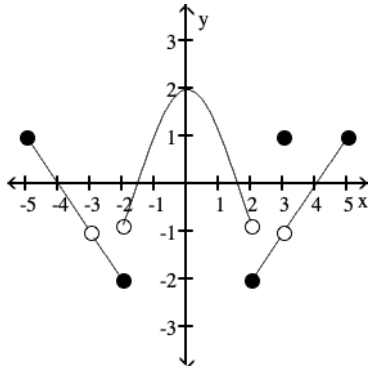
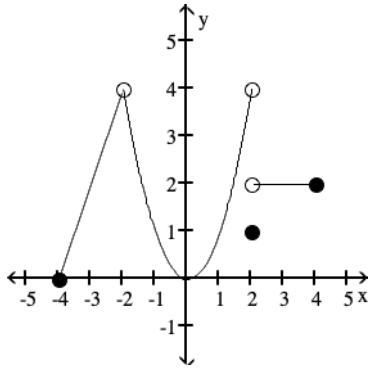
17) $\lim_{x \to 3} f(x)$ exists.




A) False B) True

Answer: B

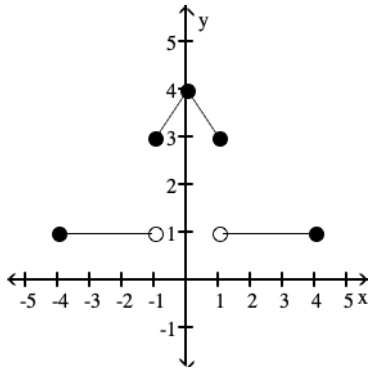
18) $\lim_{x \to -2} f(x) = f(-2)$




A) False B) True

Answer: A

19) $\lim_{x \to 0^+} f(x) = \lim_{x \to 0^-} f(x)$




A) False B) True

Answer: B



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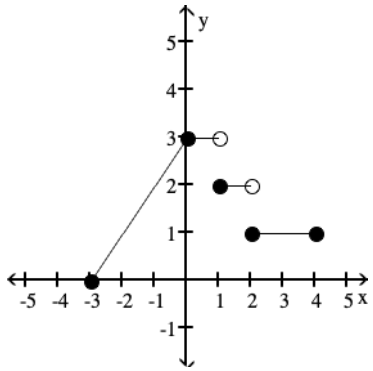
20) $\lim_{x \to 0^+} f(x) = 3$



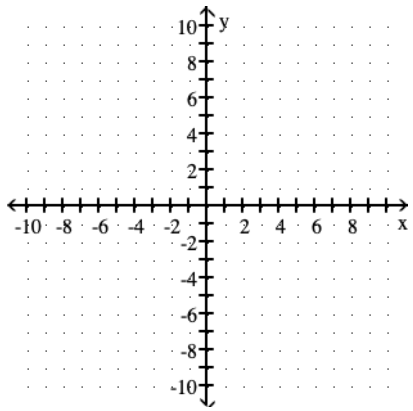
A) False

B) True

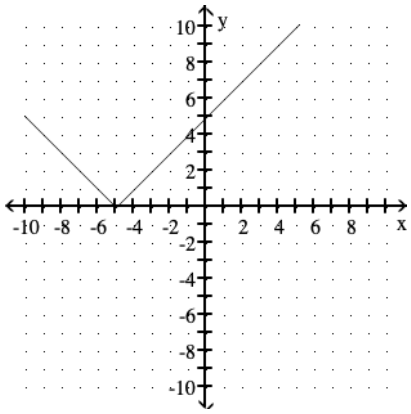
Answer: B

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

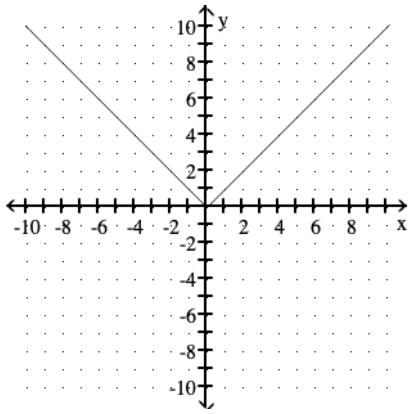
21) $f(x) = |x|$; $\lim_{x \to -2} f(x)$



A) $\lim_{x \to -2} f(x) = 3$



B) $\lim_{x \to -2} f(x) = 0$





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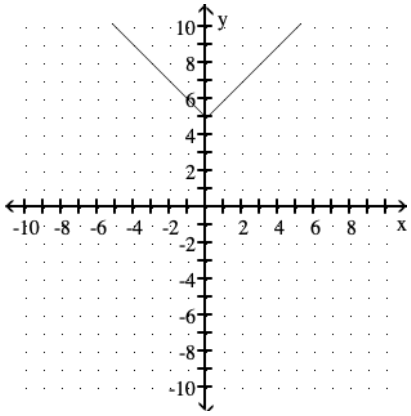
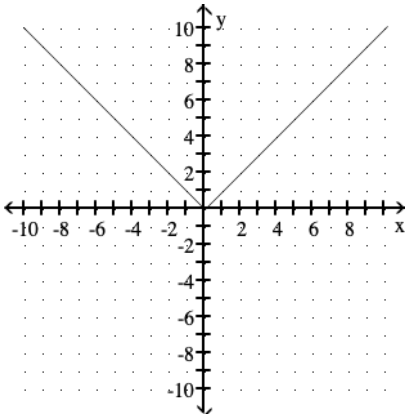
C) $\lim_{x \to -2} f(x) = 7$

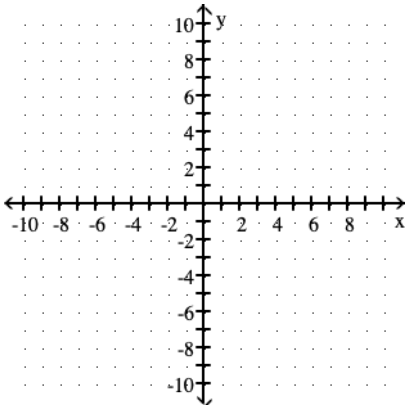



D) $\lim_{x \to -2} f(x) = 2$

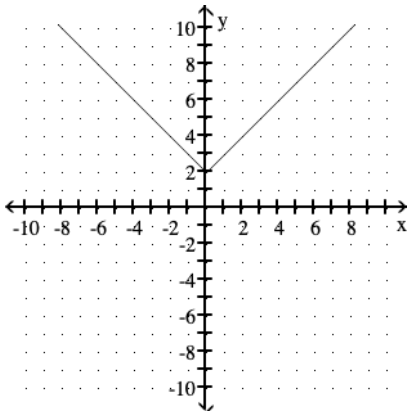



Answer: D

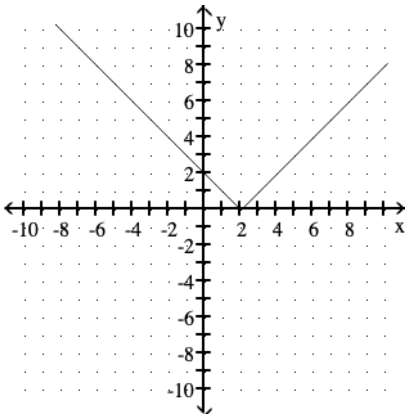
22) $f(x) = |x - 2|$; $\lim_{x \to 0} f(x)$




A) $\lim_{x \to 0} f(x) = 2$




B) $\lim_{x \to 0} f(x) = -2$



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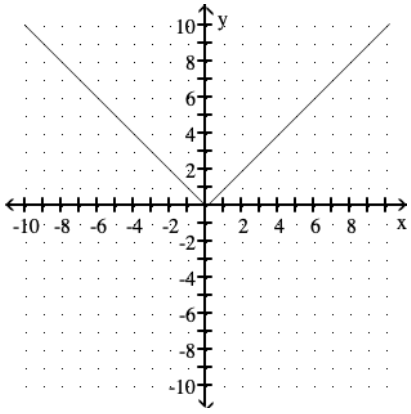
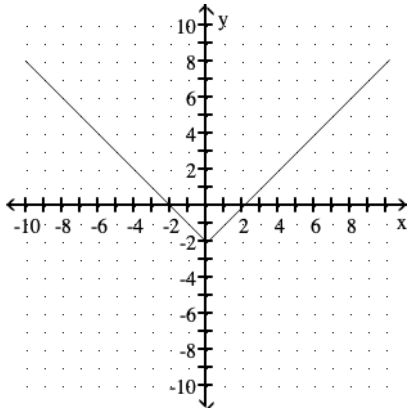
C) $\lim_{x \to 0} f(x) = 0$

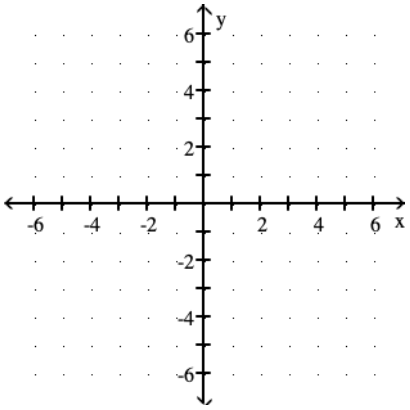



D) $\lim_{x \to 0} f(x) = -2$

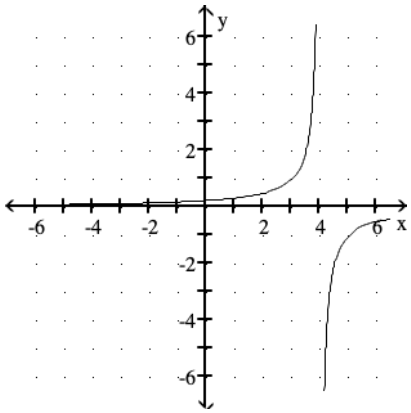



Answer: B

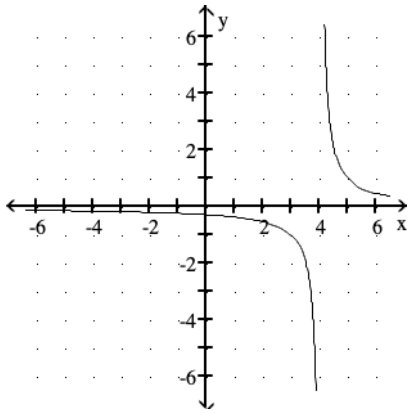
23) $f(x) = \dfrac{1}{x + 4}$; $\lim_{x \to -4} f(x)$




A) $\lim_{x \to 4} f(x)$ does not exist




B) $\lim_{x \to 4} f(x) = 0$



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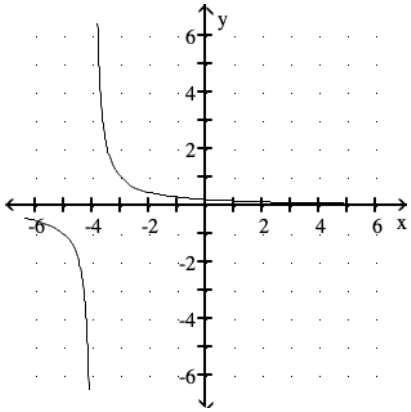
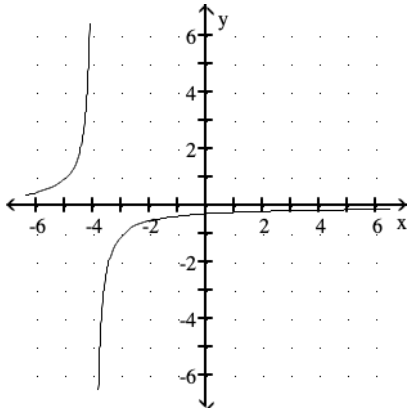
C) $\lim_{x \to -4} f(x)$ does not exist

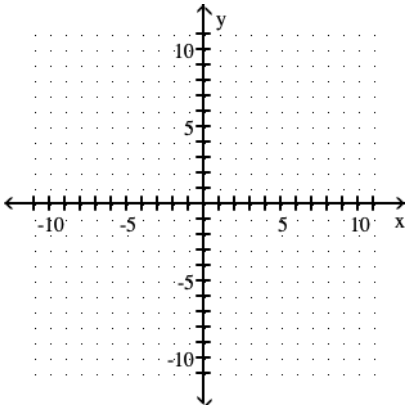



D) $\lim_{x \to -4} f(x) = 0$

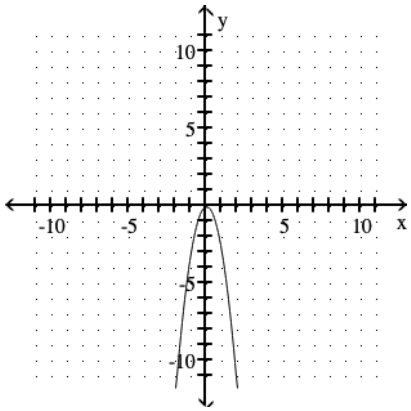



Answer: C

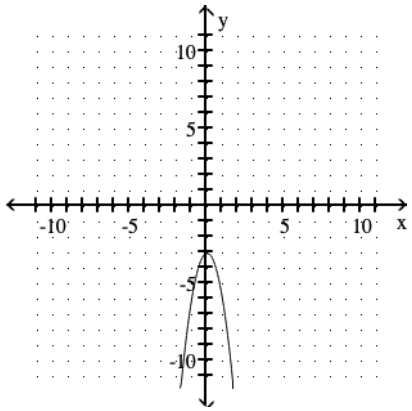
24) $f(x) = -3x^2$; $\lim_{x \to 0} f(x)$




A) $\lim_{x \to 0} f(x) = 0$




B) $\lim_{x \to 0} f(x) = -3$



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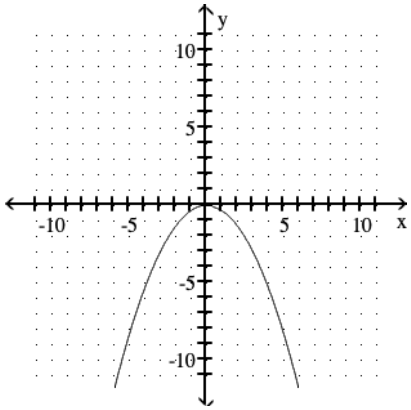
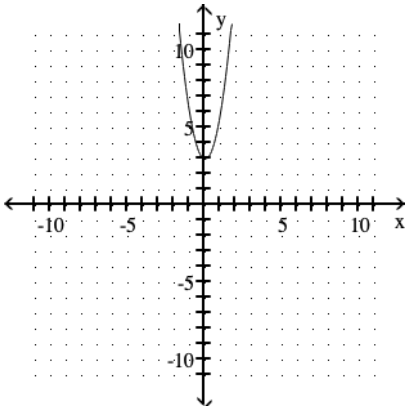
C) $\lim_{x \to 0} f(x) = 0$

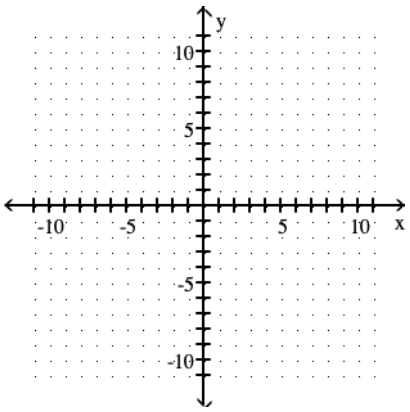



D) $\lim_{x \to 0} f(x) = 3$

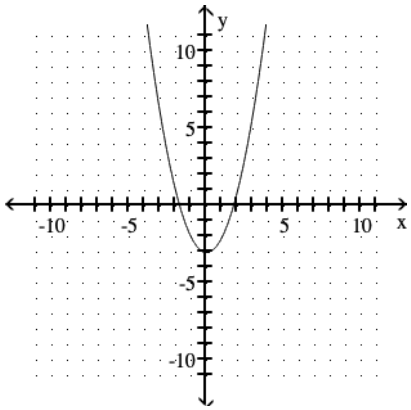



Answer: A

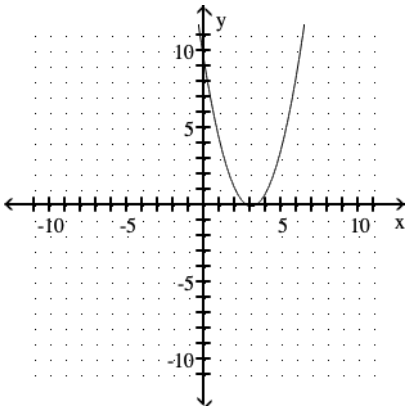
25) $y = x^2 + 3$; $\lim_{x \to 0} f(x)$




A) $\lim_{x \to 0} f(x) = -3$




B) $\lim_{x \to 0} f(x) = 3$



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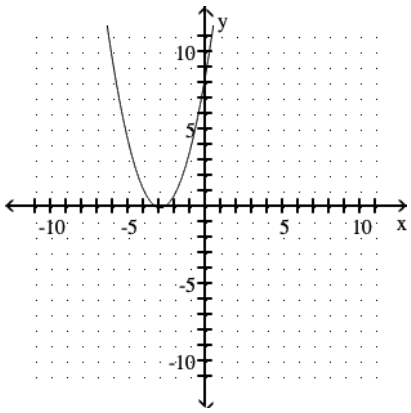
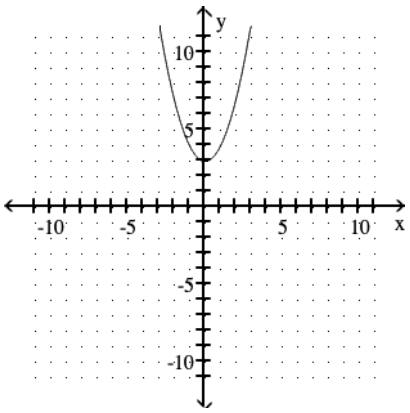
C) $\lim_{x \to 0} f(x) = -3$

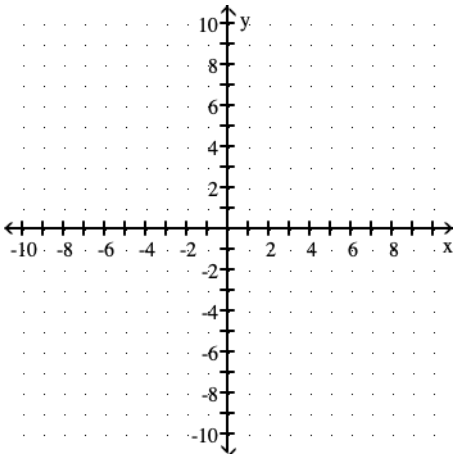



D) $\lim_{x \to 0} f(x) = 3$

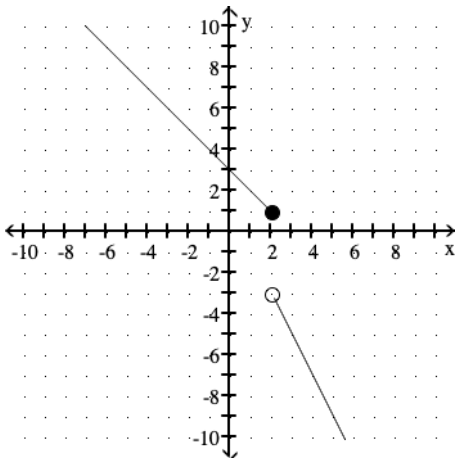



Answer: D

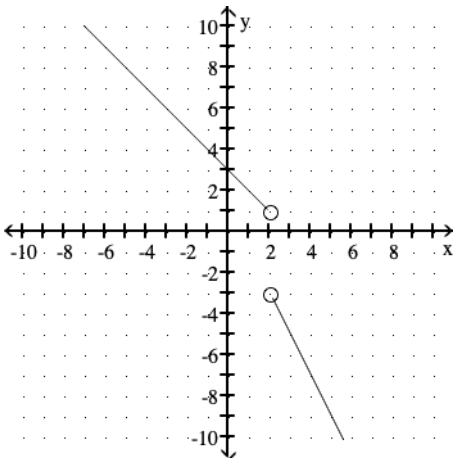
26) $f(x) = \begin{cases} 3 - x, & \text{for } x \le 2, \\ 1 - 2x, & \text{for } x > 2. \end{cases}$; $\lim_{x \to 2^+} f(x)$




A) $\lim_{x \to 2^+} f(x) = -3$




B) $\lim_{x \to 2^+} f(x) = -3$



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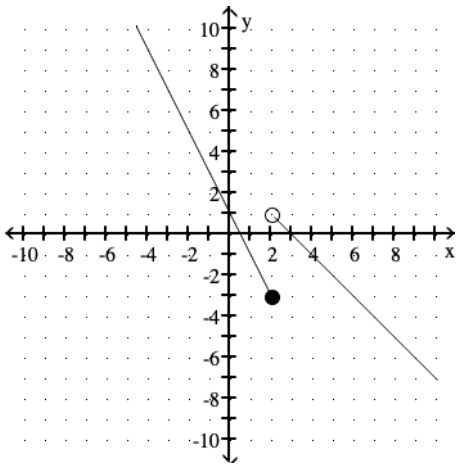
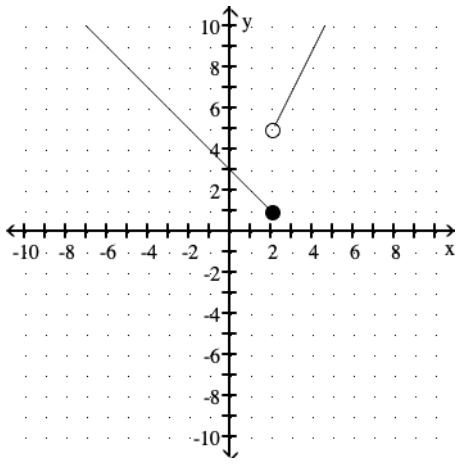
C) $\lim_{x \to 2^+} f(x) = 1$

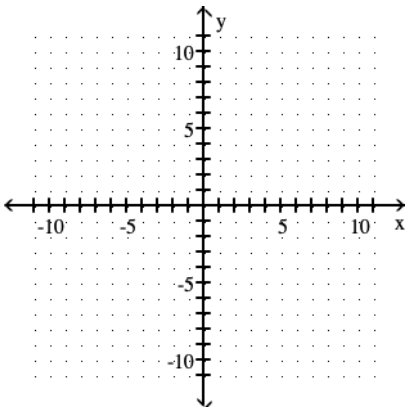



D) $\lim_{x \to 2^+} f(x) = 5$

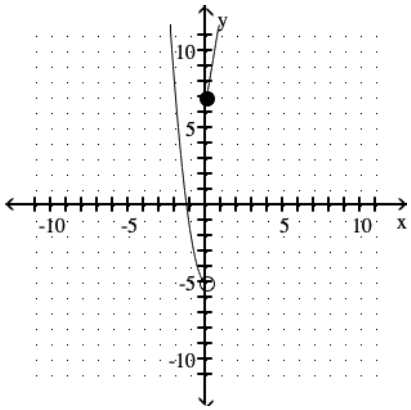



Answer: A

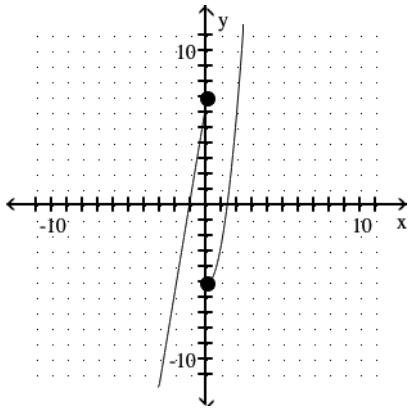
27) $y(x) = \begin{cases} 6x + 7, & \text{for } x < 0, \\ 2x^2 - 5, & \text{for } x \geq 0. \end{cases}$; $\lim_{x \to 0} f(x)$




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




B) $\lim_{x \to 0} f(x) = 7$



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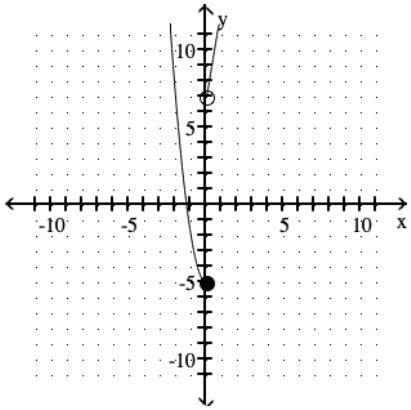
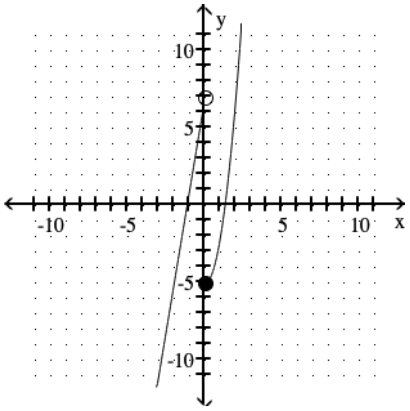
C) $\lim_{x \to 0} f(x) = -5$

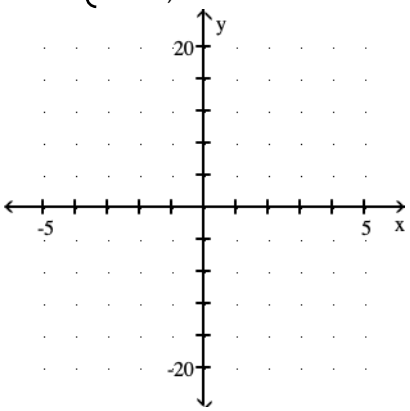



D) $\lim_{x \to 0} f(x)$ does not exist

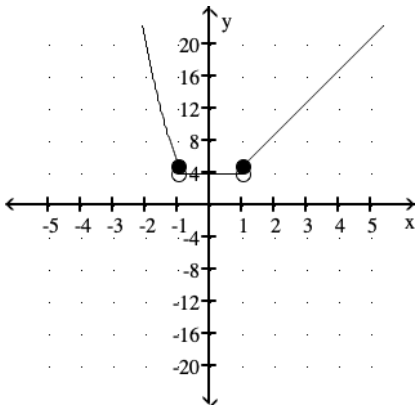



Answer: D

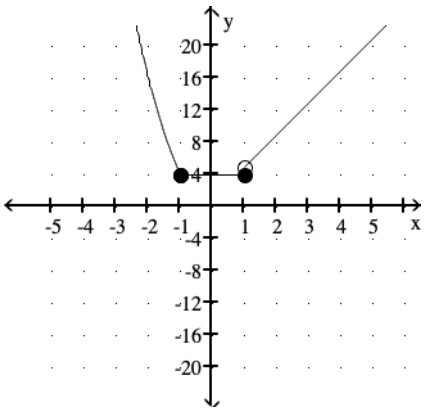
28) $f(x) = \begin{cases} 4x^2, & \text{for } x \le -1, \\ 4, & \text{for } -1 < x \le 1, \\ 4x + 1, & \text{for } x > 1. \end{cases}$; $\lim_{x \to -1^-} f(x)$




A) $\lim_{x \to -1^-} f(x) = 5$




B) $\lim_{x \to -1^-} f(x) = 4$



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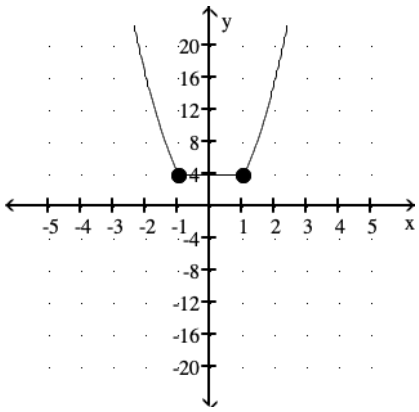
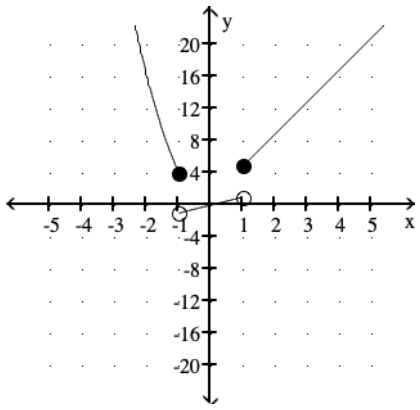
C) $\lim_{x \to -1^-} f(x) = 4$

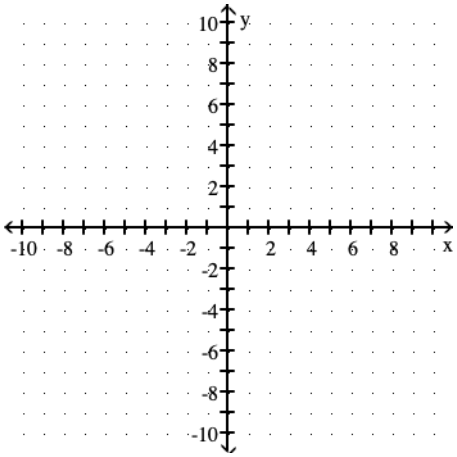


D) $\lim_{x \to -1^-} f(x)$ does not exist

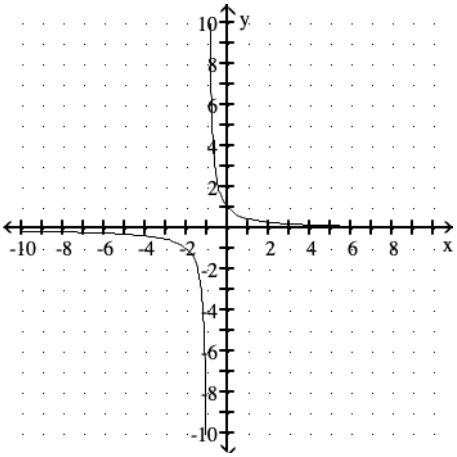


Answer: B

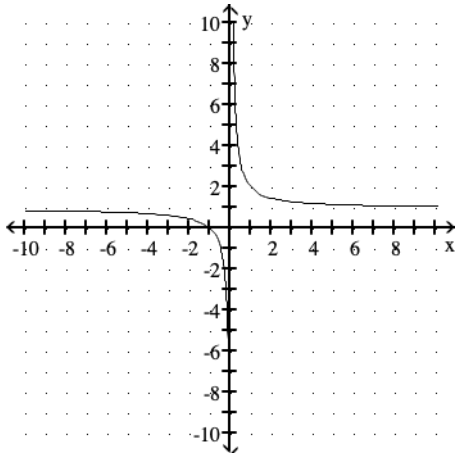
29) $y = \frac{1}{x} + 1$; $\lim_{x \to \infty} f(x)$



A) $\lim_{x \to \infty} f(x) = 0$



B) $\lim_{x \to \infty} f(x) = 1$





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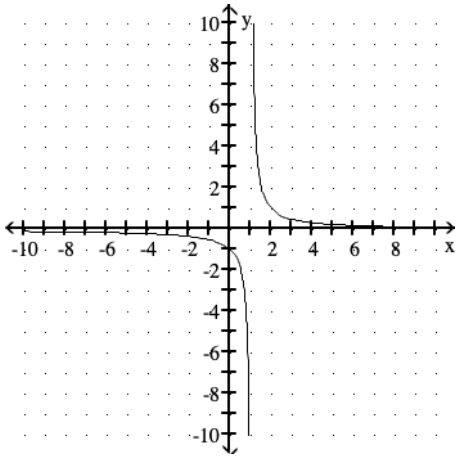
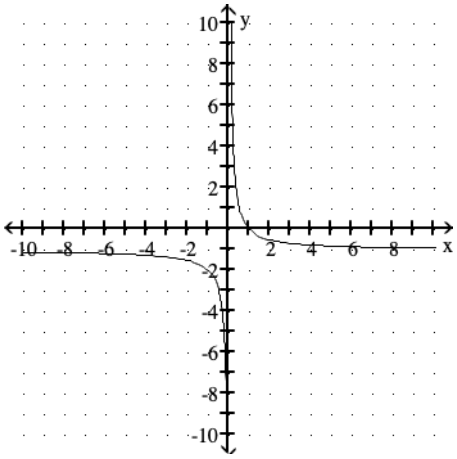
C) $\lim_{x \to \infty} f(x) = 0$




D) $\lim_{x \to \infty} f(x) = -1$

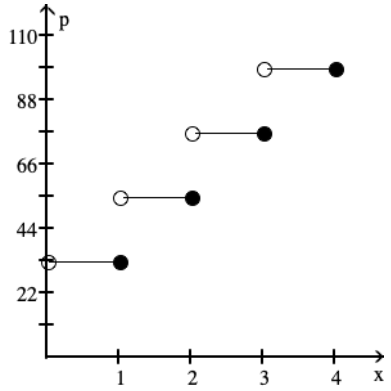



Answer: B

**Solve the problem.**

30) Given is a graph of a portion of the postage function, which depicts the cost (in cents) of mailing a letter, p, versus the weight (in ounces) of the letter, x. Find each limit, if it exists:

$\lim_{x \to 3^-} p(x)$, $\lim_{x \to 3^+} p(x)$, $\lim_{x \to 3} p(x)$




A) 77; 99; does not exist

B) 99; 77; does not exist

C) 77; 99; 77

D) 77; 77; 77

Answer: A



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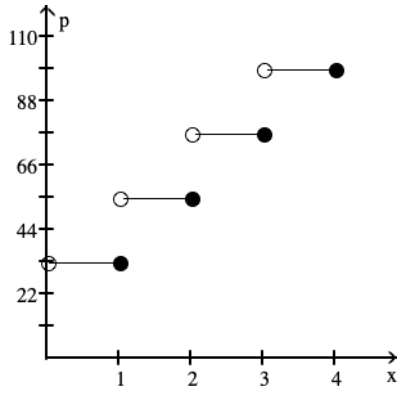
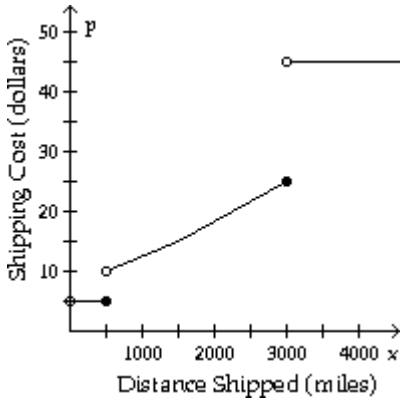
31) Given is a graph of a portion of the postage function, which depicts the cost (in cents) of mailing a letter, p, versus the weight (in ounces) of the letter, x. What is the postage for a letter weighing 1.1 ounces? 2 ounces? 2.1 ounces? Is the postage function continuous?




A) 55 cents; 77 cents; 77 cents; no
B) 55 cents; 55 cents; 77 cents; no
C) 33 cents; 55 cents; 77 cents; no
D) 55 cents; 55 cents; 77 cents; yes

Answer: B

32) Suppose that the cost, p, of shipping a 3-pound parcel depends on the distance shipped, x, according to the function p(x) depicted in the graph. Is p continuous at x = 50? at x = 500? at x = 1500? at x = 3000?




A) Yes; yes; yes; no
B) No; no; yes; no
C) Yes; no; no; no
D) Yes; no; yes; no

Answer: D



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33) Suppose that the cost, p, of shipping a 3–pound parcel depends on the distance shipped, x, according to the function p(x) depicted in the graph. Find each limit, if it exists:

$\lim_{x \to 100} p(x), \quad \lim_{x \to 500} p(x), \quad \lim_{x \to 1500} p(x)$

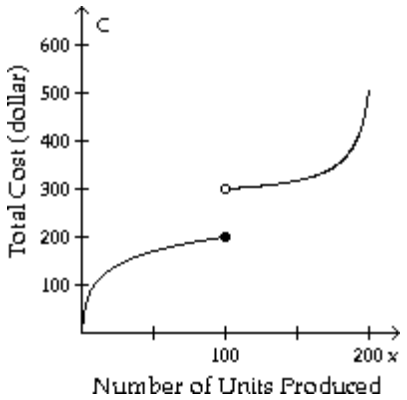



A) 5; 10; 15
B) 5; does not exist; 15
C) 5; does not exist; does not exist
D) 5; 5; 15

Answer: B

34) 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:

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




A) 200; does not exist; does not exist
B) 200; 300; does not exist
C) 200; 300; 200
D) 200; 200; 200

Answer: B



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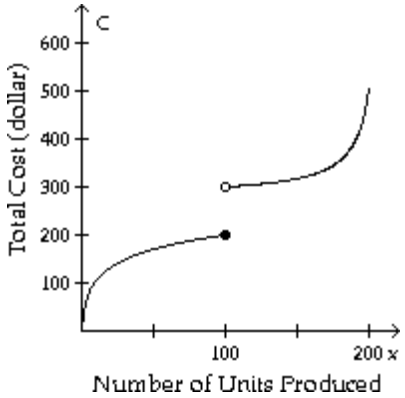
35) Suppose that the cost, C, of producing x units of a product can be illustrated by the given graph. Is C(x) continuous at x = 50? x = 100? x = 150?

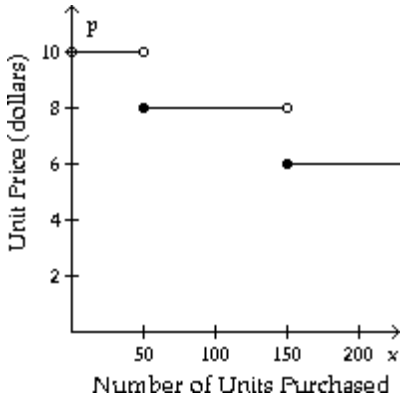



A) Yes; yes; yes B) No; no; no C) Yes; no; no D) Yes; no; yes

Answer: D

36) Suppose that the unit price, p, for x units of a product can be illustrated by the given graph. Find each limit, if it exists:

$\lim_{x \to 50^-} p(x)$, $\lim_{x \to 50^+} p(x)$, $\lim_{x \to 50} p(x)$, $\lim_{x \to 75} p(x)$




A) 8; 8; 8; 8 B) 10; 8; 8; 8

C) 8; 8; does not exist; 8 D) 10; 8; does not exist; 8

Answer: D



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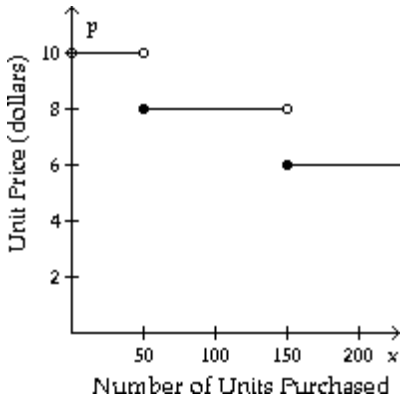
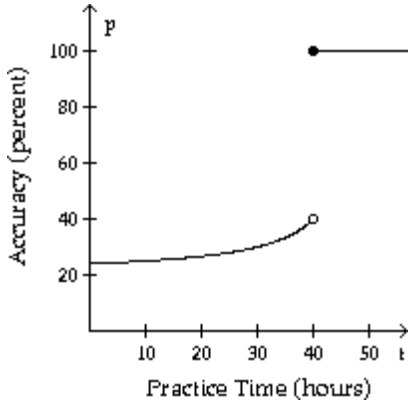
37) Suppose that the unit price, p, for x units of a product can be illustrated by the given graph. Is p continuous at x = 50? x = 100? x = 150?




A) Yes; no; yes B) No; yes; no C) No; yes; yes D) No; no; no

Answer: B

38) Consider the learning curve defined in the graph. Depicted is the accuracy, p, expressed as a percentage, in performing a series of short tasks versus the accumulated amount of time spent practicing the tasks, t. Is p(t) continuous at t = 25? at t = 40? at t = 45?




A) Yes; yes; yes B) No; no; no C) Yes; no; no D) Yes; no; yes

Answer: D



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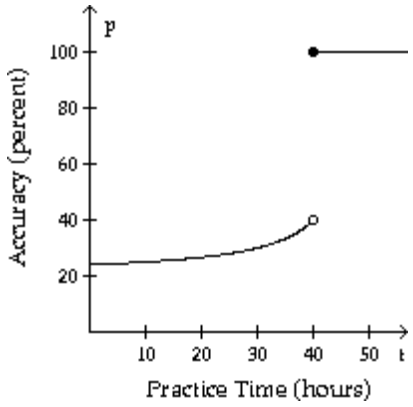
39) Consider the learning curve defined in the graph. Depicted is the accuracy, p, expressed as a percentage, in performing a series of short tasks versus the accumulated amount of time spent practicing the tasks, t. Find each limit, if it exists:

$\lim_{x \to 40^-} p(x), \quad \lim_{x \to 40^+} p(x), \quad \lim_{x \to 40} p(x)$




A) 40; 40; 40
B) 100; 100; 100
C) 40; 100; does not exist
D) 40; 100; 100

Answer: C

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

40) $\lim_{x \to 6} (7x + 5)$

A) 5
B) 12
C) –37
D) 47

Answer: D

41) $\lim_{x \to 2} (x^2 + 8x - 2)$

A) 18
B) 0
C) Does not exist
D) –18

Answer: A

42) $\lim_{x \to 0} (x^2 - 5)$

A) Does not exist
B) –5
C) 0
D) 5

Answer: B

43) $\lim_{x \to 2} (x^3 + 5x^2 - 7x + 1)$

A) 15
B) Does not exist
C) 29
D) 0

Answer: A

44) $\lim_{x \to 2} (3x^5 - 3x^4 - 4x^3 + x^2 + 5)$

A) 89
B) 121
C) –23
D) 25

Answer: D



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45) $\lim_{x \to 7} \frac{x^2 + 49}{x + 7}$

A) 14 B) 0 C) 7 D) Does not exist

Answer: C

46) $\lim_{x \to -2} \frac{x^2 - 4}{x - 2}$

A) Does not exist B) 0 C) 4 D) 1

Answer: B

**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.**

47) $\lim_{x \to 6} \frac{x^2 - 36}{x - 6}$

A) 6 B) 12 C) 1 D) Does not exist

Answer: B

48) $\lim_{x \to -10} \frac{x^2 - 100}{x + 10}$

A) –10 B) Does not exist C) 1 D) –20

Answer: D

49) $\lim_{x \to 3} \frac{x^2 + 3x - 18}{x^2 - 9}$

A) $\frac{3}{2}$ B) 0 C) Does not exist D) $-\frac{1}{2}$

Answer: A

50) $\lim_{x \to -3} \frac{2x^2 - 3x - 27}{9 - x^2}$

A) $\frac{1}{2}$ B) $\frac{5}{2}$ C) $-\frac{1}{2}$ D) $-\frac{5}{2}$

Answer: D

51) $\lim_{x \to 1} \frac{1 - x^3}{x - 1}$

A) $\frac{3}{2}$ B) 3 C) $-\frac{3}{2}$ D) -3

Answer: D



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52) $\lim_{x \to 2} \frac{x^3 - 8}{2 - x}$

A) - 6 B) 6 C) -12 D) 12

Answer: C

53) $\lim_{x \to 4} \frac{x - 4}{\sqrt{x} - 2}$

A) 8 B) -4 C) -2 D) 4

Answer: D

54) $\lim_{x \to 9} \frac{\sqrt{x} - 3}{x - 9}$

A) 0 B) $\frac{1}{3}$ C) 3 D) $\frac{1}{6}$

Answer: D

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

55) $\lim_{x \to 0} \sqrt{x} - 2$

A) 2 B) –2 C) 0 D) Does not exist

Answer: B

56) $\lim_{x \to 3} \sqrt{x^2 + 4x + 4}$

A) 5 B) ±5 C) Does not exist D) 25

Answer: A

57) $\lim_{x \to 3} \sqrt{x - 8}$

A) 2.23606798 B) 0 C) –2.236068 D) Does not exist

Answer: D

58) $\lim_{x \to 16} \sqrt{x^2 - 9}$

A) $\sqrt{247}$ B) $\pm\sqrt{247}$ C) Does not exist D) 123.5

Answer: A

59) $\lim_{x \to -3^-} \sqrt{x^2 - 9}$

A) Does not exist B) $3\sqrt{6}$ C) 1.5 D) 0

Answer: D



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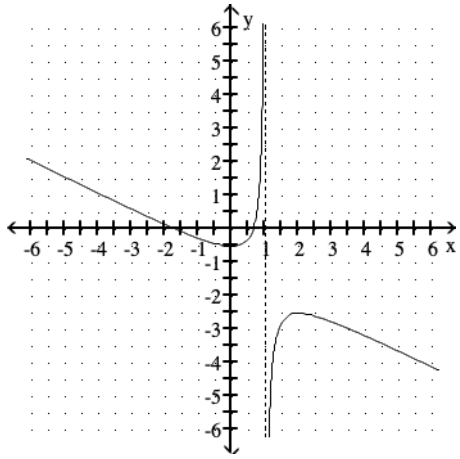
**Determine whether the function shown is continuous over the interval (–5, 5).**

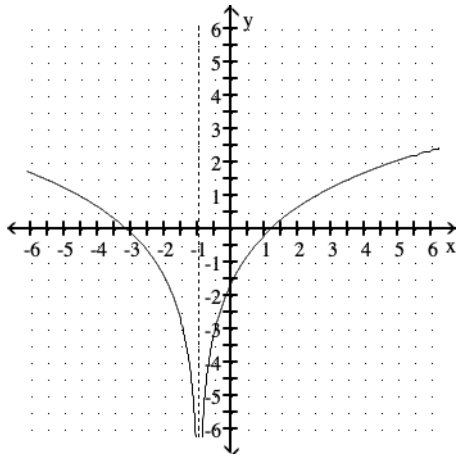
60)



A) Yes B) No

Answer: B

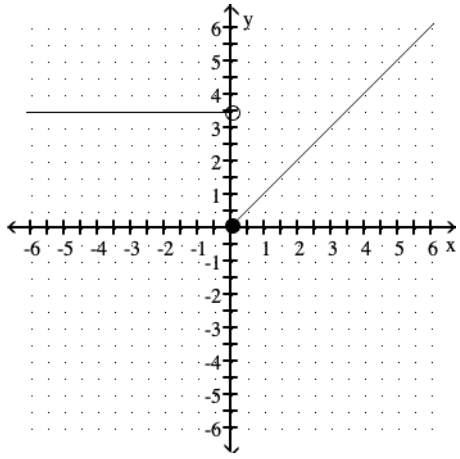
61)



A) Yes B) No

Answer: B

62)



A) Yes B) No

Answer: B



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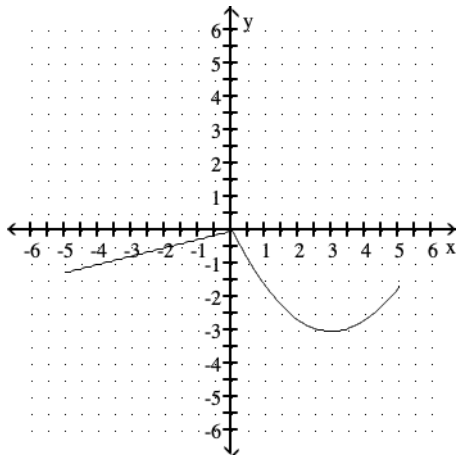
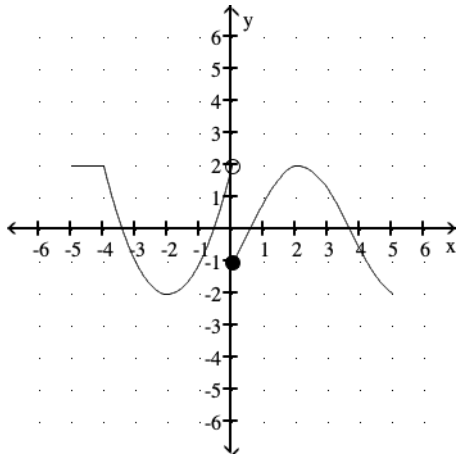
63)




A) Yes B) No

Answer: A

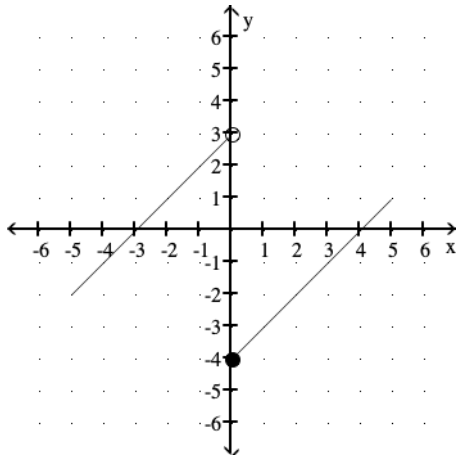
64)




A) Yes B) No

Answer: B

65)




A) Yes B) No

Answer: B



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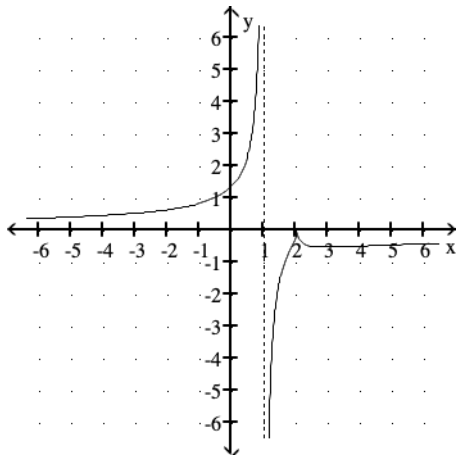
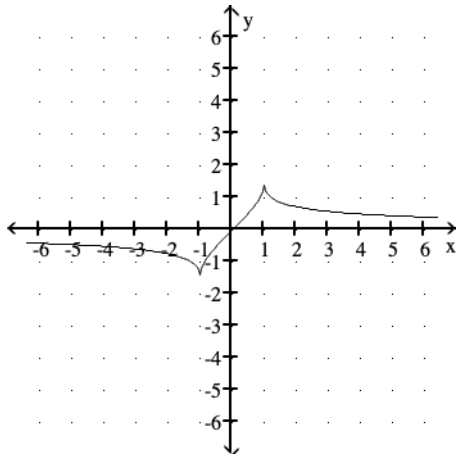
66)



A) Yes B) No

Answer: B

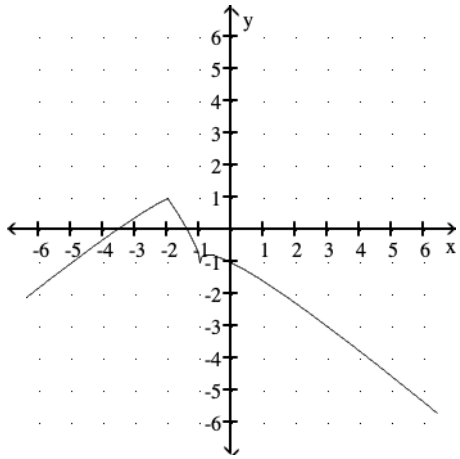
67)



A) Yes B) No

Answer: A

68)



A) Yes B) No

Answer: A



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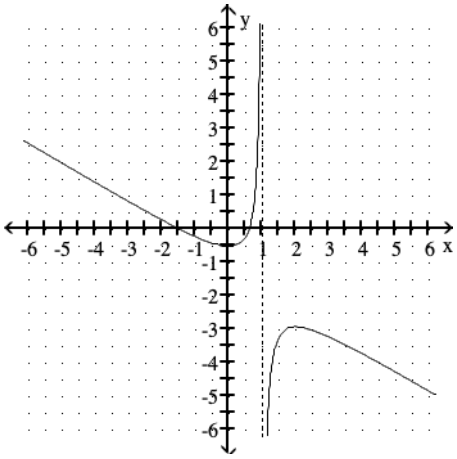
**Use the graph to answer the question.**

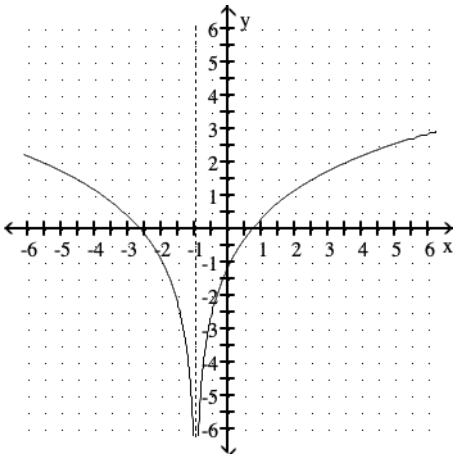
69) Is f continuous at x = 1?



A) Yes B) No

Answer: B

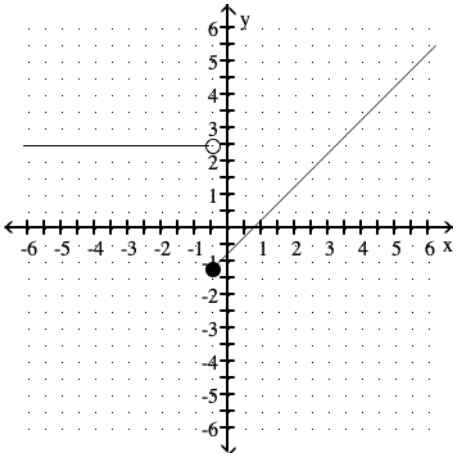
70) Is f continuous at x = –1?



A) No B) Yes

Answer: A

71) Is f continuous at x = 0?



A) No B) Yes

Answer: B



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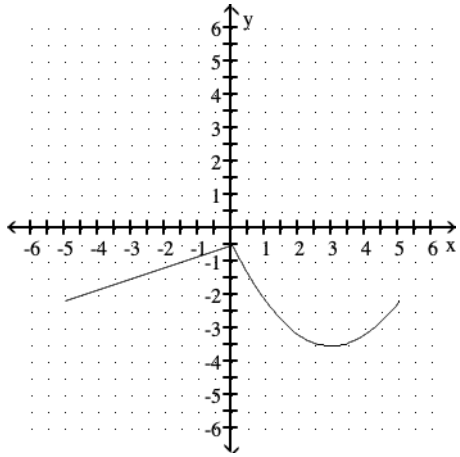
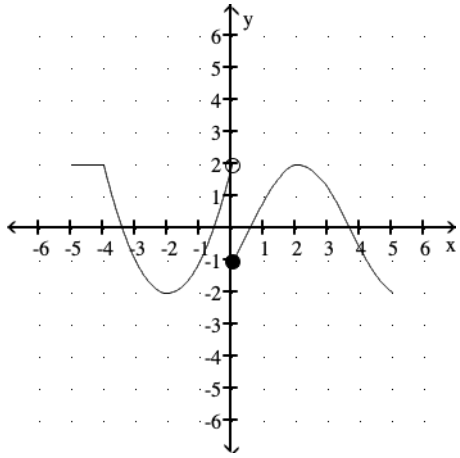
72) Is f continuous at x = 3?



A) Yes B) No

Answer: A

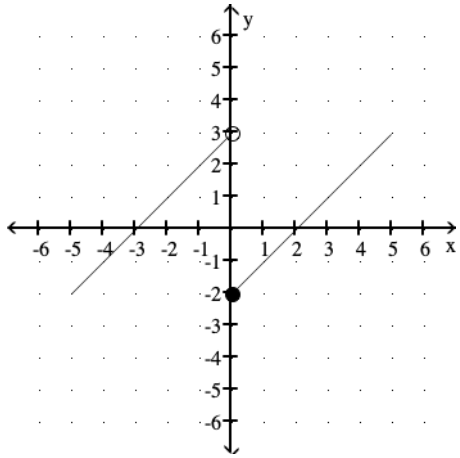
73) Is f continuous at x = –3?



A) No B) Yes

Answer: B

74) Is f continuous at x = 3?



A) No B) Yes

Answer: B



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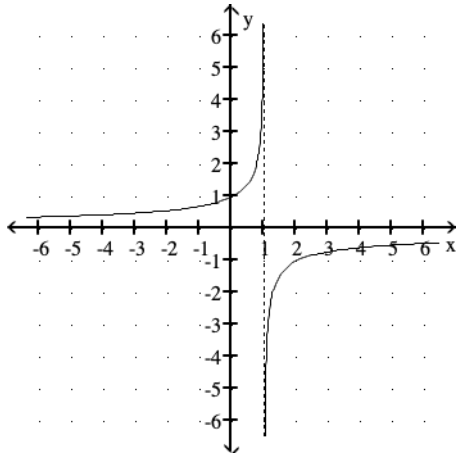
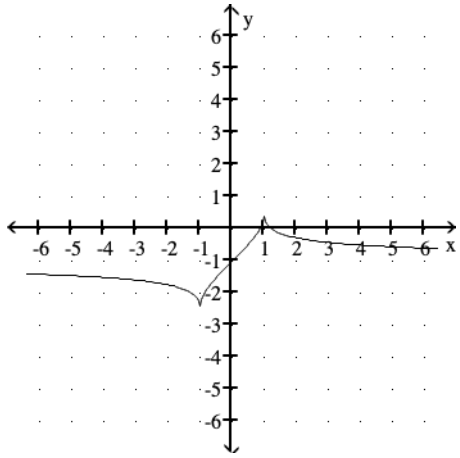
75) Is f continuous at x = –1?



A) Yes B) No

Answer: A

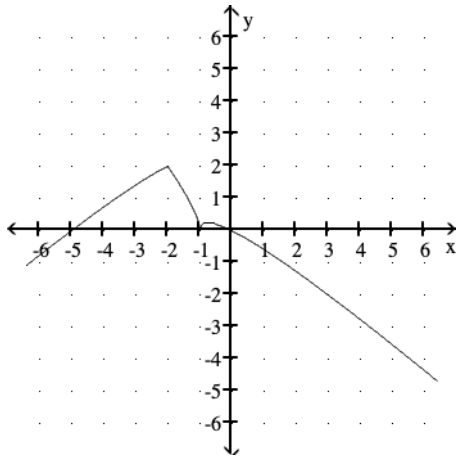
76) Is f continuous at x = –1?



A) Yes B) No

Answer: A

77) Is f continuous at x = 1?



A) Yes B) No

Answer: A



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**Evaluate or determine that the limit does not exist for each of the limits (a) $\lim_{x \to d-} f(x)$, (b) $\lim_{x \to d+} f(x)$, and (c) $\lim_{x \to d} f(x)$ for the given function f and number d.**

78) $f(x) = \begin{cases} x^2 + 4, & \text{for } x < 0 \\ -5, & \text{for } x \geq 0 \end{cases}$; $d = -5$

A) (a) 29
(b) 29
(c) 29

B) (a) –5
(b) 4
(c) Does not exist

C) (a) 4
(b) –5
(c) Does not exist

D) (a) 4
(b) –5
(c) –5

Answer: A

79) $f(x) = \begin{cases} -3x + 7, & \text{for } x < 1 \\ 1, & \text{for } x = 1 \\ 7x - 12, & \text{for } x > 1 \end{cases}$; $d = 1$

A) (a) 4
(b) –5
(c) –1

B) (a) 4
(b) –5
(c) Does not exist

C) (a) –5
(b) 4
(c) –1

D) (a) –5
(b) 4
(c) Does not exist

Answer: B

80) $f(x) = \begin{cases} -7x + 5, & \text{for } x \leq 1 \\ -4x + 2, & \text{for } x > 1 \end{cases}$; $d = 1$

A) (a) 2
(b) 5
(c) Does not exist

B) (a) 5
(b) 2
(c) Does not exist

C) (a) –2
(b) –2
(c) Does not exist

D) (a) –2
(b) –2
(c) –2

Answer: D

81) $f(x) = \begin{cases} \dfrac{1}{x - 5}, & \text{for } x > 5 \\ x^2 - 5x, & \text{for } x \leq 5 \end{cases}$; $d = 5$

A) (a) 0
(b) Does not exist
(c) Does not exist

B) (a) 0
(b) Does not exist
(c) 0

C) (a) Does not exist
(b) 0
(c) Does not exist

D) (a) Does not exist
(b) 0
(c) 0

Answer: A



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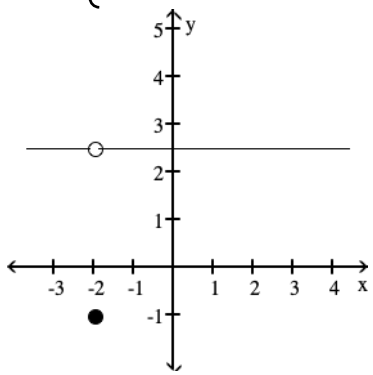
**Determine the continuity of the function at the given points.**

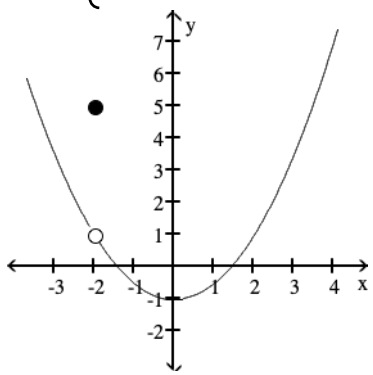
82) $f(x) = \begin{cases} -1, & \text{for } x = -2 \\ 2.5, & \text{for } x \neq -2 \end{cases}$ at $x = -2$ and $x = -3$




A) The function f is continuous at both $x = -3$ and $x = -2$.
B) The function f is continuous at $x = -3$ but not at $x = -2$.
C) The function f is continuous at $x = -2$ but not at $x = -3$.
D) The function f is continuous at neither $x = -3$ nor $x = -2$.

Answer: B

83) $f(x) = \begin{cases} 5, & \text{for } x = -2 \\ \frac{1}{2}x^2 - 1, & \text{for } x \neq -2 \end{cases}$ at $x = -2$ and $x = -3$




A) The function f is continuous at both $x = -3$ and $x = -2$.
B) The function f is continuous at $x = -2$ but not at $x = -3$.
C) The function f is continuous at $x = -3$ but not at $x = -2$.
D) The function f is continuous at neither $x = -3$ nor $x = -2$.

Answer: C



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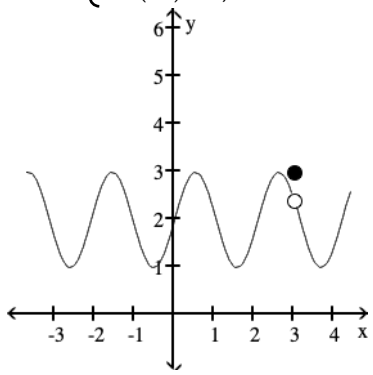
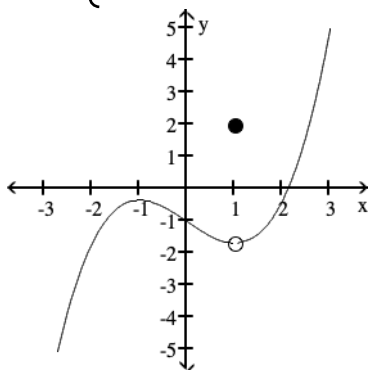
84) $f(x) = \begin{cases} 3, & \text{for } x = 3 \\ \sin(3x) + 2, & \text{for } x \neq 3 \end{cases}$ at $x = 3$ and $x = 1$




A) The function f is continuous at neither $x = 1$ nor $x = 3$.
B) The function f is continuous at $x = 3$ but not at $x = 1$.
C) The function f is continuous at $x = 1$ but not at $x = 3$.
D) The function f is continuous at both $x = 1$ and $x = 3$.

Answer: C

85) $f(x) = \begin{cases} 2, & \text{for } x = 1, \\ \frac{1}{3}x^3 - x - 1, & \text{for } x \neq 1 \end{cases}$ at $x = 1$ and $x = 1.5$




A) The function f is continuous at both $x = 1.5$ and $x = 1$.
B) The function f is continuous at neither $x = 1.5$ nor $x = 1$.
C) The function f is continuous at $x = 1$ but not at $x = 1.5$.
D) The function f is continuous at $x = 1.5$ but not at $x = 1$.

Answer: D



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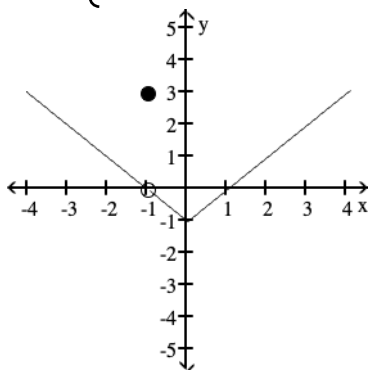
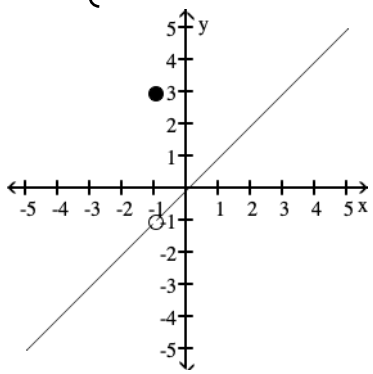
86) $f(x) = \begin{cases} 3, & \text{for } x = -1 \\ |x| - 1, & \text{for } x \neq -1 \end{cases}$ at $x = -1$ and $x = -3$




A) The function f is continuous at $x = -3$ but not at $x = -1$.
B) The function f is continuous at neither $x = -3$ nor $x = -1$.
C) The function f is continuous at both $x = -3$ and $x = -1$.
D) The function f is continuous at $x = -1$ but not at $x = -3$.

Answer: A

87) $f(x) = \begin{cases} 3, & \text{for } x = -1 \\ x, & \text{for } x \neq -1 \end{cases}$ at $x = -1$ and $x = 2$




A) The function f is continuous at $x = -1$ but not at $x = 2$.
B) The function f is continuous at neither $x = 2$ nor $x = -1$.
C) The function f is continuous at both $x = 2$ and $x = -1$.
D) The function f is continuous at $x = 2$ but not at $x = -1$.

Answer: D



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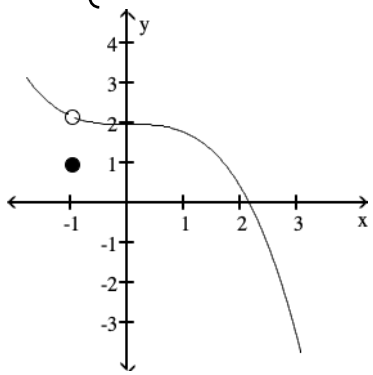
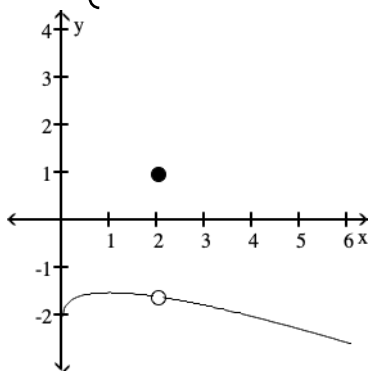
88) $f(x) = \begin{cases} 1, & \text{for } x = -1 \\ 2 - \frac{1}{3}x^3, & \text{for } x \neq -1 \end{cases}$ at $x = -1$ and $x = 2$




A) The function f is continuous at neither $x = 2$ nor $x = -1$.
B) The function f is continuous at $x = -1$ but not at $x = 2$.
C) The function f is continuous at both $x = 2$ and $x = -1$.
D) The function f is continuous at $x = 2$ but not at $x = -1$.

Answer: D

89) $f(x) = \begin{cases} 1, & \text{for } x = 2 \\ \sqrt{x} - \frac{1}{2}x - 2, & \text{for } x \neq 2 \end{cases}$ at $x = 2$ and $x = 4$




A) The function f is continuous at both $x = 4$ and $x = 2$.
B) The function f is continuous at $x = 2$ but not at $x = 4$.
C) The function f is continuous at $x = 4$ but not at $x = 2$.
D) The function f is continuous at neither $x = 4$ nor $x = 2$.

Answer: C



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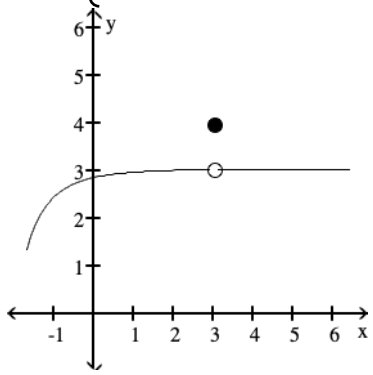
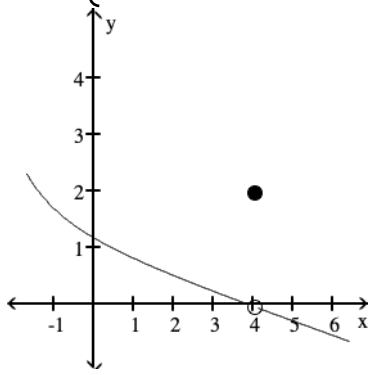
90) $f(x) = \begin{cases} 4, & \text{for } x = 3, \\ \dfrac{(x-1)}{(x+3)^2} + 3, & \text{for } x \neq 3 \end{cases}$ at $x = 3$ and $x = 2$




A) The function f is continuous at x = 2 but not at x = 3.
B) The function f is continuous at x = 3 but not at x = 2.
C) The function f is continuous at neither x = 2 nor x = 3.
D) The function f is continuous at both x = 2 and x = 3.

Answer: A

91) $f(x) = \begin{cases} 2, & \text{for } x = 4 \\ \dfrac{(3-x)}{(x+4)^2} - \dfrac{1}{4}x + 1, & \text{for } x \neq 4 \end{cases}$ at $x = 4$ and $x = 1$




A) The function f is continuous at both x = 1 and x = 4.
B) The function f is continuous at x = 4 but not at x = 1.
C) The function f is continuous at x = 1 but not at x = 4.
D) The function f is continuous at neither x = 1 nor x = 4.

Answer: C

**Provide an appropriate response.**

92) Is the function given by f(x) = 28x + 5 continuous at x = 4? Why or why not?

A) No, $\lim_{x \to 4} f(x)$ does not exist
B) Yes, $\lim_{x \to 4} f(x) = f(4)$

Answer: B

93) Is the function given by $f(x) = \sqrt{x}$ continuous at x = −8? Why or why not?

A) No, f(−8) does not exist
B) Yes, $\lim_{x \to -8} f(x) = f(-8)$

Answer: A



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94) Is the function given by $f(x) = \dfrac{x + 1}{x^2 - 8x + 15}$ continuous at x = 3? Why or why not?

A) No, f(3) does not exist and $\lim\limits_{x \to 3} f(x)$ does not exist

B) Yes, $\lim\limits_{x \to 3} f(x) = f(3)$

Answer: A

95) Is the function given by $f(x) = \sqrt{8x + 1}$ continuous at $x = -\dfrac{1}{8}$? Why or why not?

A) Yes, $\lim\limits_{x \to -\frac{1}{8}} f(x) = f\left(-\dfrac{1}{8}\right)$

B) No, $\lim\limits_{x \to -\frac{1}{8}} f(x)$ does not exist

Answer: B

96) Is the function given by $f(x) = \begin{cases} x^2 + 3, & \text{for } x < 0 \\ 4, & \text{for } x \geq 0 \end{cases}$ continuous at x = –5? Why or why not?

A) No, $\lim\limits_{x \to -5} f(x) = f(-5)$ does not exist

B) Yes, $\lim\limits_{x \to -5} f(x) = f(-5)$

Answer: B

97) Is the function given by $f(x) = \begin{cases} -2x - 1, & \text{for } x < 1 \\ 1, & \text{for } x = 1 \\ 5x - 11, & \text{for } x > 1 \end{cases}$ continuous at x = 1? Why or why not?

A) No, $\lim\limits_{x \to 1} f(x)$ does not exist

B) Yes, $\lim\limits_{x \to 1} f(x) = f(1)$

Answer: A

98) Is the function given by $f(x) = \begin{cases} -5x + 11, & \text{for } x \leq 1 \\ 7x - 1, & \text{for } x > 1 \end{cases}$ continuous at x = 1? Why or why not?

A) Yes, $\lim\limits_{x \to 1} f(x) = f(1)$

B) No, $\lim\limits_{x \to 1} f(x)$ does not exist

Answer: A

99) Is the function given by $f(x) = \begin{cases} \dfrac{1}{x - 3}, & \text{for } x > 3 \\ x^2 + 5x, & \text{for } x \leq 3 \end{cases}$ continuous at x = 3? Why or why not?

A) Yes, $\lim\limits_{x \to 3} f(x) = f(3)$

B) No, $\lim\limits_{x \to 3} f(x)$ does not exist

Answer: B

**Find the intervals on which the function is continuous.**

100) Is the function given by $f(x) = x^2 - 9x + 20$ continuous over the interval (–4, 4)? Why or why not?

A) No, since f(x) is not continuous at x = 4

B) Yes, f(x) is continuous at each point on (–4, 4)

Answer: B



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101) Is the function given by $f(x) = \frac{1}{x + 4}$ continuous over the interval $(-\infty, 0)$? Why or why not?

A) Yes, f(x) is continuous at each point on $(-\infty, 0)$ B) No, since f(x) is not continuous at $x = -4$

Answer: B

102) Is the function given by $f(x) = \frac{5}{(x + 5)^2 + 10}$ continuous on $\mathcal{R}$? Why or why not?

A) Yes, f(x) is continuous at each real number B) No, since f(x) is not continuous at $x = -5$

Answer: A

103) Is the function given by $f(x) = \frac{x + 4}{x^2 - 15x + 56}$ continuous over the interval $[-7, 7]$? Why or why not?

A) No, since f(x) is not continuous at $x = 7$ B) Yes, f(x) is continuous at each point on $[-7, 7]$

Answer: A

104) Is the function given by $f(x) = \sqrt{10x + 3}$ continuous continuous on $\mathcal{R}$?

A) Yes, f(x) is continuous at each real number

B) No, since f(x) is not continuous over the interval $\left(-\infty, -\frac{3}{10}\right)$

Answer: B

**Solve the problem.**

105) A coffee house sells coffee by the pound, charging \$8.50 per pound for quantities up to and including 50 pounds. Above 50 pounds, the coffee house charges \$7.75 per pound for the entire quantity, plus a quantity surcharge, k. If x represents the number of pounds, the price function is

$$p(x) = \begin{cases} 8.5x, & \text{for } x \le 50, \\ 7.75x + k, & \text{for } x > 50. \end{cases}$$

Find k such that the price function p is continuous at $x = 50$. Then explain why it is preferable to have continuity at $x = 50$.

A) $k = 270$; It is preferable so that the coffee house makes a profit.

B) $k = 580$; It is preferable so that the coffee house makes a profit.

C) $k = 37.5$; It is preferable so that the coffee house does not lose revenue.

D) $k = 812.5$; It is preferable so that the coffee house does not lose revenue.

Answer: C



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106) A biologist controls the humidity H (as a percentage) inside a terrarium. From an initial humidity level of 0%, she allows the humidity in the terrarium to increase by 7% per hour for the next 8 hours. After the 8th hour, she allows the terrarium to dry out (lose humidity) at the rate of 15% per hour. The humidity function H is defined by

$$H(t) = \begin{cases} 7t, & \text{for } t \le 8, \\ k - 15t, & \text{for } t > 8. \end{cases}$$

Find k such that H is continuous at t = 24. Then explain why H must be continuous at t = 8 hours.

A) k = 216; H must be continuous at t = 8 hours because time changes continuously.
B) k = 64; H must be continuous at t = 8 hours because the humidity level changes continuously.
C) k = 176; H must be continuous at t = 8 hours because the humidity level changes continuously.
D) k = 104; H must be continuous at t = 8 hours because time changes continuously.

Answer: C

**Find the limit by using the TABLE and TRACE features of your graphing calculator.**

107) $\lim\limits_{x \to 49} \dfrac{\sqrt{x} - 7}{x - 49}$

A) 0 B) 7 C) $\frac{1}{7}$ D) $\frac{1}{14}$

Answer: D

108) $\lim\limits_{x \to 49} \dfrac{7 - \sqrt{x}}{49 - x}$

A) 14 B) 0 C) 7 D) $\frac{1}{14}$

Answer: D

109) $\lim\limits_{x \to 0} \dfrac{\sqrt{25 + x} - \sqrt{25 - x}}{x}$

A) $\frac{1}{10}$ B) 5 C) $\frac{1}{5}$ D) 0

Answer: C

110) $\lim\limits_{x \to 0} \dfrac{\sqrt{1 - x} - 1}{x}$

A) $\frac{1}{2}$ B) 1 C) 2 D) $-\frac{1}{2}$

Answer: D

111) $\lim\limits_{x \to 0} \dfrac{\sqrt{9 + 2x} - 3}{x}$

A) 9 B) $\frac{2}{3}$ C) $\frac{1}{6}$ D) $\frac{1}{3}$

Answer: D



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112) $\lim_{x \to 0} \dfrac{\sqrt{6 + 6x} - \sqrt{6}}{x}$

A) $\dfrac{\sqrt{6}}{2}$ B) $\sqrt{6}$ C) 0 D) $\dfrac{1}{2}$

Answer: A

113) $\lim_{x \to 0} \dfrac{9 - \sqrt{81 - x^2}}{x}$

A) $\dfrac{1}{9}$ B) $\dfrac{1}{18}$ C) 18 D) 0

Answer: D

114) $\lim_{x \to 3} \dfrac{x^2 - 9}{\sqrt{x^2 + 7} - 4}$

A) 3 B) 4 C) 8 D) $\dfrac{1}{4}$

Answer: C

115) $\lim_{x \to -1} \dfrac{x^2 - 1}{\sqrt{x^2 + 3} - 2}$

A) 1 B) 2 C) 4 D) $\dfrac{1}{4}$

Answer: C

**Provide an appropriate response.**

116) Decide whether the function $f(x) = x^2 + 8x - 4$ is continuous for all x, and provide a short statement supporting your conclusion.

A) Yes, polynomial functions are continuous; there are no breaks in the graph of a polynomial function.
B) Yes, polynomial functions are defined for all x.
C) No, there is a break in the graph of this function at $x = 0$.
D) No, this polynomial is not defined for all x.

Answer: A

117) Given $f(x) = x + 5$ and $g(x) = x - 8$, where is the function $f(x)/g(x)$ continuous?

A) The function $f(x)/g(x)$ is continuous for all x.
B) The function $f(x)/g(x)$ is continuous for all x except $x = -5$ and $x = 8$.
C) The function $f(x)/g(x)$ is continuous for all x except $x = 8$.
D) The function $f(x)/g(x)$ is continuous for all x except $x = -5$.

Answer: C



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118) Given $f(x) = \sqrt[3]{2x}$ and $g(x) = x - 4$, where is the function $f(x)/g(x)$ continuous?

A) The function $f(x)/g(x)$ is continuous for all x except $x < 0$ and $x = -4$.

B) The function $f(x)/g(x)$ is continuous for all x except $x = 4$.

C) The function $f(x)/g(x)$ is continuous for all x.

D) The function $f(x)/g(x)$ is continuous for all x except $x = -4$.

Answer: B

119) Why does the general continuity principle regarding the quotient $g(x)/f(x)$ include the phrase "so long as the inputs x do not yield outputs $f(x) = 0$"?

A) Whenever $f(x) = 0$, the function $g(x)/f(x)$ is so large that it would be difficult to graph it.

B) One needs to avoid an infinite $g(x)$.

C) The function $g(x)/f(x)$ is not defined for any x such that $f(x) = 0$, and a function cannot be continuous at any point at which it is undefined.

D) The quotient $g(x)/f(x)$ is an invalid function unless there is no x for which $f(x) = 0$.

Answer: C

120) Write the formal notation for the principle "the limit of a quotient is the quotient of the limits" and include a statement of any restrictions on the principle.

A) $\lim\limits_{x \to a} \dfrac{g(x)}{f(x)} = \dfrac{g(a)}{f(a)}$, provided that $f(a) \neq 0$.

B) If $\lim\limits_{x \to a} g(x) = M$ and $\lim\limits_{x \to a} f(x) = L$, then $\lim\limits_{x \to a} \dfrac{g(x)}{f(x)} = \dfrac{\lim\limits_{x \to a} g(x)}{\lim\limits_{x \to a} f(x)} = \dfrac{M}{L}$, provided that $f(a) \neq 0$.

C) $\lim\limits_{x \to a} \dfrac{g(x)}{f(x)} = \dfrac{g(a)}{f(a)}$.

D) If $\lim\limits_{x \to a} g(x) = M$ and $\lim\limits_{x \to a} f(x) = L$, then $\lim\limits_{x \to a} \dfrac{g(x)}{f(x)} = \dfrac{\lim\limits_{x \to a} g(x)}{\lim\limits_{x \to a} f(x)} = \dfrac{M}{L}$, provided that $L \neq 0$.

Answer: D

121) What conditions, when present, are sufficient to conclude that a function $f(x)$ is continuous at $x = a$?

A) $f(a)$ exists, the limit of $f(x)$ as $x \to a$ from the left exists, and the limit of $f(x)$ as $x \to a$ from the right exists.

B) $f(a)$ exists, and the limit of $f(x)$ as $x \to a$ exists.

C) The limit of $f(x)$ as $x \to a$ from the left exists, the limit of $f(x)$ as $x \to a$ from the right exists, and these two limits are the same.

D) $f(a)$ exists, the limit of $f(x)$ as $x \to a$ exists, and the limit of $f(x)$ as $x \to a$ is $f(a)$.

Answer: D



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122) What conditions, when present, are sufficient to conclude that a function f(x) has a limit as x approaches some value of a?

A) Either the limit of f(x) as x→a from the left exists or the limit of f(x) as x→a from the right exists

B) The limit of f(x) as x→a from the left exists, the limit of f(x) as x→a from the right exists, and these two limits are the same.

C) f(a) exists, the limit of f(x) as x→a from the left exists, and the limit of f(x) as x→a from the right exists.

D) The limit of f(x) as x→a from the left exists, the limit of f(x) as x→a from the right exists, and at least one of these limits is the same as f(a).

Answer: B

123) Provide a short sentence that summarizes the general limit principle given by the formal notation $\lim_{x\to a}[f(x)\pm g(x)] = \lim_{x\to a} f(x) \pm \lim_{x\to a} g(x) = L \pm M$, given that $\lim_{x\to a} f(x) = L$ and $\lim_{x\to a} g(x) = M$.

A) The limit of a sum or a difference is the sum or the difference of the limits.

B) The sum or the difference of two functions is the sum of two limits.

C) The sum or the difference of two functions is continuous.

D) The limit of a sum or a difference is the sum or the difference of the functions.

Answer: A

124) The statement "the limit of a constant times a function is the constant times the limit" follows from a combination of two fundamental limit principles. What are they?

A) The limit of a product is the product of the limits, and a constant is continuous.

B) The limit of a function is a constant times a limit, and the limit of a constant is the constant.

C) The limit of a product is the product of the limits, and the limit of a quotient is the quotient of the limits.

D) The limit of a constant is the constant, and the limit of a product is the product of the limits.

Answer: D

125) When can direct substitution of a for x be used to find the limit of a function f(x) as x approaches a?

A) Always

B) When f is continuous at a

C) Only when f is continuous for all x

D) When f is continuous for all x, except x = a

Answer: B

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

126) $f(x) = 3x^2$

A) 2x + h

B) 6x + h

C) 6x + 3h

D) 6x

Answer: C

127) $f(x) = -8x^2$

A) −16x

B) 16x

C) −16x + h

D) −16x − 8h

Answer: D

128) $f(x) = 2x^3$

A) $6x^2 + 6xh + 2h$

B) $6x^2$

C) $6x^2 + h$

D) $6x^2 + 6xh + 2h^2$

Answer: D

129) $f(x) = -2x^3$

A) $6x^2 - h$

B) $-6x^2$

C) $-6x^2 - 6xh - 2h$

D) $-6x^2 - 6xh - 2h^2$

Answer: D



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130) $f(x) = \frac{8}{x}$

A) $-\frac{8}{x^2 + xh}$ B) $\frac{8}{x^2 + xh}$ C) $-\frac{8}{x^2 + h}$ D) $\frac{8}{x^2 + h}$

Answer: A

131) $f(x) = 9x + 4$

A) $9 + h$ B) $9h$ C) $-9$ D) $9$

Answer: D

132) $f(x) = x^2 + 10x$

A) $2x + h + 10$ B) $2(x + h) + 10$ C) $2x + 10h$ D) $2xh + h + 10$

Answer: A

133) $f(x) = x^3 + x$

A) $2x^3 + 3x^2 + 3xh + h^2 + 1$ B) $3x^2 + 3xh + h^2 + 1$

C) $3x^2 + 3xh + h^2 + h$ D) $2x^3 + 3x^2 + 3xh + h^2$

Answer: B

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

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

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

A)

| x | h | $\frac{f(x + h) - f(x)}{h}$ |
|---|---|---|
| 3 | 2 | −30 |
| 3 | 1 | −24 |
| 3 | 0.1 | −18.6 |
| 3 | 0.01 | −18.06 |

B)

| x | h | $\frac{f(x + h) - f(x)}{h}$ |
|---|---|---|
| 3 | 2 | −60 |
| 3 | 1 | −48 |
| 3 | 0.1 | −37.2 |
| 3 | 0.01 | −36.12 |

C)

| x | h | $\frac{f(x + h) - f(x)}{h}$ |
|---|---|---|
| 3 | 2 | −48 |
| 3 | 1 | −42 |
| 3 | 0.1 | −36.6 |
| 3 | 0.01 | −36.06 |

D)

| x | h | $\frac{f(x + h) - f(x)}{h}$ |
|---|---|---|
| 3 | 2 | 8 |
| 3 | 1 | 7 |
| 3 | 0.1 | 6.1 |
| 3 | 0.01 | 6.01 |

Answer: C



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135) For the function $f(x) = -7x^3$, complete the table below:

| x | h | $\frac{f(x+h)-f(x)}{h}$ |
|---|---|---|
| 4 | 2 | |
| 4 | 1 | |
| 4 | 0.1 | |
| 4 | 0.01 | |

A)

| x | h | $\frac{f(x+h)-f(x)}{h}$ |
|---|---|---|
| 4 | 2 | −518 |
| 4 | 1 | −427 |
| 4 | 0.1 | −345.1 |
| 4 | 0.01 | −336.91 |

B)

| x | h | $\frac{f(x+h)-f(x)}{h}$ |
|---|---|---|
| 4 | 2 | −532 |
| 4 | 1 | −427 |
| 4 | 0.1 | −344.47 |
| 4 | 0.01 | −336.8407 |

C)

| x | h | $\frac{f(x+h)-f(x)}{h}$ |
|---|---|---|
| 4 | 2 | −420 |
| 4 | 1 | −371 |
| 4 | 0.1 | −338.87 |
| 4 | 0.01 | −336.2807 |

D)

| x | h | $\frac{f(x+h)-f(x)}{h}$ |
|---|---|---|
| 4 | 2 | −308 |
| 4 | 1 | −323 |
| 4 | 0.1 | −334.79 |
| 4 | 0.01 | −335.8799 |

Answer: B

136) For the function $f(x) = 5x - 3$, complete the table below:

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

A)

| x | h | $\frac{f(x+h)-f(x)}{h}$ |
|---|---|---|
| 2 | 2 | 10 |
| 2 | 1 | 10 |
| 2 | 0.1 | 10 |
| 2 | 0.01 | 10 |

B)

| x | h | $\frac{f(x+h)-f(x)}{h}$ |
|---|---|---|
| 2 | 2 | 10 |
| 2 | 1 | 5 |
| 2 | 0.1 | 0.5 |
| 2 | 0.01 | 0.05 |

C)

| x | h | $\frac{f(x+h)-f(x)}{h}$ |
|---|---|---|
| 2 | 2 | 5 |
| 2 | 1 | 5 |
| 2 | 0.1 | 5 |
| 2 | 0.01 | 5 |

D)

| x | h | $\frac{f(x+h)-f(x)}{h}$ |
|---|---|---|
| 2 | 2 | 7 |
| 2 | 1 | 6 |
| 2 | 0.1 | 5.1 |
| 2 | 0.01 | 5.01 |

Answer: C



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137) For the function $f(x) = \frac{8}{x}$, complete the table below:

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

Round to four decimal places.

A)

| x | h | $\frac{f(x+h)-f(x)}{h}$ |
|---|---|---|
| 3 | 2 | 0.5333 |
| 3 | 1 | 0.6667 |
| 3 | 0.1 | 0.8602 |
| 3 | 0.01 | 0.8859 |

B)

| x | h | $\frac{f(x+h)-f(x)}{h}$ |
|---|---|---|
| 3 | 2 | −1.0667 |
| 3 | 1 | −0.5333 |
| 3 | 0.1 | −0.0533 |
| 3 | 0.01 | −0.0053 |

C)

| x | h | $\frac{f(x+h)-f(x)}{h}$ |
|---|---|---|
| 3 | 2 | −1.6 |
| 3 | 1 | −2 |
| 3 | 0.1 | −2.5806 |
| 3 | 0.01 | −2.6578 |

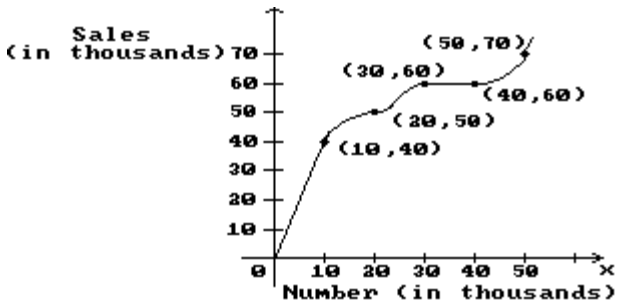
D)

| x | h | $\frac{f(x+h)-f(x)}{h}$ |
|---|---|---|
| 3 | 2 | −0.5333 |
| 3 | 1 | −0.6667 |
| 3 | 0.1 | −0.8602 |
| 3 | 0.01 | −0.8859 |

Answer: D

**Solve the problem.**

138) 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.




10 to 20

A) $\frac{1}{2}$ B) 1 C) $\frac{3}{2}$ D) 2

Answer: B



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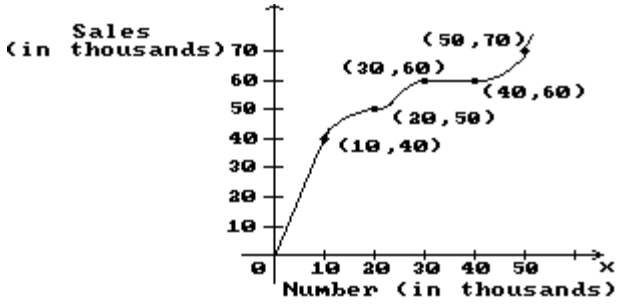
139) The graph shows the total sales in thousands of dollars from the distribution of x thousand catalogs. Find the average rate of change of sales with respect to the number of catalogs distributed for the change in x.

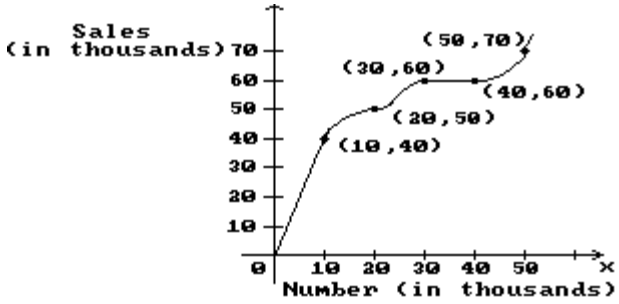



10 to 30

A) $\frac{2}{3}$ B) $\frac{1}{3}$ C) 1 D) 3

Answer: C

140) 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.




10 to 40

A) $\frac{1}{4}$ B) $\frac{2}{3}$ C) $\frac{1}{3}$ D) 4

Answer: B



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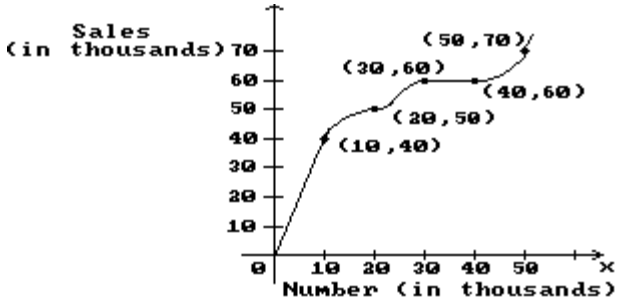
141) The graph shows the total sales in thousands of dollars from the distribution of x thousand catalogs. Find the average rate of change of sales with respect to the number of catalogs distributed for the change in x.

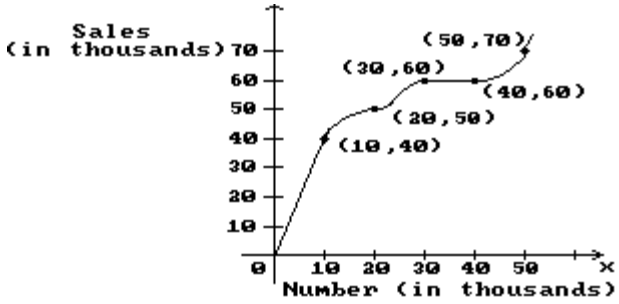



10 to 50

A) 2 B) $\frac{3}{4}$ C) $\frac{1}{4}$ D) 1

Answer: B

142) 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 to 30

A) $\frac{3}{2}$ B) 1 C) $\frac{2}{3}$ D) 2

Answer: B



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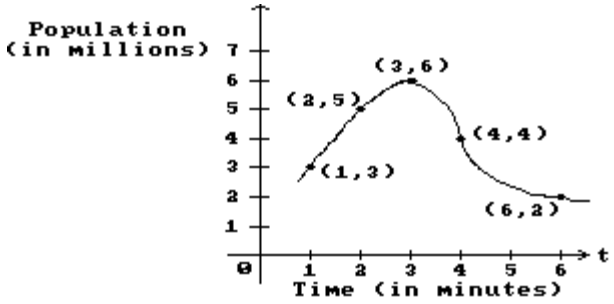
143) The graph shows the population in millions of bacteria t minutes after a bactericide is introduced into a culture. Find the average rate of change of population with respect to time for the time interval.

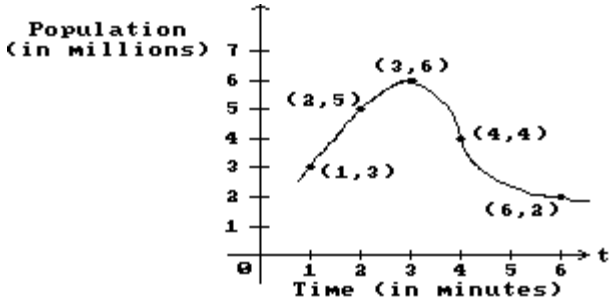



1 to 2

A) $-\frac{1}{2}$ B) 2 C) $\frac{1}{2}$ D) –2

Answer: B

144) 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.

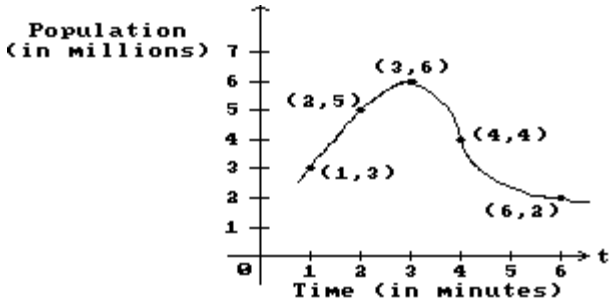



1 to 3

A) 2 B) $\frac{2}{3}$ C) 1 D) $\frac{3}{2}$

Answer: D

145) 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.




1 to 4

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

Answer: B



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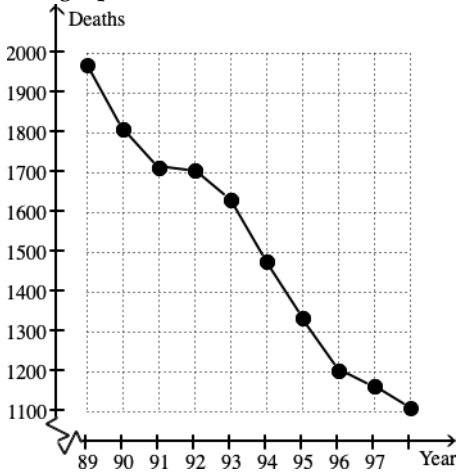
146) The graph below shows the number of tuberculosis deaths in the United States from 1989 to 1998.

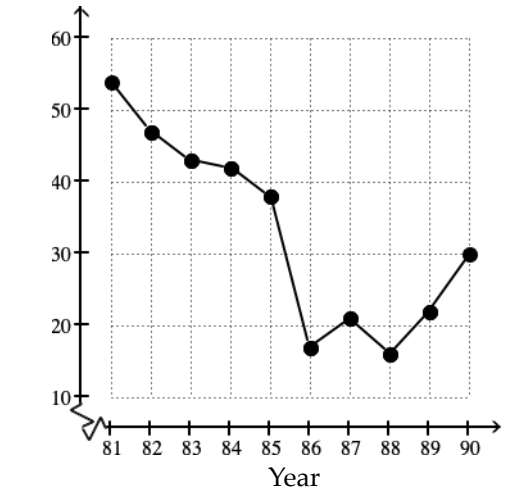



Estimate the average rate of change in tuberculosis deaths from 1993 to 1995.

A) About –300 deaths per year
B) About –150 deaths per year
C) About –80 deaths per year
D) About –1 deaths per year

Answer: B

147) The graph shows the average cost of a barrel of crude oil for the years 1981 to 1990 in constant 1996 dollars. Find the approximate average change in price from 1981 to 1987.




A) About –$33/year
B) About –$6/year
C) About –$7/year
D) About –$12/year

Answer: C



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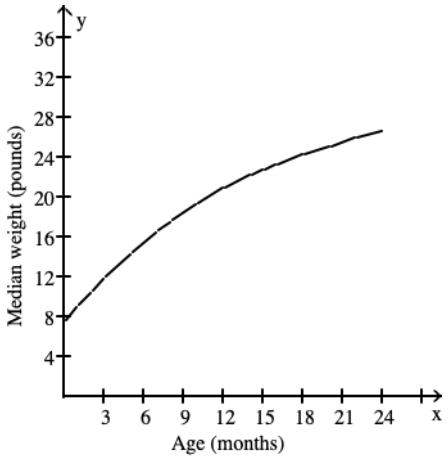
148) The graph shows the median weight of girls between the ages of 0 and 24 months.

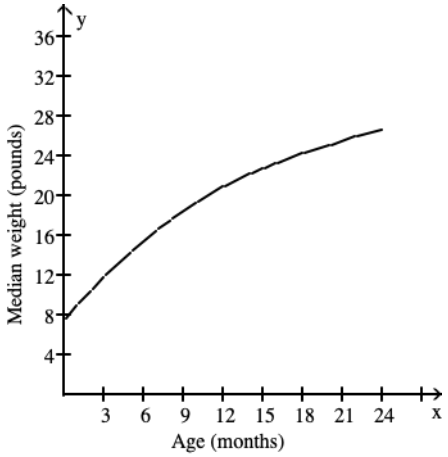



Use the graph to find the average growth rate of a typical girl during the first year of her life. Give your answer in pounds per month.

A) 1.2 lb/month B) 1.8 lb/month C) 0.8 lb/month D) 1.1 lb/month

Answer: D

149) The graph shows the median weight of girls between the ages of 0 and 24 months.




Use the graph to find the average growth rate of a typical girl during the second year of her life. Give your answer in pounds per month.

A) 0.2 lb/month B) 0.8 lb/month C) 1.1 lb/month D) 0.5 lb/month

Answer: D



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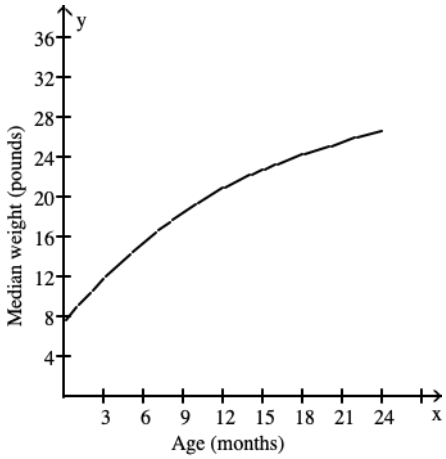
150) The graph shows the median weight of girls between the ages of 0 and 24 months.

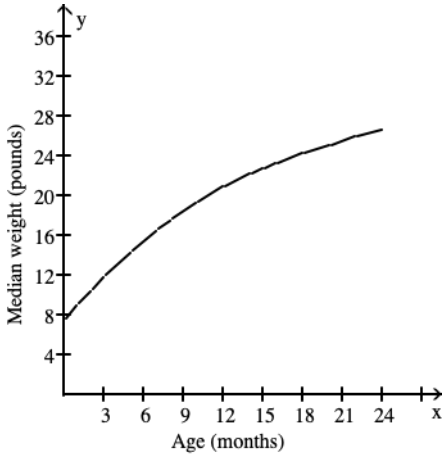



Use the graph to find the average growth rate of a typical girl during the first two years of her life. Give your answer in pounds per month.

A) 0.8 lb/month B) 0.6 lb/month C) 1.1 lb/month D) 1.6 lb/month

Answer: A

151) The graph shows the median weight of girls between the ages of 0 and 24 months.




Use the graph to find the average growth rate of a typical girl during the first nine months of her life. Give your answer in pounds per month.

A) 1.2 lb/month B) 2.0 lb/month C) 1.0 lb/month D) 1.4 lb/month

Answer: A



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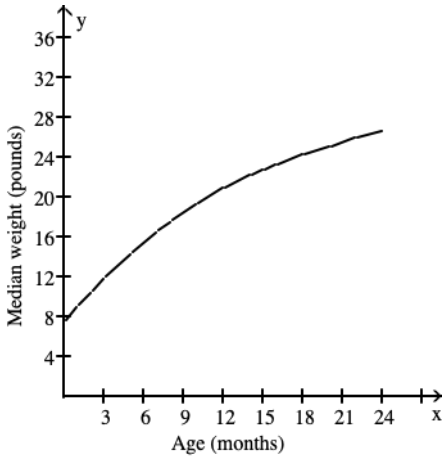
152) The graph shows the median weight of girls between the ages of 0 and 24 months.

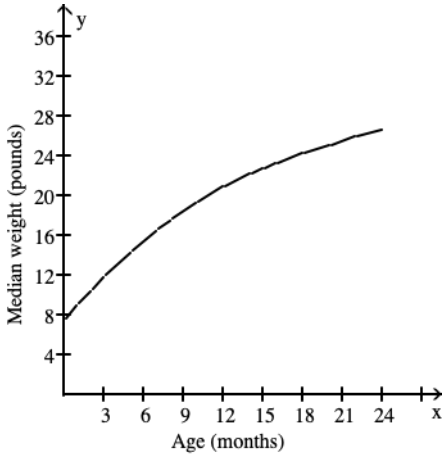



Use the graph to find the average growth rate of a typical girl during the first six months of her life. Give your answer in pounds per month.

A) 1.3 lb/month B) 1.6 lb/month C) 1.0 lb/month D) 2.6 lb/month

Answer: A

153) The graph shows the median weight of girls between the ages of 0 and 24 months.




Use the graph to find the average growth rate of a typical girl during the first three months of her life. Give your answer in pounds per month.

A) 1.2 lb/month B) 2.2 lb/month C) 4.0 lb/month D) 1.3 lb/month

Answer: D



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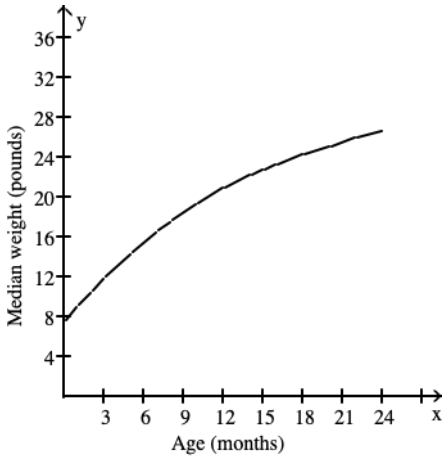
154) The graph shows the median weight of girls between the ages of 0 and 24 months.

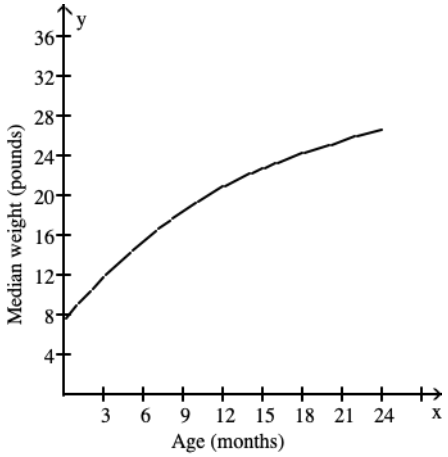



Use the graph to find the average growth rate of a typical girl between ages 12 and 18 months. Give your answer in pounds per month.

A) 1.4 lb/month B) 0.6 lb/month C) 0.8 lb/month D) 1.1 lb/month

Answer: B

155) The graph shows the median weight of girls between the ages of 0 and 24 months.




Use the graph to find the average growth rate of a typical girl between ages 12 and 15 months. Give your answer in pounds per month.

A) 0.6 lb/month B) 1.0 lb/month C) 1.5 lb/month D) 0.5 lb/month

Answer: A



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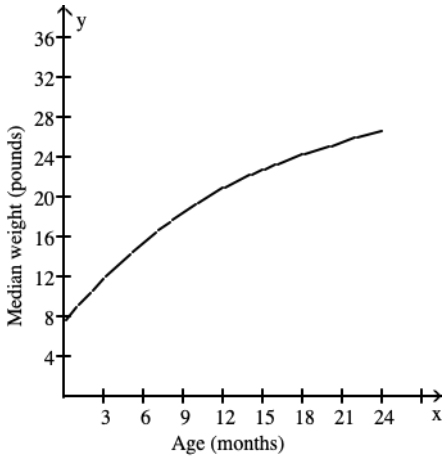
156) The graph shows the median weight of girls between the ages of 0 and 24 months.




Use the graph to find the average growth rate of a typical girl between ages 12 and 21 months. Give your answer in pounds per month.

A) 0.7 lb/month B) 1.2 lb/month C) 0.5 lb/month D) 0.9 lb/month

Answer: C

157) The average price of a ticket to a minor league baseball game can be approximated by
$p(x) = 0.03x^2 + 0.45x + 6.53$,
where x is the number of years after 1990 and p(x) is in dollars.
(i) Find p(5).
(ii) Find p(12).
(iii) Find p(12) – p(5).
(iv) Find $\frac{p(12) - p(5)}{12 - 5}$, and interpret this result.

A) (ii) \$-8.03
(ii) \$-7.61
(iii) \$-0.42
(iv) \$-0.06 is the average annual increase in ticket price from the 5th to the 12th year after 1990 (or from 1995 to 2002).

B) (i) \$5.03
(ii) \$5.45
(iii) \$-0.42
(iv) \$-0.06 is the average annual increase in ticket price from the 5th to the 12th year after 1990 (or from 1995 to 2002).

C) (i) \$9.53
(ii) \$16.25
(iii) \$-6.72
(iv) \$-0.96 is the average annual increase in ticket price from the 5th to the 12th year after 1990 (or from 1995 to 2002).

D) (i) \$12.53
(ii) \$63.77
(iii) \$-51.24
(iv) \$-7.32 is the average ticket price in 1995.

Answer: C



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158) When a balance of $6000 is owed on a credit card and interest is being charged at a rate of 16% per year, the total amount owed after t years, A(t), is given by

$A(t) = 6000(1.16)^t$.

Find $\frac{A(12) - A(6)}{12 - 6}$, and interpret this result.

A) $3499.63 is the average annual increase in the debt from the 6th to the 12th year.
B) $3499.63 is the total amount owed on the debt from the 6th to the 12th year.
C) $95,120,040.89 is the average annual increase in the debt from the 6th to the 12th year.
D) $95,120,040.89 is the total amount owed on the debt up to and including the 12th year.

Answer: A

159) Suppose that the dollar cost of producing x radios is $c(x) = 400 + 20x - 0.2x^2$. Find the average cost per radio of producing the first 45 radios.

A) –$2.00 B) $495.00 C) $11.00 D) $895.00

Answer: C

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

$s(t) = 9t^2$

Find the average rate of change of distance with respect to time (average velocity) as t changes from $t_1 = 3$ to $t_2 = 7$.

A) 51.4 miles/hr B) 45 miles/hr C) 90 miles/hr D) 63 miles/hr

Answer: C

161) At the beginning of a trip, the odometer on a car reads 24,437 and the car has a full tank of gas. At the end of the trip the odometer reads 24,694 and there are 2.2 gallons remaining in the tank. The tank can hold a total of 9 gallons. What is the average rate of change of the number of miles with respect to the number of gallons? Assume that the tank was not filled during the trip.

A) 257 miles B) 37.79 miles/gal C) 28.56 miles/gal D) 22.95 miles/gal

Answer: B

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

162) $f(x) = b - mx$

A) $-mx$ B) $-m$ C) $-m + h$ D) $-mx + h$

Answer: B

163) $f(x) = ax^3 + bx$

A) $3ax^2 + 3axh + h^2 + b$
B) $a(2x^2 + 3x^2 + 3xh + h^2) + h$
C) $a(3x^2 + 3xh + h^2) + h$
D) $a(3x^2 + 3xh + h^2) + b$

Answer: D

164) $f(x) = ax^4$

A) $a(h^3 + 4xh^2 + 6x^2h + 4x^3)$
B) $a(h^3 + 4xh + 6x^2h) + 4x^3$
C) $ah^3 + 4xh^2 + 6x^2h + 4x^3$
D) $a(h^3 + 4xh^2 + 4x^2h + 4x^3)$

Answer: A



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165) $f(x) = \dfrac{3}{x + 7}$

A) $\dfrac{-3}{h(x + 7)(x + 7 + h)}$

B) $\dfrac{3}{(x + 7)(x + 7)}$

C) $\dfrac{3h}{(x + 7)(x + 7 + h)}$

D) $\dfrac{-3}{(x + 7)(x + 7 + h)}$

Answer: D

166) $f(x) = \dfrac{x}{4 - x}$

A) $-\dfrac{4h}{(x - 4)(x + h - 4)}$

B) $\dfrac{4}{(x - 4)(x + h - 4)}$

C) $\dfrac{1}{(x - 4)(x + h - 4)}$

D) $-\dfrac{x}{(x - 4)(x + h - 4)}$

Answer: B

167) $f(x) = \sqrt{x + 2}$

A) $\dfrac{1}{\sqrt{x + 2 + h} + \sqrt{x + 2}}$

B) $\dfrac{1}{\sqrt{x + h} + \sqrt{x}}$

C) $\sqrt{x + 2 + h} + \sqrt{x + 2}$

D) $\dfrac{h}{\sqrt{x + 2 + h} - \sqrt{x + 2}}$

Answer: A

168) $f(x) = \sqrt{9 - 8x}$

A) $\dfrac{8}{\sqrt{9 - 8(x + h)} - \sqrt{9 - 8x}}$

B) $\sqrt{9 - 8(x + h)} + \sqrt{9 - 8x}$

C) $\dfrac{1}{\sqrt{9h - 8(x + h)} + \sqrt{9 - 8x}}$

D) $-\dfrac{8}{\sqrt{9 - 8(x + h)} + \sqrt{9 - 8x}}$

Answer: D

169) $f(x) = \dfrac{x^3 + 1}{x}$

A) $\dfrac{2x + h - 1}{x(x + h)}$

B) $2x + h - 1$

C) $\dfrac{x(2x + h)(x + h) - 1}{x(x + h)}$

D) $2x + h - \dfrac{1}{x}$

Answer: C



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170) $f(x) = \dfrac{1}{\sqrt{x-9}}$

A) $-\dfrac{1}{\sqrt{x-9}\sqrt{x-9+h}(\sqrt{x-9}+\sqrt{x-9+h})}$

B) $-\dfrac{1}{\sqrt{x-9}\sqrt{x-9+h}(\sqrt{x-9}-\sqrt{x-9+h})}$

C) $\dfrac{h}{\sqrt{x-9}\sqrt{x-9+h}(\sqrt{x-9}-\sqrt{x-9+h})}$

D) $\dfrac{1}{\sqrt{x-9}\sqrt{x-9+h}(\sqrt{x-9}+\sqrt{x-9+h})}$

Answer: A

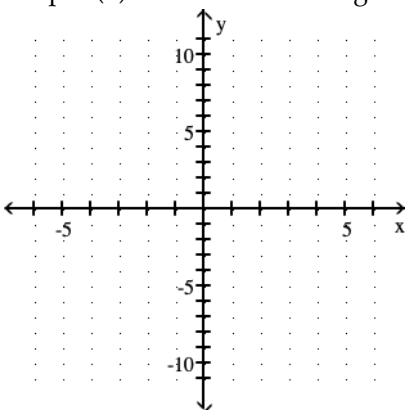
171) $f(x) = \dfrac{3}{x^2}$

A) $\dfrac{3(h+x)}{x^2(x+h)^2}$ B) $-\dfrac{3(h+2x+xh)}{x^2(x+h)^2}$ C) $-\dfrac{3(h+2x)}{x^2(x+h)^2}$ D) $\dfrac{(h+2x)}{x^2(x+h)^2}$

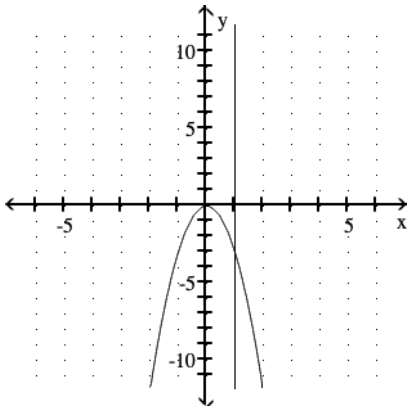
Answer: C

**Graph the function and the indicated tangent line.**

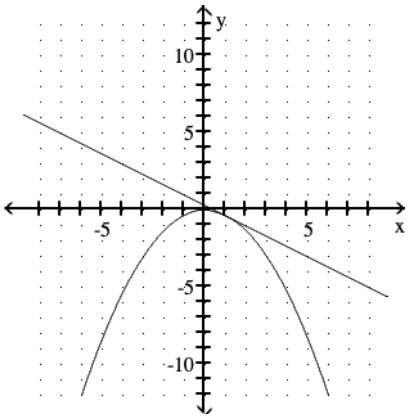
172) Graph $f(x) = -3x^2$ and the tangent line to the graph at the point whose x–coordinate is 1.




A)




B)



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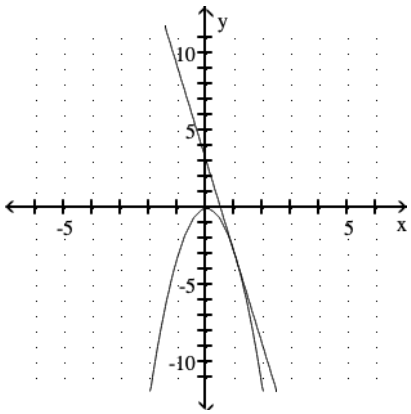
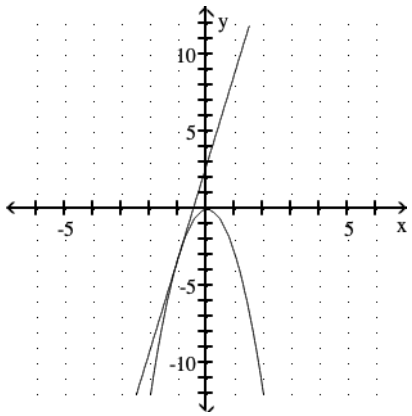
C)

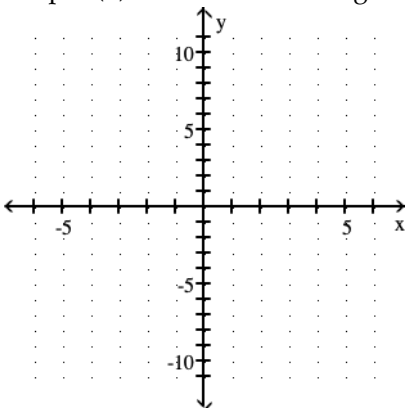



D)

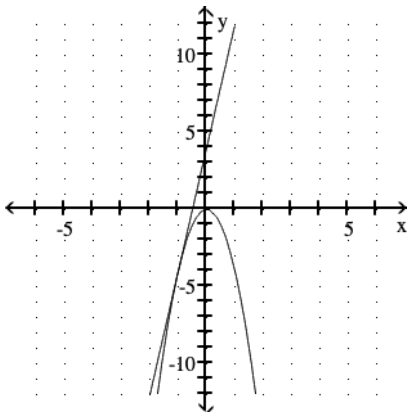



Answer: C

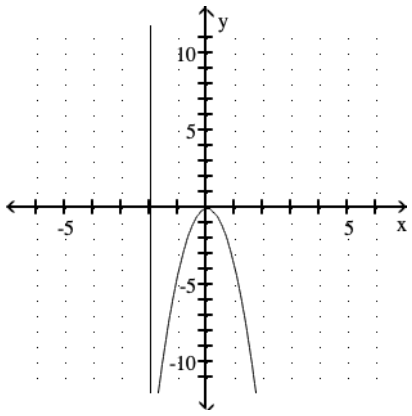
173) Graph $f(x) = -4x^2$ and the tangent line to the graph at the point whose x–coordinate is –2.




A)




B)



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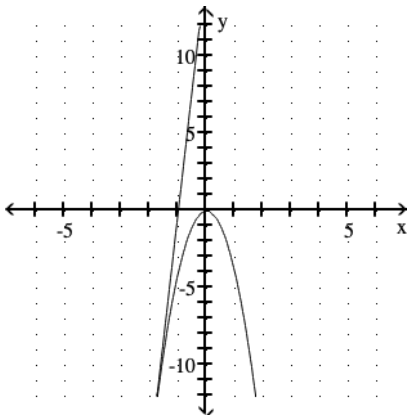
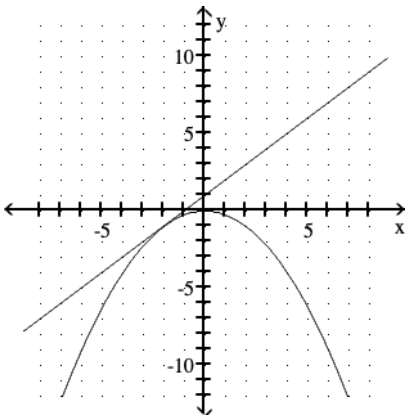
C)

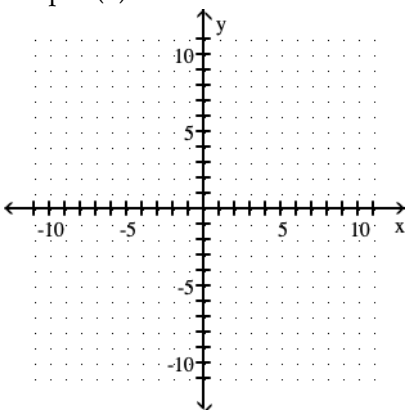



D)

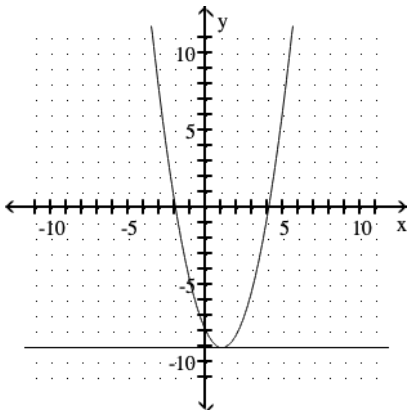



Answer: C

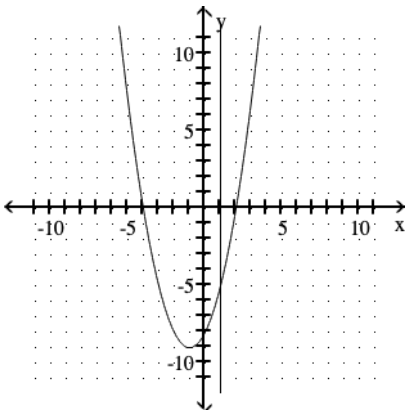
174) Graph $f(x) = x^2 + 2x - 8$ and the tangent line to the graph at the point whose x–coordinate is 1.




A)




B)



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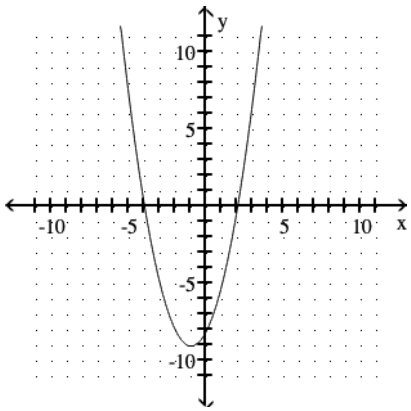
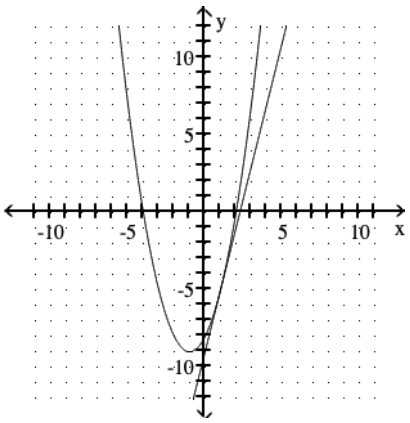
C)

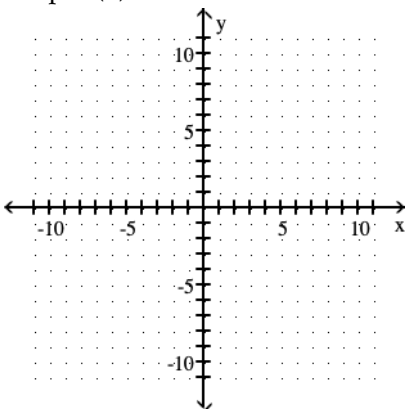



D)

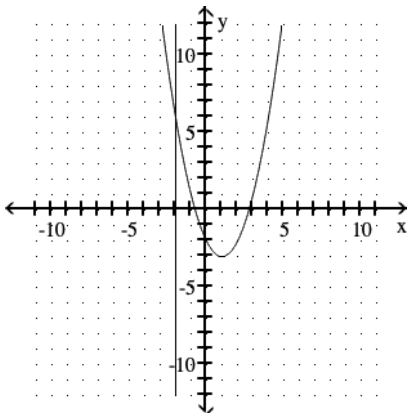



Answer: D

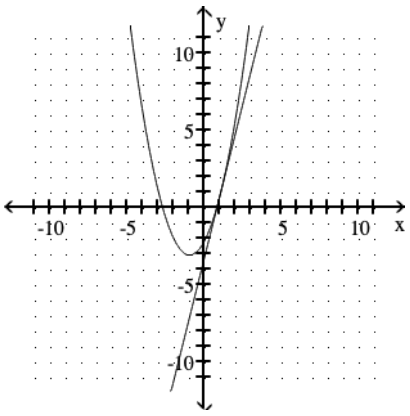
175) Graph $f(x) = x^2 - 2x - 2$ and the tangent line to the graph at the point whose x–coordinate is –2.




A)




B)



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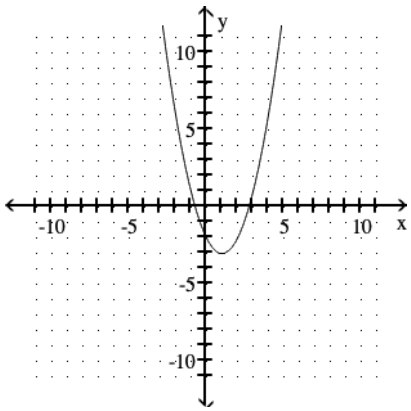
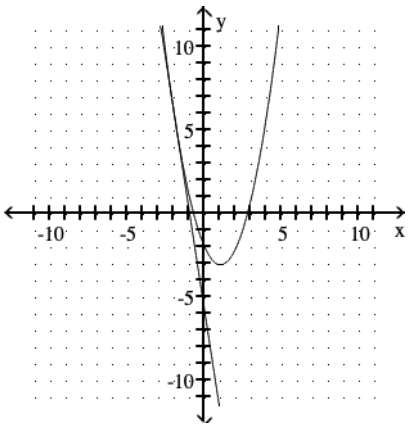
C)

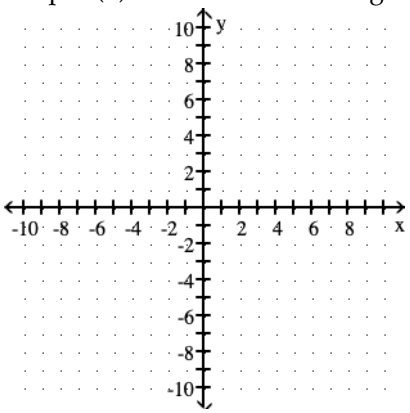



D)

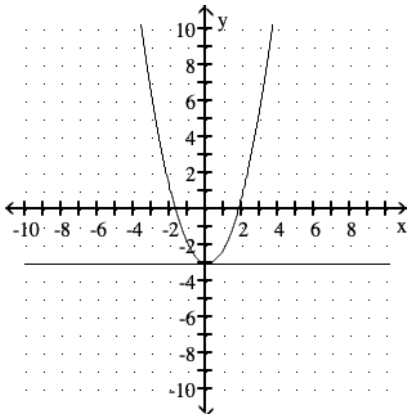



Answer: D

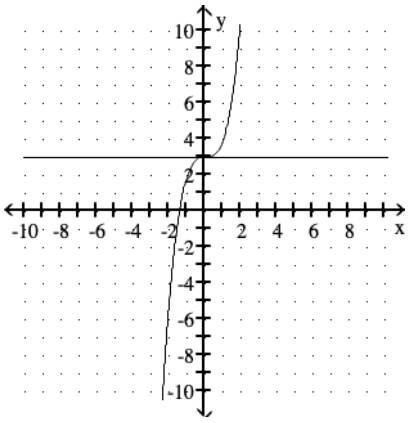
176) Graph $f(x) = x^3 + 3$ and the tangent line to the graph at the point whose x–coordinate is 0.




A)




B)



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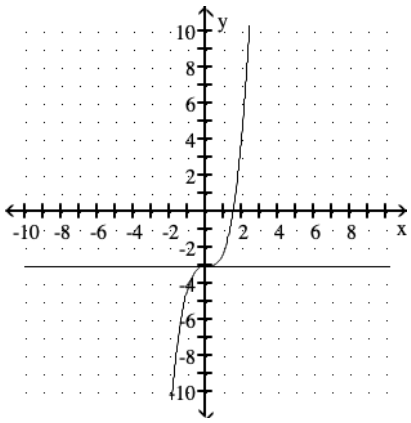
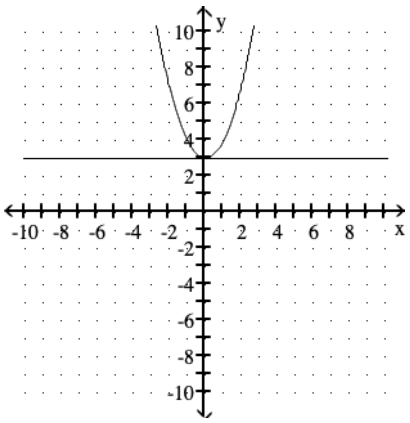
C)

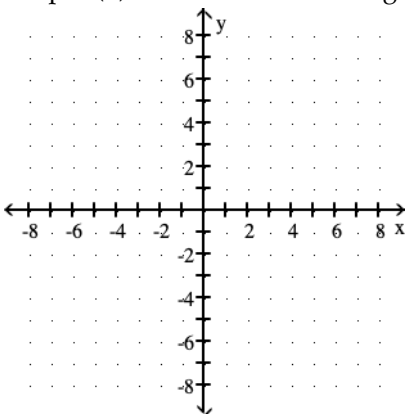



D)

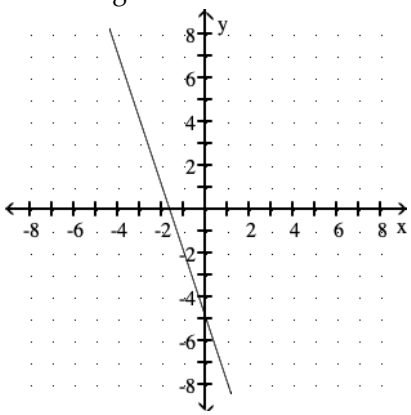



Answer: B

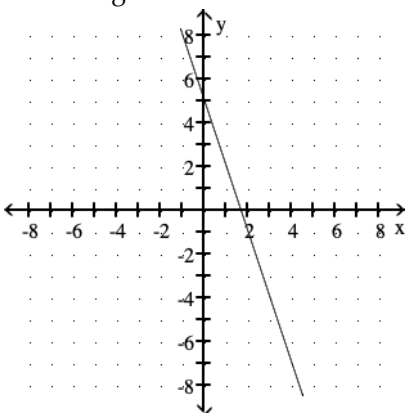
177) Graph f(x) = –3x + 5 and the tangent line to the graph at the point whose x–coordinate is –3.




A) The tangent line is identical to the graph of the original function.




B) The tangent line is identical to the graph of the original function.



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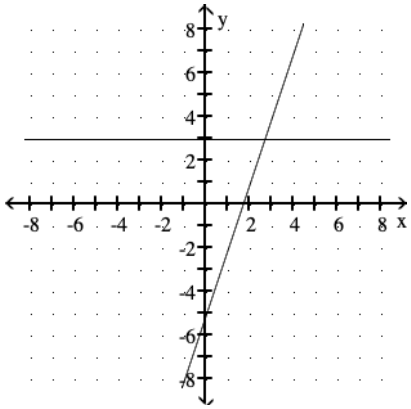
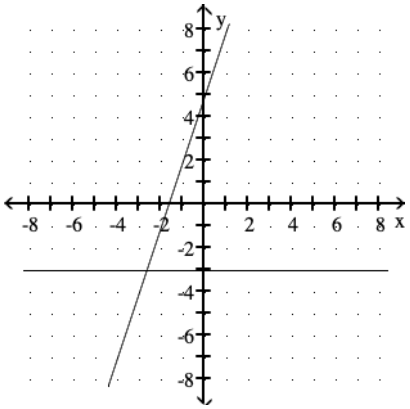
C)

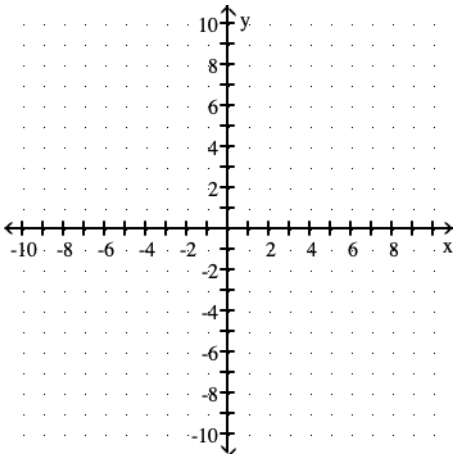



D)



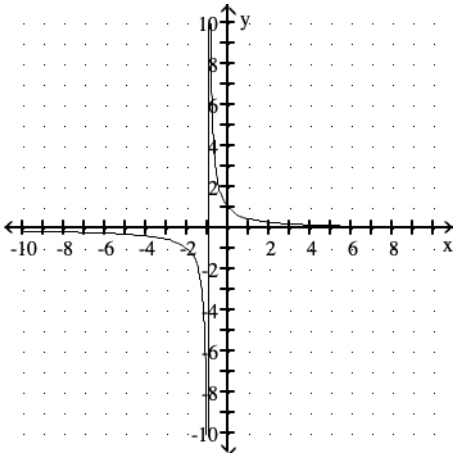

Answer: B

178) Graph $f(x) = \frac{1}{x} - 1$ and the tangent line to the graph at the point whose x–coordinate is 0.




A) There is no tangent line for x = 0.

B)



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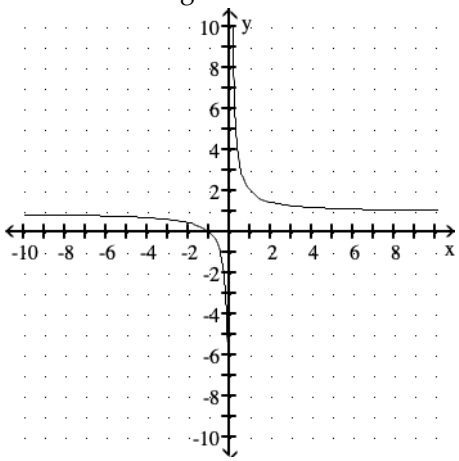
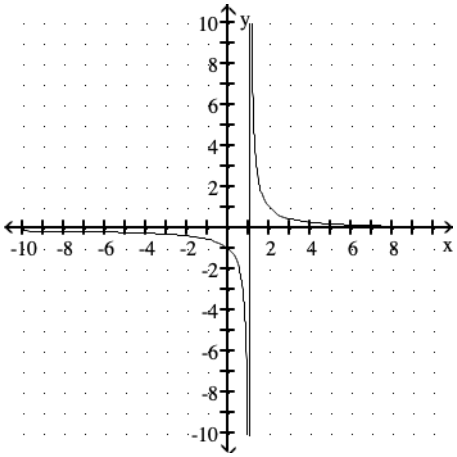
C) There is no tangent line for x = 0.




D)




Answer: A

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

179) $f(x) = 2x^2$ at $x = 1$

A) $f'(x) = 4x$; $f'(1) = 4$

B) $f'(x) = 4x^2$; $f'(1) = 4$

C) $f'(x) = 4x$; $f'(1) = 2$

D) $f'(x) = 2x$; $f'(1) = 2$

Answer: A

180) $f(x) = 5x + 9$ at $x = 2$

A) $f'(x) = 0$; $f'(2) = 0$

B) $f'(x) = 5$; $f'(2) = 5$

C) $f'(x) = 5x$; $f'(2) = 10$

D) $f'(x) = 9$; $f'(2) = 9$

Answer: B

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

A) $f'(x) = 2x - 5$; $f'(4) = 3$

B) $f'(x) = x + 5$; $f'(4) = 9$

C) $f'(x) = 4x + 5$; $f'(4) = 21$

D) $f'(x) = 2x + 5$; $f'(4) = 13$

Answer: D

182) $f(x) = \frac{1}{3}x - \frac{1}{2}$ at $x = 6$

A) $f'(x) = -\frac{1}{2}$; $f'(6) = -\frac{1}{2}$

B) $f'(x) = \frac{1}{3}$; $f'(6) = \frac{1}{3}$

C) $f'(x) = -\frac{1}{3}$; $f'(6) = -\frac{1}{3}$

D) $f'(x) = \frac{1}{2}$; $f'(6) = \frac{1}{2}$

Answer: B

183) $f(x) = 5x^2 + x$ at $x = -4$

A) $f'(x) = 10x - 1$; $f'(-4) = -41$

B) $f'(x) = x - 10$; $f'(-4) = -14$

C) $f'(x) = x + 10$; $f'(-4) = 6$

D) $f'(x) = 10x + 1$; $f'(-4) = -39$

Answer: D



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184) $f(x) = 2x^2 + x - 3$ at $x = 4$

A) $f'(x) = 4x - 1$; $f'(4) = 15$
B) $f'(x) = 4x + 3$; $f'(4) = 19$
C) $f'(x) = 4x + 1$; $f'(4) = 17$
D) $f'(x) = 2x - 3$; $f'(4) = 5$

Answer: C

185) $f(x) = x^2 + 11x - 15$ at $x = 1$

A) $f'(x) = 11x$; $f'(1) = 11$
B) $f'(x) = 2x - 11$; $f'(1) = -9$
C) $f'(x) = 2x + 11$; $f'(1) = 13$
D) $f'(x) = 11x + 15$; $f'(1) = 26$

Answer: C

186) $f(x) = 3x^2 + 5x - 7$ at $x = -2$

A) $f'(x) = 6x + 5$; $f'(-2) = -7$
B) $f'(x) = 2x + 5$; $f'(-2) = 1$
C) $f'(x) = 3x + 5$; $f'(-2) = -1$
D) $f'(x) = 6x - 5$; $f'(-2) = -17$

Answer: A

187) $f(x) = 1 - x^3$ at $x = 1$

A) $f'(x) = 3x^2 - 1$; $f'(1) = 2$
B) $f'(x) = -3x^2$; $f'(1) = -3$
C) $f'(x) = 1 - 3x$; $f'(1) = -2$
D) $f'(x) = -3x$; $f'(1) = -3$

Answer: B

188) $f(x) = \frac{8}{x}$ at $x = -1$

A) $f'(x) = -8x^2$; $f'(-1) = -8$
B) $f'(x) = \frac{8}{x^2}$; $f'(-1) = 8$
C) $f'(x) = 8$; $f'(-1) = 8$
D) $f'(x) = -\frac{8}{x^2}$; $f'(-1) = -8$

Answer: D

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

189) $f(x) = \frac{x^2}{4}$ at $(-4, 4)$

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

Answer: A

190) $f(x) = \frac{x^3}{2}$ at $(4, 32)$

A) $y = 24x - 64$
B) $y = 64x + 24$
C) $y = 8x + 64$
D) $y = 8x - 64$

Answer: A

191) $f(x) = \frac{x^3}{4}$ at $(-5, -\frac{125}{4})$

A) $y = \frac{125}{2}x + \frac{75}{4}$
B) $y = \frac{25}{4}x + \frac{125}{2}$
C) $y = \frac{75}{4}x + \frac{125}{2}$
D) $y = \frac{125}{2}x + \frac{25}{4}$

Answer: C



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192) $f(x) = \frac{40}{x}$ at (1, 40)

A) $y = -80x + 120$ B) $y = -40x + 40$ C) $y = -40x$ D) $y = -40x + 80$

Answer: D

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

A) $y = -36x + 36$ B) $y = -36x$ C) $y = -36x + 72$ D) $y = -72x + 108$

Answer: C

194) $f(x) = x^2 - 2$ at (–4, 14)

A) $y = -8x - 18$ B) $y = -8x - 34$ C) $y = -4x - 18$ D) $y = -8x - 36$

Answer: A

195) $f(x) = x^2 + 3$ at (4, 19)

A) $y = 8x - 26$ B) $y = 4x - 13$ C) $y = 8x - 13$ D) $y = 8x - 29$

Answer: C

196) $f(x) = x^2 - x$ at (4, 12)

A) $y = 7x - 20$ B) $y = 7x + 16$ C) $y = 7x - 16$ D) $y = 7x + 20$

Answer: C

197) $f(x) = x^3 - x^2$ at (0, 0)

A) $y = 3$ B) $y = -2$ C) $y = 0$ D) $y = 1$

Answer: C

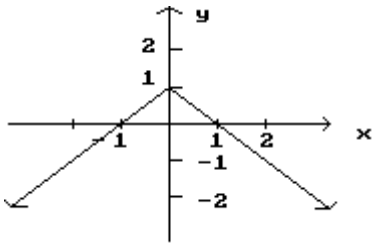
198) $f(x) = x - x^2$ at (–1, –2)

A) $y = 3x + 1$ B) $y = -3x + 1$ C) $y = -x - 1$ D) $y = -x + 1$

Answer: A

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

199)




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

Answer: B



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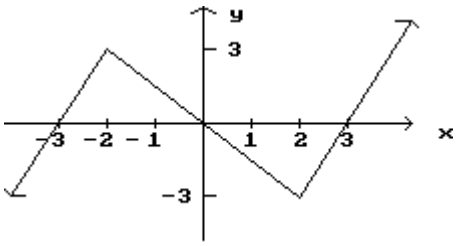
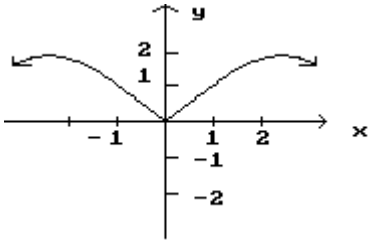
200)




A) x = −3, x = 3 B) x = −2, x = 0, x = 2 C) x = −3, x = 0, x = 3 D) x = −2, x = 2

Answer: D

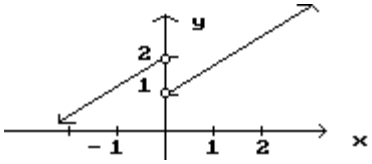
201)




A) x = 2 B) x = −2, x = 2 C) x = −2, x = 0, x = 2 D) x = 0

Answer: D

202)




A) x = 2 B) x = 1 C) x = 0 D) x = 0, x = 1, x = 2

Answer: C

203)

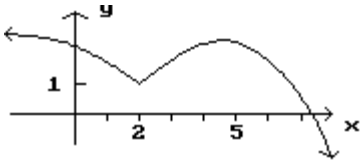



A) x = 1, x = 2, x = 3 B) x = 1, x = 3

C) Function is differentiable at all points D) x = 2

Answer: C

204)




A) x = 2 B) Function is differentiable at all points.

C) x = 2, x = 5 D) x = 5

Answer: A



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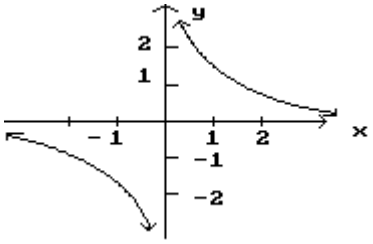
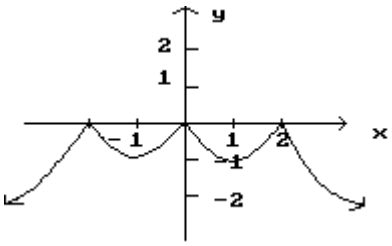
205)




A) Function is differentiable at all points.
B) x = 0
C) x = –1, x = 1
D) x = –1, x = 0, x = 1

Answer: B

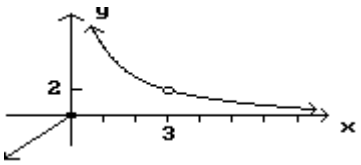
206)




A) Function is differentiable at all points.
B) x = 0
C) x = –2, x = 0, x = 2
D) x = –2, x = 2

Answer: C

207)




A) Function is differentiable at all points.
B) x = 0
C) x = 3
D) x = 0, x = 3

Answer: D



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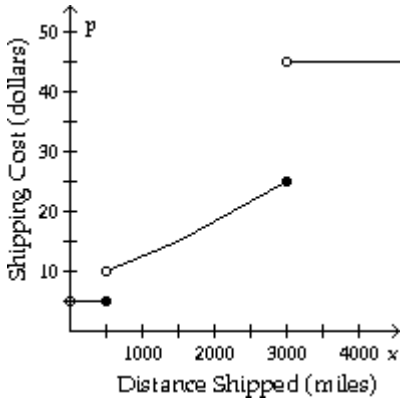
**Solve the problem.**

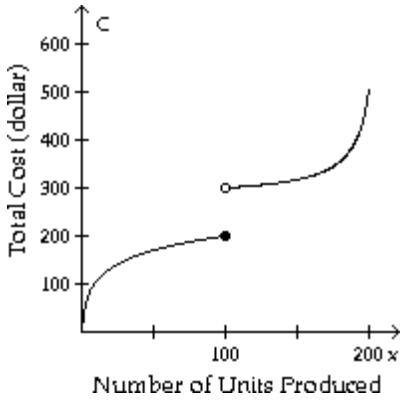
208) Suppose that the cost, p, of shipping a 3–pound parcel depends on the distance shipped, x, according to the function p(x) depicted in the graph. At what values is the function p not differentiable?




A) 0, 3000
B) Function is differentiable for all x in the domain
C) 0, 500, 3000
D) 500, 3000

Answer: D

209) Suppose that the cost, C, of producing x units of a product can be illustrated by the given graph. At what values is the function C not differentiable?




A) 0, 100, 200
B) 0, 100
C) Function is differentiable for all x in the domain
D) 100

Answer: D



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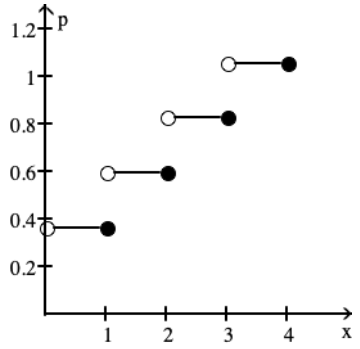
210) Postal rates are \$0.37 for the first ounce and \$0.23 for each additional ounce (or fraction thereof). If x is the weight of a letter in ounces, then p(x) is the cost of mailing the letter, where

$p(x) = \$0.37$, if $0 < x \le 1$,
$p(x) = \$0.60$, if $1 < x \le 2$,
$p(x) = \$0.83$, if $2 < x \le 3$,

and so on, up to 13 ounces. The graph of p is shown below.




At what values is the function p not differentiable?

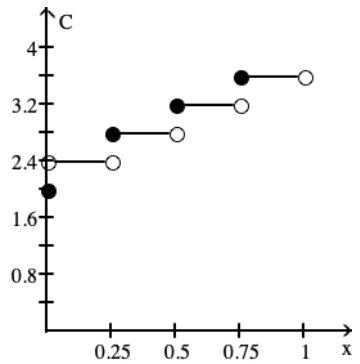
A) 0, 1, 2, 3, 4, 5, 6, 7, 8 , 9, 10, 11, 12, .....
B) Function is differentiable for all x in the domain
C) 1, 2, 3, 4, 5, 6, 7, 8 , 9, 10, 11, 12
D) 0, 1, 2, 3, 4, 5, 6, 7, 8 , 9, 10, 11, 12

Answer: C

211) In one city, taxicabs charge passengers \$2.00 for entering a cab and then \$0.40 for each one–quarter of a mile (or fraction thereof) that the cab travels. (There are additional charges for slow traffic and idle times, but these are not considered here). If x is the distance traveled in miles, then C(x) is the cost of the taxi fare, where

$C(x) = \$2.00$, if $x = 0$,
$C(x) = \$2.40$, if $0 < x < 0.25$,
$C(x) = \$2.80$, if $0.25 \le x < 0.5$,
$C(x) = \$3.20$, if $0.5 \le x < 0.75$,

and so on. The graph of C is shown below.




At what values is the function C not differentiable?

A) Function is differentiable for all x in the domain
B) 0.25, 0.5, 0.75
C) 0.25, 0.5, 0.75, 1.0, 1.25, 1.5.....
D) 0.25, 0.5, 0.75, 1.0

Answer: C



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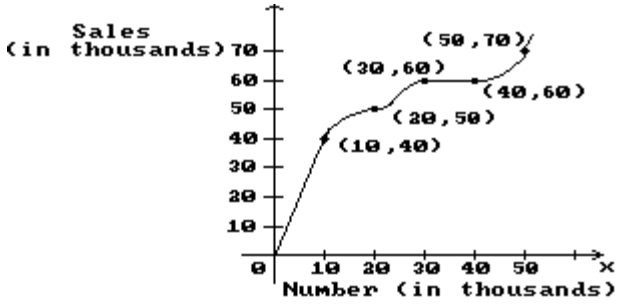
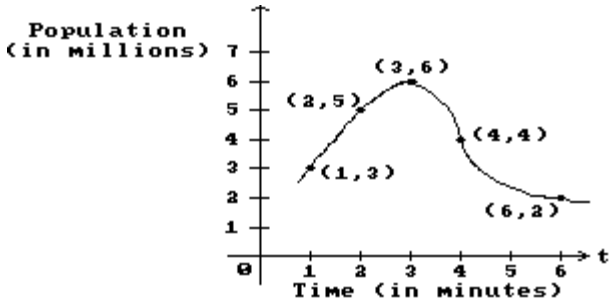
212) The graph shows the total sales in thousands of dollars from the distribution of x thousand catalogs. At what values is the function not differentiable?




A) 10, 20, 40
B) Function is differentiable for all x in the domain
C) 10, 20, 30, 40, 50
D) 20, 30

Answer: B

213) The graph shows the population in millions of bacteria t minutes after a bactericide is introduced into a culture. At what values of t is the function not differentiable?




A) 1, 2, 3, 4, 6
B) 3, 4
C) 3
D) Function is differentiable for all t in the domain

Answer: D

**Find f'(x).**

214) $f(x) = \frac{1}{5x^2}$

A) $f'(x) = -\frac{1}{5x^3}$ B) $f'(x) = \frac{2}{5x^3}$ C) $f'(x) = -\frac{2}{5x^3}$ D) $f'(x) = -\frac{2}{5x}$

Answer: C



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215) $f(x) = \frac{2}{x^3}$

A) $f'(x) = -\frac{6}{x^2}$ B) $f'(x) = -\frac{6}{x^4}$ C) $f'(x) = \frac{6}{x^4}$ D) $f'(x) = \frac{2}{x^4}$

Answer: B

216) $f(x) = \frac{8}{x + 2}$

A) $f'(x) = \frac{8}{(x + 2)^2}$ B) $f'(x) = 8$ C) $f'(x) = -8(x + 2)^2$ D) $f'(x) = -\frac{8}{(x + 2)^2}$

Answer: D

217) $f(x) = \sqrt{x + 4}$

A) $f'(x) = \frac{\sqrt{x + 4}}{x + 4}$ B) $f'(x) = -\frac{1}{2\sqrt{x + 4}}$ C) $f'(x) = \frac{1}{2\sqrt{x + 4}}$ D) $f'(x) = \frac{\sqrt{x + 4}}{2}$

Answer: C

218) $f(x) = \frac{x}{x + 4}$

A) $f'(x) = \frac{4}{(x + 4)^2}$ B) $f'(x) = \frac{4}{x^2}$ C) $f'(x) = \frac{4}{x + 4}$ D) $f'(x) = \frac{-4}{(x + 4)^2}$

Answer: A

219) $f(x) = \sqrt{5x}$

A) $f'(x) = \frac{1}{\sqrt{5x}}$ B) $f'(x) = 5\sqrt{5x}$ C) $f'(x) = \frac{5}{2\sqrt{5x}}$ D) $f'(x) = \frac{5}{\sqrt{5x}}$

Answer: C

**Find the derivative.**

220) $y = x^7$

A) $\frac{dy}{dx} = 7x^6$ B) $\frac{dy}{dx} = x^7$ C) $\frac{dy}{dx} = 7x^7$ D) $\frac{dy}{dx} = x^6$

Answer: A

221) $y = 7 - 10x^2$

A) $\frac{dy}{dx} = 7 - 20x$ B) $\frac{dy}{dx} = 7 - 10x$ C) $\frac{dy}{dx} = -20x$ D) $\frac{dy}{dx} = -20$

Answer: C

222) $y = 0.95x^{11.8}$

A) $\frac{dy}{dx} = 0.95x^{10.8}$ B) $\frac{dy}{dx} = 11.21x^{10.8}$ C) $\frac{dy}{dx} = 11.21x^{11.8}$ D) $\frac{dy}{dx} = 12.16x^{12.8}$

Answer: B



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223) $y = 9 - 5x^3$

A) $\frac{dy}{dx} = -10x^2$ B) $\frac{dy}{dx} = -15x$ C) $\frac{dy}{dx} = -15x^2$ D) $\frac{dy}{dx} = 9 - 15x^2$

Answer: C

224) $y = 5x^2 - 2.1x$

A) $\frac{dy}{dx} = 5x^2 - 2.1$ B) $\frac{dy}{dx} = 10x^2 - 2.1$ C) $\frac{dy}{dx} = 5x - 2.1$ D) $\frac{dy}{dx} = 10x - 2.1$

Answer: D

225) $y = \frac{1}{2}x^8 - \frac{1}{4}x^4$

A) $\frac{dy}{dx} = 4x^8 - x^4$ B) $\frac{dy}{dx} = 4x^7 - x^3$ C) $\frac{dy}{dx} = 4x^9 - x^5$ D) $\frac{dy}{dx} = \frac{1}{2}x^7 - \frac{1}{4}x^3$

Answer: B

226) $f(x) = 6x^{130}$

A) $f'(x) = 6x^{129}$ B) $f'(x) = 780x^{129}$ C) $f'(x) = 780x^{130}$ D) $f'(x) = 780x^{131}$

Answer: B

227) $f(x) = 7x - 3$

A) $f'(x) = 0$ B) $f'(x) = 7$ C) $f'(x) = 4$ D) $f'(x) = 7x$

Answer: B

228) $f(x) = 4x^2 - 3x + 8$

A) $f'(x) = 4x^2 - 3$ B) $f'(x) = 4x - 3$ C) $f'(x) = 8x^2 - 3$ D) $f'(x) = 8x - 3$

Answer: D

229) $f(x) = 2x^4 + 7x^3 - 6$

A) $f'(x) = 4x^3 + 3x^2$ B) $f'(x) = 4x^3 + 3x^2 - 7$

C) $f'(x) = 8x^3 + 21x^2 - 7$ D) $f'(x) = 8x^3 + 21x^2$

Answer: D

230) $y = 6x^{-2} - 7x^3 - 9x$

A) $\frac{dy}{dx} = -12x^{-3} - 21x^2$ B) $\frac{dy}{dx} = -12x^{-3} - 21x^2 - 9$

C) $\frac{dy}{dx} = -12x^{-1} - 21x^2$ D) $\frac{dy}{dx} = -12x^{-1} - 21x^2 - 9$

Answer: B

231) $y = -10\sqrt{x}$

A) $\frac{dy}{dx} = \frac{5}{\sqrt{x}}$ B) $\frac{dy}{dx} = -\frac{5}{\sqrt{x}}$ C) $\frac{dy}{dx} = -\frac{10}{\sqrt{x}}$ D) $\frac{dy}{dx} = 5\sqrt{x}$

Answer: B



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232) $y = \sqrt[5]{x^4}$

A) $\frac{dy}{dx} = \frac{1}{\sqrt[5]{x}}$ B) $\frac{dy}{dx} = \frac{4}{5\sqrt[5]{x}}$ C) $\frac{dy}{dx} = \frac{5\sqrt[4]{x}}{4}$ D) $\frac{dy}{dx} = \frac{4\sqrt[5]{x}}{5}$

Answer: B

233) $y = \frac{9}{x} - \frac{x}{9}$

A) $\frac{dy}{dx} = \frac{9}{x^2} - \frac{1}{9}$ B) $\frac{dy}{dx} = -9x - \frac{1}{9}$ C) $\frac{dy}{dx} = -\frac{9}{x^2} - \frac{1}{9}$ D) $\frac{dy}{dx} = -\frac{9}{x^2} + \frac{x}{9}$

Answer: C

234) $y = \frac{3}{x^3} - \frac{3}{x}$

A) $\frac{dy}{dx} = -\frac{9}{x^2} - 3x$ B) $\frac{dy}{dx} = -\frac{9}{x^4} + \frac{3}{x^2}$ C) $\frac{dy}{dx} = \frac{3}{x^4} + \frac{3}{x^2}$ D) $\frac{dy}{dx} = -\frac{9}{x^4} - \frac{3}{x^2}$

Answer: B

235) $f(x) = 20x^{1/2} - \frac{1}{2}x^{20}$

A) $f'(x) = 10x^{1/2} - 10x^{19}$ B) $f'(x) = 10x^{1/2} - 10x^{10}$

C) $f'(x) = 10x^{-1/2} - 10x^{19}$ D) $f'(x) = 10x^{-1/2} - 10x^{10}$

Answer: C

236) $f(x) = 9x^{7/5} - 5x^2 + 10^4$

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

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

Answer: C

237) $f(x) = 5\sqrt{x} + \sqrt[3]{x} - 3\sqrt[4]{x} + 4\sqrt[5]{x}$

A) $f'(x) = \frac{1}{2}x^{-1/2} + \frac{1}{3}x^{-2/3} + \frac{1}{4}x^{-3/4} + \frac{1}{5}x^{-4/5}$ B) $f'(x) = \frac{5}{2}x^{1/2} + \frac{1}{3}x^{2/3} - \frac{3}{4}x^{3/4} + \frac{4}{5}x^{4/5}$

C) $f'(x) = \frac{5}{2}x^{-1/2} + \frac{1}{3}x^{2/3} - \frac{3}{4}x^{3/4} + \frac{4}{5}x^{-4/5}$ D) $f'(x) = \frac{5}{2}x^{-1/2} + \frac{1}{3}x^{-2/3} - \frac{3}{4}x^{-3/4} + \frac{4}{5}x^{-4/5}$

Answer: D

238) $f(x) = \sqrt[4]{x}$

A) $f'(x) = \frac{1}{4}x^{-3/4}$ B) $f'(x) = -\frac{5}{4}x^{-5/4}$ C) $f'(x) = 3(\sqrt[3]{x})$ D) $f'(x) = \frac{5}{4}x^{5/4}$

Answer: A



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239) $f(x) = \frac{4}{\sqrt{x}} - \frac{3}{x} + \frac{6}{x^4}$

A) $f'(x) = \frac{2}{x^{1/2}} - \frac{3}{x^2} - \frac{24}{x^5}$

B) $f'(x) = -\frac{2}{x^{3/2}} - \frac{3}{x^2} - \frac{24}{x^3}$

C) $f'(x) = -2\sqrt{x} + \frac{3}{x^2} - \frac{24}{x^3}$

D) $f'(x) = -\frac{2}{x^{3/2}} + \frac{3}{x^2} - \frac{24}{x^5}$

Answer: D

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

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

A) −5 B) −33 C) −13 D) −38

Answer: B

241) If $f(x) = \sqrt{x}$, find $f'(9)$.

A) $\frac{1}{18}$ B) $\frac{2}{3}$ C) $\frac{3}{2}$ D) $\frac{1}{6}$

Answer: D

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

A) 3 B) −10 C) −8 D) 5

Answer: A

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

A) $\frac{187}{8}$ B) $\frac{197}{8}$ C) $\frac{91}{4}$ D) $\frac{101}{4}$

Answer: A

244) If $y = 9\sqrt{x^5} - 7\sqrt{x^3}$, find $\left.\frac{dy}{dx}\right|_{x=4}$

A) 6 B) 159 C) 8 D) 96

Answer: B

245) If $y = -\frac{8}{x} + \frac{5}{x^2}$, find $\left.\frac{dy}{dx}\right|_{x=2}$

A) $-\frac{3}{4}$ B) $\frac{3}{4}$ C) $-\frac{13}{4}$ D) $\frac{13}{4}$

Answer: B



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

A) 8 B) 2 C) –2 D) –8

Answer: B

247) If $y = \frac{7}{x} - \sqrt{x}$, find $\left.\frac{dy}{dx}\right|_{x=4}$

A) $\frac{11}{16}$ B) $-\frac{11}{16}$ C) $-\frac{3}{16}$ D) $\frac{3}{16}$

Answer: B

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

248) $f(x) = x^2 - 2$ at (2, 2)

A) $y = 4x - 12$ B) $y = 4x - 6$ C) $y = 2x - 6$ D) $y = 4x - 10$

Answer: B

249) $f(x) = x^2 + 1$ at (3, 10)

A) $y = 3x - 8$ B) $y = 6x - 8$ C) $y = 6x - 17$ D) $y = 6x - 16$

Answer: B

250) $f(x) = x^2 - x$ at (–4, 20)

A) $y = -9x - 16$ B) $y = -9x + 12$ C) $y = -9x + 16$ D) $y = -9x - 12$

Answer: A

251) $f(x) = x^3 - x^2$ at (0, 0)

A) $y = 0$ B) $y = -2$ C) $y = 1$ D) $y = 3$

Answer: A

252) $f(x) = x - x^2$ at (–2, –6)

A) $y = -5x + 4$ B) $y = -3x - 4$ C) $y = -3x + 4$ D) $y = 5x + 4$

Answer: D

253) $f(x) = \frac{27}{x}$ at (1, 27)

A) $y = -27x + 27$ B) $y = -27x + 54$ C) $y = -54x + 81$ D) $y = -27x$

Answer: B

254) $y = 4\sqrt{x^3} - 5\sqrt{x}$ at (16, 236)

A) $y = \frac{197}{8}x - 158$ B) $y = \frac{101}{4}x - 168$ C) $y = \frac{187}{8}x - 138$ D) $y = \frac{91}{4}x - 128$

Answer: C



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**Find all values of x (if any) where the tangent line to the graph of the function is horizontal.**

255) $y = 6x + 3$

A) 0 B) $-\frac{1}{2}$ C) None D) All real numbers

Answer: C

256) $y = -2$

A) All real numbers B) None C) 0 D) –2

Answer: A

257) $y = x^2 + 2x - 3$

A) –1 B) $\frac{1}{2}$ C) 0 D) 1

Answer: A

258) $y = 2 + 8x - x^2$

A) 8 B) –4 C) –8 D) 4

Answer: D

259) $y = x^3 - 3x^2 + 1$

A) 0, 2 B) 0 C) –2, 0, 2 D) 2

Answer: A

260) $y = x^3 - 12x + 2$

A) 2, –2 B) 0 C) 0, 2 D) –2, 0, 2

Answer: A

261) $y = x^7 + \sqrt{x}$

A) $-\frac{1}{16}$ B) None C) $8\sqrt{\frac{1}{16}}$ D) 0

Answer: B

262) $y = x^3 + 8x^2 - 204x + 34$

A) $-\frac{34}{3}, \frac{34}{3}, 6$ B) $-\frac{34}{3}, 6$ C) $\frac{34}{3}, -6$ D) 6

Answer: B

263) $y = -0.01x^2 - 0.1x + 60$

A) -5 B) 2.5 C) -2.5 D) 5

Answer: A

264) $y = \frac{1}{3}x^3 - 2x + 7$

A) –7, 7 B) $7 - \sqrt{2}, 7 + \sqrt{2}$ C) –2, 2 D) $-\sqrt{2}, \sqrt{2}$

Answer: D



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**For the given function, find the points on the graph at which the tangent line has slope 1.**

265) $y = 15x - x^2$

A) (1, 14) B) (7, 56) C) (14, 112) D) (7.5, 56.25)

Answer: B

266) $y = -0.25x^2 + 7x$

A) (12, 48) B) (14, 49) C) (1, 6.75) D) (0, 0)

Answer: A

267) $y = -0.5x^2 + 7x$

A) (0, 0) B) (6, 24) C) (3, 12) D) (1, 6.5)

Answer: B

268) $y = \frac{1}{3}x^3 - \frac{3}{2}x^2 + x$

A) (0, 0) and $\left(3, -\frac{3}{2}\right)$ B) (1, 0) and $\left(3, -\frac{3}{2}\right)$ C) (0, 0) and $\left(3, -\frac{7}{6}\right)$ D) $\left(3, -\frac{3}{2}\right)$

Answer: A

269) $y = \frac{1}{3}x^3 - 2x^2 + x$

A) (0, 0) and $(4, 1)$ B) (0, 0)

C) $\left(4, -\frac{10}{3}\right)$ D) (0, 0) and $\left(4, -\frac{20}{3}\right)$

Answer: D

270) $y = \frac{1}{3}x^3 - 6x^2 + x$

A) (0, 0) and (12, –300) B) (0, 0) and (12, –276)

C) (0, 1) and (12, –288) D) (12, –300)

Answer: B

271) $y = x^3 - \frac{3}{2}x^2 + x$

A) $\left(3, \frac{33}{2}\right)$ and $\left(1, \frac{1}{2}\right)$ B) (1, 0) and $\left(1, \frac{1}{2}\right)$

C) (0, 0) and $\left(1, \frac{1}{2}\right)$ D) $\left(3, \frac{33}{2}\right)$ and $\left(0, \frac{1}{2}\right)$

Answer: C



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272) $y = \frac{1}{3}x^3 - \frac{1}{2}x^2 + x + 1$

A) (0, 1) and $\left(1, \frac{11}{6}\right)$ B) (0, 1) and $\left(1, \frac{7}{6}\right)$ C) (0, 0) and $\left(1, \frac{7}{6}\right)$ D) (0, 0) and $\left(1, \frac{5}{6}\right)$

Answer: A

273) $y = \frac{1}{3}x^3 - 4x^2 + x + 1$

A) (0, 0) and $\left(8, -\frac{229}{3}\right)$ B) (0, 1) and $\left(8, -\frac{229}{3}\right)$

C) (0, 1) and $\left(8, -\frac{232}{3}\right)$ D) (0, 0) and $\left(8, -\frac{38}{3}\right)$

Answer: B

274) $y = \frac{1}{3}x^3 - 2x^2 + 4x + 1$

A) (0, 3) and (3, 3) B) $\left(1, \frac{10}{3}\right)$ and (3, 4) C) (1, 3) and (3, 4) D) $\left(0, \frac{10}{3}\right)$ and (3, 4)

Answer: B

**Solve the problem.**

275) The perimeter, P, in feet, of a square garden plot is given by
$P(s) = 4s$,
where s is the length of one side of the garden plot, in feet.

(i) Find the rate of change of the perimeter with respect to the length of the side, s.
(ii) Explain the meaning of your answer to part (i).

A) (i) $P'(s) = 4s$; (ii) The perimeter is changing at the variable rate of 4s feet for every change of 1 foot in the side of the plot.

B) (i) $P'(s) = 4$; (ii) The perimeter is changing at the constant rate of 4 feet for every change of 1 foot in the side of the plot.

C) (i) $P'(s) = \frac{4}{s}$; (ii) The perimeter is changing at the variable rate of $\frac{4}{s}$ feet for every change of 1 foot in the side of the plot.

D) (i) $P'(s) = s$; (ii) The perimeter is changing at the variable rate of s feet for every change of 1 foot in the side of the plot.

Answer: B



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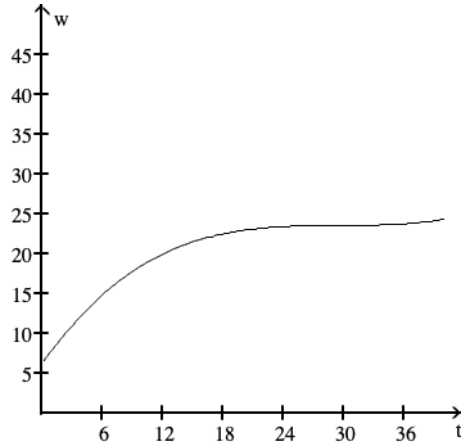
276) The median weight of a baby chimpanzee whose age is between 0 and 36 months can be approximated by the function $w(t) = 6.71 + 1.72t - 0.0581t^2 + 0.000656t^3$, where t is measured in months and w is measured in pounds.




Use this approximation to find the following for a baby chimpanzee with median weight:
(i) The rate of change of weight with respect to time.
(ii) The weight of the baby chimpanzee at age 30 months (rounded to the nearest pound).
(iii) The rate of change of the baby's weight with respect to time at age 30 months (rounded to the nearest hundredth).

A) (i) $w'(t) = 1.72 + 0.1162t - 0.001968t^2$;
(ii) w(30) is about 24 pounds;
(iii) w'(30) is about 3.43 pounds/month

B) (i) $w'(t) = 1.72 - 0.1743t + 0.002624t^2$;
(ii) w(30) is about 24 pounds;
(iii) w'(30) is about -1.15 pounds/month

C) (i) $w'(t) = 1.72 - 0.1162t + 0.001968t^2$;
(ii) w(30) is about 24 pounds;
(iii) w'(30) is about 0.01 pounds/month

D) (i) $w'(t) = 1.72 - 0.0581t + 0.001312t^2$;
(ii) w(30) is about 24 pounds;
(iii) w'(30) is about 1.16 pounds/month

Answer: C

277) If the price (in dollars) of a product is given by $P(x) = \frac{1024}{x} + 2200$, where x represents the demand for the product, find the rate of change of price when the demand is 16 units.

A) \$4/unit B) -\$64/unit C) \$64/unit D) -\$4/unit

Answer: D

278) The area $A(r) = \pi r^2$ of a circular oil spill changes with the radius. At what rate does the area change with respect to the radius when r = 9 ft?

A) 18 $ft^2/ft$ B) $81\pi$ $ft^2/ft$ C) $9\pi$ $ft^2/ft$ D) $18\pi$ $ft^2/ft$

Answer: D

279) Exposure to ionizing radiation is known to increase the incidence of cancer. One thousand laboratory rats are exposed to identical doses of ionizing radiation, and the incidence of cancer is recorded during subsequent days. The researchers find that the total number of rats that have developed cancer t months after the initial exposure is modeled by $N(t) = 1.18t^{2.2}$ for $0 \le t \le 10$ months. Find the rate of growth of the number of cancer cases at the 7th month.

A) 21.8 cases/month
B) 187.7 cases/month
C) 26.8 cases/month
D) 30.8 cases/month

Answer: C



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280) The body–mass index (BMI) is calculated using the equation $BMI = \frac{703w}{h^2}$, where w is in pounds and h is in inches. Find the rate of change of BMI with respect to weight for Sally, who is 62" tall and weighs 120 lbs. If both Sally and her brother Jesse gain the same small amount of weight, who will see the largest increase in BMI? Jesse is 73" tall and weighs 190 lbs.

A) 0.183, Jesse B) 21.946, Jesse C) 21.946, Sally D) 0.183, Sally

Answer: D

281) The velocity of water in ft/s at the point of discharge is given by $v = 11.57\sqrt{P}$, where P is the pressure in $lb/in.^2$ of the water at the point of discharge. Find the rate of change of the velocity with respect to pressure if the pressure is 30.00 $lb/in.^2$.

A) 2.11 ft/s per $lb/in.^2$ B) 0.1928 ft/s per $lb/in.^2$

C) 31.69 ft/s per $lb/in.^2$ D) 1.0562 ft/s per $lb/in.^2$

Answer: D

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

282) $f(x) = x^2 - 2x + 9$

A) (2, ∞) B) (4.5, ∞) C) (1, ∞) D) (9, ∞)

Answer: C

283) $f(x) = x^2 + 3x + 8$

A) (4, ∞) B) (8, ∞) C) (-1.5, ∞) D) (1.5, ∞)

Answer: C

284) $f(x) = \frac{1}{3}x^3 - 6x^2 - 13x + 9$

A) (-13, ∞) B) (–1, ∞)

C) (–∞, –1) and (13, ∞) D) (–∞, 1) and (13, ∞)

Answer: C

285) $f(x) = \frac{2}{3}x^3 + 2x^2 - 16x + 8$

A) (–∞, -4) and (2, ∞) B) (–∞, –2) and (4, ∞) C) (–∞, -4) D) (4, ∞)

Answer: A

**Find the derivative.**

286) $y = (x + 8)(5x + 5)$

A) 0 B) 10x + 45 C) 5 D) 10x + 85

Answer: B

287) $y = (2x - 6)(4x + 1)$

A) 16x – 26 B) 8x – 22 C) 16x – 11 D) 16x – 22

Answer: D



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288) $y = (3x + 2)^2$

A) $6x + 4$ B) $9x + 6$ C) $18x + 12$ D) $9x + 4$

Answer: C

289) $y = (2x^2 + 5x)^2$

A) $16x^3 + 30x^2 + 50x$ B) $16x^3 + 60x^2 + 50x$ C) $8x^3 + 30x^2 + 25x$ D) $8x^3 + 30x^2 + 50x$

Answer: B

290) $y = (x^2 + 2)^3$

A) $6x^5 + 24x^3 + 24x$ B) $6x^5 + 20x^3 + 24x$ C) $6x^5 + 12x^3 + 12x$ D) $3x^5 + 24x^3 + 24x$

Answer: A

291) $y = \sqrt{x}(3x - 5) + 6x - 10$

A) $2x^{1/2} - 5x^{-1/2} + 6$ B) $4.5x^{1/2} - 2.5x^{-1/2} + 6$

C) $4.5x^{1/2} - 5x^{-1/2} + 6$ D) $2x^{1/2} - 2.5x^{-1/2} + 6$

Answer: B

292) $y = \dfrac{x^2 - 4}{x}$

A) $y' = x + \dfrac{4}{x^2}$ B) $y' = 1 - \dfrac{4}{x^2}$ C) $y' = 1 + \dfrac{4}{x}$ D) $y' = 1 + \dfrac{4}{x^2}$

Answer: D

293) $y = \dfrac{x + 3}{\sqrt{x}}$

A) $\dfrac{1}{2\sqrt{x}} - \dfrac{3}{2\,x^{3/2}}$ B) $x^{3/2} + 3\sqrt{x}$ C) $\dfrac{1}{\sqrt{x}} + \dfrac{3}{x^{3/2}}$ D) $\dfrac{1}{2\sqrt{x}} - \dfrac{3}{2\,x}$

Answer: A

294) $y = \dfrac{x^2 + 8x + 3}{\sqrt{x}}$

A) $\dfrac{2x + 8}{2x^{3/2}}$ B) $\dfrac{2x + 8}{x}$ C) $\dfrac{3x^2 + 8x - 3}{2x^{3/2}}$ D) $\dfrac{3x^2 + 8x - 3}{x}$

Answer: C

**Differentiate.**

295) $y = x \cdot x^2$

A) $\dfrac{dy}{dx} = x^2$ B) $\dfrac{dy}{dx} = x^3$ C) $\dfrac{dy}{dx} = 3x^2$ D) $\dfrac{dy}{dx} = 3x^3$

Answer: C



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296) $y = 2x(4x^2 - 2x)$

A) $\frac{dy}{dx} = 24x^2 - 8x$ B) $\frac{dy}{dx} = 24x^2 - 4x$ C) $\frac{dy}{dx} = 16x^2 - 8x$ D) $\frac{dy}{dx} = 16x^2 - 4x$

Answer: A

297) $y = (2 - 5x^2)(3x^2 - 60)$

A) $\frac{dy}{dx} = -60x^4 + 612x^2$ B) $\frac{dy}{dx} = -60x^3 + 612x$

C) $\frac{dy}{dx} = -60x^3 + 612$ D) $\frac{dy}{dx} = 15x^3 + 306x$

Answer: B

298) $f(x) = (5x - 5)(6x + 1)$

A) $f'(x) = 60x - 12.5$ B) $f'(x) = 60x - 35$ C) $f'(x) = 60x - 25$ D) $f'(x) = 30x - 25$

Answer: C

299) $f(x) = (4x^3 + 3)(3x^7 - 8)$

A) $f'(x) = 16x^9 + 63x^6 - 96x$ B) $f'(x) = 120x^9 + 63x^6 - 96x^2$

C) $f'(x) = 120x^9 + 63x^6 - 96x$ D) $f'(x) = 16x^9 + 63x^6 - 96x^2$

Answer: B

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

A) $f'(x) = 100x^3 - 20x^2 + 60x + 5$ B) $f'(x) = 75x^3 + 60x^2 - 20x + 5$

C) $f'(x) = 100x^3 - 60x^2 + 6x + 5$ D) $f'(x) = 25x^3 + 20x^2 - 60x + 5$

Answer: C

301) $f(x) = (x^2 - 2x + 2)(3x^3 - x^2 + 4)$

A) $f'(x) = 15x^4 - 28x^3 + 24x^2 + 4x - 8$ B) $f'(x) = 15x^4 - 24x^3 + 24x^2 + 4x - 8$

C) $f'(x) = 3x^4 - 28x^3 + 24x^2 + 4x - 8$ D) $f'(x) = 3x^4 - 24x^3 + 24x^2 + 4x - 8$

Answer: A

302) $f(x) = (4x + 6)^2$

A) $f'(x) = 16x + 36$ B) $f'(x) = 32x + 48$ C) $f'(x) = 16x + 24$ D) $f'(x) = 8x + 12$

Answer: B

303) $f(x) = (3x^4 + 8)^2$

A) $f'(x) = 9x^{16} + 64$ B) $f'(x) = 144x^{15} + 96x^3$

C) $f'(x) = 6x^4 + 16$ D) $f'(x) = 72x^7 + 192x^3$

Answer: D



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304) $y = \left(\frac{2}{x} + x\right)\left(\frac{2}{x} - x\right)$

A) $\frac{dy}{dx} = -\frac{8}{x^3} - 2x$ B) $\frac{dy}{dx} = -\frac{4}{x^3} - 2x$ C) $\frac{dy}{dx} = -\frac{8}{x} + 2x$ D) $\frac{dy}{dx} = \frac{8}{x^3} + 2x$

Answer: A

305) $f(x) = (5x - 3)(\sqrt{x} + 3)$

A) $f'(x) = 7.5x^{1/2} - 1.5x^{-1/2} + 15$ B) $f'(x) = 3.33x^{1/2} - 3x^{-1/2} + 15$

C) $f'(x) = 3.33x^{1/2} - 1.5x^{-1/2} + 15$ D) $f'(x) = 7.5x^{1/2} - 3x^{-1/2} + 15$

Answer: A

306) $f(x) = (6\sqrt{x} - 2)(5\sqrt{x} + 7)$

A) $f'(x) = 30x + 32x^{1/2}$ B) $f'(x) = 30x + 16x^{1/2}$

C) $f'(x) = 30 + 32x^{-1/2}$ D) $f'(x) = 30 + 16x^{-1/2}$

Answer: D

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

A) $g'(x) = -8x^{-9} - 25x^{-6} - 9x^{-2}$ B) $g'(x) = -8x^{-9} - 25x^{-4} - 9x^{-4}$

C) $g'(x) = -8x^{-9} - 25x^{-6} - 9x^{-4}$ D) $g'(x) = -8x^{-7} - 25x^{-6} - 9x^{-4}$

Answer: C

308) $f(x) = \left(x + \frac{5}{x}\right)(x^2 - 6)$

[Do not use algebra before differentiating]

A) $f'(x) = 2x\left(x + \frac{5}{x}\right) + \left(1 - \frac{5}{x^2}\right)(x^2 - 6)$ B) $f'(x) = 2x\left(1 - \frac{5}{x^2}\right)$

C) $f'(x) = 2x\left(x + \frac{5}{x}\right) + (1 - 5x)(x^2 - 6)$ D) $f'(x) = x\left(x + \frac{5}{x}\right) + \left(1 + \frac{5}{x}\right)(x^2 - 6)$

Answer: A

309) $f(x) = (2x^5 - 2x^3 - 2)(9x^2 - 5\sqrt{x})$

[Do not use algebra before differentiating]

A) $f'(x) = (9x^2 - 5\sqrt{x})(2x^4 - 2x^2) + \left(9x - \frac{5}{2\sqrt{x}}\right)(2x^5 - 2x^3 - 2)$

B) $f'(x) = (10x^4 - 6x^2)\left(18x - \frac{5}{2\sqrt{x}}\right)$

C) $f'(x) = (9x^2 - 5\sqrt{x})(10x^4 - 6x^2) + \left(18x - \frac{5}{2\sqrt{x}}\right)(2x^5 - 2x^3 - 2)$

D) $f'(x) = (9x^2 - 5\sqrt{x})(10x^4 - 6x^2 - 2) + \left(18x - \frac{5\sqrt{x}}{2}\right)(2x^5 - 2x^3 - 2)$

Answer: C



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310) $y = \dfrac{x}{4x - 5}$

A) $\dfrac{dy}{dx} = -\dfrac{5}{4x - 5}$ B) $\dfrac{dy}{dx} = \dfrac{8x - 5}{(4x - 5)^2}$ C) $\dfrac{dy}{dx} = -\dfrac{5x}{(4x - 5)^2}$ D) $\dfrac{dy}{dx} = -\dfrac{5}{(4x - 5)^2}$

Answer: D

311) $y = \dfrac{2x - 6}{6x^2 + 1}$

A) $\dfrac{dy}{dx} = \dfrac{-12x^2 + 70x + 8}{(6x^2 + 1)^2}$

B) $\dfrac{dy}{dx} = \dfrac{12x^3 - 24x^2 + 74x}{(6x^2 + 1)^2}$

C) $\dfrac{dy}{dx} = \dfrac{-12x^2 + 72x + 2}{(6x^2 + 1)^2}$

D) $\dfrac{dy}{dx} = \dfrac{36x^2 - 72x + 2}{(6x^2 + 1)^2}$

Answer: C

312) $y = \dfrac{x^3}{x - 1}$

A) $\dfrac{dy}{dx} = \dfrac{2x^3 - 3x^2}{(x - 1)^2}$ B) $\dfrac{dy}{dx} = \dfrac{-2x^3 + 3x^2}{(x - 1)^2}$ C) $\dfrac{dy}{dx} = \dfrac{2x^3 + 3x^2}{(x - 1)^2}$ D) $\dfrac{dy}{dx} = \dfrac{-2x^3 - 3x^2}{(x - 1)^2}$

Answer: A

313) $y = \dfrac{x^2 - 4}{x}$

A) $\dfrac{dy}{dx} = 1 - \dfrac{4}{x^2}$ B) $\dfrac{dy}{dx} = 1 + \dfrac{4}{x}$ C) $\dfrac{dy}{dx} = 1 + \dfrac{4}{x^2}$ D) $\dfrac{dy}{dx} = x + \dfrac{4}{x^2}$

Answer: C

314) $y = \dfrac{5x + 9}{3x - 1}$

A) $\dfrac{dy}{dx} = \dfrac{22}{3x - 1}$ B) $\dfrac{dy}{dx} = -\dfrac{32}{(3x - 1)^2}$ C) $\dfrac{dy}{dx} = -\dfrac{32x}{(3x - 1)^2}$ D) $\dfrac{dy}{dx} = \dfrac{30x + 22}{(3x - 1)^2}$

Answer: B

315) $g(x) = \dfrac{x^2 + 5}{x^2 + 6x}$

A) $g'(x) = \dfrac{6x^2 - 10x - 30}{x^2(x + 6)^2}$

B) $g'(x) = \dfrac{4x^3 + 18x^2 + 10x + 30}{x^2(x + 6)^2}$

C) $g'(x) = \dfrac{2x^3 - 5x^2 - 30x}{x^2(x + 6)^2}$

D) $g'(x) = \dfrac{x^4 + 6x^3 + 5x^2 + 30x}{x^2(x + 6)^2}$

Answer: A



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316) $q(t) = \dfrac{6t}{t^2 - 7t - 2}$

A) $q'(t) = \dfrac{-6(t^2 - 7t + 2)}{(t^2 - 7t - 2)^2}$

B) $q'(t) = \dfrac{-6t^2}{(t^2 - 7t - 2)^2}$

C) $q'(t) = \dfrac{6}{2t - 7}$

D) $q'(t) = \dfrac{-6(t^2 + 2)}{(t^2 - 7t - 2)^2}$

Answer: D

317) $f(x) = \dfrac{x + 9}{x - 9}$

A) $f'(x) = \dfrac{-18}{(x + 9)^2}$

B) $f'(x) = \dfrac{-9}{(x - 9)^2}$

C) $f'(x) = \dfrac{2}{x - 9}$

D) $f'(x) = \dfrac{-18}{(x - 9)^2}$

Answer: D

318) $f(x) = \dfrac{1}{x^7 + 2}$

A) $f'(x) = \dfrac{7x^6}{(x^7 + 2)^2}$

B) $f'(x) = \dfrac{1}{(7x^7 + 2)^2}$

C) $f'(x) = -\dfrac{1}{(7x^7 + 2)^2}$

D) $f'(x) = -\dfrac{7x^6}{(x^7 + 2)^2}$

Answer: D

319) $g(x) = \dfrac{x^2}{x - 11}$

A) $g'(x) = \dfrac{22x}{(x - 11)^2}$

B) $g'(x) = \dfrac{x^2}{(x - 11)^2}$

C) $g'(x) = \dfrac{x^2 + 22x}{(x - 11)^2}$

D) $g'(x) = \dfrac{x^2 - 22x}{(x - 11)^2}$

Answer: D

320) $y = \dfrac{x^2 - 3x + 2}{x^7 - 2}$

A) $\dfrac{dy}{dx} = \dfrac{-5x^8 + 18x^7 - 14x^6 - 4x + 6}{(x^7 - 2)^2}$

B) $\dfrac{dy}{dx} = \dfrac{-5x^8 + 19x^7 - 14x^6 - 4x + 6}{(x^7 - 2)^2}$

C) $\dfrac{dy}{dx} = \dfrac{-5x^8 + 18x^7 - 14x^6 - 3x + 6}{(x^7 - 2)^2}$

D) $\dfrac{dy}{dx} = \dfrac{-5x^8 + 18x^7 - 13x^6 - 4x + 6}{(x^7 - 2)^2}$

Answer: A



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321) $y = \dfrac{x^2 + 2x - 2}{x^2 - 2x + 2}$

A) $\dfrac{dy}{dx} = \dfrac{4x^2 + 8x}{(x^2 - 2x + 2)^2}$

B) $\dfrac{dy}{dx} = \dfrac{-4x^2 + 8x}{(x^2 - 2x + 2)^2}$

C) $\dfrac{dy}{dx} = \dfrac{-4x^2 - 8x}{(x^2 - 2x + 2)^2}$

D) $\dfrac{dy}{dx} = \dfrac{4x^2 - 8x}{(x^2 - 2x + 2)^2}$

Answer: B

322) $y = \dfrac{\sqrt{x} + 3}{\sqrt{x} - 3}$

A) $\dfrac{dy}{dx} = -\dfrac{\sqrt{x} + 3}{(\sqrt{x} - 3)^2}$

B) $\dfrac{dy}{dx} = -\dfrac{3}{\sqrt{x}\,(\sqrt{x} - 3)^2}$

C) $\dfrac{dy}{dx} = -\dfrac{3\sqrt{x}}{(\sqrt{x} - 3)^2}$

D) $\dfrac{dy}{dx} = \dfrac{3}{2\sqrt{x}\,(\sqrt{x} - 3)^2}$

Answer: B

323) $y = \dfrac{3x^2 + x - 1}{x^3 - 9x^2}$

A) $\dfrac{dy}{dx} = \dfrac{-3x^4 - 3x^3 + 21x^2 - 18x}{(x^3 - 9x^2)^2}$

B) $\dfrac{dy}{dx} = \dfrac{15x^4 - 2x^3 + 12x^2 - 18x}{x^3 - 9x^2}$

C) $\dfrac{dy}{dx} = \dfrac{15x^4 - 108x^3 + 12x^2 - 18x}{(x^3 - 9x^2)^2}$

D) $\dfrac{dy}{dx} = \dfrac{-3x^4 - 2x^3 + 12x^2 - 18x}{(x^3 - 9x^2)^2}$

Answer: D

324) $y = \dfrac{x^2 + 8x + 3}{\sqrt{x}}$

A) $\dfrac{dy}{dx} = \dfrac{3x^2 + 8x - 3}{2x^{3/2}}$

B) $\dfrac{dy}{dx} = \dfrac{2x + 8}{x}$

C) $\dfrac{dy}{dx} = \dfrac{3x^2 + 8x - 3}{x}$

D) $\dfrac{dy}{dx} = \dfrac{2x + 8}{2x^{3/2}}$

Answer: A



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325) $y = \dfrac{4x - 3}{x^2 - 4x + 1}$

A) $\dfrac{dy}{dx} = \dfrac{4x^3 - 24x^2 + 26x - 12}{(x^2 - 4x + 1)^2}$

B) $\dfrac{dy}{dx} = \dfrac{12x^2 - 38x + 16}{(x^2 - 4x + 1)^2}$

C) $\dfrac{dy}{dx} = \dfrac{4x^2 + 6x - 8}{x^2 - 4x + 1}$

D) $\dfrac{dy}{dx} = \dfrac{-4x^2 + 6x + -8}{(x^2 - 4x + 1)^2}$

Answer: D

326) $f(t) = \dfrac{t^3}{\sqrt{t - 3}}$

A) $f'(t) = \dfrac{5t^3 - 18t^2}{2(\sqrt{t - 3})^2}$

B) $f'(t) = \dfrac{5t^{5/2} - 18t^2}{2(\sqrt{t - 3})^2}$

C) $f'(t) = \dfrac{5t^3 - 18t^2}{2\sqrt{t}\,(\sqrt{t - 3})^2}$

D) $f'(t) = \dfrac{t^{5/2} - 9t^2}{2(\sqrt{t - 3})^2}$

Answer: B

327) $h(r) = \dfrac{r^2 + 4r + 1}{7r + 9}$

A) $h'(r) = \dfrac{7r^2 + 20r + 29}{(7r + 9)^2}$

B) $h'(r) = \dfrac{7r^2 + 18r + 29}{7r + 9}$

C) $h'(r) = \dfrac{2r + 4}{7}$

D) $h'(r) = \dfrac{7r^2 + 18r + 29}{(7r + 9)^2}$

Answer: D

328) $q(t) = \dfrac{t^2 - 4t - 3}{t^2 + 3t - 7}$

A) $q'(t) = \dfrac{7t^2 - 8t + 28}{(t^2 + 3t - 7)^2}$

B) $q'(t) = \dfrac{7t^2 - 8t + 37}{(t^2 + 3t - 7)^2}$

C) $q'(t) = \dfrac{7t^2 - 14t + 37}{(t^2 + 3t - 7)^2}$

D) $q'(t) = \dfrac{7t^2 - 8t + 37}{t^2 + 3t - 7}$

Answer: B

329) $f(x) = \dfrac{x}{6 + x^{-1}}$

A) $f'(x) = \dfrac{6x^2}{(6x + 1)^2}$

B) $f'(x) = \dfrac{6x^2 + 2x}{(6x + 1)^2}$

C) $f'(x) = -x^2$

D) $f'(x) = \dfrac{1}{(6 + x^{-1})^2}$

Answer: B



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**Write an equation of the tangent line to the graph of y = f(x) at the point on the graph where x has the indicated value.**

330) $f(x) = (-5x^2 + 5x - 2)(-2x + 3)$, $x = 0$

A) $y = 19x + 6$ B) $y = 19x - 6$ C) $y = \frac{1}{19}x - 6$ D) $y = \frac{1}{19}x + 6$

Answer: B

331) $f(x) = \frac{-2x^2 + 15}{2x + 3}$, $x = 0$

A) $y = -\frac{10}{3}x - 5$ B) $y = \frac{10}{3}x + 5$ C) $y = \frac{10}{3}x - 5$ D) $y = -\frac{10}{3}x + 5$

Answer: D

**Solve the problem.**

332) Assume that the temperature of a person during an illness is given by $T(t) = \frac{3t}{t^2 + 1} + 98.6$, where T is the temperature, in degrees Fahrenheit, at time t, in hours. Find the rate of change of the temperature with respect to time.

A) $\frac{dT}{dt} = \frac{3(1 - t^2)}{(t^2 + 1)^2}$ B) $\frac{dT}{dt} = \frac{3}{t^2 + 1}$ C) $\frac{dT}{dt} = \frac{3(t^2 - 1)}{(t^2 + 1)^2}$ D) $\frac{dT}{dt} = \frac{3(1 - t^2)}{t^2 + 1}$

Answer: A

333) The population P, in thousands, of a small city is given by $P(t) = \frac{700t}{2t^2 + 1}$, where t is the time, in months. Find the growth rate.

A) $P'(t) = \frac{700(1 - 2t^2)}{(2t^2 + 1)^2}$ B) $P'(t) = \frac{700(1 - 2t^2)}{2t^2 + 1}$

C) $P'(t) = \frac{700(2t^2 - 1)}{(2t^2 + 1)^2}$ D) $P'(t) = \frac{700(1 + 6t^2)}{(2t^2 + 1)^2}$

Answer: A

334) A men's suit manufacturer finds that the cost, in dollars, of producing x suits is given by $C(x) = 970 + 13\sqrt{x}$. Find the rate at which the average cost is changing when 200 suits have been produced. Round the answer to four decimal places.

A) –\$0.0265 / suit B) \$0.0265 / suit C) \$5.3096 / suit D) –\$5.3096 / suit

Answer: A

335) A vitamin water maker finds that the revenue, in dollars, from the sale of x bottles of vitamin water is given by $R(x) = 9.3x^{0.7}$. Find the rate at which average revenue is changing when 63 bottles of vitamin water have been produced. Round the answer to four decimal places.

A) –\$0.0128 / bottle B) \$1.8784 / bottle C) –\$1.8784 / bottle D) \$0.0128 / bottle

Answer: A



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336) An appliance manufacturer has determined that the cost, in dollars, of producing x espresso makers is given by $C(x) = 4200 + 1.4x^{0.6}$. If the revenue from the sale of x espresso makers is given by $R(x) = 59x^{0.8}$, find the rate at which the average profit per espresso maker is changing when 60 espresso makers have been made and sold. Round to the nearest cent.

A) -$1.26/espresso maker
B) $1.08/espresso maker
C) $1.26/espresso maker
D) –$1.08/espresso maker

Answer: B

**Differentiate.**

337) $f(x) = \dfrac{(x - 1)(x^2 + x + 1)}{9}$

A) $f'(x) = \dfrac{x^2}{9}$
B) $f'(x) = \dfrac{x^2}{27}$
C) $f'(x) = \dfrac{x^2}{81}$
D) $f'(x) = \dfrac{x^2}{3}$

Answer: D

338) $f(x) = \dfrac{(x + 4)(x + 1)}{(x - 4)(x - 1)}$

A) $f'(x) = \dfrac{-10x^2 + 40}{(x - 4)^2(x - 1)^2}$
B) $f'(x) = \dfrac{-x^2 + 8}{(x - 4)^2(x - 1)^2}$
C) $f'(x) = \dfrac{10x - 40}{(x - 4)^2(x - 1)^2}$
D) $f'(x) = \dfrac{10x^2 - 40}{(x - 4)^2(x - 1)^2}$

Answer: A

339) $f(x) = \dfrac{(x - 9)(x^2 + 3x)}{x^3}$

A) $f'(x) = \dfrac{12}{x^2} - \dfrac{54}{x^3}$
B) $f'(x) = 54 + \dfrac{54}{x}$
C) $f'(x) = x - \dfrac{54}{x^2} - \dfrac{54}{x^3}$
D) $f'(x) = \dfrac{6}{x^2} + \dfrac{54}{x^3}$

Answer: D

340) $f(x) = \left(\dfrac{1 + 2x}{2x}\right)(2 - x)$

A) $f'(x) = \dfrac{1}{x^2} + 1$
B) $f'(x) = x^2 - 1$
C) $f'(x) = \dfrac{1}{x^2} + 2$
D) $f'(x) = -\dfrac{1}{x^2} - 1$

Answer: D



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341) $f(t) = \left(\frac{t^7 + 4}{2t}\right)\left(\frac{t^8 + 6}{t}\right)$

A) $f'(t) = \frac{13}{2}t^{12} + 12t^5 + 15t^4 - \frac{24}{t^3}$

B) $f'(t) = \frac{1}{2}t^{12} + 2t^5 + 3t^4 + \frac{24}{t^3}$

C) $f'(t) = \frac{17}{2}t^{16} + 20t^9 + 27t^8 - \frac{24}{t^3}$

D) $f'(t) = \frac{13}{2}t^{12} - \frac{24}{t^3}$

Answer: A

342) $f(x) = \frac{(3x - 1)(2x^2 + 2)}{4x + 3}$

A) $f'(x) = \frac{24x^3 + 46x^2 + 12x + 26}{(4x + 3)^2}$

B) $f'(x) = \frac{48x^3 + 46x^2 - 12x + 26}{4x + 3}$

C) $f'(x) = \frac{48x^3 + 46x^2 - 12x + 26}{(4x + 3)^2}$

D) $f'(x) = \frac{48x^3 + 54x^2 - 12x + 26}{(4x + 3)^2}$

Answer: C

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

A) $f'(x) = \frac{-2x^2 - 3x + 7}{(7 - x^2)^2}$

B) $f'(x) = \frac{3x^2 + 14x + 21}{(7 - x^2)^2}$

C) $f'(x) = \frac{-3x^2 - 14x + 21}{(7 - x^2)^2}$

D) $f'(x) = \frac{-3x^2 - 14x - 21}{(7 - x^2)^2}$

Answer: B

344) $f(x) = x(x^2 + 2)(x^3 + 6x + 4)$

A) $f'(x) = x(x^2 + 2)(3x^2 + 6) + (x^3 + 6x + 4)$

B) $f'(x) = x(x^2 + 2)(3x^2 + 6) + 2x(x^3 + 6x + 4)$

C) $f'(x) = x(x^2 + 2)(3x^2 + 6) + (x^3 + 6x + 4)(3x^2 + 2)$

D) $f'(x) = x(x^2 + 2)(3x^2 + 6x + 4) + (x^3 + 6x + 4)(3x^2 + 2)$

Answer: C

345) $f(x) = (4x + 5)^2$

A) $f'(x) = 4(4x + 5)$ B) $f'(x) = 8(4x + 5)$ C) $f'(x) = 8(4x + 5)^2$ D) $f'(x) = 2(4x + 5)$

Answer: B



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346) $f(x) = (-9x - 5)^4$

A) $f'(x) = -36(-9x - 5)^3$

B) $f'(x) = -9(-9x - 5)^3$

C) $f'(x) = 4(-9x - 5)^3$

D) $f'(x) = -36(-9x - 5)^4$

Answer: A

347) $f(x) = (3 - 8x)^{250}$

A) $f'(x) = -2000(3 - 8x)^{249}$

B) $f'(x) = 2000(3 - 8x)^{249}$

C) $f'(x) = 250(3 - 8x)^{249}$

D) $f'(x) = -2000(3 - 8x)^{250}$

Answer: A

348) $f(x) = (4x^2 - 8)^4$

A) $f'(x) = 4(4x^2 - 8)^3$

B) $f'(x) = (32x - 8)(4x^2 - 8)^3$

C) $f'(x) = 32(4x^2 - 8)^3$

D) $f'(x) = 32x(4x^2 - 8)^3$

Answer: D

349) $f(x) = \sqrt{1 - 4x}$

A) $f'(x) = -\dfrac{2x}{\sqrt{1 - 4x}}$

B) $f'(x) = -\dfrac{4}{\sqrt{1 - 4x}}$

C) $f'(x) = \dfrac{1}{2\sqrt{1 - 4x}}$

D) $f'(x) = -\dfrac{2}{\sqrt{1 - 4x}}$

Answer: D

350) $f(x) = \sqrt[3]{4x^2 - x}$

A) $f'(x) = \dfrac{8x}{(4x^2 - x)^{2/3}}$

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

C) $f'(x) = \dfrac{8x - 1}{3(4x^2 - x)^{2/3}}$

D) $f'(x) = \dfrac{8x - 1}{3(4x^2 - x)^{1/3}}$

Answer: C

351) $f(x) = \dfrac{1}{5x^2 + 4}$

A) $f'(x) = -\dfrac{1}{(5x^2 + 4)^2}$

B) $f'(x) = -\dfrac{10x + 4}{(5x^2 + 4)^2}$

C) $f'(x) = -\dfrac{10x}{5x^2 + 4}$

D) $f'(x) = -\dfrac{10x}{(5x^2 + 4)^2}$

Answer: D



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352) $f(x) = \dfrac{1}{\sqrt{4x + 8}}$

A) $f'(x) = -\dfrac{1}{2(4x + 8)^{3/2}}$

B) $f'(x) = \dfrac{4}{(4x + 8)^{3/2}}$

C) $f'(x) = -\dfrac{2}{(4x + 8)^{1/2}}$

D) $f'(x) = -\dfrac{2}{(4x + 8)^{3/2}}$

Answer: D

353) $f(x) = \sqrt{11x - x^3}$

A) $f'(x) = \dfrac{1}{2\sqrt{11x - x^3}}$

B) $f'(x) = \dfrac{1}{2\sqrt{11 - 3x^2}}$

C) $f'(x) = \dfrac{-3x^2}{\sqrt{11x - x^3}}$

D) $f'(x) = \dfrac{11 - 3x^2}{2\sqrt{11x - x^3}}$

Answer: D

354) $f(x) = \dfrac{1}{(5x^2 + 9x - 1)^3}$

A) $f'(x) = \dfrac{(10x + 9)}{(5x^2 + 9x - 1)^4}$

B) $f'(x) = -\dfrac{3}{(5x^2 + 9x - 1)^4}$

C) $f'(x) = -\dfrac{3(10x + 9)}{(5x^2 + 9x - 1)^4}$

D) $f'(x) = -\dfrac{3(10x + 9)}{(5x^2 + 9x - 1)^3}$

Answer: C

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

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

B) $f'(x) = \dfrac{x}{\sqrt[3]{x^3 - 8}}$

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

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

Answer: D

356) $f(x) = \sqrt{15x - x^7}$

A) $f'(x) = \dfrac{15 - 7x^6}{2\sqrt{15x - x^7}}$

B) $f'(x) = \dfrac{-7x^6}{\sqrt{15x - x^7}}$

C) $f'(x) = \dfrac{1}{2\sqrt{15 - 7x^6}}$

D) $f'(x) = \dfrac{1}{2\sqrt{15x - x^7}}$

Answer: A



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357) $f(x) = \dfrac{5}{(2x - 3)^4}$

A) $f'(x) = \dfrac{-40}{(2x - 3)^5}$ B) $f'(x) = \dfrac{5}{8(2x - 3)^5}$ C) $f'(x) = \dfrac{5}{4(2x - 3)^3}$ D) $f'(x) = \dfrac{-40}{(2x - 3)^3}$

Answer: A

358) $y = (3x^2 + 5x + 1)^{3/2}$

A) $\dfrac{dy}{dx} = (6x + 5)(3x^2 + 5x + 1)^{1/2}$ B) $\dfrac{dy}{dx} = (3x^2 + 5x + 1)^{1/2}$

C) $\dfrac{dy}{dx} = \dfrac{3}{2}(3x^2 + 5x + 1)^{1/2}$ D) $\dfrac{dy}{dx} = \dfrac{3}{2}(6x + 5)(3x^2 + 5x + 1)^{1/2}$

Answer: D

359) $g(x) = \left(5x^5 - 3x + \dfrac{1}{x^2}\right)^{6/5}$

A) $g'(x) = \dfrac{6}{5}\left(25x^4 - 3 - \dfrac{2}{x^3}\right)^{1/5}$ B) $g'(x) = \dfrac{6}{5}\left(5x^5 - 3x + \dfrac{1}{x^2}\right)^{1/5}$

C) $g'(x) = \dfrac{6}{5}\left(5x^5 - 3x + \dfrac{1}{x^2}\right)^{1/5}\left(25x^4 - 3 - \dfrac{2}{x^3}\right)$ D) $g'(x) = \dfrac{6}{5}\left(5x^5 - 3x + \dfrac{1}{x^2}\right)^{1/5}\left(25x^4 - 3 - \dfrac{2}{x}\right)$

Answer: C

360) $f(x) = \sqrt[3]{x^7 + 5x}$

A) $f'(x) = \dfrac{1}{3}(x^7 + 5x)^{-2/3}(7x^6 + 5)$ B) $f'(x) = \dfrac{1}{3}(7x^6 + 5)^{-2/3}$

C) $f'(x) = \dfrac{1}{3}(x^7 + 5x)^{1/2}(7x^6 + 5)$ D) $f'(x) = \dfrac{1}{3}(x^7 + 5x)^{-2/3}$

Answer: A

361) $f(x) = (3x^5 - 4x^4 + 2)^{304}$

A) $f'(x) = 304(3x^5 - 4x^4 + 2)^{303}(15x^4 - 16x^3)$ B) $f'(x) = 304(15x^4 - 16x^3)^{303}$

C) $f'(x) = 304(3x^5 - 4x^4 + 2)^{303}$ D) $f'(x) = 304(3x^5 - 4x^4 + 2)^{303}(5x^4 - 4x^3)$

Answer: A

362) $f(x) = (4x^2 - 4)^4 - (1 + 4x^3)^5$

A) $f'(x) = 32x(4x^2 - 4)^3 - 12x^2(1 + 4x^3)^4$ B) $f'(x) = (32x - 4)(4x^2 - 4)^3 - (1 + 60x^2)(1 + 4x^3)^4$

C) $f'(x) = 32x(4x^2 - 4)^3 - 60x^2(1 + 4x^3)^4$ D) $f'(x) = 4(4x^2 - 4)^3 - 5(1 + 4x^3)^4$

Answer: C



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363) $f(x) = \sqrt{1 - 14x} + (1 - 7x)^2$

A) $f'(x) = -\frac{7}{\sqrt{1 - 14x}} - 14(1 - 7x)$

B) $f'(x) = -\frac{14}{\sqrt{1 - 14x}} - 7(1 - 7x)$

C) $f'(x) = \frac{7}{\sqrt{1 - 14x}} + 14(1 - 7x)$

D) $f'(x) = \frac{1}{2\sqrt{1 - 14x}} + 2(1 - 7x)$

Answer: A

364) $f(x) = 3x(4x + 3)^3$

A) $f'(x) = 3(4x + 3)^2(16x + 3)$

B) $f'(x) = 3(16x + 3)^2$

C) $f'(x) = 3(4x + 3)^3(7x + 3)$

D) $f'(x) = 3(4x + 3)^2$

Answer: A

365) $f(x) = \left(\frac{4x + 5}{x - 3}\right)^5$

A) $f'(x) = \left(\frac{4x + 5}{x - 3}\right)^4$

B) $f'(x) = \left(\frac{-85}{(x - 3)^2}\right)^4$

C) $f'(x) = \frac{-85(4x + 5)^4}{(x - 3)^2(x - 3)^4}$

D) $f'(x) = \frac{17(4x + 5)^4}{(x - 3)^2(x - 3)^4}$

Answer: C

366) $y = (x + 1)^2(x^2 + 1)^{-3}$

A) $\frac{dy}{dx} = -2(x + 1)(x^2 + 1)^{-4}(2x^2 + 3x - 1)$

B) $\frac{dy}{dx} = 2(x + 1)(x^2 + 1)^{-4}(2x^2 - 3x - 1)$

C) $\frac{dy}{dx} = 2(x + 1)(x^2 + 1)^{-4}(2x^2 + 3x - 1)$

D) $\frac{dy}{dx} = -2(x + 1)(x^2 + 1)^{-4}(2x^2 - 3x - 1)$

Answer: A

367) $y = (2x - 1)^3(x + 7)^{-3}$

A) $\frac{dy}{dx} = 45(2x - 1)^3(x + 7)^{-2}$

B) $\frac{dy}{dx} = 45(2x - 1)^2(x + 7)^{-3}$

C) $\frac{dy}{dx} = 45(2x - 1)^3(x + 7)^{-4}$

D) $\frac{dy}{dx} = 45(2x - 1)^2(x + 7)^{-4}$

Answer: D

368) $y = x\sqrt{x^2 + 1}$

A) $\frac{dy}{dx} = \frac{\sqrt{x^2 + 1}}{x^2 + 1}$

B) $\frac{dy}{dx} = \frac{\sqrt{x^2 + 1}}{2x^2 + 1}$

C) $\frac{dy}{dx} = \frac{2x^2 + 1}{\sqrt{x^2 + 1}}$

D) $\frac{dy}{dx} = \frac{x^2 + 1}{\sqrt{x^2 + 1}}$

Answer: C



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369) $y = \dfrac{\sqrt[3]{x^2 + 3}}{x}$

A) $\dfrac{dy}{dx} = \dfrac{x^2 + 9}{3x^2(x^2 + 3)^{2/3}}$

B) $\dfrac{dy}{dx} = \dfrac{-3}{x^2(x^2 + 3)^{2/3}}$

C) $\dfrac{dy}{dx} = \dfrac{-x^2 - 9}{3x^2(x^2 + 3)^{2/3}}$

D) $\dfrac{dy}{dx} = \dfrac{3}{x^2(x^2 + 3)^{2/3}}$

Answer: C

370) $y = \dfrac{1}{5}(9x + 12)^3 + \left(1 - \dfrac{1}{x^3}\right)^{-1}$

A) $\dfrac{dy}{dx} = \dfrac{3}{5}(9x + 12)^2 - \left(1 - \dfrac{1}{x^3}\right)^{-2}$

B) $\dfrac{dy}{dx} = \dfrac{27}{5}(9x + 12)^2 - \dfrac{3}{x^4}\left(1 - \dfrac{1}{x^3}\right)^{-2}$

C) $\dfrac{dy}{dx} = \dfrac{3}{5}(9x)^2 - \left(\dfrac{3}{x^4}\right)^{-2}$

D) $\dfrac{dy}{dx} = \dfrac{9}{5}(9x + 12)^2 + \dfrac{3}{x^4}\left(1 - \dfrac{1}{x^3}\right)^{-2}$

Answer: B

371) $h(z) = \sqrt[5]{\dfrac{7z + 2}{-8z + 1}}$

A) $h'(z) = \dfrac{23(7z + 2)^{-4/5}}{5(1 - 8z)^2(1 - 8z)^{-4/5}}$

B) $h'(z) = -\dfrac{7(7z + 2)^{-4/5}}{40(1 - 8z)^{-4/5}}$

C) $h'(z) = \dfrac{(7z + 2)^{-4/5}}{5(1 - 8z)^{-4/5}}$

D) $h'(z) = \dfrac{23(7z + 2)^{-4/5}}{(1 - 8z)^2(1 - 8z)^{-4/5}}$

Answer: A

**Find an expression for dy/dx.**

372) $y = u^2$ and $u = 5x - 1$

A) $10x - 5$ B) $50x - 10$ C) $25x - 5$ D) $50x$

Answer: B

373) $y = \dfrac{4}{u^2}$ and $u = 7x - 5$

A) $-\dfrac{56}{7x - 5}$ B) $-\dfrac{28}{7x - 5}$ C) $\dfrac{56x}{7x - 5}$ D) $-\dfrac{56}{(7x - 5)^3}$

Answer: D

374) $y = u(u - 1)$ and $u = x^2 + x$

A) $4x^3 + 6x^2 - 2x$ B) $2x^2 + 4x + 1$ C) $4x^3 + 6x^2 - 1$ D) $2x^2 + 4x$

Answer: C



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375) $y = u^{-3/4}$ and $u = x^2 + 5x + 6$

A) $\dfrac{-3(2x + 5)}{4(x^2 + 5x + 6)^{-1/4}}$

B) $\dfrac{-3}{4(x^2 + 5x + 6)^{7/4}}$

C) $\dfrac{-3}{4(2x + 5)(x^2 + 5x + 6)^{3/4}}$

D) $\dfrac{-3(2x + 5)}{4(x^2 + 5x + 6)^{7/4}}$

Answer: D

376) $y = (u + 3)(u - 3)$ and $u = x^2 + 6$

A) $2(x^2 + 6) + 2x$ B) $2(x^2 + 6)$ C) $4x(x^2 + 6)^2$ D) $4x(x^2 + 6)$

Answer: D

377) $y = \dfrac{u + 5}{u - 5}$ and $u = \sqrt{x} + 9$

A) $\dfrac{-10}{\sqrt{x}(\sqrt{x} + 4)^2}$ B) $\dfrac{10}{\sqrt{x}(\sqrt{x} + 4)^2}$ C) $\dfrac{-5}{\sqrt{x}(\sqrt{x} + 4)^2}$ D) $\dfrac{5}{(\sqrt{x} + 4)^2}$

Answer: C

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

378) $y = \sqrt{x^2 + 1}$ at the point $(-2, \sqrt{5})$

A) $y = \dfrac{-2}{\sqrt{5}}(x + 2) + \sqrt{5}$

B) $y = \dfrac{1}{2\sqrt{5}}(x + 2) + \sqrt{5}$

C) $y = -\dfrac{1}{2\sqrt{5}}(x + 2) + \sqrt{5}$

D) $y = 2\sqrt{5}(x + 2) - \sqrt{5}$

Answer: A

379) $y = \dfrac{(x^3 - 3x)^2}{(3x - 7)^2}$ at the point (2, 4)

A) $y = 60(x - 2) + 4$ B) $y = -60(x - 2) + 4$ C) $y = -12(x - 2) + 4$ D) $y = 12(x - 2) + 4$

Answer: A

380) $y = (x^2 + 28)^{4/5}$ at $x = 2$

A) $y = \dfrac{4}{5}x + \dfrac{64}{5}$ B) $y = \dfrac{8}{5}x$ C) $y = \dfrac{8}{5}x + \dfrac{96}{5}$ D) $y = \dfrac{8}{5}x + \dfrac{64}{5}$

Answer: D

381) $y = x^3\sqrt{x^3 + 3}$ at $x = 1$

A) $y = \dfrac{35}{6}x + \dfrac{20}{3}$ B) $y = \dfrac{27}{4}x - \dfrac{13}{4}$ C) $y = \dfrac{27}{4}x - \dfrac{19}{4}$ D) $y = \dfrac{35}{6}x - \dfrac{20}{3}$

Answer: C



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**Find functions f(x) and g(x) such that h(x) = (f ∘ g)(x).**

382) $h(x) = \dfrac{1}{x^2 - 2}$

A) $f(x) = \dfrac{1}{x}$, $g(x) = x^2 - 2$

B) $f(x) = \dfrac{1}{x^2}$, $g(x) = x - 2$

C) $f(x) = \dfrac{1}{x^2}$, $g(x) = -\dfrac{1}{2}$

D) $f(x) = \dfrac{1}{2}$, $g(x) = x^2 - 2$

Answer: A

383) $h(x) = \dfrac{8}{x^2} + 1$

A) $f(x) = \dfrac{8}{x^2}$, $g(x) = 1$

B) $f(x) = \dfrac{1}{x}$, $g(x) = \dfrac{8}{x} + 1$

C) $f(x) = x$, $g(x) = \dfrac{8}{x} + 1$

D) $f(x) = x + 1$, $g(x) = \dfrac{8}{x^2}$

Answer: D

384) $h(x) = \dfrac{10}{\sqrt{2x + 1}}$

A) $f(x) = 10$, $g(x) = \sqrt{2 + 1}$

B) $f(x) = \dfrac{10}{x}$, $g(x) = 2x + 1$

C) $f(x) = \sqrt{2x + 1}$, $g(x) = 10$

D) $f(x) = \dfrac{10}{\sqrt{x}}$, $g(x) = 2x + 1$

Answer: D

385) $h(x) = (-7x - 5)^4$

A) $f(x) = (-7x)^4$, $g(x) = -5$

B) $f(x) = -7x^4$, $g(x) = x - 5$

C) $f(x) = -7x - 5$, $g(x) = x^4$

D) $f(x) = x^4$, $g(x) = -7x - 5$

Answer: D

386) $h(x) = \sqrt{10 + 6x^2}$

A) $f(x) = \sqrt{x}$, $g(x) = 10 + 6x^2$

B) $f(x) = 10 + 6x^2$, $g(x) = \sqrt{x}$

C) $f(x) = \sqrt[4]{10 + 6x^2}$, $g(x) = \sqrt[4]{10 + 6x^2}$

D) $f(x) = \sqrt{10 + 6x}$, $g(x) = x$

Answer: A

387) $h(x) = (x^{1/2} + 2)^3 + 3(x^{1/2} + 2)^2 - 5$

A) $f(x) = (x + 2)^3 + 3x^2 - 5$, $g(x) = x^{1/2}$

B) $f(x) = x^3 + 3x^2 - 5$, $g(x) = x^{1/2} + 2$

C) $f(x) = (x + 2)^3 + 3(x + 2)^2 - 5$, $g(x) = x^{1/2} + 2$

D) $f(x) = x^{1/2} + 2$, $g(x) = x^3 + 3x^2 - 5$

Answer: B



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388) $h(x) = \dfrac{6}{(3x^2 - 6x + 1)^3}$

A) $f(x) = x^{-3}$, $g(x) = 3x^2 - 6x + 1$

B) $f(x) = \dfrac{1}{x}$, $g(x) = (3x^2 - 6x + 1)^3$

C) $f(x) = \dfrac{6}{x}$, $g(x) = (3x^2 - 6x + 1)^3$

D) $f(x) = 6x^{-3}$, $g(x) = 3x^2 - 6x + 1$

Answer: D

**Find (f ∘ g)(x) and (g ∘ f)(x).**

389) $f(x) = 5x + 9$; $g(x) = 4x - 7$

A) $(f \circ g)(x) = 20x + 26$
$(g \circ f)(x) = 20x - 29$

B) $(f \circ g)(x) = 20x - 26$
$(g \circ f)(x) = 20x + 29$

C) $(f \circ g)(x) = 20x - 29$
$(g \circ f)(x) = 20x + 26$

D) $(f \circ g)(x) = 20x + 29$
$(g \circ f)(x) = 20x - 26$

Answer: B

390) $f(x) = 2x + 11$; $g(x) = 11x + 2$

A) $(f \circ g)(x) = 22x + 123$
$(g \circ f)(x) = 22x + 123$

B) $(f \circ g)(x) = 22x + 15$
$(g \circ f)(x) = 22x + 123$

C) $(f \circ g)(x) = 22x + 123$
$(g \circ f)(x) = 22x + 15$

D) $(f \circ g)(x) = 22x + 15$
$(g \circ f)(x) = 22x + 15$

Answer: B

391) $f(x) = 5x^3 + 8$; $g(x) = 2x$

A) $(f \circ g)(x) = 10x^3 + 8$
$(g \circ f)(x) = 40x^3 + 16$

B) $(f \circ g)(x) = 10x^3 + 16$
$(g \circ f)(x) = 40x^3 + 8$

C) $(f \circ g)(x) = 40x^3 + 16$
$(g \circ f)(x) = 10x^3 + 8$

D) $(f \circ g)(x) = 40x^3 + 8$
$(g \circ f)(x) = 10x^3 + 16$

Answer: D

392) $f(x) = \dfrac{2}{x}$; $g(x) = 2x^3$

A) $(f \circ g)(x) = \dfrac{4}{x^3}$
$(g \circ f)(x) = \dfrac{1}{x^3}$

B) $(f \circ g)(x) = \dfrac{1}{x^3}$
$(g \circ f)(x) = \dfrac{4}{x^3}$

C) $(f \circ g)(x) = \dfrac{16}{x^3}$
$(g \circ f)(x) = \dfrac{1}{x^3}$

D) $(f \circ g)(x) = \dfrac{1}{x^3}$
$(g \circ f)(x) = \dfrac{16}{x^3}$

Answer: D



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393) $f(x) = \frac{7}{x^4}$; $g(x) = 2x^3$

A) $(f \circ g)(x) = \frac{686}{7x^{12}}$
$(g \circ f)(x) = \frac{16}{x^{12}}$

B) $(f \circ g)(x) = \frac{7x^{12}}{16}$
$(g \circ f)(x) = \frac{x^{12}}{686}$

C) $(f \circ g)(x) = \frac{7}{16x^{12}}$
$(g \circ f)(x) = \frac{686}{x^{12}}$

D) $(f \circ g)(x) = \frac{7x^{12}}{686}$
$(g \circ f)(x) = \frac{x^{12}}{16}$

Answer: C

394) $f(x) = \sqrt{x + 5}$; $g(x) = 4x - 1$

A) $(f \circ g)(x) = \sqrt{4x^2 + 1}$
$(g \circ f)(x) = \sqrt{4x^2 - 5}$

B) $(f \circ g)(x) = \sqrt{4x^2 - 5}$
$(g \circ f)(x) = \sqrt{4x^2 - 5}$

C) $(f \circ g)(x) = 2\sqrt{x + 1}$
$(g \circ f)(x) = 4\sqrt{x + 5} - 1$

D) $(f \circ g)(x) = 2\sqrt{x + 5}$
$(g \circ f)(x) = 4\sqrt{x + 1} - 1$

Answer: C

395) $f(x) = \frac{1}{x - 5}$; $g(x) = x + 5$

A) $(f \circ g)(x) = x - 5$
$(g \circ f)(x) = \frac{1}{x - 5}$

B) $(f \circ g)(x) = \frac{1}{x - 5}$
$(g \circ f)(x) = x - 5$

C) $(f \circ g)(x) = \frac{1}{x}$
$(g \circ f)(x) = \frac{5x - 24}{x - 5}$

D) $(f \circ g)(x) = \frac{5x - 24}{x - 5}$
$(g \circ f)(x) = \frac{1}{x}$

Answer: C

396) $f(x) = 5x^2$; $g(x) = x + 3$

A) $(f \circ g)(x) = 5x^2 + 3$
$(g \circ f)(x) = 5x^2 + 30x + 49$

B) $(f \circ g)(x) = 5x^2 + 45$
$(g \circ f)(x) = 5x^2 + 30x + 3$

C) $(f \circ g)(x) = 5x^2 + 30x + 3$
$(g \circ f)(x) = 5x^2 + 45$

D) $(f \circ g)(x) = 5x^2 + 30x + 45$
$(g \circ f)(x) = 5x^2 + 3$

Answer: D

397) $f(x) = x^2 + 2x + 3$; $g(x) = x - 4$

A) $(f \circ g)(x) = x^2 + 2x - 1$
$(g \circ f)(x) = x^2 + 6x + 11$

B) $(f \circ g)(x) = x^2 + 6x + 11$
$(g \circ f)(x) = x^2 + 2x - 1$

C) $(f \circ g)(x) = x^2 - 6x + 11$
$(g \circ f)(x) = x^2 + 2x - 1$

D) $(f \circ g)(x) = x^2 + 2x - 1$
$(g \circ f)(x) = x^2 - 6x + 11$

Answer: C



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**Calculate the requested derivative from the given information.**

398) Given $f(u) = u^2$ and $g(x) = u = x^5 + 2$, find $(f \circ g)'(1)$.

A) –30 B) 15 C) 6 D) 30

Answer: D

399) Given $f(u) = \frac{u - 1}{u + 1}$, $g(x) = u = \sqrt{x}$, find $(f \circ g)'(25)$.

A) $\frac{1}{36}$ B) $\frac{1}{180}$ C) $\frac{2}{36}$ D) $\frac{2}{180}$

Answer: B

400) Given $f(u) = \sqrt[3]{u}$ and $g(x) = u = 1 + 2x^3$, find $(f \circ g)'(0)$.

A) 0 B) $\frac{2}{3}$ C) –2 D) $\frac{2}{\sqrt[3]{9}}$

Answer: A

401) Given $f(u) = u^3$ and $g(x) = u = \frac{x + 4}{x - 2}$, find $(f \circ g)'(1)$.

A) – 75 B) 450 C) 75 D) – 450

Answer: D

402) Given $f(u) = \frac{1}{u}$ and $g(x) = u = 4x - x^2$, find $(f \circ g)'(1)$.

A) $-\frac{1}{2}$ B) $\frac{2}{9}$ C) $-\frac{2}{9}$ D) $\frac{1}{2}$

Answer: C

403) Given $f(u) = \frac{u}{u^2 - 1}$ and $u = g(x) = 9x^2 + x + 2$, find $(f \circ g)'(0)$.

A) $\frac{1}{3}$ B) $\frac{11}{9}$ C) $\frac{5}{9}$ D) $-\frac{5}{9}$

Answer: D

**Use the Chain Rule to differentiate the function. You may need to apply the rule more than once.**

404) $f(x) = (4x^3 - (8x + 9)^2)^7$

A) $f'(x) = 7[4x^3 - (8x + 9)^2]^6[12x^2 - 16(8x + 9)]$ B) $f'(x) = 7[4x^3 - (8x + 9)^2]^7[12x^1 - 2(8x + 9)]$

C) $f'(x) = 7[4x^3 - (8x + 9)^2]^7[12x^1 - 16(8x + 9)]$ D) $f'(x) = 7[4x^3 - (8x + 9)^2]^6[12x^2 - 2(8x + 9)]$

Answer: A



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405) $f(x) = (-x^7 - 9x - \sqrt{1-2x})^5$

A) $f'(x) = 5(-x^7 - 9x - \sqrt{1-2x})^4\left(-7x^6 - 9 + \frac{1}{\sqrt{1-2x}}\right)$

B) $f'(x) = -5(x^7 - 9x - \sqrt{1-2x})^4)(7x^6 - 9 - \sqrt{1-2x})$

C) $f'(x) = 5(-x^7 - 9x - \sqrt{1-2x})^4\left(-7x^6 - 9 + \frac{1}{2\sqrt{1-2x}}\right)$

D) $f'(x) = -5(x^7 - 9x - \sqrt{1-2x})^4\left(7x^6 - 9 - \frac{1}{2}\sqrt{1-2x}\right)$

Answer: A

406) $f(x) = \sqrt{x^2 - \sqrt{1+7x}}$

A) $f'(x) = \left(\frac{1}{2\sqrt{x^2 - \sqrt{1+7x}}}\right)\left(2x - \frac{7}{2\sqrt{1+7x}}\right)$

B) $f'(x) = \left(\frac{2}{\sqrt{2x^2 - \sqrt{1+7x}}}\right)\left(x - \frac{7}{2\sqrt{1+7x}}\right)$

C) $f'(x) = \left(\frac{1}{\sqrt{x^2 - \sqrt{1+7x}}}\right)\left(2x - \frac{7}{\sqrt{1+7x}}\right)$

D) $f'(x) = \left(\frac{2}{\sqrt{x^2 - \sqrt{1+7x}}}\right)\left(x - \frac{7}{\sqrt{1+7x}}\right)$

Answer: A

407) $f(x) = \sqrt[4]{8x - (x^2 - x + 8)^5}$

A) $f'(x) = \frac{1}{4}(8x - (x^2 - x + 8)^5)^{3/4}[8 - 5(x^2 - x + 8)^4(2x - 1)]$

B) $f'(x) = \frac{1}{4}(8x - (x^2 - x + 8)^5)^{-3/4}[8 - 5(x^2 - x + 8)^4(2x - 1)]$

C) $f'(x) = \frac{1}{4}(8x - (x^2 - x + 8)^5)^{3/4}[8 - 5(x^2 - x + 8)^4]$

D) $f'(x) = \frac{1}{4}(8x - (x^2 - x + 8)^5)^{-3/4}[8 - 5(x^2 - x + 8)^4]$

Answer: B

**Solve the problem.**

408) $1200 is deposited in an account with an interest rate of r% per year, compounded monthly. At the end of 8 years, the balance in the account is given by $A = 1200\left(1 + \frac{r}{1200}\right)^{96}$. Find the rate of change of A with respect to r when r = 6. Round answer to the nearest hundredth, if necessary.

A) $\frac{dA}{dr} = 154.96$ B) $\frac{dA}{dr} = 96.48$ C) $\frac{dA}{dr} = 154.19$ D) $\frac{dA}{dr} = 96.96$

Answer: C



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409) If \$5000 is invested at interest rate i, compounded quarterly, it will grow in 5 years to an amount A, in dollars, given by $A = 5000\left(1 + \frac{i}{4}\right)^{20}$. Find the rate of change, $\frac{dA}{di}$.

A) $\frac{dA}{di} = 25{,}000\left(1 + \frac{i}{4}\right)^{20}$

B) $\frac{dA}{di} = 100{,}000\left(1 + \frac{i}{4}\right)^{19}$

C) $\frac{dA}{di} = 100{,}000\left(1 + \frac{i}{4}\right)^{20}$

D) $\frac{dA}{di} = 25{,}000\left(1 + \frac{i}{4}\right)^{19}$

Answer: D

410) The formula $E = 1000(100 - T) + 580(100 - T)^2$ is used to approximate the elevation (in meters) above sea level at which water boils at a temperature of T (in degrees Celsius). Find the rate of change of E with respect to T for a temperature of 85°C.

A) –18,400 m/°C B) –67,700 m/°C C) 18,400 m/°C D) –17,400 m/°C

Answer: A

411) The concentration of a certain drug in the bloodstream t minutes after swallowing a pill containing the drug can be approximated using the equation $C(t) = \frac{1}{9}(4t + 1)^{-1/2}$, where C(t) is the concentration in arbitrary units and t is in minutes. Find the rate of change of concentration with respect to time at t = 12 minutes.

A) $-\frac{1}{6174}$ units/min B) $-\frac{1}{63}$ units/min C) $-\frac{2}{63}$ units/min D) $-\frac{2}{3087}$ units/min

Answer: D

412) The dosage for Carboplatin Chemotherapy drugs depends on several parameters of the drug as well as the age, weight, and sex of the patient. For a male patient, the formulas giving the dosage for a certain drug are:

$$D = A(c + 25)$$

and

$$c = \frac{(140 - y)w}{72x},$$

where A and x depend on which drug is used, D is the dosage in milligrams (mg), c is called the creatine clearance, y is the patient's age in years, and w is the patient's weight in kg. For a 50 year old man, find an expression for $\frac{dD}{dw}$ in terms of A and x.

A) $\frac{dD}{dw} = \frac{5A}{4x}$ B) $\frac{dD}{dw} = \frac{5A}{4x} + 25A$ C) $\frac{dD}{dw} = \frac{5}{4x}$ D) $\frac{dD}{dw} = \frac{5Aw}{4x}$

Answer: A

413) A circular oil slick spreads so that as its radius changes, its area changes. Both the radius r and the area A change with respect to time. If dr/dt is found to be 2.0 m/hr, find dA/dt when r = 37.8 m. Hint: $A(r) = \pi r^2$, and, using the Chain Rule, $\frac{dA}{dt} = \frac{dA}{dr} \cdot \frac{dr}{dt}$.

A) $37.8\pi$ m$^2$/hr B) $302.4\pi$ m$^2$/hr C) $75.6\pi$ m$^2$/hr D) $151.2\pi$ m$^2$/hr

Answer: D



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**Differentiate.**

414) $y = \sqrt{(9x + 6)^7 - 6}$

A) $\frac{7(9x + 6)^6}{2\sqrt{(9x + 6)^7 - 6}}$ B) $\frac{63(9x + 6)^6}{\sqrt{(9x + 6)^7 - 6}}$ C) $\frac{7(9x + 6)^6}{\sqrt{(9x + 6)^7 - 6}}$ D) $\frac{63(9x + 6)^6}{2\sqrt{(9x + 6)^7 - 6}}$

Answer: D

415) $y = \sqrt[4]{x^4 - 8x - 1} \cdot x^4$

A) $\frac{20x^9 - 136x^3 - 16x^4}{4(x^4 - 8x - 1)^{3/4}}$ B) $\frac{20x^8 - 136x^3 - 16x^2}{4(x^4 - 8x - 1)^{1/4}}$

C) $\frac{20x^7 - 136x^4 - 16x^3}{4(x^4 - 8x - 1)^{3/4}}$ D) $\frac{20x^7 - 144x^4 - 20x^3}{4(x^4 - 8x - 1)^{1/4}}$

Answer: C

416) $y = \left(\frac{x}{\sqrt{4 - x}}\right)^3$

A) $\frac{-3x^2(8 + x)}{2(4 - x)^{5/2}}$ B) $\frac{3x^2(8 + x)}{(4 - x)^{5/2}}$ C) $\frac{-3x^2(8 - x)}{2(4 - x)^{5/2}}$ D) $\frac{3x^2(8 - x)}{2(4 - x)^{5/2}}$

Answer: D

417) $y = \left(\frac{x^2 + x + 1}{x^2 - 1}\right)^5$

A) $\frac{5(x^2 + x + 1)^4(x^2 - 4x + 1)}{(x^2 - 1)^6}$ B) $\frac{5(x^2 + x + 1)^4(x^2 + 4x - 1)}{(x^2 - 1)^7}$

C) $\frac{5(x^2 + x + 1)^4(-x^2 + 4x - 1)}{(x^2 - 1)^7}$ D) $\frac{5(x^2 + x + 1)^4(-x^2 - 4x - 1)}{(x^2 - 1)^6}$

Answer: D

418) $F(t) = [7t(t + 9)^4 - 1]^3$

A) $3[7t(t + 9)^4 - 1](t + 9)^3(4t + 9)$ B) $42[7t(t + 9)^4 - 1](t + 9)^3(6t + 9)$

C) $21[7t(t + 9)^4 - 1](t + 9)^3(5t + 9)$ D) $21[7t(t + 9)^4 - 1](t + 9)^3(4t - 9)$

Answer: C

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

419) $y = 4x - 2$

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

Answer: A



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420) $y = 6x^2 + 6x - 7$

A) $12x + 6$ B) 12 C) 6 D) 0

Answer: B

421) $y = 5x^4 - 6x^2 + 4$

A) $20x^2 - 12x$ B) $20x^2 - 12$ C) $60x^2 - 12$ D) $60x^2 - 12x$

Answer: C

422) $y = 2x^{3/2} - 6x^{1/2}$

A) $3x^{1/2} - 3x^{-1/2}$ B) $3x^{-1/2} + 3x^{-3/2}$

C) $1.5x^{1/2} + 1.5x^{-1/2}$ D) $1.5x^{-1/2} + 1.5x^{-3/2}$

Answer: D

423) $y = \dfrac{1}{x^2 - 1}$

A) $\dfrac{6x^2 + 2}{(x^2 - 1)^3}$ B) $\dfrac{6x^2 + 2}{(x^2 - 1)^4}$ C) $\dfrac{6x^2 - 2}{(x^2 - 1)^3}$ D) $\dfrac{6x^2 - 2}{(x^2 - 1)^4}$

Answer: A

424) $y = x^2 + \sqrt{x}$

A) $\dfrac{2x^{3/2} + 1}{x^{3/2}}$ B) $\dfrac{8x^{3/2} - 1}{4x^{3/2}}$ C) $\dfrac{2x^{3/2} - 1}{x^{3/2}}$ D) $\dfrac{8x^{3/2} + 1}{4x^{3/2}}$

Answer: B

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

A) $-\dfrac{10}{4(3x - 7)^{3/2}}$ B) $\dfrac{10}{4(3x - 7)^{3/2}}$ C) $-\dfrac{9}{4(3x - 7)^{3/2}}$ D) $\dfrac{9}{4(3x - 7)^{3/2}}$

Answer: C

426) $y = (4x + 5)^3$

A) $12x + 15$ B) $4x + 5$ C) $384x + 480$ D) $24x + 30$

Answer: C

427) $y = \dfrac{x}{x + 1}$

A) $(x + 1)^{-3}$ B) $(x + 1)^{-2}$ C) $-2(x + 1)^{-2}$ D) $-2(x + 1)^{-3}$

Answer: D

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

A) $40(x^2 + 7x)^{39}(2x + 7)$ B) $1560(x^2 + 7x)^{38}$

C) $40(x^2 + 7x)^{38}(2x^2 + 92x + 273)$ D) $40(x^2 + 7x)^{38}(158x^2 + 1106x + 1911)$

Answer: D



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

429) $\frac{d^3y}{dx^3}$ of $y = 2x^3 + 2x^2 - 5x$

A) 6 B) $12x + 6$ C) $6x + 12$ D) 12

Answer: D

430) $\frac{d^4y}{dx^4}$ of $y = 5x^5 - 2x^2 - 4x + 1$

A) $300x$ B) $600x$ C) $400x^2 + 4$ D) $400x + 4$

Answer: B

431) $\frac{d^4y}{dx^4}$ of $y = 7x^6 - 5x^4 + 4x^2$

A) $1680x^2 - 60x$ B) $1680x^2 - 60$ C) $2520x^2 - 120$ D) $2520x^2 - 120x$

Answer: C

432) $\frac{d^3y}{dx^3}$ of $y = \frac{1}{x + 1}$

A) $-6(x + 1)^{-3}$ B) $6(x + 1)^{-4}$ C) $-6(x + 1)^{-4}$ D) $6(x + 1)^{-3}$

Answer: C

433) $\frac{d^4y}{dx^4}$ of $y = \sqrt{x + 2}$

A) $\frac{15}{16(x + 2)^{7/2}}$ B) $\frac{15}{16(x + 2)^{5/2}}$ C) $-\frac{15}{16(x + 2)^{7/2}}$ D) $-\frac{15}{16(x + 2)^{5/2}}$

Answer: C

434) $\frac{d^3y}{dx^3}$ of $y = \frac{x}{x + 1}$

A) $6(x + 1)^{-3}$ B) $6(x + 1)^{-4}$ C) $-6(x + 1)^{-3}$ D) $-6(x + 1)^{-4}$

Answer: B

435) $\frac{d^4y}{dx^4}$ of $y = \sqrt[3]{x}$

A) $-\frac{81}{80x^{11/3}}$ B) $\frac{80}{81x^{11/3}}$ C) $\frac{81}{80x^{11/3}}$ D) $-\frac{80}{81x^{11/3}}$

Answer: D



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436) $\frac{d^5y}{dx^5}$ of $y = 2x^6 - 3x^4 + 5x^2 - 2$

A) 1440 B) $720x^2 - 72$ C) $1440x$ D) 0

Answer: C

437) $\frac{d^6y}{dx^6}$ of $y = 4x^7 + 2x^5 - 4x^3 - 4$

A) $10{,}080x^2 + 240$ B) 0 C) $20{,}160x$ D) 20,160

Answer: C

**Solve the problem.**

438) If s is a distance given by $s(t) = t^2 + 4t + 10$, find the acceleration, a(t).

A) $a(t) = 2t + 4$ B) $a(t) = 10$ C) $a(t) = 2$ D) $a(t) = 2t$

Answer: C

439) If s is a distance given by $s(t) = 9t^3 + t + 4$, find the acceleration, a(t).

A) $a(t) = 27t$ B) $a(t) = 54t$ C) $a(t) = 3t^2 + 1$ D) $a(t) = 27t^2 + 1$

Answer: B

440) If s is a distance given by $s(t) = 5t^3 + 8t^2 + 4t$ , find the acceleration, a(t).

A) $a(t) = 15t^2 + 16t$ B) $a(t) = 46t + 4$ C) $a(t) = 30t + 16$ D) $a(t) = 30t$

Answer: C

441) If s is a distance given by $s(t) = 3t^4 + 9t^3 + 4t$ , find the acceleration, a(t).

A) $a(t) = 12t^2 + 27t$ B) $a(t) = 36t + 54$

C) $a(t) = 36t^2 + 54t$ D) $a(t) = 12t^3 + 27t^2 + 4$

Answer: C

442) If s is a distance given by $s(t) = 2t^4 + 3t^2 + 2t$, find the acceleration, a(t).

A) $a(t) = 24t^2 + 6$ B) $a(t) = 8t^3 + 6t + 2$ C) $a(t) = 8t^2 + 6t + 2$ D) $a(t) = 24t + 6$

Answer: A

443) A population grows from an initial size of 100,000 people to an amount P(t), given by $P(t) = 100{,}000(1 + 0.9t + t^2)$, where t is measured in years from 1987. How rapidly is the growth rate of the population increasing t years from 1987?

A) 200,000 people per year$^2$ B) $90{,}000t + 200{,}000$ people per year$^2$

C) $(200{,}000t + 90{,}000)$ people per year$^2$ D) 100,000 people per year$^2$

Answer: A

444) A population grows from an initial size of 10 people to an amount P(t), given by $P(t) = 10(4 + 0.5t + t^3)$, where t is measured in years from 1996. Find the acceleration in the population t years from 1996.

A) 60t people per year$^2$ B) $(5 + 30t^2)$ people per year$^2$

C) 60 people per year$^2$ D) 30t people per year$^2$

Answer: A



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445) A population grows from an initial size of 2 people to an amount P(t), given by $P(t) = 2(1 + 2t + t^3)$, where t is measured in years from 1993. Find the acceleration in the population t years from 1993.

A) 3t people per year$^2$ B) $(4 + 3t^2)$ people per year$^2$

C) $(4 + 6t^2)$ people per year$^2$ D) 12t people per year$^2$

Answer: D

446) A population grows from an initial size of 0.2 people to an amount P(t), given by $P(t) = 0.2(2 + 0.4t + t^3)$, where t is measured in years from 1991. How rapidly is the growth rate of the population increasing t years from 1991?

A) 1.2 B) 1.2t C) 0.08 + 0.6t D) $0.08 + 0.6t^2$

Answer: B

447) For a motorcycle traveling at speed v (in mph) when the brakes are applied, the distance d (in feet) required to stop the motorcycle may be approximated by the formula $d = 0.05\ v^2 + v$. Find the instantaneous rate of change of distance with respect to velocity when the speed is 42 mph.

A) 43 mph B) 10.4 mph C) 4.2 mph D) 5.2 mph

Answer: D

**Provide an appropriate response.**

448) What information does the difference quotient, $\frac{f(x + h) - f(x)}{h}$, provide about the differentiable function f(x)?

A) The limit of f(x) as x approaches h.
B) The slope of the line tangent to f(x) at the point (x, f(x)).
C) The average rate of change of f(x) over the interval [x, x + h].
D) The instantaneous rate of change of f(x) as a function of x.

Answer: C

449) What is the difference between the information provided by a secant line and the information provided by a tangent line?

A) The slope of a secant line is the instantaneous rate of change of a function at a point, whereas the slope of a tangent line is the average rate of change of a function over an interval.
B) The slope of a secant line is the average rate of change of a function over an interval, whereas the slope of a tangent line is the instantaneous rate of change of a function at a point.
C) The slope of a secant line drawn for a function f(x) is the average value of f(x) over an interval, whereas the slope of a tangent line is the instantaneous value of f(x) at a point.
D) A secant line touches the graph of a function just once, but a tangent line generally touches the curve twice.

Answer: B



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450) What is the derivative of a function f(x)?

A) The derivative of the function f(x) is a function, usually denoted f'(x), whose output f'(a) is the instantaneous rate of change of f(x) at the point (a, f(a)), where a is any value of x in the domain for f(x) where f'(x) exists.

B) The derivative of the function f(x) is a function, usually denoted f'(x), whose output f'(a) is the average value of f(x) at the point (a, f(a)), where a is any value of x in the domain for f(x) where f'(x) exists.

C) The derivative of the function f(x) is a function, usually denoted f'(x), whose output f'(a) is the average rate of change of f(x) at the point (a, f(a)), where a is any value of x in the domain for f(x) where f'(x) exists.

D) The derivative of the function f(x) is a function, usually denoted f'(x), whose output f'(a) is the instantaneous value of f(x) at the point (a, f(a)), where a is any value of x in the domain for f(x) where f'(x) exists.

Answer: A

451) Is it true that a function must be continuous at a point in order to have a derivative at that point? If a function is continuous at a point, must it have a derivative at that point?

A) Yes; yes B) No; no C) Yes; no D) No; yes

Answer: C

452) What are four ways that a function may fail to be differentiable at a point?

A) The function is not defined at the point; the function is discontinuous at the point; the function has a peak or a valley at the point; the function has a vertical tangent at the point.

B) The function is not defined at the point; the function is discontinuous at the point; the function has a limit at the point; the function has a vertical tangent at the point.

C) The function is not defined at the point; the function is discontinuous at the point; the function has a corner or similar sharp change in direction at the point; the function has a vertical tangent at the point.

D) The function is not defined at the point; the function is discontinuous at the point; the function has a corner or similar sharp change in direction at the point; the function has a horizontal tangent at the point.

Answer: C

453) Suppose that y is a function of u, and that u is itself a function of x. How does one find the derivative of y in terms of x?

A) The sum rule: $\frac{d(y+u)}{dx} = \frac{dy}{dx} + \frac{du}{dx}$

B) The product rule: $\frac{d(y \cdot u)}{dx} = y \cdot \frac{du}{dx} + u \cdot \frac{dy}{dx}$

C) The chain rule: $\frac{dy}{dx} = \frac{dy}{du} \cdot \frac{du}{dx}$

D) The difference rule: $\frac{d(y-u)}{dx} = \frac{dy}{dx} - \frac{du}{dx}$

Answer: C

454) What is f(g(x))?

A) The composition of functions, f(g(x)), is the result of substituting g, expressed in terms of the independent variable x, in place of the independent variable in the expression for f.

B) The function f(g(x)) is the result of substituting x in place of the independent variable in the expression for f.

C) The function f(g(x)) is the derivative of g in terms of x.

D) The function f(g(x)) is the product of f(x) and g(x).

Answer: A



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455) The first derivative is to instantaneous velocity as the second derivative is to _____.

A) Instantaneous acceleration
B) Average velocity
C) Average momentum
D) Instantaneous speed

Answer: A

456) Critique the validity of the expression $\sqrt{\frac{d^2y}{dx^2}} = \frac{dy}{dx}$.

A) It is valid, because $\frac{d^2y}{dx^2}$ cannot be negative.

B) It is valid, because a derivative can be squared the same as any function.

C) It is not valid, because it should read "$\sqrt{\frac{d^2y}{dx^2}} = \pm \frac{dy}{dx}$".

D) It is not valid, because the notation $\frac{d^2y}{dx^2}$ does not mean the square of $\frac{dy}{dx}$.

Answer: D

457) A second derivative will not exist for a function at a point if _____.

A) The first derivative is not defined at the point; the first derivative is discontinuous at the point; the first derivative has a corner or similar sharp change in direction at the point; or the first derivative has a horizontal tangent at the point.
B) The function is not defined at the point, the function is discontinuous at the point; the first derivative has a peak or a valley at the point, or the function has a vertical tangent at the point.
C) The first derivative is not defined at the point, the first derivative is discontinuous at the point, the first derivative has a limit at the point; or the function has a vertical tangent at the point.
D) The function is not defined at the point, the first derivative is discontinuous at the point; the first derivative has a corner or similar sharp change in direction at the point; the first derivative has a vertical tangent at the point.

Answer: D



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1) D
2) A
3) C
4) B
5) B
6) C
7) B
8) D
9) D
10) B
11) B
12) B
13) B
14) B
15) A
16) B
17) B
18) A
19) B
20) B
21) D
22) B
23) C
24) A
25) D
26) A
27) D
28) B
29) B
30) A
31) B
32) D
33) B
34) B
35) D
36) D
37) B
38) D
39) C
40) D
41) A
42) B
43) A
44) D
45) C
46) B
47) B
48) D
49) A



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50) D
51) D
52) C
53) D
54) D
55) B
56) A
57) D
58) A
59) D
60) B
61) B
62) B
63) A
64) B
65) B
66) B
67) A
68) A
69) B
70) A
71) B
72) A
73) B
74) B
75) A
76) A
77) A
78) A
79) B
80) D
81) A
82) B
83) C
84) C
85) D
86) A
87) D
88) D
89) C
90) A
91) C
92) B
93) A
94) A
95) B
96) B
97) A
98) A



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99) B
100) B
101) B
102) A
103) A
104) B
105) C
106) C
107) D
108) D
109) C
110) D
111) D
112) A
113) D
114) C
115) C
116) A
117) C
118) B
119) C
120) D
121) D
122) B
123) A
124) D
125) B
126) C
127) D
128) D
129) D
130) A
131) D
132) A
133) B
134) C
135) B
136) C
137) D
138) B
139) C
140) B
141) B
142) B
143) B
144) D
145) B
146) B
147) C



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148) D
149) D
150) A
151) A
152) A
153) D
154) B
155) A
156) C
157) C
158) A
159) C
160) C
161) B
162) B
163) D
164) A
165) D
166) B
167) A
168) D
169) C
170) A
171) C
172) C
173) C
174) D
175) D
176) B
177) B
178) A
179) A
180) B
181) D
182) B
183) D
184) C
185) C
186) A
187) B
188) D
189) A
190) A
191) C
192) D
193) C
194) A
195) C
196) C



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197) C
198) A
199) B
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202) C
203) C
204) A
205) B
206) C
207) D
208) D
209) D
210) C
211) C
212) B
213) D
214) C
215) B
216) D
217) C
218) A
219) C
220) A
221) C
222) B
223) C
224) D
225) B
226) B
227) B
228) D
229) D
230) B
231) B
232) B
233) C
234) B
235) C
236) C
237) D
238) A
239) D
240) B
241) D
242) A
243) A
244) B
245) B



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246) B
247) B
248) B
249) B
250) A
251) A
252) D
253) B
254) C
255) C
256) A
257) A
258) D
259) A
260) A
261) B
262) B
263) A
264) D
265) B
266) A
267) B
268) A
269) D
270) B
271) C
272) A
273) B
274) B
275) B
276) C
277) D
278) D
279) C
280) D
281) D
282) C
283) C
284) C
285) A
286) B
287) D
288) C
289) B
290) A
291) B
292) D
293) A
294) C



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295) C
296) A
297) B
298) C
299) B
300) C
301) A
302) B
303) D
304) A
305) A
306) D
307) C
308) A
309) C
310) D
311) C
312) A
313) C
314) B
315) A
316) D
317) D
318) D
319) D
320) A
321) B
322) B
323) D
324) A
325) D
326) B
327) D
328) B
329) B
330) B
331) D
332) A
333) A
334) A
335) A
336) B
337) D
338) A
339) D
340) D
341) A
342) C
343) B



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344) C
345) B
346) A
347) A
348) D
349) D
350) C
351) D
352) D
353) D
354) C
355) D
356) A
357) A
358) D
359) C
360) A
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362) C
363) A
364) A
365) C
366) A
367) D
368) C
369) C
370) B
371) A
372) B
373) D
374) C
375) D
376) D
377) C
378) A
379) A
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381) C
382) A
383) D
384) D
385) D
386) A
387) B
388) D
389) B
390) B
391) D
392) D



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393) C
394) C
395) C
396) D
397) C
398) D
399) B
400) A
401) D
402) C
403) D
404) A
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406) A
407) B
408) C
409) D
410) A
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419) A
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433) C
434) B
435) D
436) C
437) C
438) C
439) B
440) C
441) C



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442) A
443) A
444) A
445) D
446) B
447) D
448) C
449) B
450) A
451) C
452) C
453) C
454) A
455) A
456) D
457) D



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