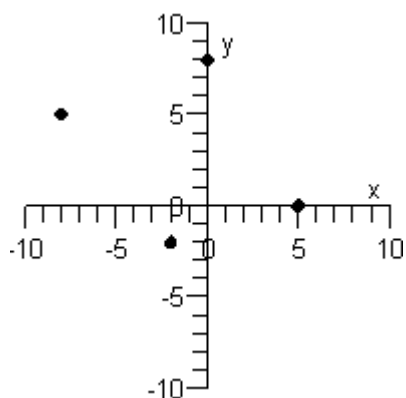


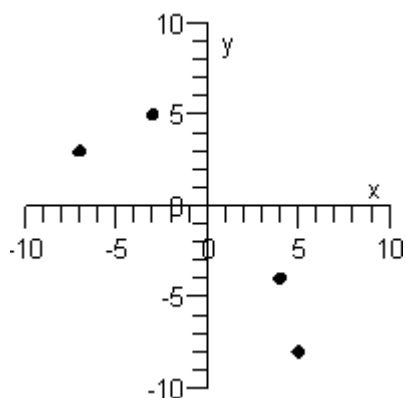
1. Plot the points below whose coordinates are given on a Cartesian coordinate system.

$(0, 8), (-8, 5), (-2, -2), (5, 0)$

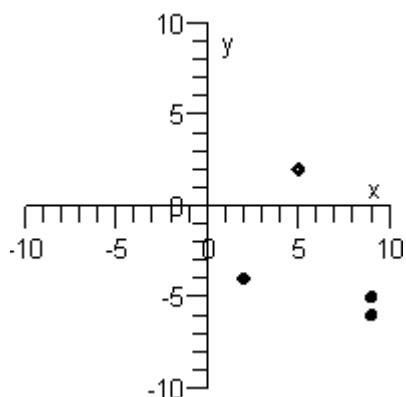
A)



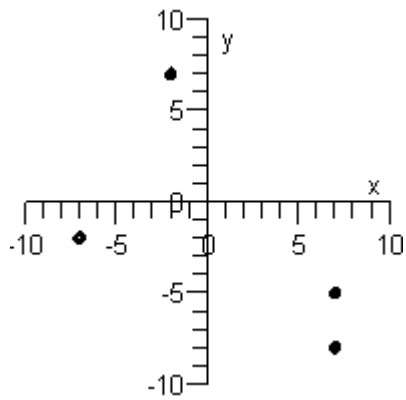
B)



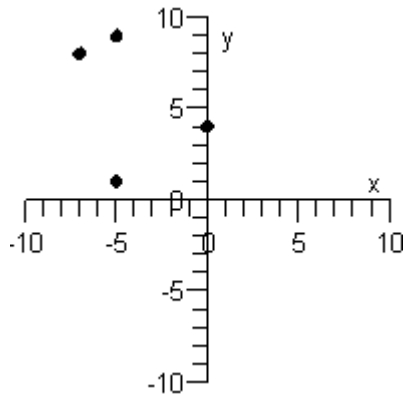
C)



D)



E)



Ans: A

2. Find the distance between the points. Round to the nearest hundredth, if necessary.

$(-6, 2), (7, -4)$

- A) 2.24
- B) 6.08
- C) 14.32
- D) 13.15
- E) 13.6

Ans: C

3. Find the midpoint of the line segment joining the points.

$(0, 9), (4, -3)$

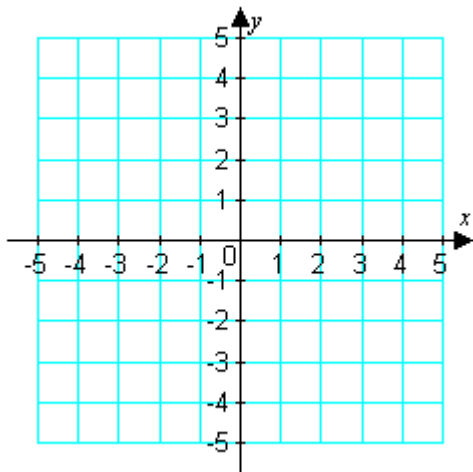
- A) $(-2, -3)$
- B) $(3, 2)$
- C) $(6, -2)$
- D) $(-2, 6)$
- E) $(2, 3)$

Ans: E

4. Find x such that the distance between the point $(-2, 5)$ and $(x, 17)$ is 15.
- A) $x = -14, -11$
 - B) $x = -14, 10$
 - C) $x = -11, 10$
 - D) $x = -14, 7$
 - E) $x = -11, 7$
- Ans: E

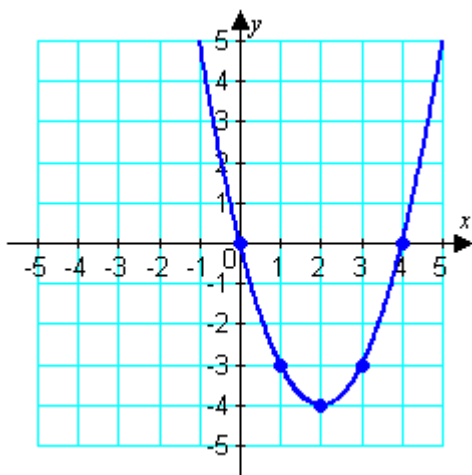
5. After completing the table, use the resulting solution points to sketch the graph of the equation $y = x^2 - 4x$.

x	0	1	2	3	4
y					
(x, y)					



Ans:

x	0	1	2	3	4
y	0	-3	-4	-3	0
(x, y)	(0,0)	(1,-3)	(2,-4)	(3,-3)	(4,0)



6. Find the x - and y -intercepts of the graph of the following equation.

$$9x + 6y = 11$$

- A) $x\text{-int: } \left(\frac{3}{2}, 0\right); y\text{-int: } \left(0, \frac{2}{3}\right)$
B) $x\text{-int: } \left(\frac{3}{2}, 0\right); y\text{-int: } \left(0, \frac{11}{6}\right)$
C) $x\text{-int: } \left(\frac{11}{9}, 0\right); y\text{-int: } \left(0, \frac{11}{6}\right)$
D) $x\text{-int: } \left(\frac{9}{11}, 0\right); y\text{-int: } \left(0, \frac{3}{2}\right)$
E) $x\text{-int: } \left(\frac{11}{9}, 0\right); y\text{-int: } \left(0, \frac{2}{3}\right)$

Ans: C

7. Find the x - and y -intercepts of the graph of the equation below.

$$y = x\sqrt{x+3}$$

- A) $(3, 0), (0, 3)$
B) $(0, 0), (-3, 0)$
C) $(0, 0), (3, 0)$
D) $(0, 0), (-3, 0), (3, 0)$
E) $(0, 0), (3, 0), (0, 3)$

Ans: B

8.

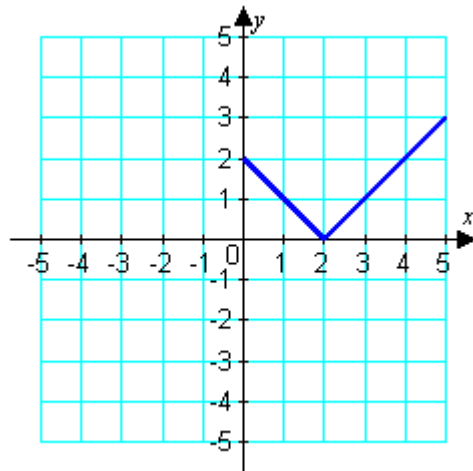
Given $y = \frac{x^3}{x^4 + 1}$, use the algebraic tests to determine symmetry with respect to both axes and the origin.

- A) y -axis symmetry only
B) x -axis symmetry only
C) origin symmetry only
D) x -axis, y -axis, and origin symmetry
E) no symmetry

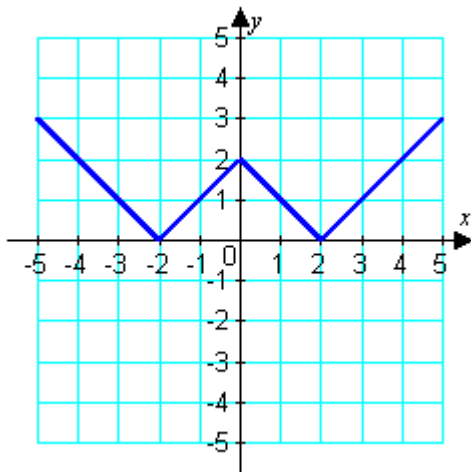
Ans: C

9. Given $x^2 + y^2 = 4$, use the algebraic tests to determine symmetry with respect to both axes and the origin.
- A) y -axis symmetry only
 - B) x -axis symmetry only
 - C) origin symmetry only
 - D) x -axis, y -axis, and origin symmetry
 - E) no symmetry
- Ans: D

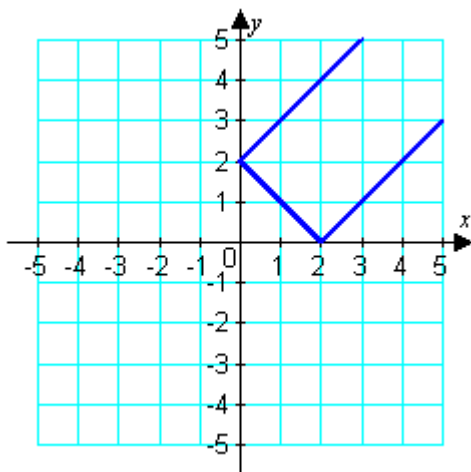
10. Assuming that the graph shown has y -axis symmetry, sketch the complete graph.



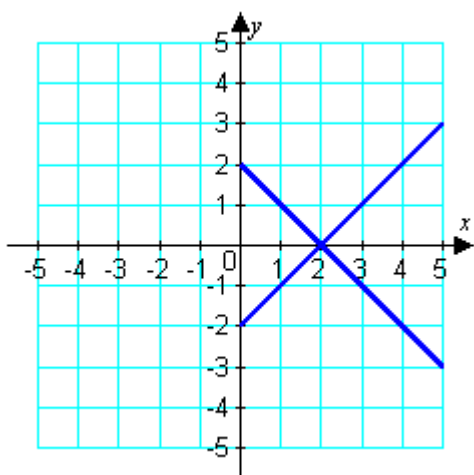
A)



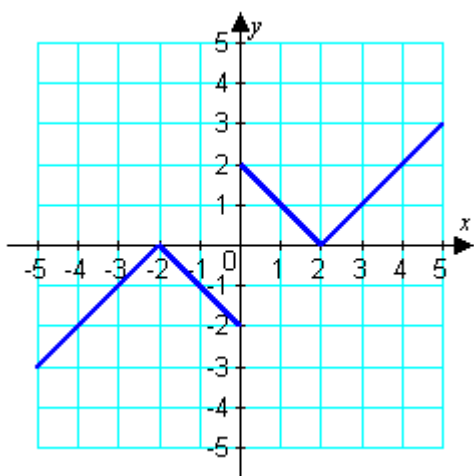
B)



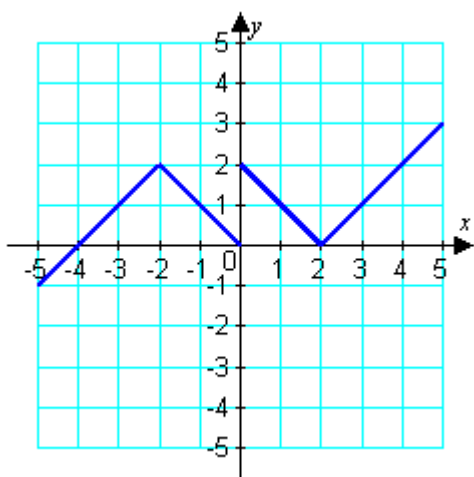
C)



D)



E)

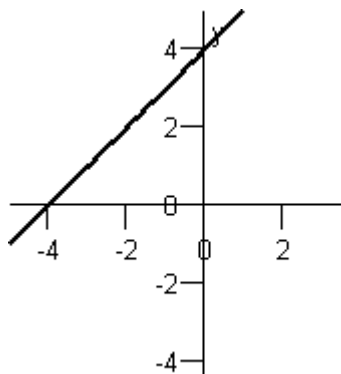


Ans: A

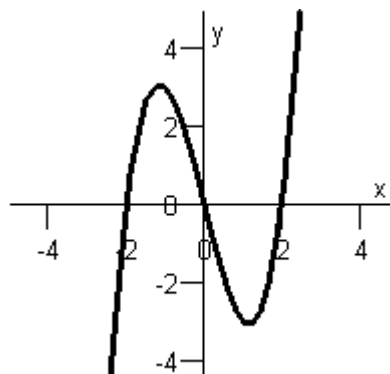
11. Match the equation below with its graph.

$$y = 4 + x$$

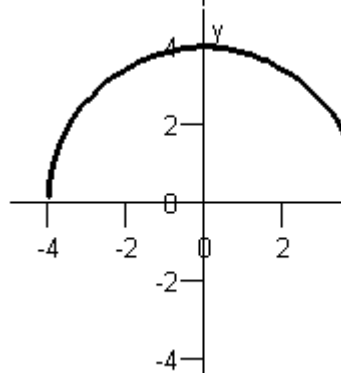
Graph I :



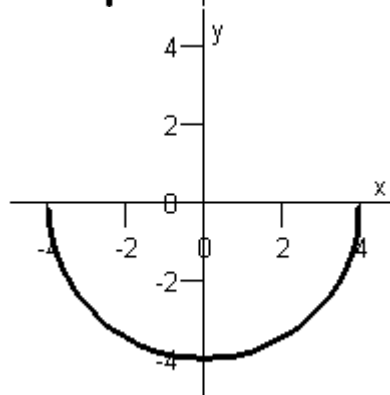
Graph IV :



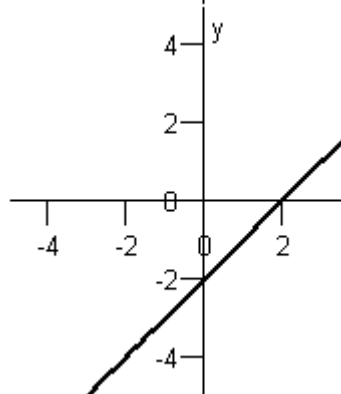
Graph II :



Graph V :



Graph III :



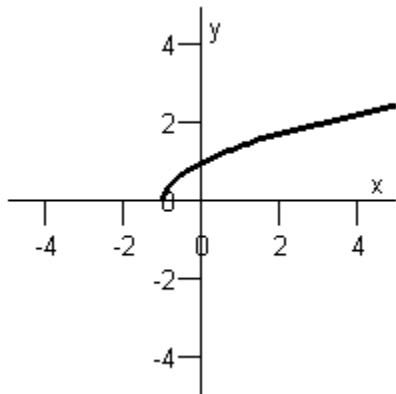
- A) Graph IV
- B) Graph III
- C) Graph V
- D) Graph II
- E) Graph I

Ans: E

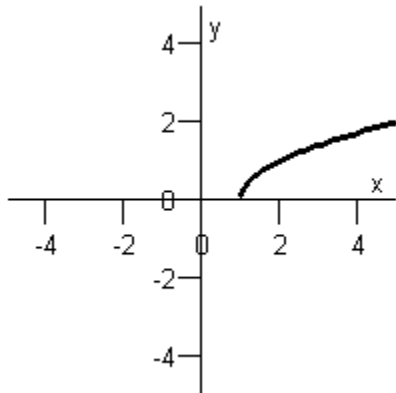
12. Sketch the graph of the equation below.

$$y = \sqrt{x+1}$$

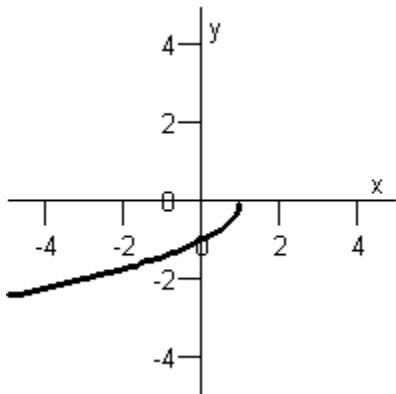
A)



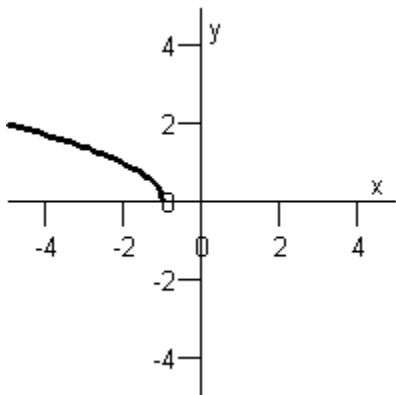
B)



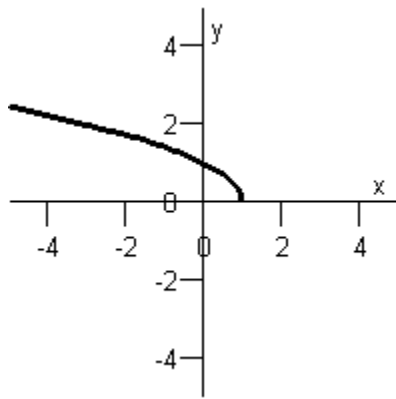
C)



D)



E)

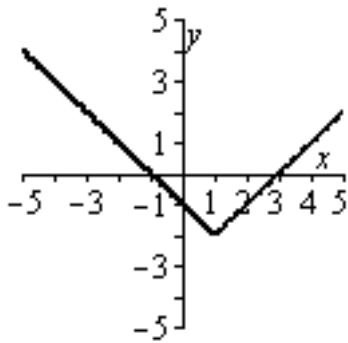


Ans: A

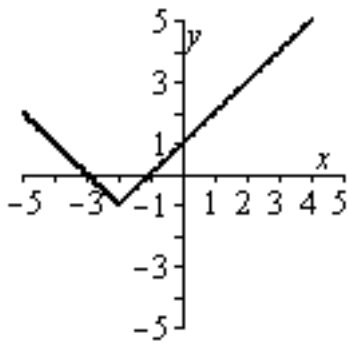
13. Graph the following equation by plotting points that satisfy the equation.

$$y = |x + 1| - 2$$

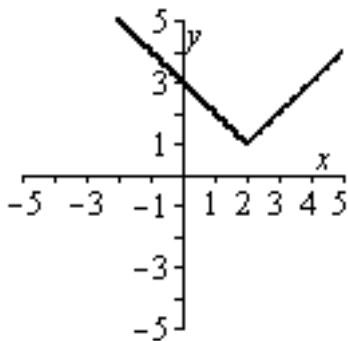
A)



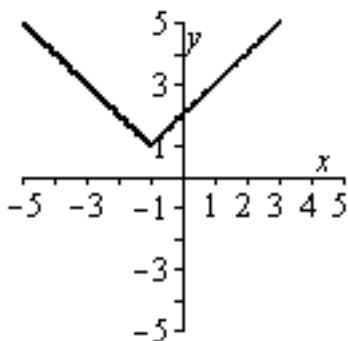
B)



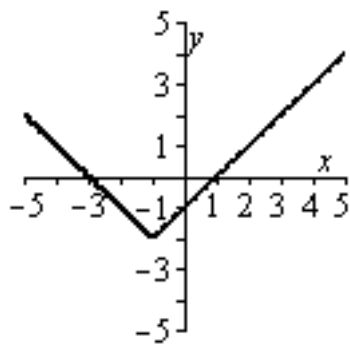
C)



D)



E)

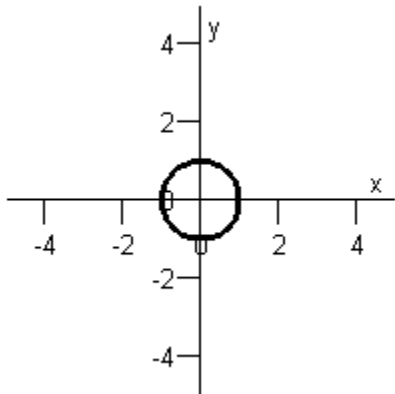


Ans: E

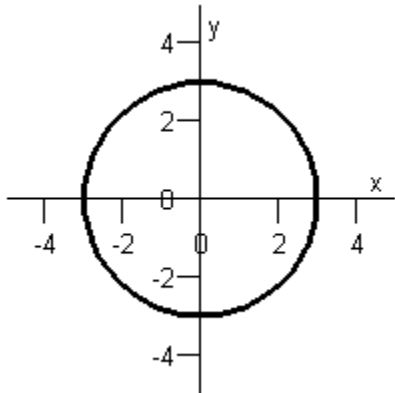
14. Sketch the graph of the equation below.

$$x^2 + y^2 = 9$$

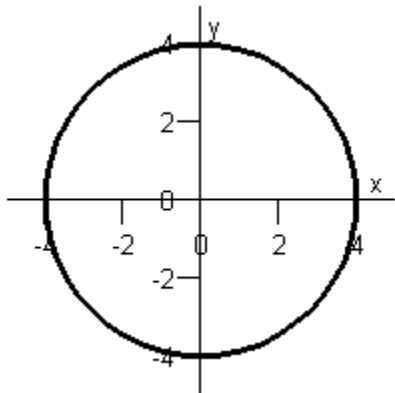
A)



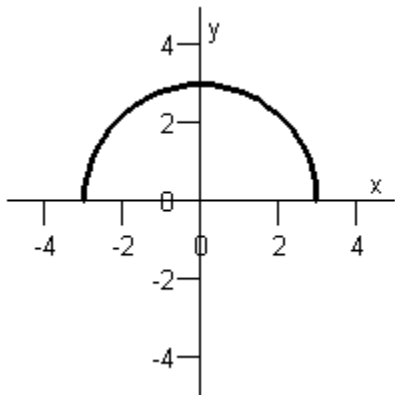
B)



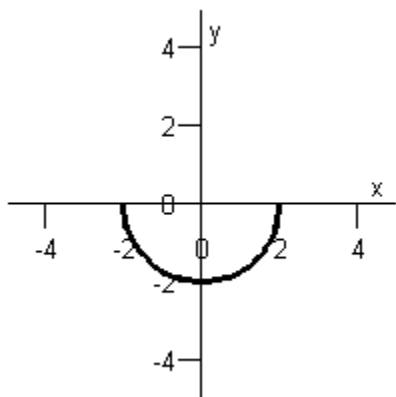
C)



D)



E)



Ans: B

15. Find an equation of a circle that satisfies the following condition. Write your answer in standard form.

Center: $(1, 2)$; passing through $(5, -3)$

- A) $(x+1)^2 + (y+2)^2 = (\sqrt{41})^2$
B) $(x-5)^2 + (y+3)^2 = (\sqrt{41})^2$
C) $(x-1)^2 + (y-2)^2 = (\sqrt{34})^2$
D) $(x-1)^2 + (y-2)^2 = (\sqrt{41})^2$
E) $(x-5)^2 + (y+3)^2 = (\sqrt{34})^2$

Ans: D

16. Write the standard form of the equation of the circle whose diameter has endpoints of $(8, -12)$ and $(14, -4)$.

- A) $(x-11)^2 + (y+8)^2 = 25$
B) $(x-11)^2 + (y+8)^2 = 5$
C) $(x+8)^2 + (y-11)^2 = 25$
D) $(x-8)^2 + (y+11)^2 = 25$
E) $(x+11)^2 + (y-8)^2 = 5$

Ans: A

17. The population y (in millions of people) of North America from 1980 to 2050 can be modeled by

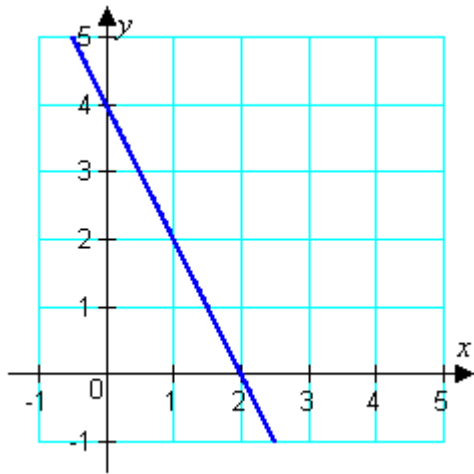
$$y = 5.3x + 430, \quad -30 \leq x \leq 40$$

where x represents the year, with $x = 40$ corresponding to 2050. Find the y-intercept of the graph of the model. What does it represent in the given situation?

- A) $(0, 483)$; It represents the population (in millions of people) of North America in 2020.
- B) $(0, 536)$; It represents the population (in millions of people) of North America in 2030.
- C) $(0, 377)$; It represents the population (in millions of people) of North America in 2000.
- D) $(0, 430)$; It represents the population (in millions of people) of North America in 2010.
- E) $(0, 324)$; It represents the population (in millions of people) of North America in 1990.

Ans: D

18. Estimate the slope of the line.

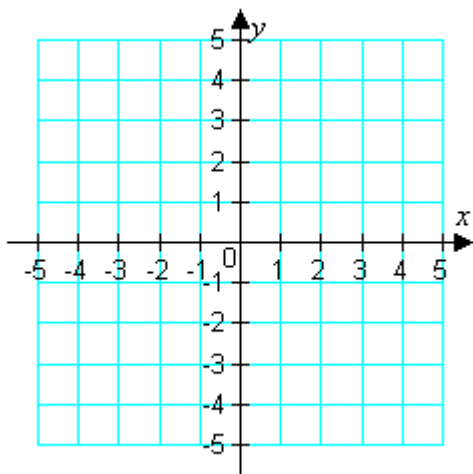


- A) $-\frac{1}{2}$
- B) 2
- C) -2
- D) $\frac{1}{2}$
- E) -3

Ans: C

19. Plot the points and find the slope of the line passing through the pair of points.

$(0, 4), (5, 2)$



- A) slope: $-\frac{5}{2}$
- B) slope: $\frac{5}{2}$
- C) slope: $-\frac{4}{3}$
- D) slope: $-\frac{2}{5}$
- E) slope: $\frac{2}{5}$

Ans: D

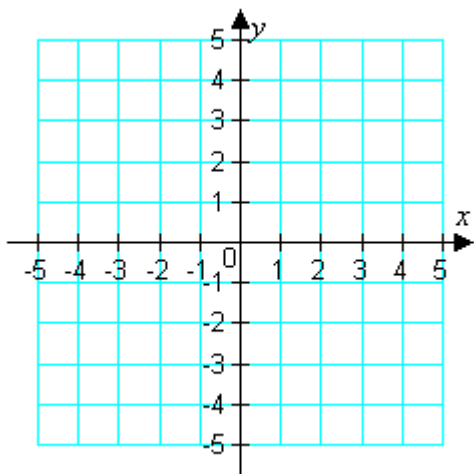
20. Find the slope of the line that passes through the points $(7, -2)$ and $(7, -3)$.

- A) -9
- B) -1
- C) 1
- D) 0
- E) undefined

Ans: E

21. Plot the points and find the slope of the line passing through the pair of points.

$(1, 0), (-2, 0)$



- A) slope: 0
- B) slope: 1
- C) slope: -3
- D) slope: $-\frac{1}{3}$
- E) slope: undefined

Ans: A

22. Find the slope of the line that passes through the points $A(-4, -2)$ and $B(10, 9)$.

- A) $\frac{11}{14}$
- B) $-\frac{1}{2}$
- C) $-\frac{11}{14}$
- D) $\frac{13}{12}$
- E) $\frac{7}{6}$

Ans: A

23. Use the point on the line and the slope of the line to determine whether any of the three additional points lies on the line.

Point

$(-2, 4)$

Slope

$$m = \frac{1}{2}$$

I: $(8, 6)$

II: $(2, 6)$

III: $(4, 7)$

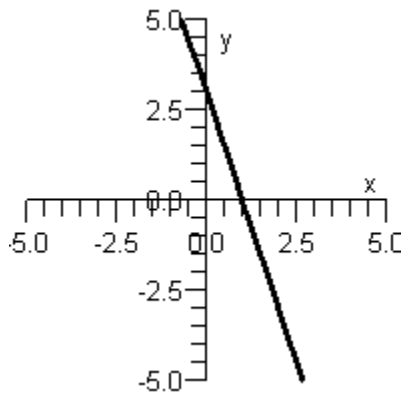
- A) Only points II and III lie on the line.
- B) Only point II lies on the line.
- C) Only point III lies on the line.
- D) Only points I and II lie on the line.
- E) Only points I and III lie on the line.

Ans: A

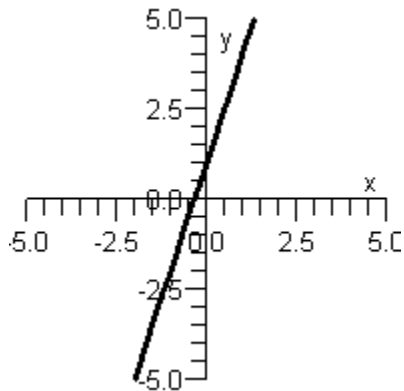
24. Graph y as a function of x by finding the slope and y -intercept of the line below.

$$y = 3x + 1$$

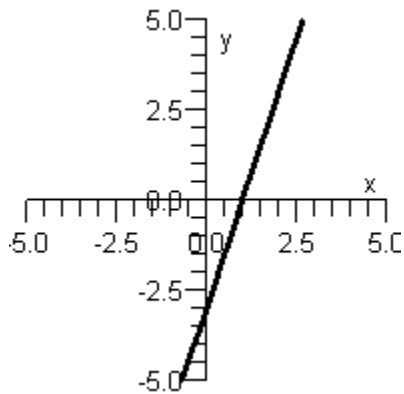
A)



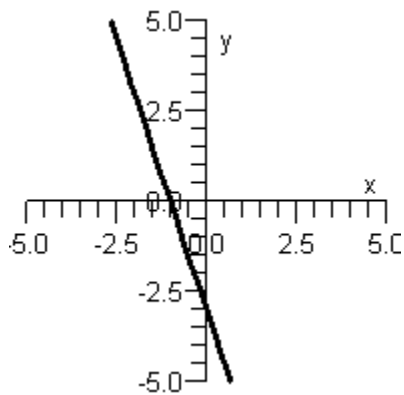
B)



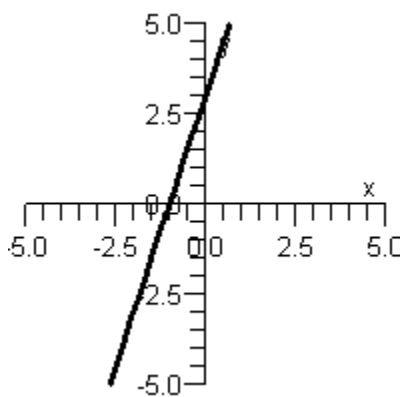
C)



D)



E)



Ans: B

25. Find the slope and y-intercept of the equation of the line.

$$y = 3x - 4$$

- A) $\frac{1}{3}$; slope: $\frac{1}{3}$; y-intercept: -4
- B) $-\frac{1}{4}$; slope: $-\frac{1}{4}$; y-intercept: 3
- C) slope: 3 ; y-intercept: -4
- D) slope: -4 ; y-intercept: 3
- E) slope: 3 ; y-intercept: 4

Ans: C

26. Find the slope and y-intercept of the equation of the line.

$$-3y - 9x = -12$$

- A) slope: 9 ; y-intercept: -12
- B) slope: -12 ; y-intercept: 9
- C) slope: 9 ; y-intercept: -3
- D) slope: 4 ; y-intercept: -3
- E) slope: -3 ; y-intercept: 4

Ans: E

27. Use the *intercept form* to find the equation of the line with the given intercepts.

The intercept form of the equation of a line with intercepts $(a, 0)$ and $(0, b)$ is

$$\frac{x}{a} + \frac{y}{b} = 1, \quad a \neq 0, \quad b \neq 0.$$

x-intercept: $(-4, 0)$

y-intercept: $(0, 1)$

A) $x - 4y = 1$

B) $x - 4y = -\frac{1}{4}$

C) $-4x + y = -\frac{1}{4}$

D) $4x - y = 4$

E) $x - 4y = -4$

Ans: E

28. Determine if lines L_1 and L_2 are parallel, perpendicular, or neither.

$$L_1 : 4x - 4y = -4$$

$$L_2 : 8x + 8y = 9$$

A) parallel

B) neither

C) perpendicular

Ans: C

29. Determine whether lines L_1 and L_2 passing through the pairs of points are parallel, perpendicular, or neither.

$$L_1 : (-8, 0), (4, -3)$$

$$L_2 : (0, 1), (-4, 2)$$

A) parallel

B) perpendicular

C) neither

Ans: A

30. Determine whether lines L_1 and L_2 passing through the pairs of points are parallel, perpendicular, or neither.

$$L_1 : (1, 9), (-4, 8)$$

$$L_2 : (8, -7), (7, -1)$$

A) parallel

B) perpendicular

C) neither

Ans: C

31. Determine whether lines L_1 and L_2 passing through the pairs of points are parallel, perpendicular, or neither.

$$L_1: (-5, -9), (-7, 2)$$

$$L_2: (-8, 1), (-19, -1)$$

- A) parallel
B) perpendicular
C) neither

Ans: B

32. Assume that y is directly proportional to x . If $x = 36$ and $y = 27$, determine a linear model that relates y and x .

- A) $y = \frac{4}{3}x$
B) $y = \frac{3}{5}x$
C) $y = \frac{3}{2}x$
D) $y = \frac{3}{4}x$
E) $y = \frac{2}{3}x$

Ans: D

33. Write the equation that expresses the relationship between the variables described below, then use the given data to solve for the variation of constant.

" y varies directly as z , and $y = 86.66$ when $z = 14$."

- A) $y = \frac{k}{z}$; $k = 1213.24$
B) $y = \sqrt{k}z$; $k = 38.32$
C) $y = kz$; $k = 6.19$
D) $y = k^2z$; $k = 2.49$
E) $y = \sqrt{kz}$; $k = 536.43$

Ans: C

34. The simple interest on an investment is directly proportional to the amount of the investment. By investing \$8750 in a certain certificate of deposit, you obtained an interest payment of \$210.00 after 1 year. Determine a mathematical model that gives the interest, I , for this CD after 1 year in terms of the amount invested, P .

- A) $I = (0.022)P$
- B) $I = (0.027)P$
- C) $I = (0.019)P$
- D) $I = (0.028)P$
- E) $I = (0.024)P$

Ans: E

35. The sales tax on an item with a retail price of \$612 is \$61.20. Create a mathematical model that gives the retail price, y , in terms of the sales tax, x , and use it to determine the retail price of an item that has a sales tax of \$70.38.

- A) \$716.03
- B) \$705.79
- C) \$648.11
- D) \$675.43
- E) \$703.80

Ans: E

36. After opening the parachute, the descent of a parachutist follows a linear model. At 3:31 P.M., the height of the parachutist is 2800 feet. At 3:32 P.M., the height is 1600 feet. Use a linear equation that gives the height of the parachutist in terms of the time to find the time when the parachutist will reach the ground.

- A) 3:33:40 P.M.
- B) 3:33:20 P.M.
- C) 3:32:10 P.M.
- D) 3:34:00 P.M.
- E) 3:33:50 P.M.

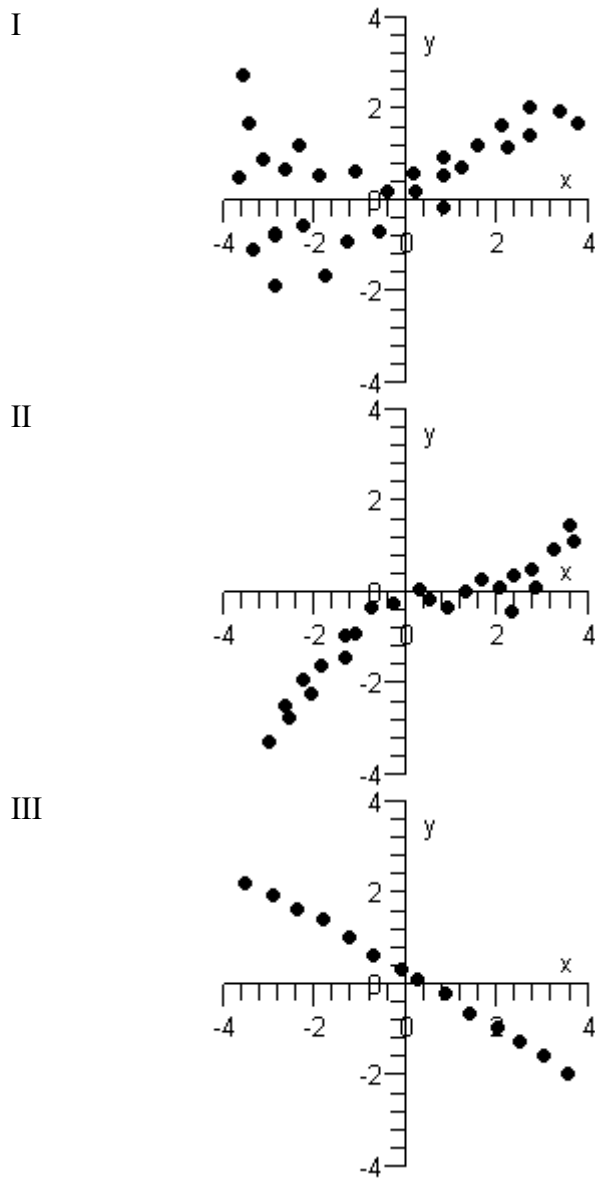
Ans: B

37. A car was purchased for \$42,000. Assuming the car depreciates at a rate of \$5040 per year (*straight-line depreciation*) for the first 5 years, write the value v of the car as a function of the time t (measured in years) for $0 \leq t \leq 5$.

- A) $v(t) = 5040t - 42,000$
- B) $v(t) = 42,000 - 5040(5)t$
- C) $v(t) = 42,000 - 5040t$
- D) $v(t) = 42,000 + 5040(5)t$
- E) $v(t) = 42,000 + 5040t$

Ans: C

38. Which of the following graphs below can be approximated by a linear model?



- A) None can be modeled linearly.
 - B) Only graph III can be modeled linearly.
 - C) Only graphs I and II can be modeled linearly.
 - D) Only graphs I and III can be modeled linearly.
 - E) Graphs I, II, and III can be modeled linearly.
- Ans: B

39. The table below shows the velocities, in feet per second, of a ball that is thrown horizontally from the top of a 50 foot building and the distances, in feet, that it lands from the base of the building. Compute the linear regression equation for these data.

Velocity (ft/sec)	Distance (ft)
15	48
25	80
29	100
33	95
38	112
40	130
48	150

- A) $y = 3.02463355x + 3.626221498$
B) $y = 3.156886228x + .5988023952$
C) $y = 3.073502956x + 2.338987407$
D) $y = 3.028222013x - 1.079962371$
E) $y = 2.944432432x - 0.7139459459$

Ans: A

40. Suppose the average remaining lifetime for women in a given country is given in the following table.

<i>Age</i>	<i>Years</i>
5	75.2
30	54.3
50	37.5
65	25.4
75	17.0

Compute the linear regression equation for these data, where x is the age, in years, and A is the remaining lifetime, in years. Round parameters to the nearest hundredth.

- A) $A(x) = -14.53x + 44.37$
B) $A(x) = -0.83x + 44.37$
C) $A(x) = -14.53x + 85.47$
D) $A(x) = -14.53x + 79.27$
E) $A(x) = -0.83x + 79.27$

Ans: E

41. Suppose the average remaining lifetime for women in a given country is given in the following table.

<i>Age</i>	<i>Years</i>
5	72.4
25	53.1
30	49.5
35	44.5
40	39.2

Find the linear regression equation for these data, whose parameters are rounded to the nearest hundredth, where x is the age, in years, and A is the remaining lifetime, in years. Use the regression equation to estimate the remaining lifetime for a 31-year old woman.

- A) 42.29 years
B) 50.75 years
C) 46.99 years
D) 55.45 years
E) 52.63 years

Ans: C

42. Which set of ordered pairs represents a function from P to Q ?

$$P = \{5, 10, 15, 20\} \qquad Q = \{-2, 0, 2\}$$

- A) $\{(5, -2), (10, 0), (10, 2), (15, 0), (20, -2)\}$
- B) $\{(15, -2), (15, 0), (15, 2)\}$
- C) $\{(15, 0), (10, -2), (5, 0), (10, 2), (15, -2)\}$
- D) $\{(10, 0), (15, 2), (20, 0)\}$
- E) $\{(5, 2), (15, 0), (5, -2), (15, 2)\}$

Ans: D

43. Given $q(x) = 6x^2 - 3$, find $q(3)$.

- A) 33
- B) 15
- C) 51
- D) 54
- E) 57

Ans: C

44. Given $t(x) = 3x^2 + 5$, find $t(-8)$.

- A) 192
- B) -19
- C) 187
- D) -43
- E) 197

Ans: E

45. Evaluate the function at the specified value of the independent variable and simplify.

$$g(s) = -6s + 3; \quad g(-0.2)$$

- A) $1.2s - 18$
- B) -1.8
- C) 4.2
- D) $-0.2s + 3$
- E) $-0.2s - 3$

Ans: C

46. Given $m(x) = 3x^2 - 6$, find $m(r)$.

- A) $3r^2 - 6$
- B) $9r^2 + 36$
- C) $-3r^2$
- D) $9r^2 - 6$
- E) $3r^2 - 6r$

Ans: A

47. Find all real values of x such that $f(x) = 0$.

$$f(x) = \frac{7x - 4}{5}$$

- A) $\frac{4}{35}$
- B) $\pm \frac{4}{35}$
- C) $\pm \frac{4}{7}$
- D) $\frac{4}{7}$
- E) $-\frac{4}{7}$

Ans: D

48. Find all real values of x such that $f(x) = 0$.

$$f(x) = 4x^2 - 25$$

- A) $\pm \frac{2}{5}$
- B) $\pm \frac{5}{2}$
- C) $\pm \frac{25}{4}$
- D) $-\frac{25}{4}$
- E) $\frac{5}{2}$

Ans: B

49. Find the domain of the function.

$$f(y) = \frac{-6y}{y + 9}$$

- A) all real numbers $y \neq -9$
- B) all real numbers $y \neq -9, y \neq 0$
- C) all real numbers
- D) $y = -9, y = 0$
- E) $y = -9$

Ans: A

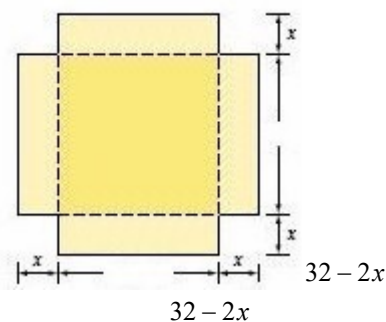
50. Find the domain of the function.

$$q(w) = \sqrt{1 - w^2}$$

- A) $-1 \leq w \leq 1$
- B) $w \leq -1$ or $w \geq 1$
- C) $w \geq 0$
- D) $w \leq 1$
- E) all real numbers

Ans: A

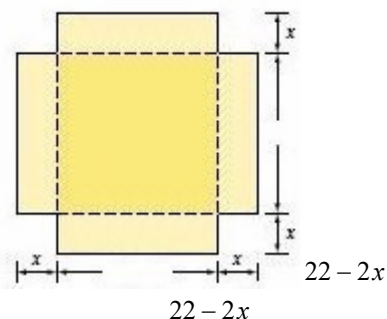
51. An open box is to be made from a square piece of cardboard having dimensions 32 inches by 32 inches by cutting out squares of area x^2 from each corner as shown in the figure below. Express the volume V of the box as a function of x .



- A) $V(x) = 32x^2 - 2x^3$
- B) $V(x) = 32x - 64x^2 + 4x^3$
- C) $V(x) = 1024 - 128x + 4x^2$
- D) $V(x) = 1024x - 128x^2 + 4x^3$
- E) $V(x) = 1024x - 64x^2 + 4x^3$

Ans: D

52. An open box is to be made from a square piece of cardboard having dimensions 22 inches by 22 inches by cutting out squares of area x^2 from each corner as shown in the figure below. If the volume of the box is given by $V(x) = 484x - 88x^2 + 4x^3$, state the domain of V .



- A) $0 < x < 22$
 B) $0 < x < 11$
 C) $88 < x < 484$
 D) $4 < x < 88$
 E) all real numbers

Ans: B

53. The national defense budget expenses V (in billions of dollars) for veterans in the United States from 1990 to 2005 can be approximated by the model

$$V = \begin{cases} -0.326t^2 + 3.40t + 28.7, & 0 \leq t \leq 6 \\ 0.441t^2 - 6.23t + 62.6, & 7 \leq t \leq 15 \end{cases}$$

where t represents the year, with $t = 0$ corresponding to 1990. Use the model to find total veteran expenses in 1995.

- A) \$61.816 billion
 B) \$37.550 billion
 C) \$37.364 billion
 D) \$32.894 billion
 E) \$44.736 billion

Ans: B

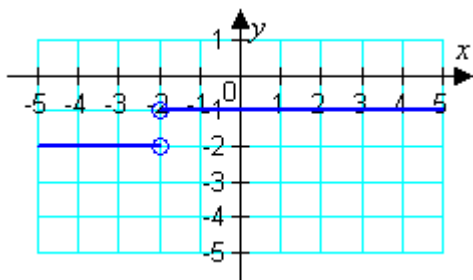
54. The inventor of a new game believes that the variable cost of producing the game is \$3.75 per unit and the fixed costs are \$5000. The inventor sells each game for \$8.99. Let x be the number of games sold. Write the average cost per unit

$\bar{C} = C/x$ as a function of x where C is defined as the total cost of producing x games.

- A) $\bar{C} = \frac{5000}{x} - 5.24x$
 B) $\bar{C} = 5000 + 3.75x$
 C) $\bar{C} = 5000 - 5.24x$
 D) $\bar{C} = \frac{5000}{x} + 3.75$
 E) $\bar{C} = \frac{5000}{x} - 5.24$

Ans: D

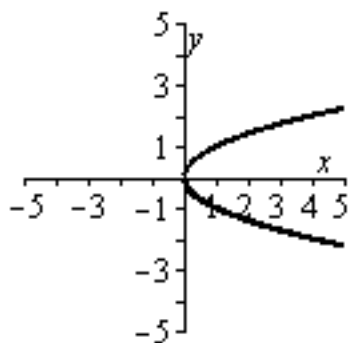
55. Use the graph of the function to find the domain and range of f .



- A) domain : $(-\infty, -2) \cup (-2, \infty)$
 range : $(-\infty, -2) \cup (-1, \infty)$
 B) domain : $(-\infty, -2) \cup (-2, \infty)$
 range : $(-1, 1)$
 C) domain : $(-\infty, -2) \cup (-2, \infty)$
 range : $\{-2, -1\}$
 D) domain : all real numbers
 range : $(-1, 1)$
 E) domain : $\{-2, -1\}$
 range : $(-\infty, -2) \cup (-2, \infty)$

Ans: C

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



- A) function
B) not a function

Ans: B

57. Use a graphing utility to graph the function and approximate (to two decimal places) any relative minimum or relative maximum values.

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

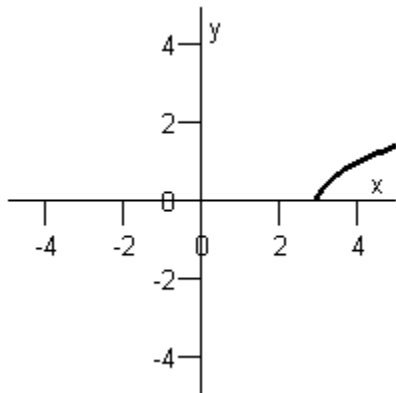
- A) relative maximum: $(-0.55, -0.37)$
relative minimum: $(1.22, -3.11)$
B) relative maximum: $(1.22, -3.11)$
relative minimum: $(-0.55, -0.37)$
C) relative maximum: $(-0.37, -0.55)$
relative minimum: $(-3.11, 1.22)$
D) relative maximum: $(-3.11, 1.22)$
relative minimum: $(-0.37, -0.55)$
E) relative maximum: $(-3.11, -34.62)$
relative minimum: $(-0.37, -0.45)$

Ans: A

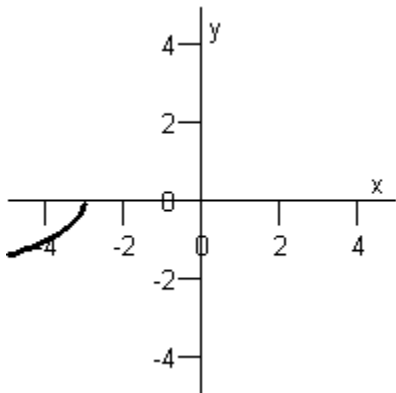
58. Sketch the graph of the function below.

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

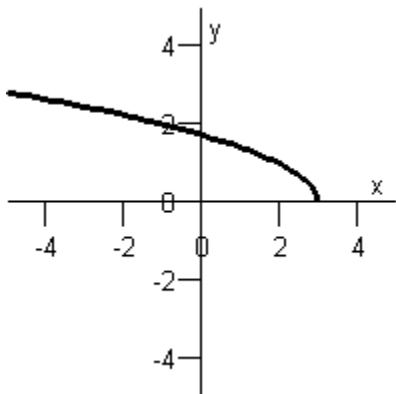
A)



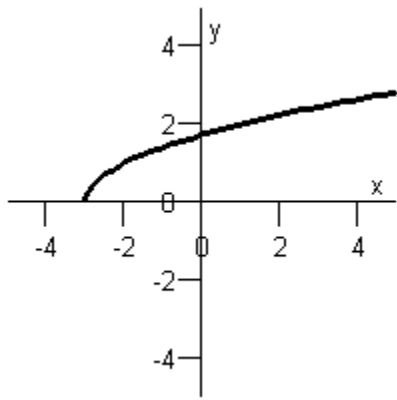
B)



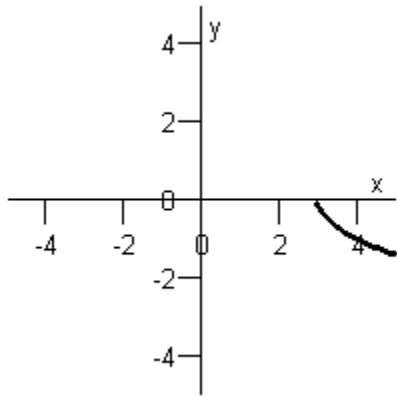
C)



D)



E)

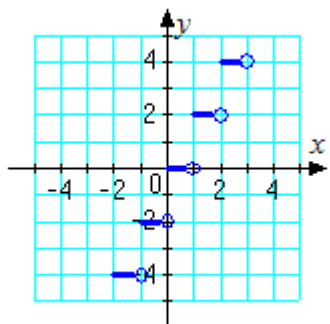


Ans: C

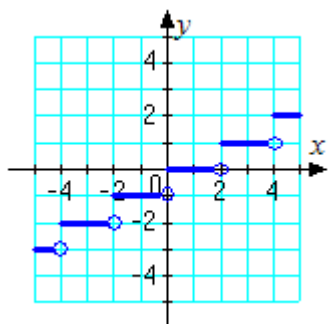
59. Which graph represents the function?

$$g(x) = \lceil 2x \rceil$$

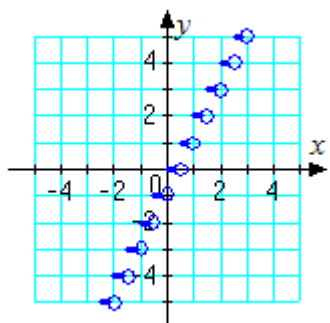
A)



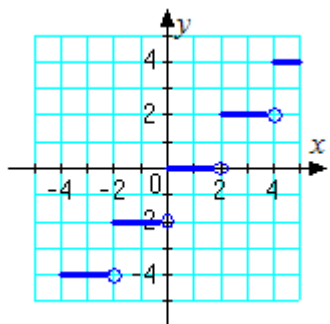
B)



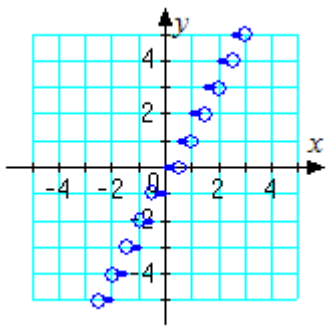
C)



D)



E)



Ans: C

60. The marketing department of a company estimates that the demand for a product is given by $p = 180 - 0.0001x$, where p is the price per unit and x is the number of units. The cost C of producing x units is given by $C = 450,000 + 50x$, and the profit P for producing and selling x units is given by

$$P = R - C = xp - C.$$

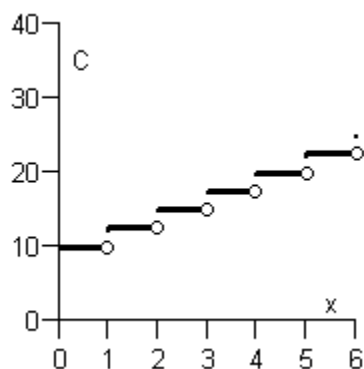
Sketch the graph of the profit function and estimate the number of units that would produce a maximum profit.

- A) 690,000 units
- B) 650,000 units
- C) 610,000 units
- D) 710,000 units
- E) 580,000 units

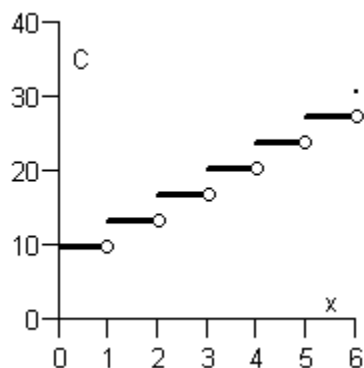
Ans: B

61. The cost of sending an overnight package from New York to Atlanta is \$9.80 for up to, but not including, 1 pound (portion of a pound). A model for the total cost C of sending the package is $C = 9.80 + 3.50\lfloor x \rfloor$, where x is the weight of the package in pounds. Which of the following is the graph of this function. Note that the function $\lfloor x \rfloor$ is the greatest integer function.

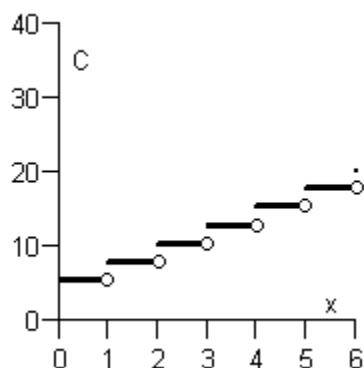
A)



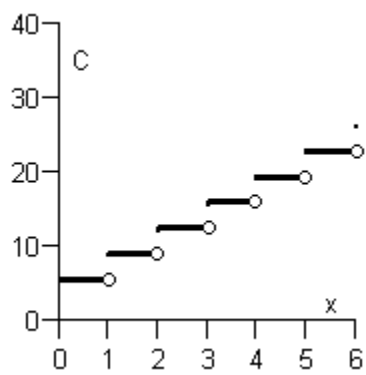
B)



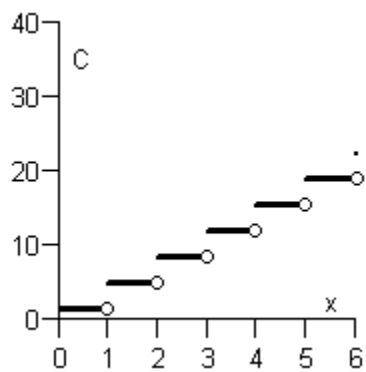
C)



D)



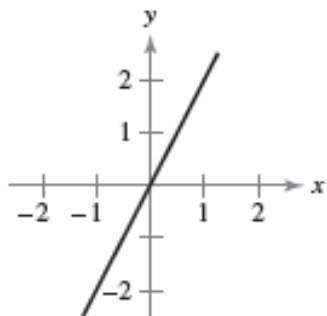
E)



Ans: B

62. Describe the increasing, decreasing, and constant behavior of the function. Find the point or points where the behavior of the function changes.

$$f(x) = 2x$$



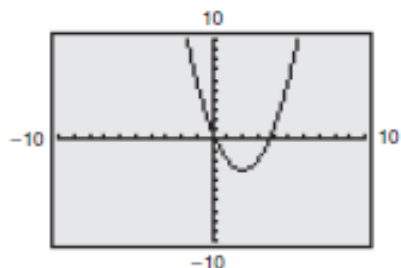
- A) Increasing on $(-\infty, \infty)$
No change in the graph's behaviour
- B) Decreasing on $(-\infty, 1)$
Increasing on $(1, \infty)$
The graph's behaviour changes at the point $(1, -1)$
- C) Increasing on $(-\infty, 0)$ and $(2, \infty)$
Decreasing on $(0, 2)$
The graph's behaviour changes at the points $(0, 0)$ and $(2, -4)$
- D) Decreasing on $(-\infty, -2)$
Increasing on $(2, \infty)$
The graph's behaviour changes at the points $(-2, 0)$ and $(2, 0)$
- E) Decreasing on $(-\infty, 0)$
Increasing on $(0, \infty)$
The graph's behaviour changes at the point $(0, 0)$

Ans: A

63. Use a graphing utility to graph the function, approximate the relative minimum or maximum of the function, and estimate the open intervals on which the function is increasing or decreasing.

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

A)

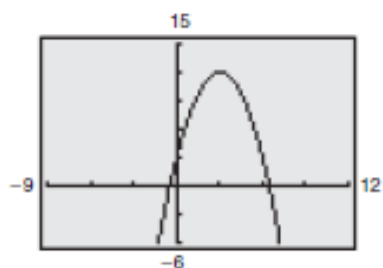


Decreasing on $(-\infty, 2)$

Increasing on $(2, \infty)$

Relative minimum: $(2, -3)$

B)

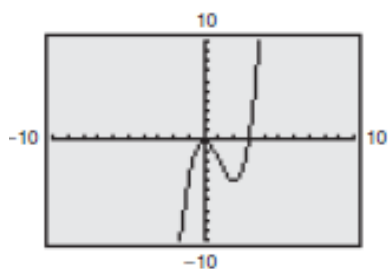


Decreasing on $(3, \infty)$

Increasing on $(-\infty, 3)$

Relative maximum: $(3, 12)$

C)



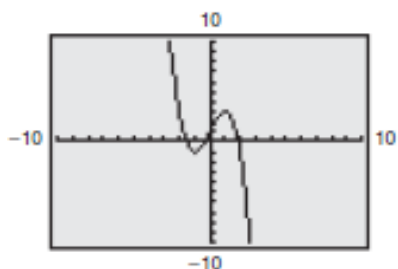
Decreasing on $(0, 2)$

Increasing on $(-\infty, 0), (2, \infty)$

Relative minimum: $(0, 0)$

Relative maximum: $(2, -4)$

D)



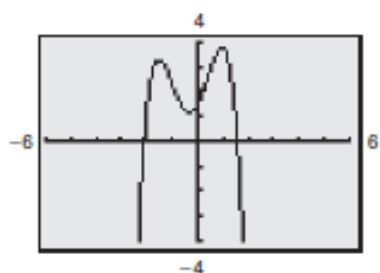
Decreasing on $(-\infty, -1), (1, \infty)$

Increasing on $(-1, 1)$

Relative minimum: $(-1, -1)$

Relative maximum: $(1, 3)$

E)



Decreasing on $(1, \infty)$

Increasing on $(-\infty, 1)$

Relative minimum: $(-1, 1)$

Relative maximum: $(1, 2)$

Ans: A

64. Evaluate the function at each specified value of the independent variable.

$$f(x) = \lfloor x \rfloor$$

a) $f(2)$

b) $f(2.5)$

c) $f(-2.5)$

d) $f(-4)$

A) 2, 2, -3, -4

B) 2, 3, -3, -4

C) 2, 2, -2, -4

D) 2, 2.5, 2.5, 4

E) 2, 2.5, -2.5, -4

Ans: A

65. Decide whether the function is even, odd, or neither.

$$g(x) = x^3 - 5x$$

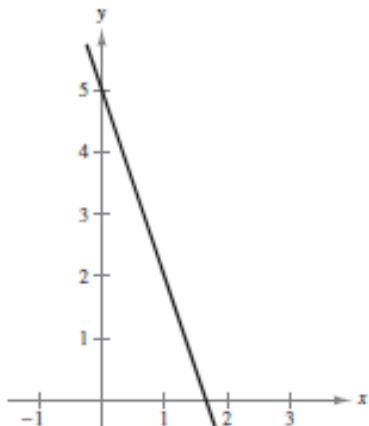
- A) Odd
- B) Even
- C) Neither even nor odd

Ans: A

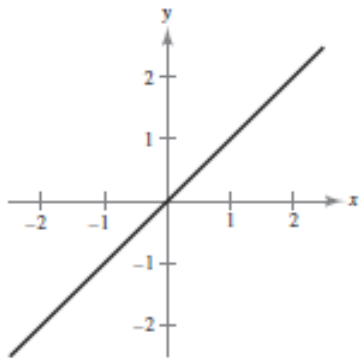
66. Sketch the graph of the function and determine whether the function is even, odd, or neither.

$$f(x) = 5 - 3x$$

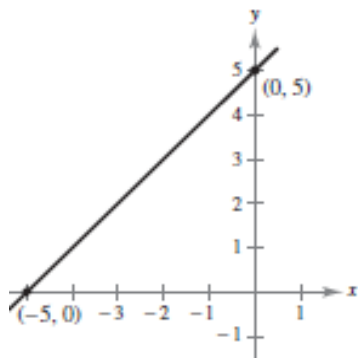
A) Neither even nor odd



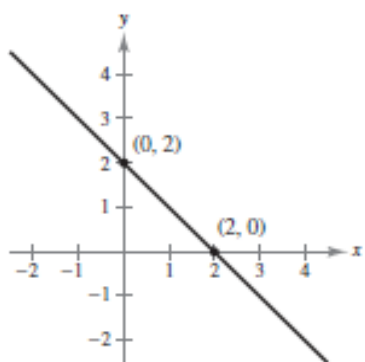
B) Even



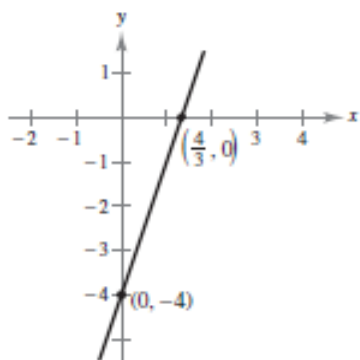
C) Odd



D) Odd



E) Neither even nor odd

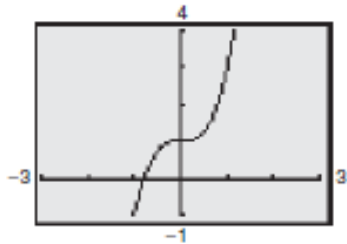


Ans: A

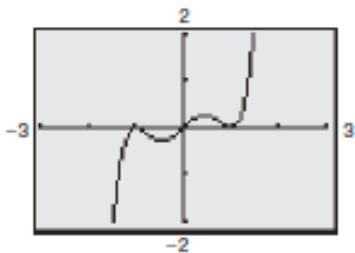
67. Use a graphing utility to graph the function and determine whether the function is even, odd, or neither.

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

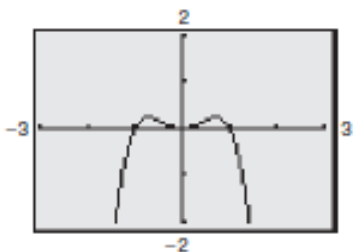
- A) Neither even nor odd



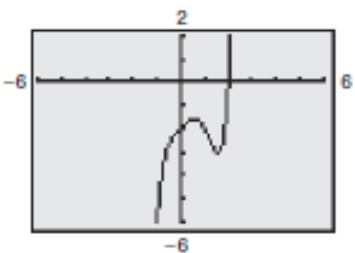
- B) Odd



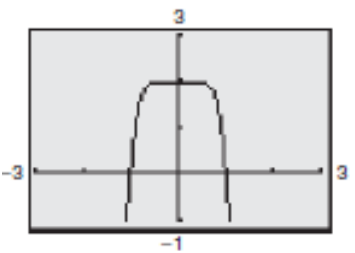
- C) Even



- D) Neither even nor odd



- E) Even

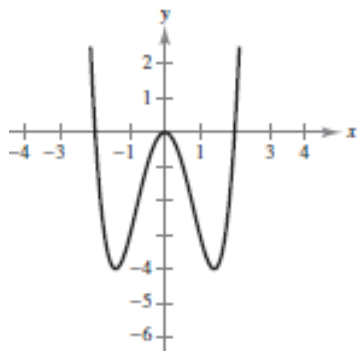


Ans: C

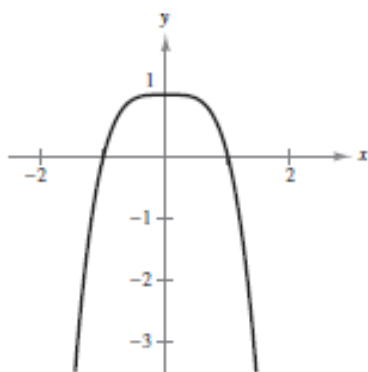
68. Sketch the graph of the function.

$$f(x) = x^2 - 9$$

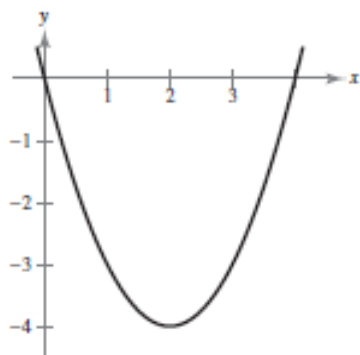
A)



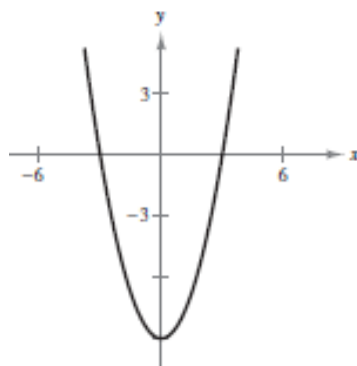
B)



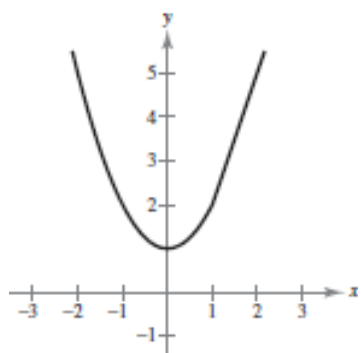
C)



D)



E)

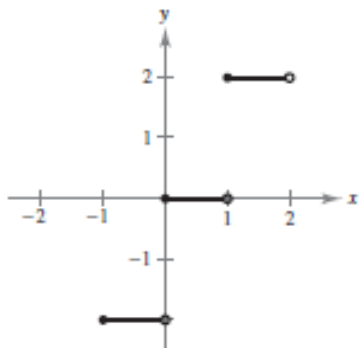


Ans: D

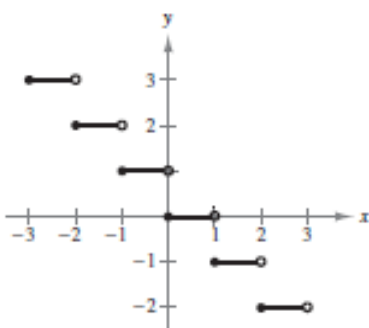
69. Sketch the graph of the function.

$$f(x) = -\lceil x \rceil$$

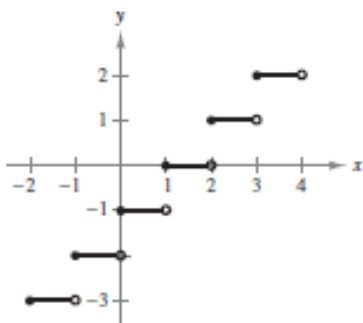
A)



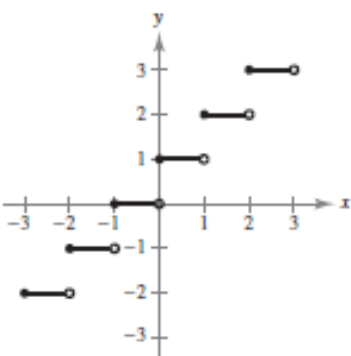
B)



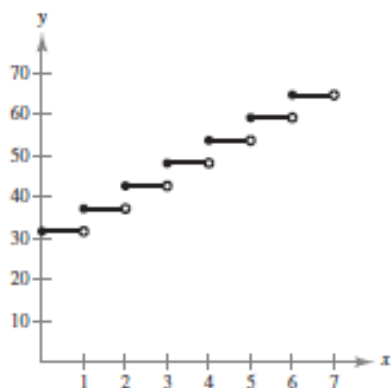
C)



D)



E)



Ans: B

70. Describe the sequence of transformation from $f(x) = x^2$ to $g(x)$ if

$$g(x) = (x - 6)^2 - 7$$

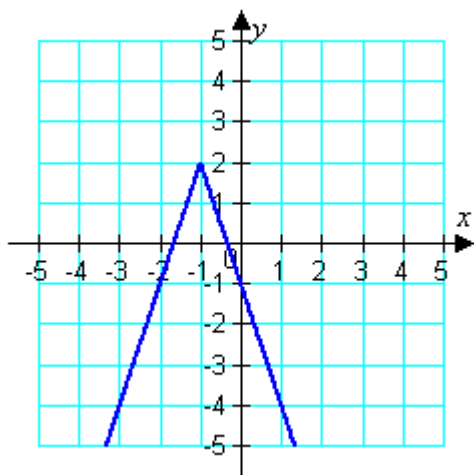
- A) Shifted seven units to the right and six units upwards.
- B) Shifted seven units to the left and six units upwards.
- C) Shifted six units to the right and seven units upwards.
- D) Shifted six units to the left and seven units upwards.
- E) Shifted six units to the right and seven units downwards.

Ans: E

71. Use the graph of

$$f(x) = |x|$$

to write an equation for the function whose graph is shown.



A)

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

B)

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

C)

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

D)

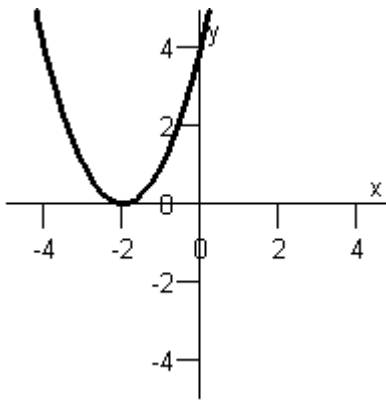
$$f(x) = -3|x - 1| + 2$$

E)

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

Ans: E

72. Use the graph of $f(x) = x^2$ to write an equation for the function whose graph is shown below.



- A) $g(x) = (x - 4)^2$
- B) $g(x) = -(x + 4)^2$
- C) $g(x) = (x + 2)^2$
- D) $g(x) = -(x - 2)^2$
- E) $g(x) = -(x - 4)^2$

Ans: C

73. Consider the graph of $f(x) = x^3$. Use your knowledge of rigid and nonrigid transformations to write an equation for the following descriptions.

The graph of f is shifted four units to the right.

- A) $y = (x + 4)^3$
- B) $y = (x - 4)^3$
- C) $y = x^3 - 4$
- D) $y = x^3 + 4$
- E) $y = -4x^3$

Ans: B

74. Consider the graph of $g(x) = \sqrt{x}$. Use your knowledge of rigid and nonrigid transformations to write an equation for the following descriptions.

The graph of g is reflected in the x -axis, shifted eight units to the right, and shifted nine unit downward.

- A) $h(x) = -\sqrt{x+8} - 9$
- B) $h(x) = -\sqrt{x-8} - 9$
- C) $h(x) = \sqrt{x-8} - 9$
- D) $h(x) = \sqrt{x+8} + 9$
- E) $h(x) = -\sqrt{x-9} + 8$

Ans: B

75. The weekly profit P (in hundreds of dollars) for a business from a product is given by the model

$$P(x) = 70 - 20x + 0.8x^2, \quad 0 \leq x \leq 20$$

where x is the amount (in hundreds of dollars) spent on advertising. Rewrite the profit equation so that x measures advertising expenditures in dollars.

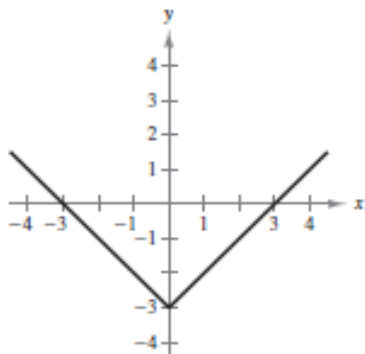
- A) $P\left(\frac{x}{100}\right) = \frac{7}{10} - \frac{x}{5} + 0.8x^2$
- B) $P\left(\frac{x}{100}\right) = \frac{7}{10} - \frac{x}{5} + 0.00008x^2$
- C) $P\left(\frac{x}{100}\right) = \frac{7}{10} - \frac{x}{5} + 0.008x^2$
- D) $P\left(\frac{x}{100}\right) = 70 - \frac{x}{5} + 0.00008x^2$
- E) $P\left(\frac{x}{100}\right) = 70 - \frac{x}{5} + 0.008x^2$

Ans: D

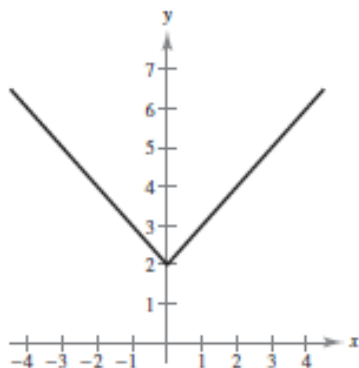
76. Describe the sequence of transformations from $f(x) = |x|$ to g . Then sketch the graph of g by hand. Verify with a graphing utility.

$$f(x) = |x| + 2$$

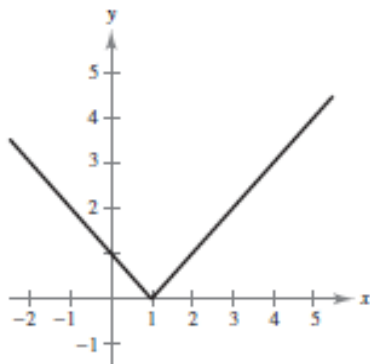
- A) Vertical shifts down 3 units



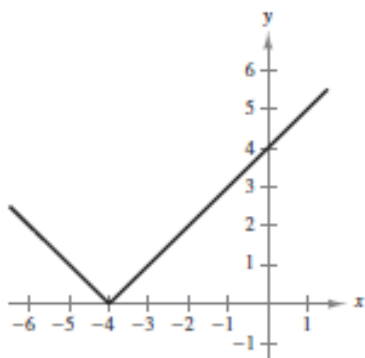
- B) Vertical shifts 2 units upward



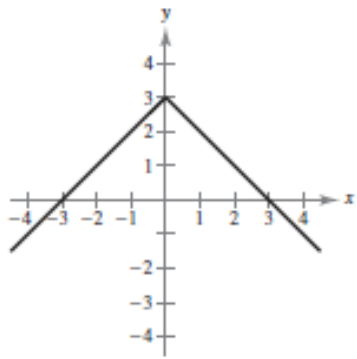
- C) Horizontal shift 1 unit to the right



- D) Horizontal shifts 4 units to the left



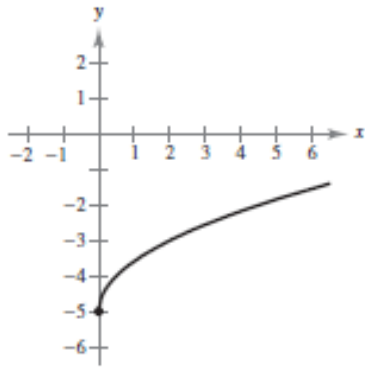
E) Vertical shifts 3 units upward



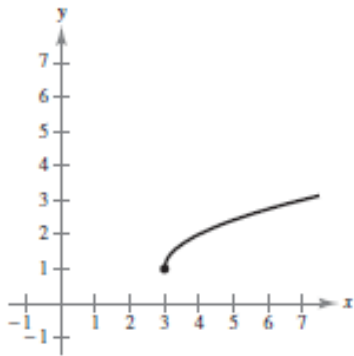
Ans: B

77. Describe the sequence of transformations from $f(x) = \sqrt{x}$ to g . Then sketch the graph of g by hand. Verify with a graphing utility.
 $g(x) = \sqrt{x-3}$

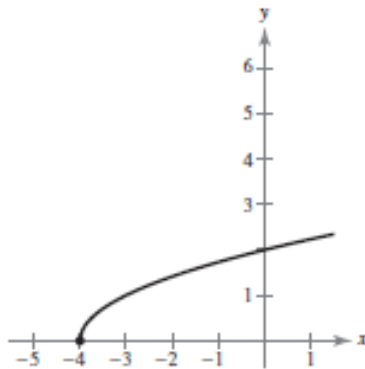
A) Shifted 5 units downward



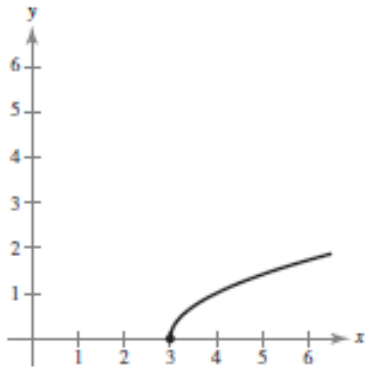
B) Shifted 1 unit upward



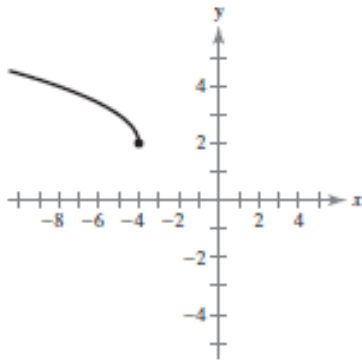
C) Shifted 4 units to the left



D) Shifts 3 units to the right

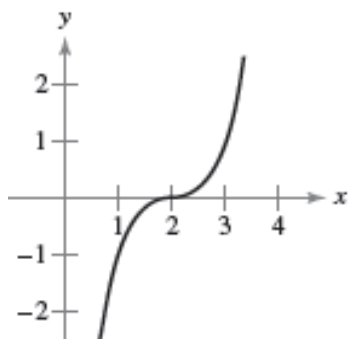


E) 4 units to the left and 2 units upward



Ans: D

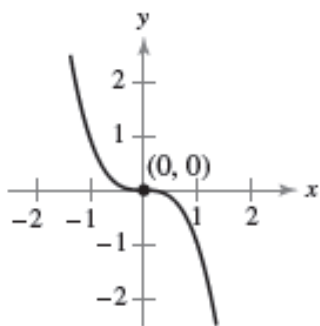
78. Identify the transformation shown in the graph and identify the associated common function. Write the equation of the graphed function.



- A) Common function: $y = x^3$
Transformation: horizontal shift 2 units to the right
Equation: $y = (x - 2)^3$
- B) Common function: $y = x$
Transformation: multiplied by $\frac{1}{2}$ shrinking
Equation: $y = \frac{1}{2}x$
- C) Common function: $y = x^2$
Transformation: reflection about the x-axis
Equation: $y = -x^2$
- D) Common function: $y = c$
Transformation: c is 7.
Equation: $y = 7$
- E) Common function: $y = \sqrt{x}$
Transformation: reflection about the x-axis and a vertical shift 1 unit upward
Equation: $y = -\sqrt{x} + 1$

Ans: B

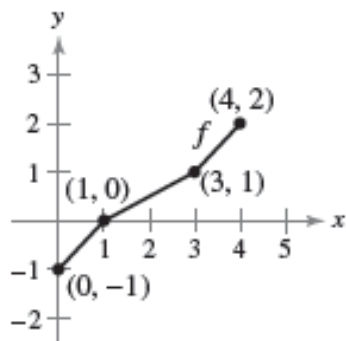
79. Use the graph of $f(x) = x^3$ to write equations for the functions whose graphs are shown.



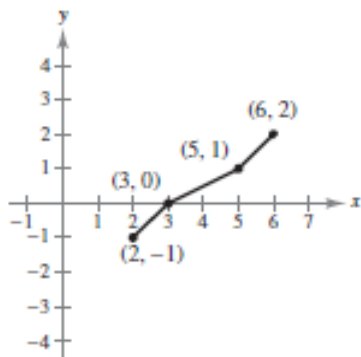
- A) $y = -x^3$
- B) $(x+1)^3 + 1$
- C) x^2
- D) $x^2 + 1$
- E) $-x^2 + 1$

Ans: A

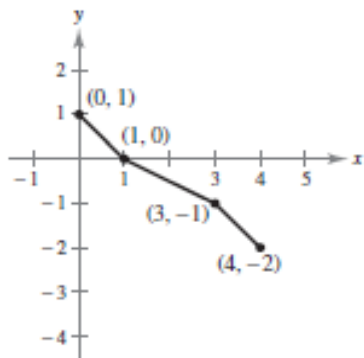
80. Use the graph of f to sketch the graph of $y = f(x) + 2$.



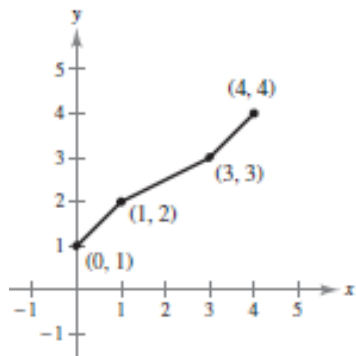
- A) Horizontal shift 2 units to the right



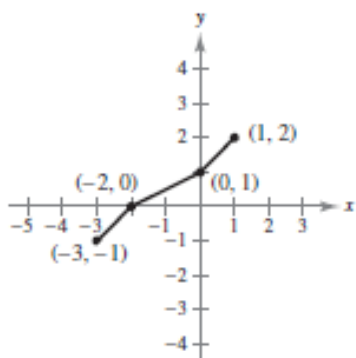
- B) Reflection in the x-axis



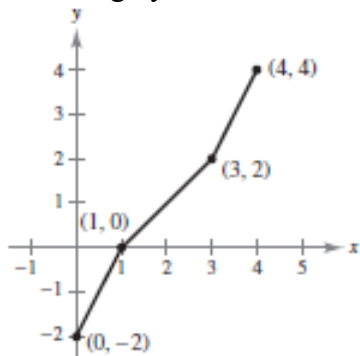
- C) Vertical shift 2 units upward



- D) Horizontal shift 3 units to the left

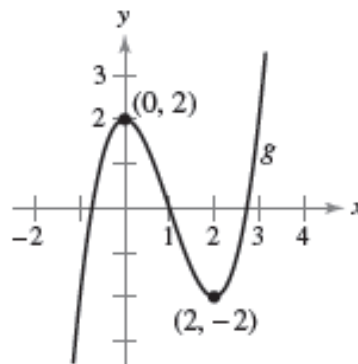
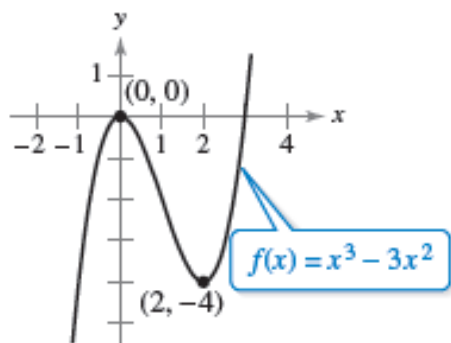


E) Stretching by 2



Ans: C

81. Use the graph of $f(x) = x^3 - 3x^2$ to write an equation for the function g .



- A) The graph is shifted 2 units upward, so
 $g(x) = x^3 - 3x^2 + 2$
- B) The graph is reflected in the x-axis and shifted 1 unit upward, so
 $g(x) = -x^3 + 3x^2 + 1$
- C) The graph is shifted 1 unit to the left, so
 $g(x) = x^3 - 3x - 2$
- D) The graph is shifted 2 unit to the left, so
 $g(x) = -x^3 + 3x^2 + 3x + 2$
- E) The graph is shifted 1 unit to the right
 $g(x) = x^3 + 3x + 1$

Ans: A

82. The point $(3, 9)$ on the graph of $f(x) = x^2$ has been shifted to the point $(4, 7)$ after a rigid transformation. Identify the shift and write the new function g in terms of f .

A) Shift: shifted 1 unit to the left.

$$h(x) = (x+1)^2$$

B) Shift: horizontally 3 units to the left and vertically 2 units downward.

$$h(x) = (x+3)^2 - 2$$

C) Shift: horizontally 2 units to the right and vertically 1 unit upward.

$$h(x) = (x-2)^2 + 1$$

D) Shift: horizontally 1 unit to the right and vertically 2 units downward.

$$h(x) = (x-1)^2 - 2$$

E) Shift: shifted 1 unit upward.

$$h(x) = x^2 + 1$$

Ans: D

83. Find $(f/g)(x)$.

$$f(x) = 4x^2 - 8x \qquad g(x) = -7 - x$$

A) $(f/g)(x) = \frac{4x^2 - 8x}{-7 - x}, x \neq 7$

B) $(f/g)(x) = \frac{4x^2 - 8x}{-7 - x}, x \neq -7$

C) $(f/g)(x) = \frac{4x^2 - 8x}{-7 - x}, x \neq 0$

D) $(f/g)(x) = \frac{4x - 8}{-7}, x \neq 0$

E) $(f/g)(x) = -\frac{4x^2}{7} + 8, x \neq 0$

Ans: B

84. Find $(f+g)(x)$.

$$f(x) = -6x^2 + 5x - 2$$

$$g(x) = -3x^2 + 1$$

A) $(f+g)(x) = -3x^4 + 5x - 3$

B) $(f+g)(x) = -9x^4 + 5x - 1$

C) $(f+g)(x) = -3x^2 + 5x - 3$

D) $(f+g)(x) = -9x^2 + 5x - 1$

E) $(f+g)(x) = 9x^2 - 5x + 1$

Ans: D

85. Find $(fg)(x)$.

$$f(x) = \sqrt{2x} \qquad g(x) = \sqrt{-x+3}$$

- A) $(fg)(x) = x\sqrt{-2} + \sqrt{6x}$
- B) $(fg)(x) = x\sqrt{-2+6x}$
- C) $(fg)(x) = \sqrt{x+3}$
- D) $(fg)(x) = \sqrt{-2x^2+3}$
- E) $(fg)(x) = \sqrt{-2x^2+6x}$

Ans: E

86. Find $(f-g)(x)$.

$$f(x) = \frac{2x}{6x+9} \qquad g(x) = -\frac{9}{x}$$

- A) $(f-g)(x) = \frac{2x+9}{5x+9}$
- B) $(f-g)(x) = \frac{2x+63}{6x+9}$
- C) $(f-g)(x) = \frac{2x+45}{6x+9}$
- D) $(f-g)(x) = \frac{2x^2+54x-81}{6x^2+9x}$
- E) $(f-g)(x) = \frac{2x^2+54x+81}{6x^2+9x}$

Ans: E

87. Evaluate $(f+g)(6)$ where $f(x) = x^2 - 7x + 12$ and $g(x) = x - 5$.

- A) -23
- B) 5
- C) 6
- D) 1
- E) 7

Ans: E

88. Evaluate $(f-g)(3)$ where $f(x) = x^2 + 5x - 50$ and $g(x) = -3x - 8$.

- A) -25
- B) -9
- C) -15
- D) -26
- E) -43

Ans: B

89. Evaluate $(fg)(2)$ where $f(x) = x^2 + 15x + 54$ and $g(x) = -10x - 6$.

- A) 2288
- B) 520
- C) -2288
- D) -392
- E) -1766

Ans: C

90. Evaluate $\left(\frac{f}{g}\right)(8)$ where $f(x) = x^2 - 6x - 135$ and $g(x) = 17x + 14$.

- A) $-\frac{7}{6}$
- B) $-\frac{119}{150}$
- C) $-\frac{119}{22}$
- D) $\frac{8}{75}$
- E) $-\frac{71}{150}$

Ans: B

91. Find $f \circ g$.

- $f(x) = -5x - 9$ $g(x) = x + 5$
- A) $(f \circ g)(x) = -5x - 34$
 - B) $(f \circ g)(x) = -5x - 4$
 - C) $(f \circ g)(x) = -5x^2 - 34x - 45$
 - D) $(f \circ g)(x) = -6x - 14$
 - E) $(f \circ g)(x) = -6x - 4$

Ans: A

92. Find $g \circ f$.

- $f(x) = x + 4$ $g(x) = x^2$
- A) $(g \circ f)(x) = x^2 + 4$
 - B) $(g \circ f)(x) = x^2 - 16$
 - C) $(g \circ f)(x) = x^2 + 16$
 - D) $(g \circ f)(x) = x^2 + 4x + 16$
 - E) $(g \circ f)(x) = x^2 + 8x + 16$

Ans: E

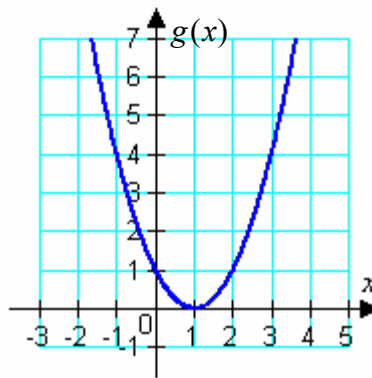
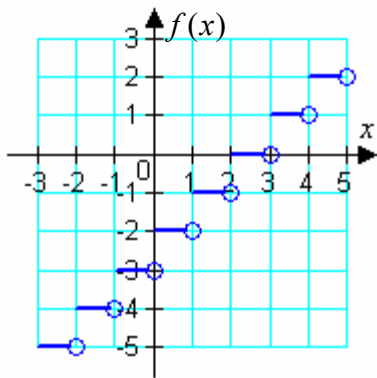
93. Determine the domain of $f \circ g$ if

$$f(x) = x^2 - 17 \quad \text{and} \quad g(x) = \sqrt{x}.$$

- A) $(-\infty, \infty)$
- B) $(-\infty, -17] \cup [17, \infty)$
- C) $(-\infty, -\sqrt{17}] \cup [\sqrt{17}, \infty)$
- D) $[\sqrt{17}, \infty)$
- E) $[0, \infty)$

Ans: C

94. Use the graphs of f and g to evaluate the function.



$$(f \circ g)(3)$$

- A) 1
- B) -2
- C) 4
- D) -1
- E) 2

Ans: E

95. The monthly cost C of running the machinery in a factory for t hours is given by

$$C(t) = 10t + 150.$$

The number of hours t needed to produce x products is given by

$$t(x) = 9x.$$

Find the equation representing the cost C of manufacturing x products.

- A) $C(x) = 90x + 150$
- B) $C(x) = 90x + 1500$
- C) $C(x) = 19x + 150$
- D) $C(x) = 19x + 160$
- E) $C(x) = 10x + 159$

Ans: A

96. You own two fast-food restaurants. During the years 2000 to 2008, the sales for the first restaurant have been increasing according to the function

$$R_1 = 323 + 11.8t, \quad t = 0, 1, 2, 3, 4, 5, 6, 7, 8$$

where R_1 represents the sales (in thousands of dollars) and t represents the year, with $t = 0$ corresponding to 2000. During the same nine-year period, the sales for the second restaurant have been decreasing according to the function

$$R_2 = 470 - 18.6t, \quad t = 0, 1, 2, 3, 4, 5, 6, 7, 8.$$

Write a function that represents the total sales for the two restaurants to determine whether the total sales have been increasing or decreasing.

- A) $R_T = -147 - 6.8t$, total sales have been decreasing.
- B) $R_T = 793 + 6.8t$, total sales have been increasing.
- C) $R_T = 793 - 6.8t$, total sales have been decreasing.
- D) $R_T = -147 + 30.4t$, total sales have been increasing.
- E) $R_T = 147 - 30.4t$, total sales have been decreasing.

Ans: C

97. A pebble is dropped into a calm pond, causing ripples in the form of concentric circles. The radius (in feet) of the outermost ripple is given by

$$r(t) = 0.5t$$

where t is time in seconds after the pebble strikes the water. The area of the outermost circle is given by the function

$$A(r) = \pi r^2.$$

Find and interpret $(A \circ r)(t)$.

- A) $(A \circ r)(t) = \pi t^2$; $A \circ r$ represents the radius of the circle at time t .
- B) $(A \circ r)(t) = 0.5\pi t^2$; $A \circ r$ represents the radius of the circle at time t .
- C) $(A \circ r)(t) = 0.25\pi t^2$; $A \circ r$ represents the radius of the circle at time t .
- D) $(A \circ r)(t) = 0.25\pi t^2$; $A \circ r$ represents the area of the circle at time t .
- E) $(A \circ r)(t) = 0.5\pi t^2$; $A \circ r$ represents the area of the circle at time t .

Ans: D