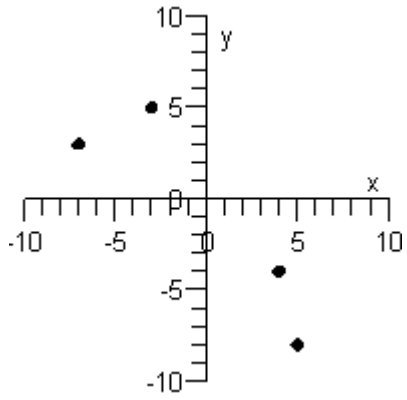
Chapter 2: Functions and Graphs

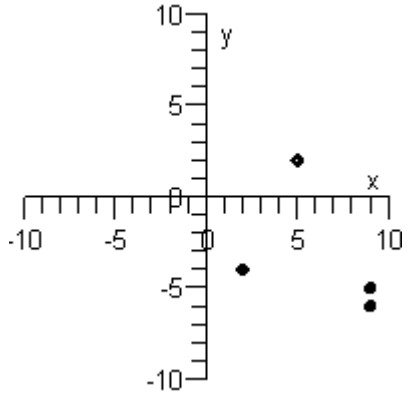
1. Plot the points below whose coordinates are given on a Cartesian coordinate system.

$(-3,5),(-7,3),(4,-4),(5,-8)$

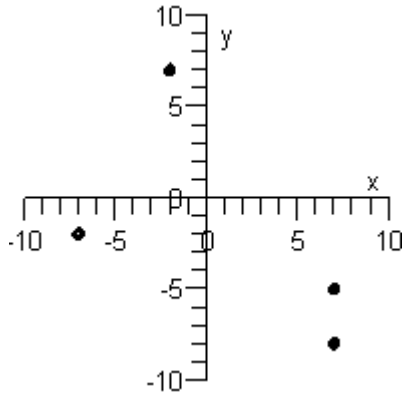
A)



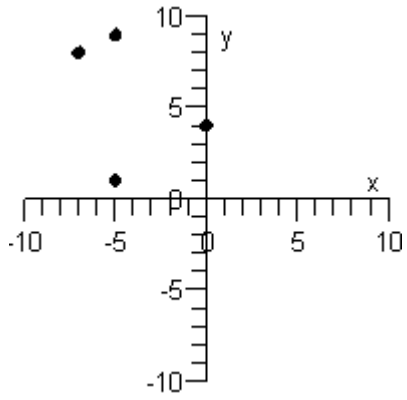
B)



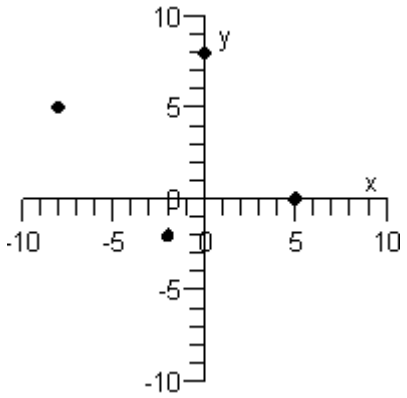
C)



D)



E)



Ans: A

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

(9, 2), (5, 5)
A) 15.65
B) 14.32
C) 5
D) 8.06
E) 7
Ans: C

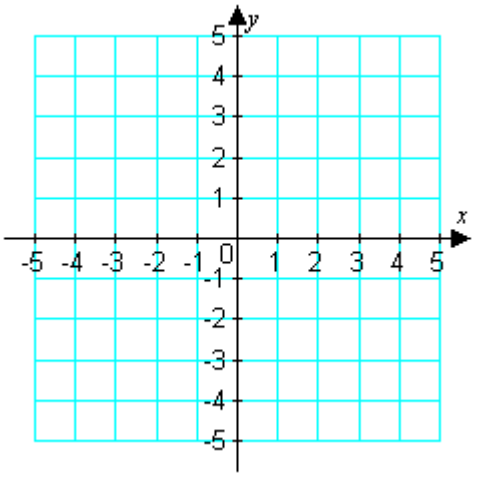
3. Find the midpoint of the line segment joining the points.

(7, –7), (–7, –5)
A) (0, 6)
B) (–6, 0)
C) (–1, 7)
D) (7, –1)
E) (0, –6)
Ans: E

4. Find x such that the distance between the point $(2,0)$ and $(x,-8)$ is 10.
A) $x = 8,10$
B) $x = -6,10$
C) $x = -4,10$
D) $x = -6,8$
E) $x = -4,8$
Ans: E

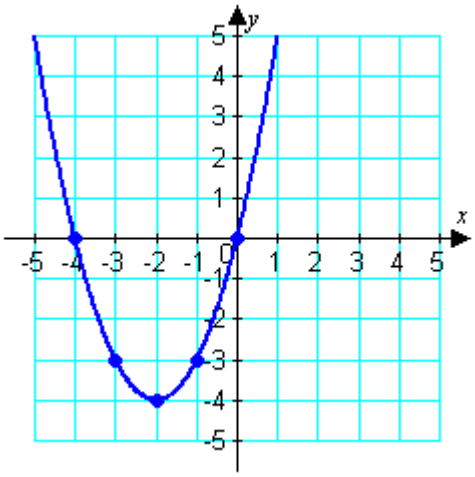
5. After completing the table, use the resulting solution points to sketch the graph of the equation $y = x^2 + 4x$.

x	–4	–3	–2	–1	0
y					
(x, y)					



Ans:

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



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

$-9x+10y=11$

A) *x*-int: $\left(-\frac{9}{10},0\right)$; *y*-int: $\left(0,-\frac{10}{9}\right)$

B) *x*-int: $\left(-\frac{9}{10},0\right)$; *y*-int: $\left(0,\frac{11}{10}\right)$

C) *x*-int: $\left(-\frac{11}{9},0\right)$; *y*-int: $\left(0,\frac{11}{10}\right)$

D) *x*-int: $\left(-\frac{9}{11},0\right)$; *y*-int: $\left(0,-\frac{9}{10}\right)$

E) *x*-int: $\left(-\frac{11}{9},0\right)$; *y*-int: $\left(0,-\frac{10}{9}\right)$

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 $y=\frac{x}{x^2+1}$, 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

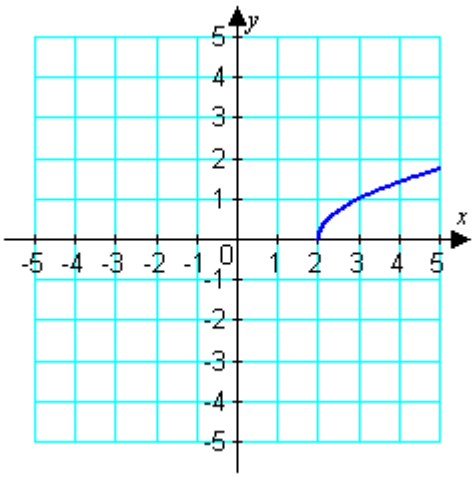
Ans: C

9. Given $x^2+y^2=4$, use the algebraic tests to determine symmetry with respect to both axes and the origin.

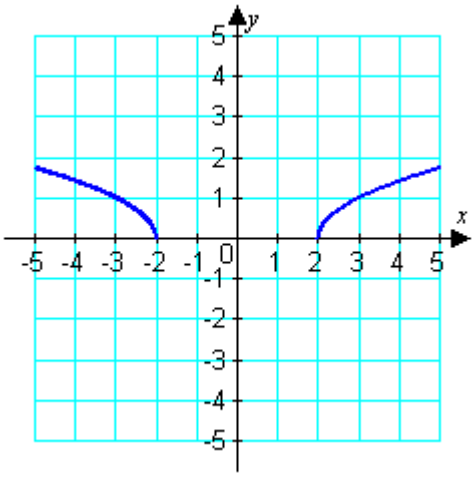
A) *y*-axis symmetry only
B) *x*-axis symmetry only
C) origin symmetry only
D) *x*-axis, *y*-axis, and origin symmetry
E) no symmetry

Ans: D

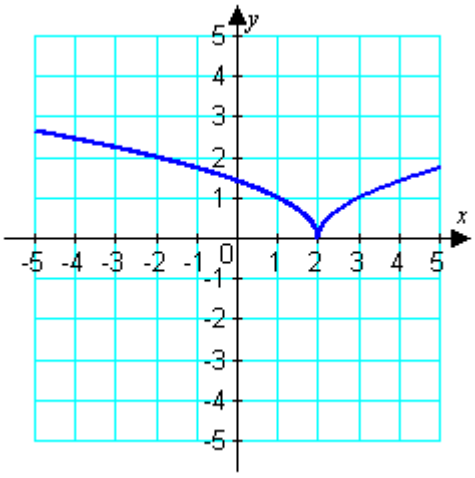
10. Assuming that the graph shown has *y*-axis symmetry, sketch the complete graph.



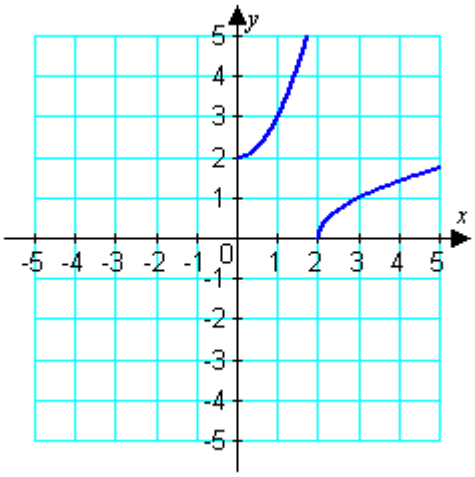
A)



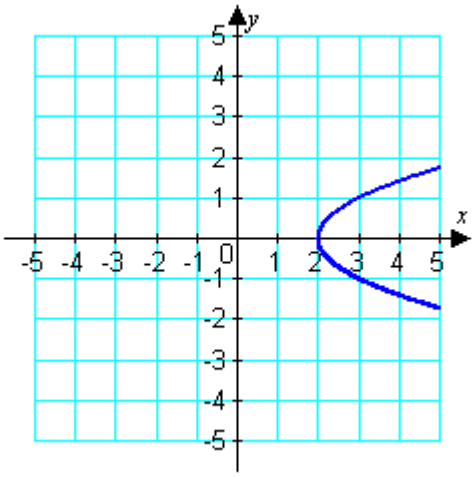
B)



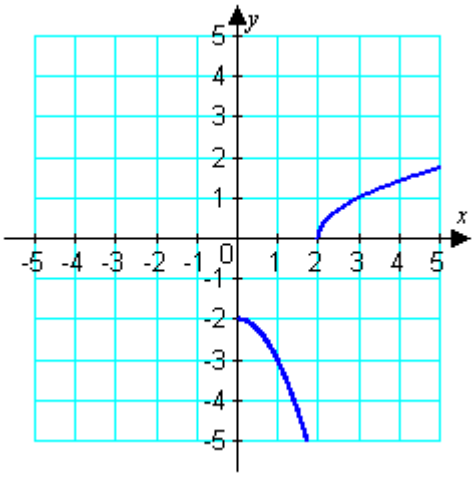
C)


y
x
5
4
3
2
1
-1
-2
-3
-4
-5
-5 -4 -3 -2 -1 0 1 2 3 4 5

D)


y
x
5
4
3
2
1
-1
-2
-3
-4
-5
-5 -4 -3 -2 -1 0 1 2 3 4 5

E)

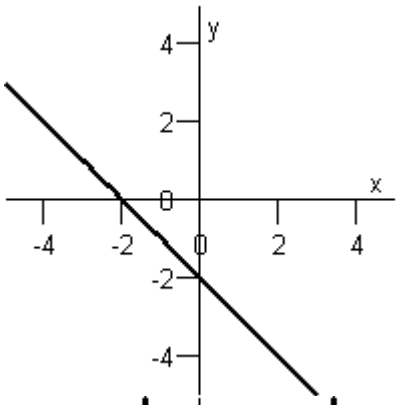

y
x
5
4
3
2
1
-1
-2
-3
-4
-5
-5 -4 -3 -2 -1 0 1 2 3 4 5

Ans: A

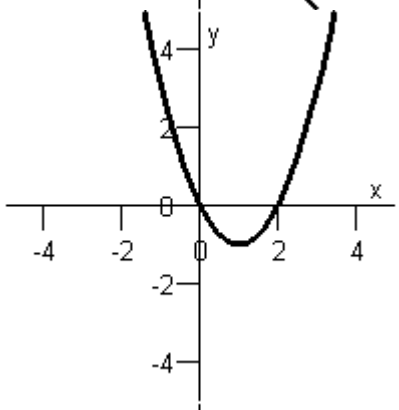
11. Match the equation below with its graph.

$$y = -2 - x$$

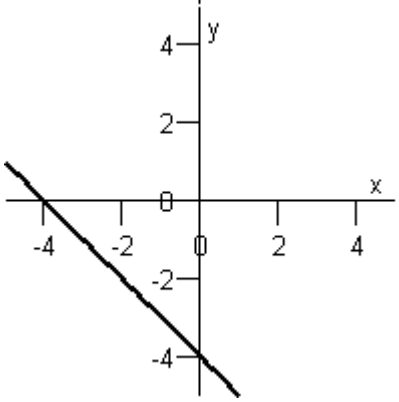
Graph I :



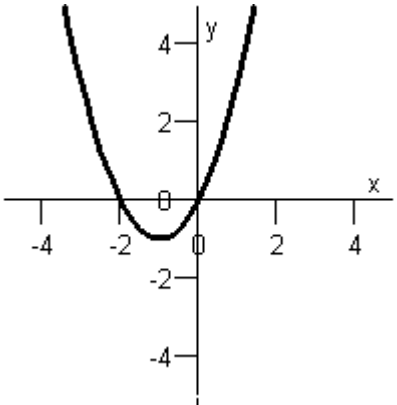
Graph II :



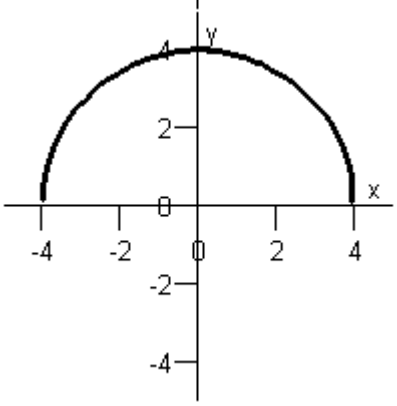
Graph III :



Graph IV :



Graph V :

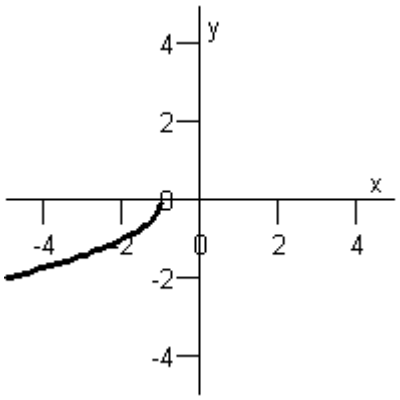


A) Graph IV
B) Graph III
C) Graph V
D) Graph II
E) Graph I
Ans: E

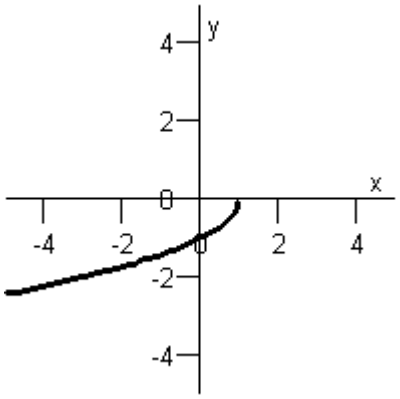
12. Sketch the graph of the equation below.

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

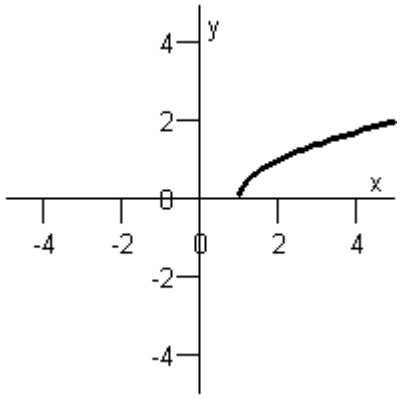
A)



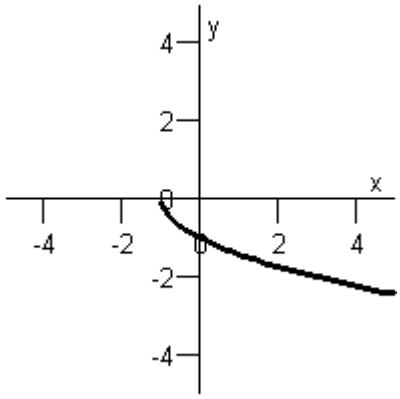
B)



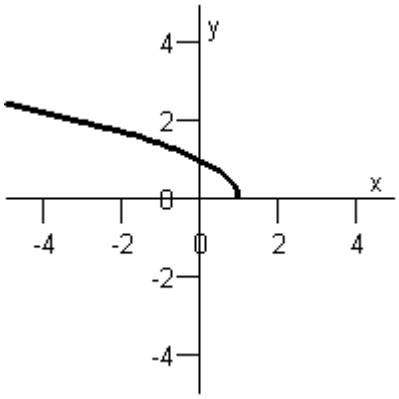
C)



D)



E)

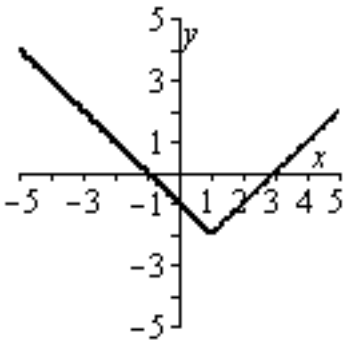


Ans: A

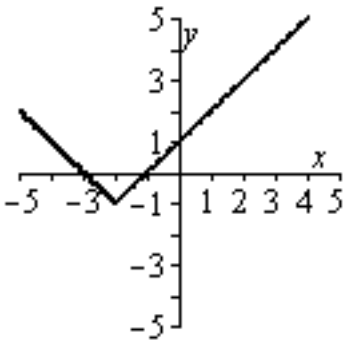
13. Graph the following equation by plotting points that satisfy the equation.

$y = |x + 1| - 2$

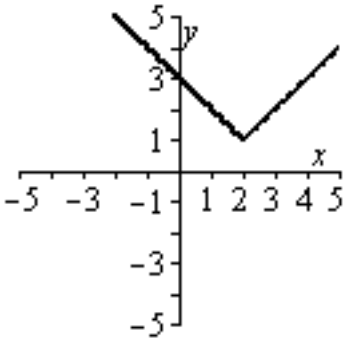
A)



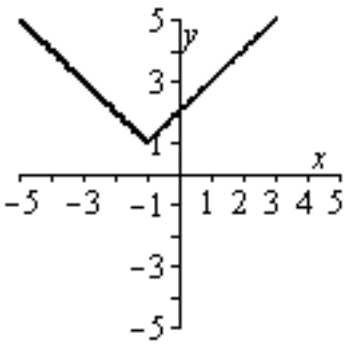
B)



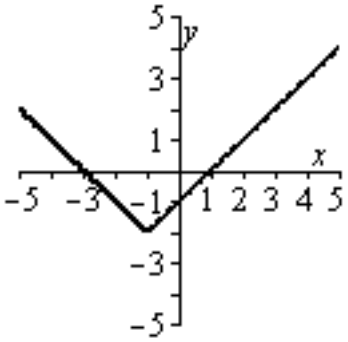
C)



D)



E)

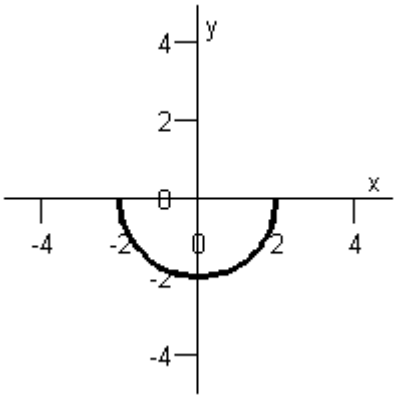


Ans: E

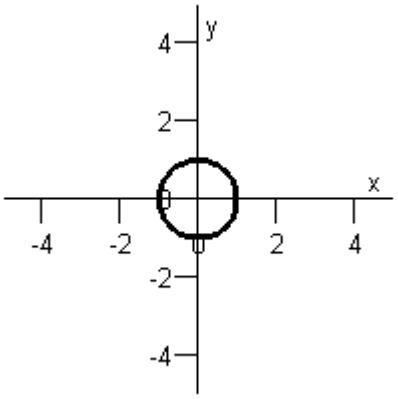
14. Sketch the graph of the equation below.

$$x^2 + y^2 = 1$$

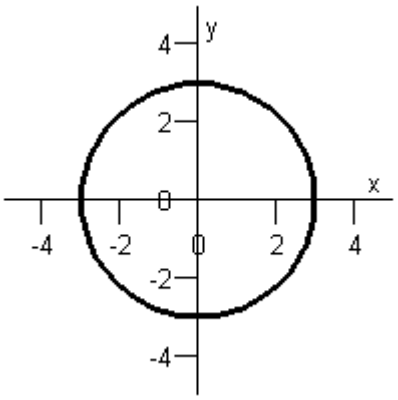
A)



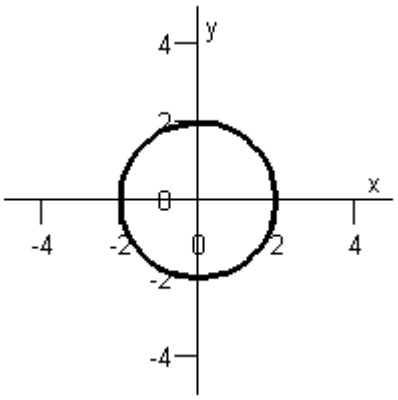
B)



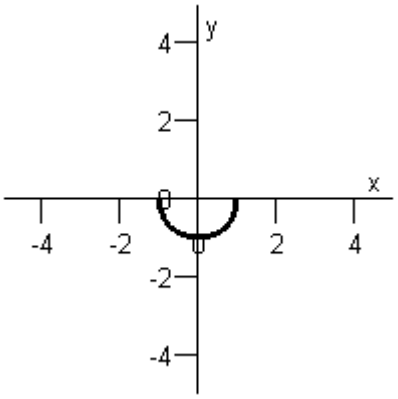
C)



D)



E)



Ans: B

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

Center: $(-4, -5)$; passing through $(2, -3)$

A) $(x-4)^2+(y-5)^2=\left(\sqrt{10}\right)^2$

B) $(x-2)^2+(y+3)^2=\left(\sqrt{10}\right)^2$

C) $(x+4)^2+(y+5)^2=\left(\sqrt{13}\right)^2$

D) $(x+4)^2+(y+5)^2=\left(2\sqrt{10}\right)^2$

E) $(x-2)^2+(y+3)^2=\left(\sqrt{13}\right)^2$

Ans: D

16. Write the standard form of the equation of the circle whose diameter has endpoints of $(0, -2)$ and $(6, 6)$.

A) $(x-3)^2+(y-2)^2=25$

B) $(x-3)^2+(y-2)^2=5$

C) $(x-2)^2+(y-3)^2=25$

D) $(x+2)^2+(y+3)^2=25$

E) $(x+3)^2+(y+2)^2=5$

Ans: A

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

$$y = 5.3x + 483, \quad -40 \le x \le 30$$

where x represents the year, with $x = 30$ corresponding to 2050. Find the y-intercept of the graph of the model. What does it represent in the given situation?

A) $(0, 642)$; It represents the population (in millions of people) of North America in 2050.

B) $(0, 324)$; It represents the population (in millions of people) of North America in 1990.

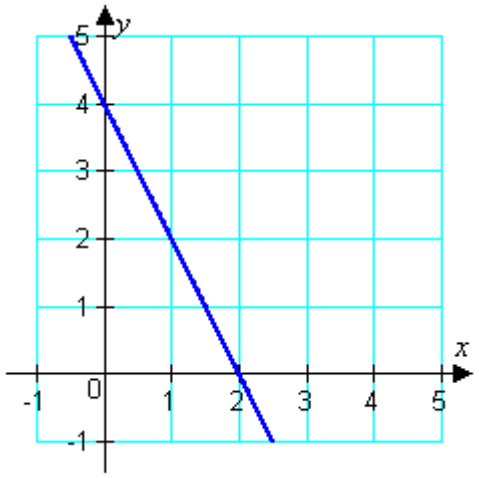
C) $(0, 536)$; It represents the population (in millions of people) of North America in 2030.

D) $(0, 483)$; It represents the population (in millions of people) of North America in 2020.

E) $(0, 271)$; It represents the population (in millions of people) of North America in 1980.

Ans: D

18. Estimate the slope of the line.



A) $-\frac{1}{2}$

B) 2

C) -2

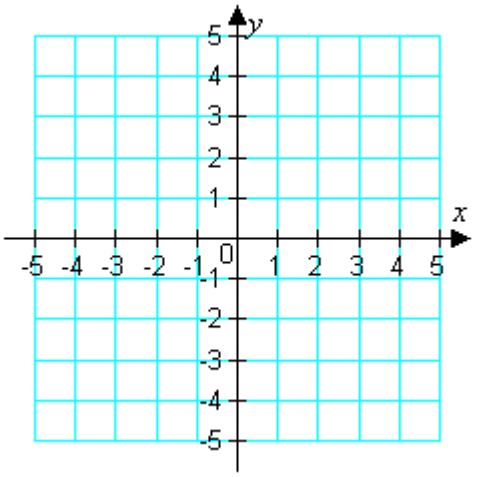
D) $\frac{1}{2}$

E) -3

Ans: C

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

(2, –4), (4, –1)



A) slope: $\frac{2}{3}$

B) slope: $-\frac{2}{3}$

C) slope: $\frac{6}{5}$

D) slope: $\frac{3}{2}$

E) slope: $-\frac{3}{2}$

Ans: D

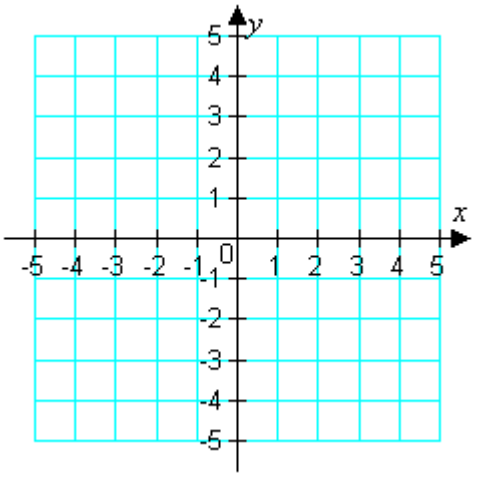
20. Find the slope of the line that passes through the points $(-6,3)$ and $(-6,-2)$.

A) 9
B) –5
C) 5
D) 0
E) undefined

Ans: E

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

(3, –2), (–4, –2)



A) slope: 0
B) slope: 1
C) slope: –7
D) slope: $-\frac{1}{7}$
E) slope: undefined
Ans: A

22. Find the slope of the line that passes through the points $A(-6,2)$ and $B(10,-7)$.

A) $-\frac{9}{16}$
B) $-\frac{17}{8}$
C) $\frac{9}{16}$
D) $-\frac{1}{8}$
E) $-\frac{5}{4}$
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	Slope
$(6,7)$	$m=\frac{1}{2}$

I: $(-2,3)$

II: $(2,8)$

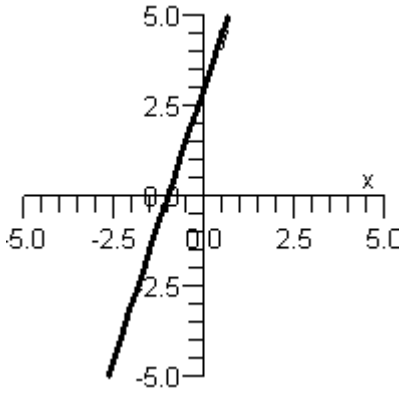
III: $(8,5)$

A) Only point I lies on the line.
B) None of the points 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

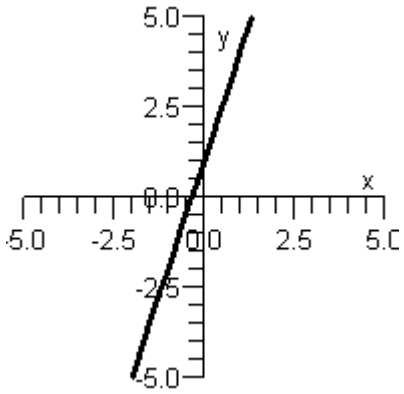
24. Graph y as a function of x by finding the slope and y-intercept of the line below.

$y = 3x + 1$

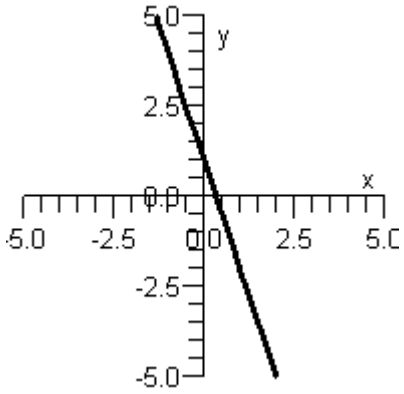
A)



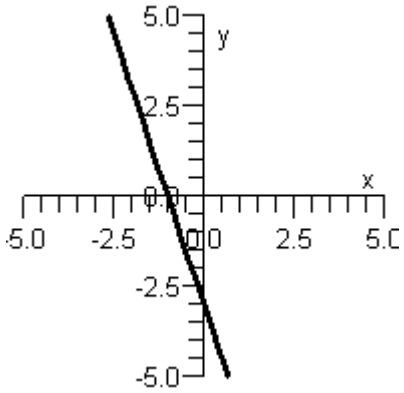
B)



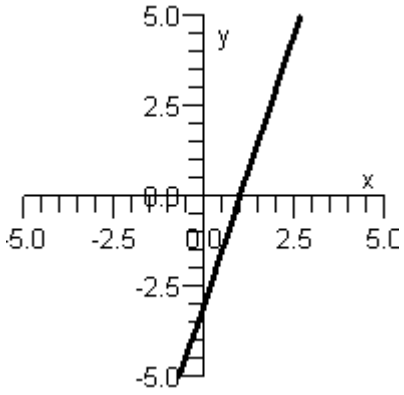
C)



D)



E)



Ans: B

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

$y = -6x + 4$

A) slope: $-\frac{1}{6}$; *y*-intercept: 4

B) slope: $\frac{1}{4}$; *y*-intercept: –6

C) slope: –6; *y*-intercept: 4

D) slope: 4; *y*-intercept: –6

E) slope: –6; *y*-intercept: –4

Ans: C

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

$-y - 8x = -2$

A) slope: 8; *y*-intercept: –2

B) slope: –2; *y*-intercept: 8

C) slope: 8; *y*-intercept: –1

D) slope: 2; *y*-intercept: –8

E) slope: –8; *y*-intercept: 2

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

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

x-intercept: (3, 0) *y*-intercept: (0, 5)

A) $5x + 3y = 1$

B) $5x+3y=\frac{1}{15}$

C) $3x+5y=\frac{1}{15}$

D) $3x + 5y = 15$

E) $5x + 3y = 15$

Ans: E

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

$$L_1 : 4x + 2y = 6$$
$$L_2 : 2x - 4y = -7$$

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 : (–5, –5), (4, 6)
L_2 : (–9, 8), (–18, –3)

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, 8), (9, –4)
L_2 : (0, 9), (1, –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 : (1, 2), (1, 4)
L_2 : (–7, –8), (–9, –8)
A) parallel
B) perpendicular
C) neither
Ans: B

32. Assume that y is directly proportional to x. If $x = 8$ and $y = 6$, 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.
"t varies directly as s, and $t = 97.66$ when $s = 19$."
A) $t = \frac{k}{s}$; $k = 1855.54$
B) $t = \sqrt{k}s$; $k = 26.42$
C) $t = ks$; $k = 5.14$
D) $t = k^2 s$; $k = 2.27$
E) $t = \sqrt{ks}$; $k = 501.97$
Ans: C

34. The simple interest on an investment is directly proportional to the amount of the investment. By investing $5750 in a certain certificate of deposit, you obtained an interest payment of $172.50 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) $I = (0.028)P$
B) $I = (0.033)P$
C) $I = (0.025)P$
D) $I = (0.034)P$
E) $I = (0.030)P$
Ans: E

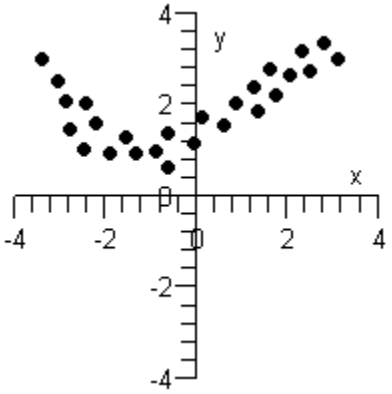
35. The sales tax on an item with a retail price of $908 is $99.88. Create a mathematical model that gives the retail price, *y*, in terms of the sales tax, *x*, and use it to determine the retail price of an item that has a sales tax of $113.50.
A) $1044.05
B) $1033.81
C) $976.13
D) $1003.45
E) $1031.82
Ans: E

36. After opening the parachute, the descent of a parachutist follows a linear model. At 7:28 P.M., the height of the parachutist is 6150 feet. At 7:31 P.M., the height is 3450 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) 7:33:30 P.M.
B) 7:34:50 P.M.
C) 7:32:00 P.M.
D) 7:37:30 P.M.
E) 7:31:00 P.M.
Ans: B

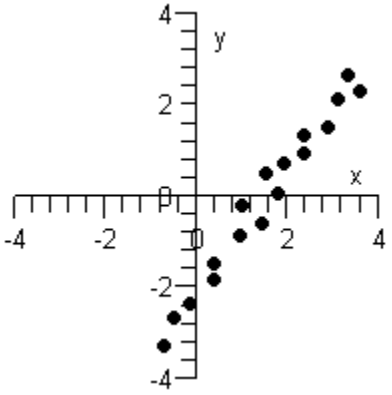
37. A motorcycle was purchased for $39,000. Assuming the motorcycle depreciates at a rate of $4680 per year (*straight-line depreciation*) for the first 7 years, write the value *v* of the motorcycle as a function of the time *t* (measured in years) for $0 \le t \le 7$.
A) $v(t) = 4680t - 39,000$
B) $v(t) = 39,000 - 4680(7)t$
C) $v(t) = 39,000 - 4680t$
D) $v(t) = 39,000 + 4680(7)t$
E) $v(t) = 39,000 + 4680t$
Ans: C

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

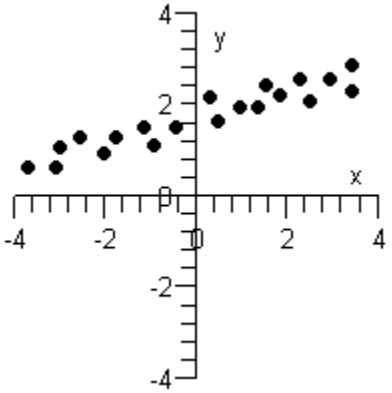
I



II



III



A) None can be modeled linearly.
B) Only graphs II and III can be modeled linearly.
C) Only graph III can be modeled linearly.
D) Only graphs I and II can be modeled linearly.
E) Only graph I 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)
10	30
15	50
22	60
25	75
35	100
40	119
50	155

A) $y = 3.028222013x - 1.079962371$

B) $y = 2.944432432x - 0.7139459459$

C) $y = 3.02463355x + 3.626221498$

D) $y = 3.156886228x + .5988023952$

E) $y = 3.073502956x + 2.338987407$

Ans: A

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

Age	*Years*
5	85.8
20	72.2
40	52.0
60	35.1
80	15.3

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) $A(x) = -0.94x + 105.51$

B) $A(x) = -17.81x + 90.51$

C) $A(x) = -17.81x + 105.51$

D) $A(x) = -0.94x + 54.89$

E) $A(x) = -0.94x + 90.51$

Ans: E

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

Age	*Years*
5	71.1
15	63.6
20	59.5
45	37.2
50	32.8

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 30-year old woman.

A) 59.79 years
B) 43.45 years
C) 49.47 years
D) 52.05 years
E) 57.21 years

Ans: C

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

$P = \{5, 10, 15, 20\}$ $Q = \{-1, 1, 3\}$

A) $\{(5, -1), (10, 1), (10, 3), (15, 1), (20, -1)\}$
B) $\{(15, -1), (15, 1), (15, 3)\}$
C) $\{(15, 1), (10, -1), (5, 1), (10, 3), (15, -1)\}$
D) $\{(10, 1), (15, 3), (20, 1)\}$
E) $\{(5, 3), (15, 1), (5, -1), (15, 3)\}$
Ans: D

43. Given $p(x) = 4x^2 + 9$, find $p(3)$.

A) 33
B) 21
C) 45
D) 36
E) 27
Ans: C

44. Given $n(x) = 5x^2 - 1$, find $n(-8)$.

A) 320
B) –41
C) 321
D) –81
E) 319
Ans: E

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

$f(y) = 6y + 3$; $f(0.8)$

A) $4.8y + 18$
B) 1.8
C) 7.8
D) $0.8y + 3$
E) $0.8y - 3$
Ans: C

46. Given $m(x) = 4x^2 + 2$, find $m(r)$.

A) $4r^2 + 2$
B) $16r^2 + 4$
C) $6r^2$
D) $16r^2 + 2$
E) $4r^2 + 2r$
Ans: A

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

$$f(x) = \frac{9x + 6}{5}$$

A) $-\frac{2}{15}$

B) $\pm\frac{2}{15}$

C) $\pm\frac{2}{3}$

D) $-\frac{2}{3}$

E) $\frac{2}{3}$

Ans: D

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

$$f(x) = 16x^2 - 25$$

A) $\pm\frac{4}{5}$

B) $\pm\frac{5}{4}$

C) $\pm\frac{25}{16}$

D) $-\frac{25}{16}$

E) $\frac{5}{4}$

Ans: B

49. Find the domain of the function.

$$q(s) = \frac{-6s}{s + 1}$$

A) all real numbers $s \neq -1$

B) all real numbers $s \neq -1$, $s \neq 0$

C) all real numbers

D) $s = -1$, $s = 0$

E) $s = -1$

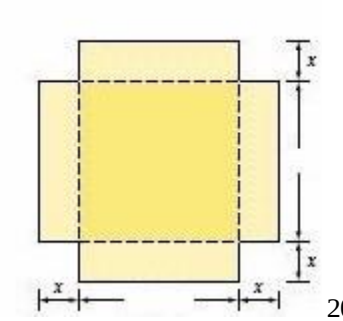
Ans: A

50. Find the domain of the function.

$q(y) = \sqrt{81 - y^2}$

A) $-9 \le y \le 9$
B) $y \le -9$ or $y \ge 9$
C) $y \ge 0$
D) $y \le 9$
E) all real numbers
Ans: A

51. An open box is to be made from a square piece of cardboard having dimensions 20 inches by 20 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.

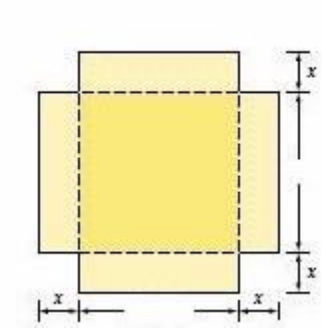


$20 - 2x$

$20 - 2x$

A) $V(x) = 20x^2 - 2x^3$
B) $V(x) = 20x - 40x^2 + 4x^3$
C) $V(x) = 400 - 80x + 4x^2$
D) $V(x) = 400x - 80x^2 + 4x^3$
E) $V(x) = 400x - 40x^2 + 4x^3$
Ans: D

52. An open box is to be made from a square piece of cardboard having dimensions 34 inches by 34 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 $V(x) = 1156x - 136x^2 + 4x^3$, state the domain of V.



A) $0 < x < 34$
B) $0 < x < 17$
C) $136 < x < 1156$
D) $4 < x < 136$
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

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

where t represents the year, with $t = 0$ corresponding to 1990. Use the model to find total veteran expenses in 2002.

A) \$51.904 billion
B) \$51.344 billion
C) \$12.404 billion
D) \$37.550 billion
E) \$30.100 billion
Ans: B

54. The inventor of a new game believes that the variable cost of producing the game is $3.65 per unit and the fixed costs are $5000. The inventor sells each game for $11.09. Let x be the number of games sold. Write the average cost per unit $\overline{C} = C/x$ as a function of x where C is defined as the total cost of producing x games.

A) $\overline{C} = \dfrac{5000}{x} - 7.44x$

B) $\overline{C} = 5000 + 3.65x$

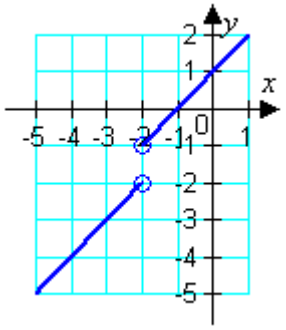
C) $\overline{C} = 5000 - 7.44x$

D) $\overline{C} = \dfrac{5000}{x} + 3.65$

E) $\overline{C} = \dfrac{5000}{x} - 7.44$

Ans: D

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



A)

domain : all real numbers

range : $(-\infty, -2) \cup (-1, \infty)$

B)

domain : all real numbers

range : all real numbers

C)

domain : $(-\infty, -2) \cup (-2, \infty)$

range : $(-\infty, -2) \cup (-1, \infty)$

D)

domain : $(-\infty, -2) \cup (-1, \infty)$

range : $(-\infty, -2) \cup (-2, \infty)$

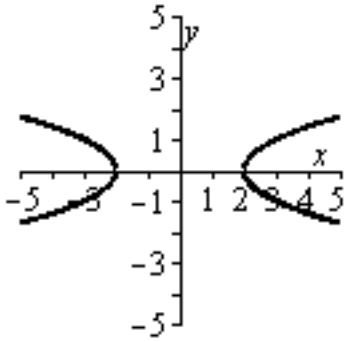
E)

Domain: all real numbers

Range: $(-\infty, -2] \cup [-1, \infty)$

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.

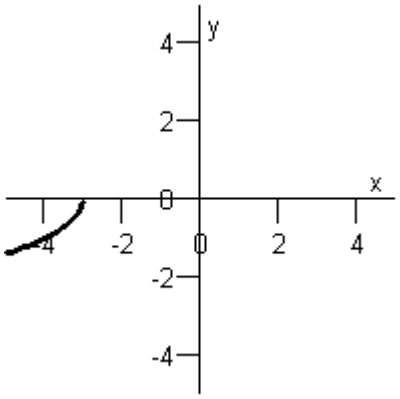
$f(x) = x^3 + 2x^2 + x - 5$

A) relative maximum: (–1.00, –5.00)
relative minimum: (–0.33, –5.15)
B) relative maximum: (–0.33, –5.15)
relative minimum: (–1.00, –5.00)
C) relative maximum: (–5.00, –1.00)
relative minimum: (–5.15, –0.33)
D) relative maximum: (–5.15, –0.33)
relative minimum: (–5.00, –1.00)
E) relative maximum: (–5.15, –93.58)
relative minimum: (–5.00, –85.00)
Ans: A

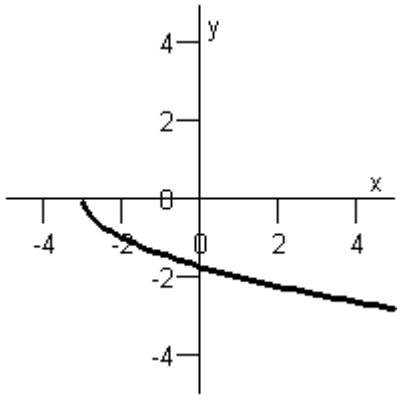
58. Sketch the graph of the function below.

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

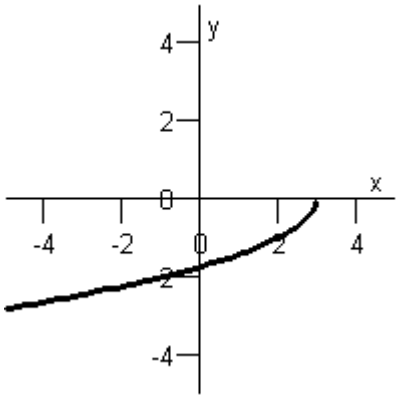
A)



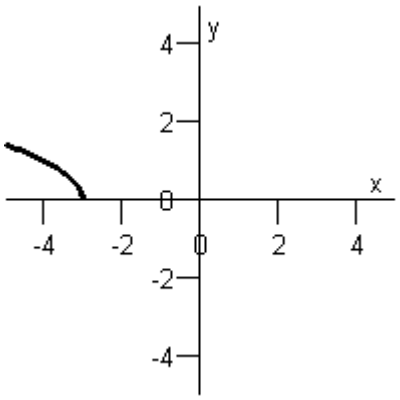
B)



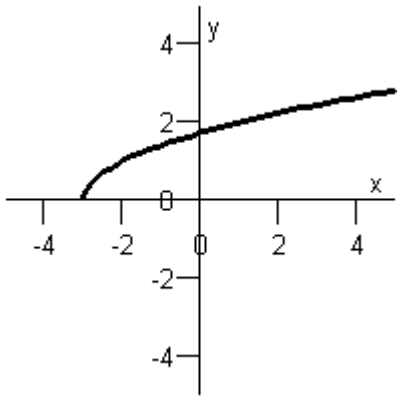
C)



D)



E)

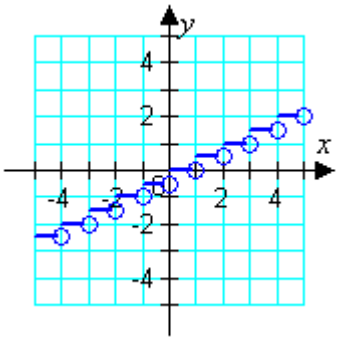


Ans: C

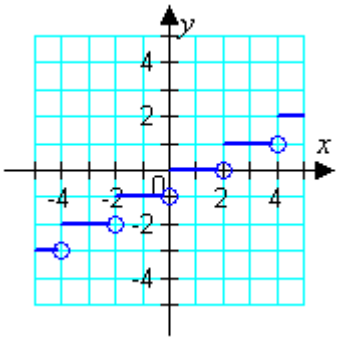
59. Which graph represents the function?

$g(x) = 2[\![x]\!]$

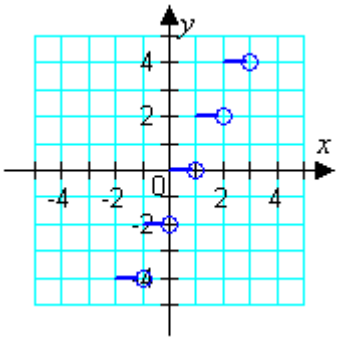
A)



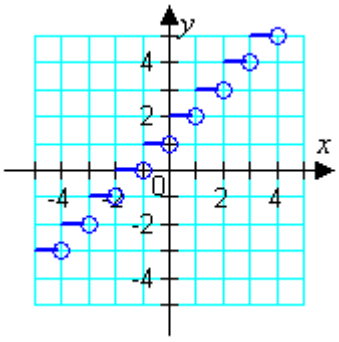
B)



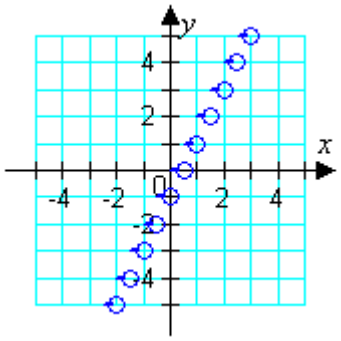
C)



D)



E)



Ans: C

60. The marketing department of a company estimates that the demand for a product is given by $p = 130 - 0.0001x$, where p is the price per unit and x is the number of units. The cost C of producing x units is given by $C = 350,000 + 10x$, and the profit P for producing and selling x units is given by

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

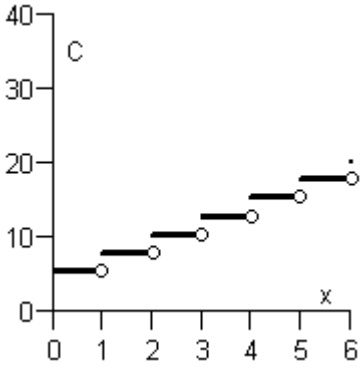
Sketch the graph of the profit function and estimate the number of units that would produce a maximum profit.

A) 590,000 units
B) 600,000 units
C) 640,000 units
D) 520,000 units
E) 620,000 units

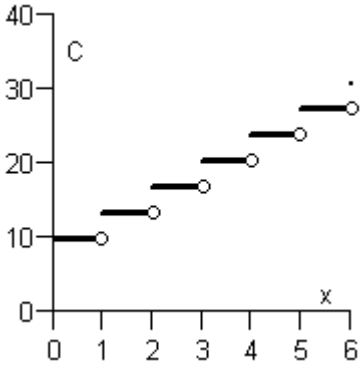
Ans: B

61. The cost of sending an overnight package from New York to Atlanta is \$9.80 for up to, but not including, the first pound and \$3.50 for each additional pound (or portion of a pound). A model for the total cost C of sending the package is $C = 9.80 + 3.50\lfloor x \rfloor$, $x > 0$, where x is the weight of the package (in pounds). Sketch the graph of this function. Note that the function $\lfloor x \rfloor$ is the greatest integer function.

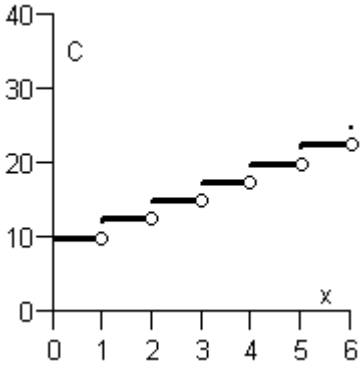
A)



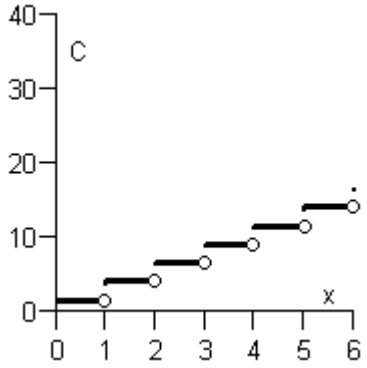
B)



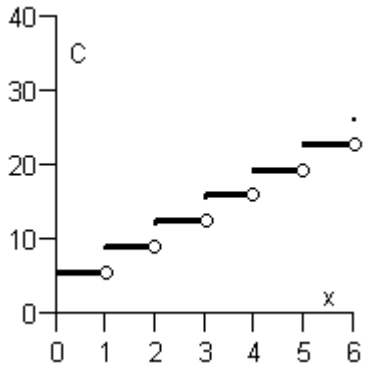
C)



D)



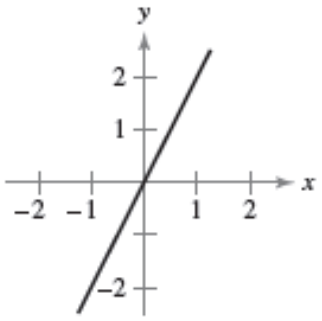
E)



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 $(-\infty, 1)$

Incresing on $(1, \infty)$

The graph's behaviour changes at the point $(1, -1)$

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

Decresing 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 $(-\infty, 0)$

Incresing on $(0, \infty)$

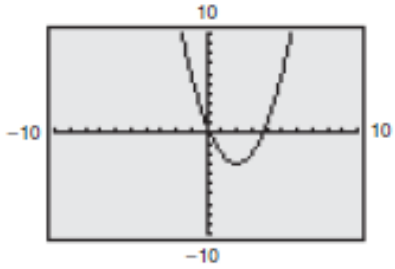
The graph's behaviour changes at the point $(0, 0)$

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)

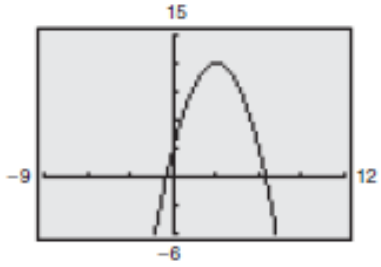


Decreasing on $(-\infty, 2)$

Increasing on $(2, \infty)$

Relative minimum: $(2, -3)$

B)

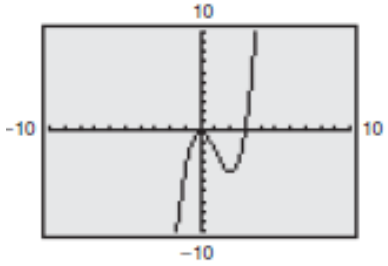


Decreasing on $(3, \infty)$

Increasing on $(-\infty, 3)$

Relative maximum: $(3,12)$

C)



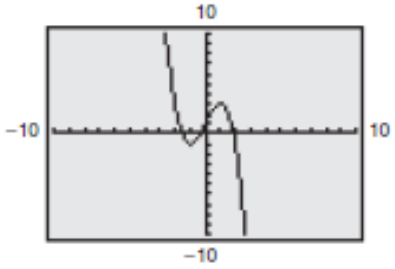
Decreasing on $(0, 2)$

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

Relative minimum: $(0, 0)$

Relative maximum: $(2, -4)$

D)



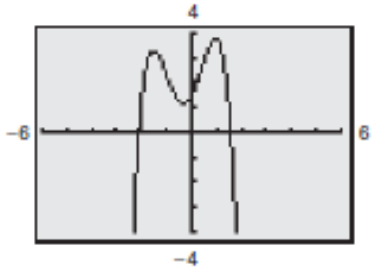
Decreasing on $(-\infty,-1),(1,\infty)$

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.
$f(x) = x$

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.

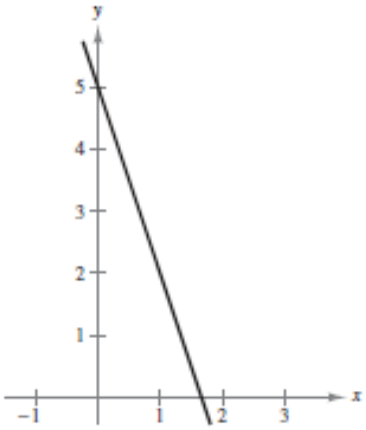
$g(x) = x^3 - 5x$

A) Odd
B) Even
C) Neither even nor odd
Ans: A

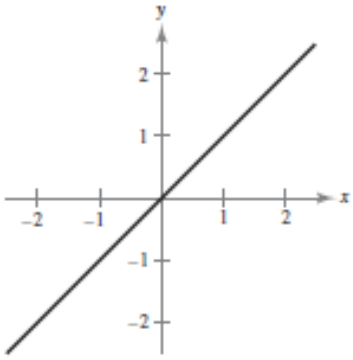
66. Sketch the graph of the function and determine whether the function is even, odd, or neither.

$f(x) = 5 - 3x$

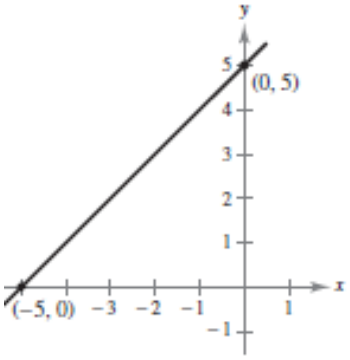
A) Neither even nor odd



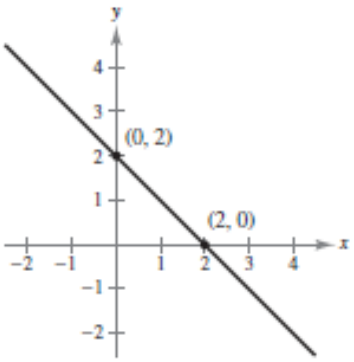
B) Even



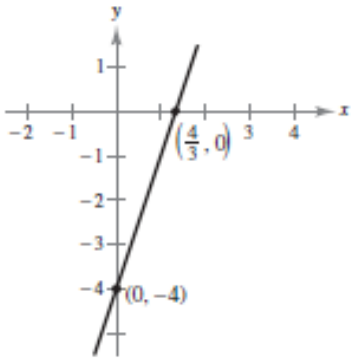
C) Odd



D) Odd



E) Neither even nor odd

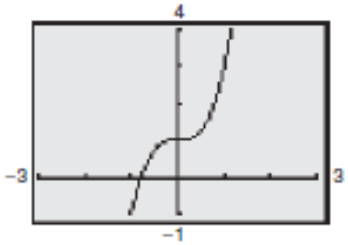


Ans: A

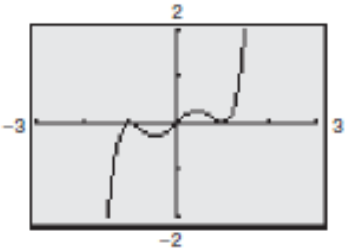
67. Use a graphing utility to graph the function and determine whether the function is even, odd, or neither.

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

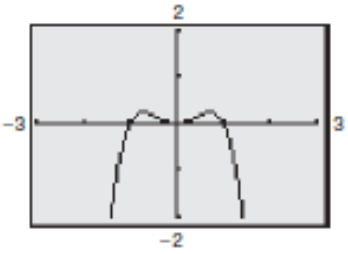
A) Neither even nor odd



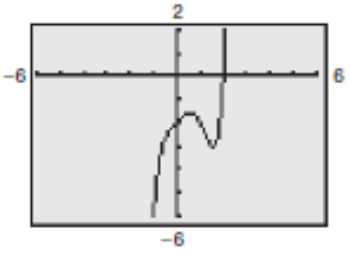
B) Odd



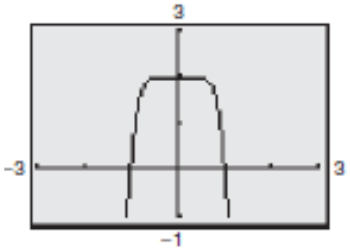
C) Even



D) Neither even nor odd



E) Even

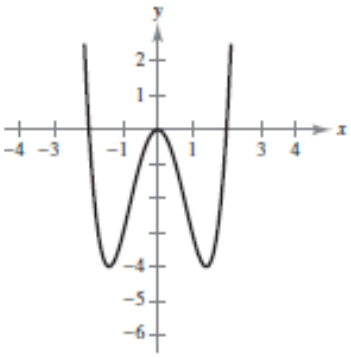


Ans: C

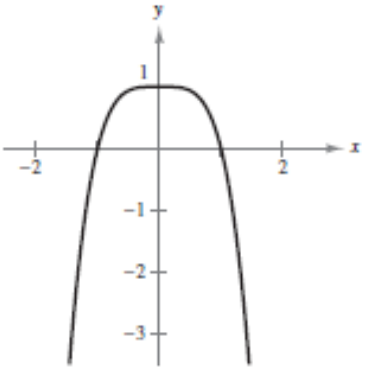
68. Sketch the graph of the function.

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

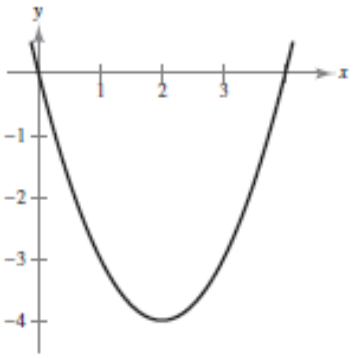
A)



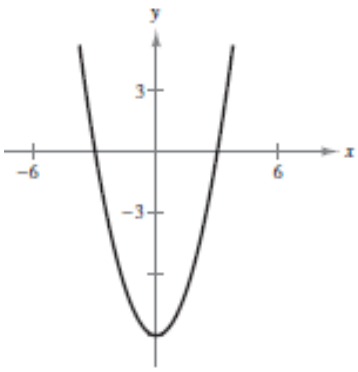
B)



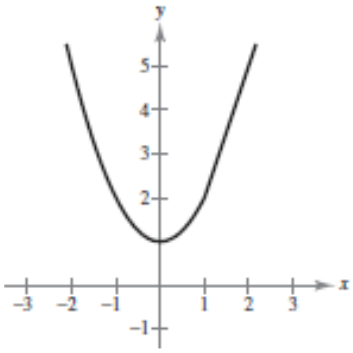
C)



D)



E)

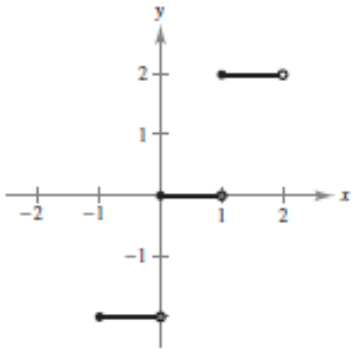


Ans: D

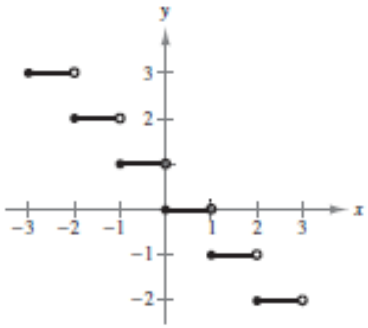
69. Sketch the graph of the function.

$f(x) = -\ x$

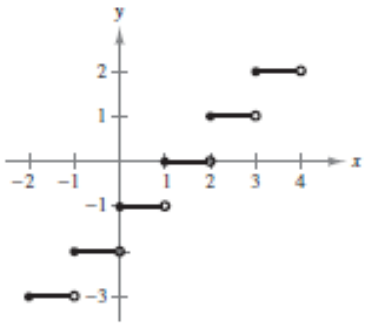
A)



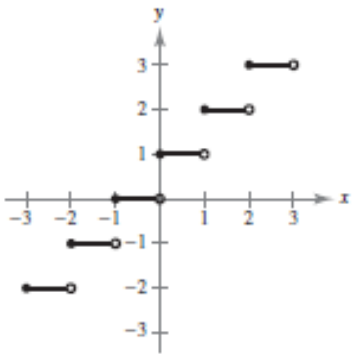
B)



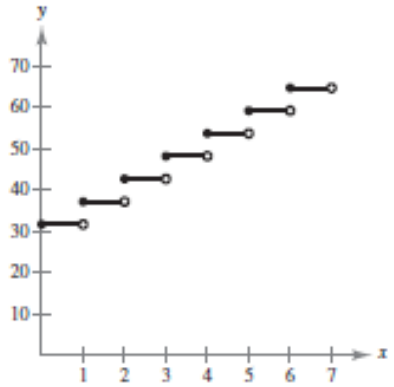
C)



D)



E)



Ans: B

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

$$g(x) = (x+5)^2 + 6$$

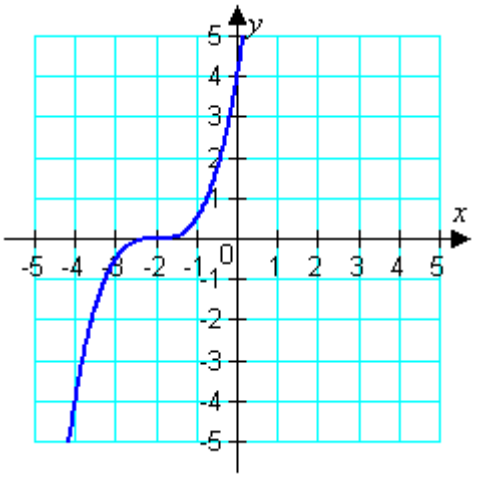
A) Shifted five units to the left and six units downwards.
B) Shifted six units to the left and five units downwards.
C) Shifted five units to the right and six units upwards.
D) Shifted six units to the right and five units downwards.
E) Shifted five units to the left and six units upwards.

Ans: E

71. Use the graph of

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

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



A)

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

B)

$$f(x) = 2x^3 + 2$$

C)

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

D)

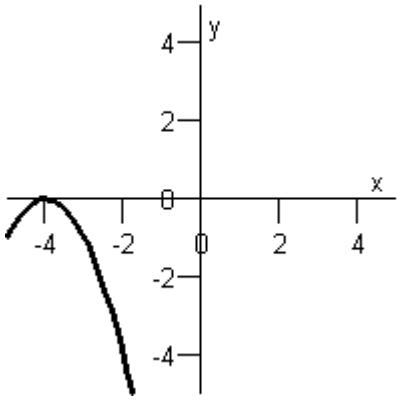
$$f(x) = 2(x+2)^3$$

E)

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

Ans: E

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



A) $g(x) = (x+4)^2$

B) $g(x) = -(x-4)^2$

C) $g(x) = -(x+4)^2$

D) $g(x) = (x-4)^2$

E) $g(x) = -(x+2)^2$

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 three units to the left.

A) $y = (x-3)^3$

B) $y = (x+3)^3$

C) $y = x^3 + 3$

D) $y = x^3 - 3$

E) $y = -3x^3$

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 five units to the left, and shifted four unit upward.

A) $h(x)=-\sqrt{x+4}+5$

B) $h(x)=-\sqrt{x+5}+4$

C) $h(x)=\sqrt{x-4}-5$

D) $h(x)=\sqrt{x+5}+4$

E) $h(x)=-\sqrt{x-5}-4$

Ans: B

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

$$P(x)=110+60x-0.8x^2,\quad 0\le x\le 20$$

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) $P\left(\frac{x}{100}\right)=\frac{11}{10}+\frac{3x}{5}-0.8x^2$

B) $P\left(\frac{x}{100}\right)=\frac{11}{10}+\frac{3x}{5}-0.00008x^2$

C) $P\left(\frac{x}{100}\right)=\frac{11}{10}+\frac{3x}{5}-0.008x^2$

D) $P\left(\frac{x}{100}\right)=110+\frac{3x}{5}-0.00008x^2$

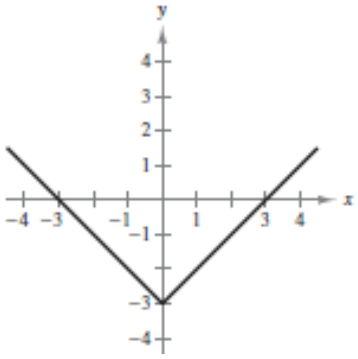
E) $P\left(\frac{x}{100}\right)=110+\frac{3x}{5}-0.008x^2$

Ans: D

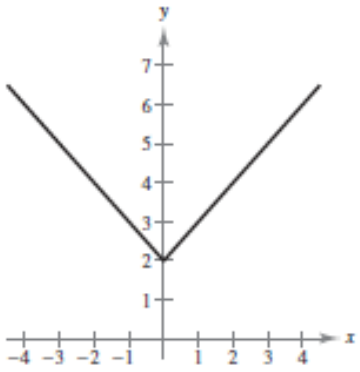
76. Describe the sequence of transformations from $f(x)=|x|$ to g. Then sketch the graph of g by hand. Verify with a graphing utility.

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

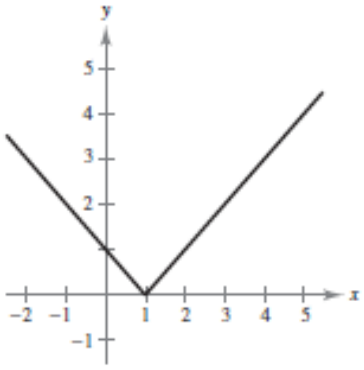
A) Vertical shifts down 3 units



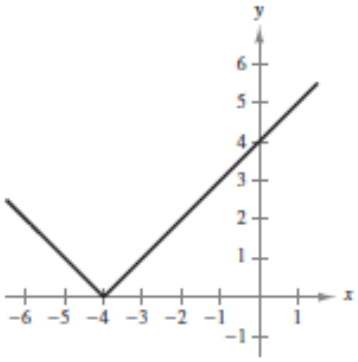
B) Vertical shifts 2 units upward



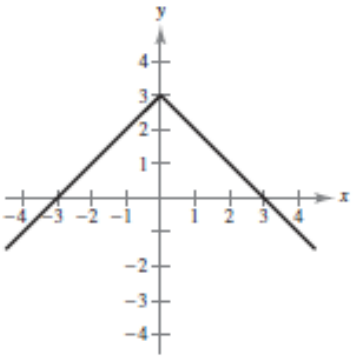
C) Horizontal shift 1 unit to the right



D) Horizontal shifts 4 units to the left



E) Vertical shifts 3 units upward

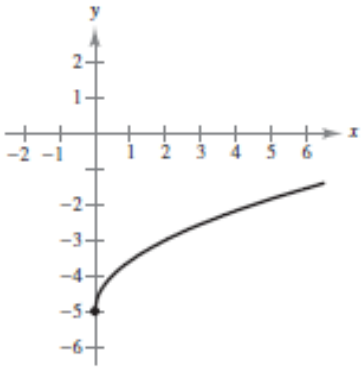


Ans: B

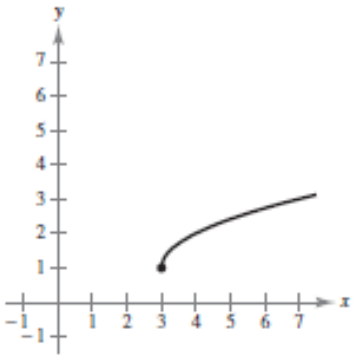
77. Describe the sequence of transformations from $f(x)=\sqrt{x}$ to g. Then sketch the graph of g by hand. Verify with a graphing utility.

$g(x)=\sqrt{x-3}$

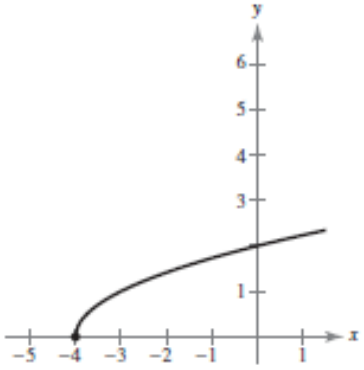
A) Shifted 5 units downward



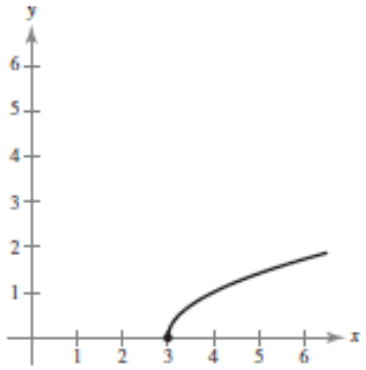
B) Shifted 1 unit upward



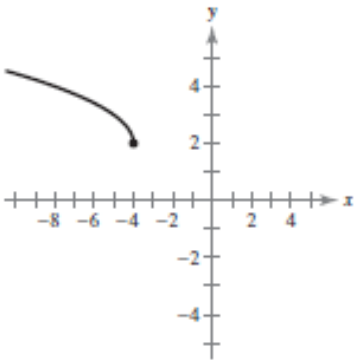
C) Shifted 4 units to the left



D) Shifts 3 units to the right

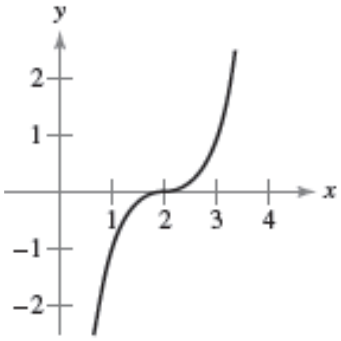


E) 4 units to the left and 2 units upward



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: $y = \frac{1}{2}x$

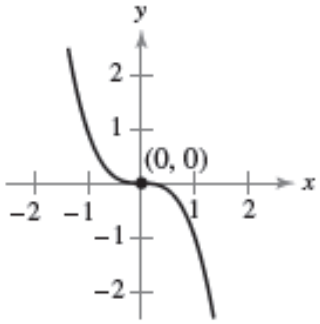
C) Common function: $y = x^2$
Transformation: reflection about the *x*-axis
Equation: $y = -x^2$

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) $(x+1)^3 + 1$

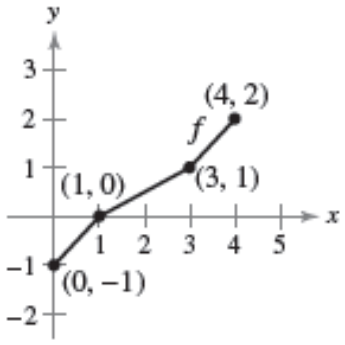
C) x^2

D) $x^2 + 1$

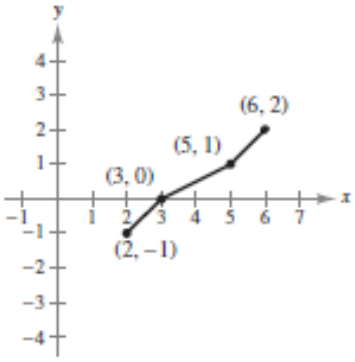
E) $-x^2 + 1$

Ans: A

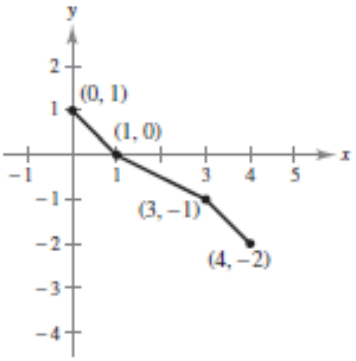
80. Use the graph of f to sketch the graph of $y = f(x) + 2$.



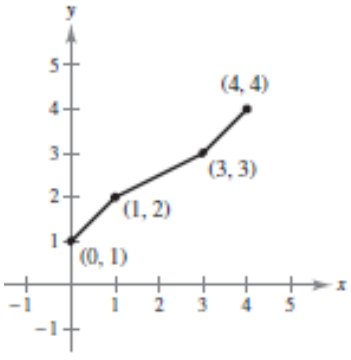
A) Horizontal shift 2 units to the right



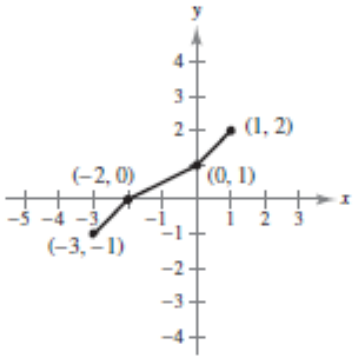
B) Reflection in the x-axis



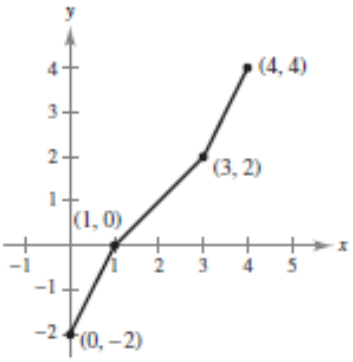
C) Vertical shift 2 units upward



D) Horizontal shift 3 units to the left

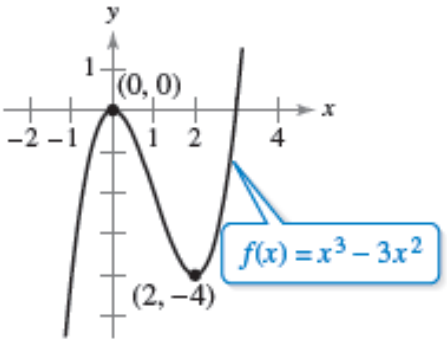


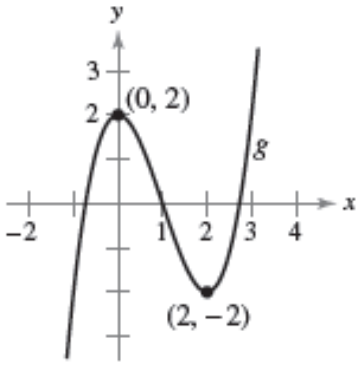
E) Stretching by 2



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 $(f/g)(x)$.

$f(x)=4x^2-4x \qquad g(x)=9-x$

A) $(f/g)(x)=\dfrac{4x^2-4x}{9-x},\ x\neq -9$

B) $(f/g)(x)=\dfrac{4x^2-4x}{9-x},\ x\neq 9$

C) $(f/g)(x)=\dfrac{4x^2-4x}{9-x},\ x\neq 0$

D) $(f/g)(x)=\dfrac{4x-4}{9},\ x\neq 0$

E) $(f/g)(x)=\dfrac{4x^2}{9}+4,\ x\neq 0$

Ans: B

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

$f(x)=-2x^2-x-7$
$g(x)=-x^2-4x+7$

A) $(f+g)(x)=-x^4+3x^2-14$
B) $(f+g)(x)=-3x^4-5x^2$
C) $(f+g)(x)=-x^2+3x-14$
D) $(f+g)(x)=-3x^2-5x$
E) $(f+g)(x)=3x^2+5x$

Ans: D

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

$f(x) = \sqrt{-3x}$ $\quad$ $g(x) = \sqrt{-6x + 2}$

A) $(fg)(x) = 3x\sqrt{2} - \sqrt{6x}$

B) $(fg)(x) = 3x\sqrt{2 - 6x}$

C) $(fg)(x) = \sqrt{-9x + 2}$

D) $(fg)(x) = \sqrt{18x^2 + 2}$

E) $(fg)(x) = \sqrt{18x^2 - 6x}$

Ans: E

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

$f(x) = -\dfrac{x}{9x - 1}$ $\quad$ $g(x) = \dfrac{7}{x}$

A) $(f - g)(x) = \dfrac{-x - 7}{8x - 1}$

B) $(f - g)(x) = \dfrac{-x - 64}{9x - 1}$

C) $(f - g)(x) = \dfrac{-x - 62}{9x - 1}$

D) $(f - g)(x) = \dfrac{-x^2 - 63x - 7}{9x^2 - x}$

E) $(f - g)(x) = \dfrac{-x^2 - 63x + 7}{9x^2 - x}$

Ans: E

87. Evaluate $(f + g)(-9)$ where $f(x) = x^2 + x - 20$ and $g(x) = 4x + 2$.

A) –72
B) 86
C) 52
D) –34
E) 18

Ans: E

88. Evaluate $(f - g)(-3)$ where $f(x) = x^2 + 7x + 6$ and $g(x) = 3x + 5$.

A) 8
B) –2
C) –14
D) –6
E) –10

Ans: B

89. Evaluate $(fg)(3)$ where $f(x) = x^2 + 13x + 30$ and $g(x) = 5x + 3$.

A) –1404
B) 324
C) 1404
D) 0
E) 1173
Ans: C

90. Evaluate $\left(\frac{f}{g}\right)(-5)$ where $f(x) = x^2 - 17x - 18$ and $g(x) = -11x + 13$.

A) $\frac{31}{34}$
B) $\frac{23}{17}$
C) $\frac{23}{2}$
D) $\frac{55}{34}$
E) $\frac{7}{68}$
Ans: B

91. Find $f \circ g$.

$f(x) = 5x - 4$ $g(x) = x - 9$

A) $(f \circ g)(x) = 5x - 49$
B) $(f \circ g)(x) = 5x - 13$
C) $(f \circ g)(x) = 5x^2 - 49x + 36$
D) $(f \circ g)(x) = 4x + 5$
E) $(f \circ g)(x) = 4x - 13$
Ans: A

92. Find $g \circ f$.

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

A) $(g \circ f)(x) = x^2 - 7$
B) $(g \circ f)(x) = x^2 - 49$
C) $(g \circ f)(x) = x^2 + 49$
D) $(g \circ f)(x) = x^2 - 7x + 49$
E) $(g \circ f)(x) = x^2 - 14x + 49$
Ans: E

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

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

A) $(-\infty, \infty)$

B) $(-\infty, -2] \cup [2, \infty)$

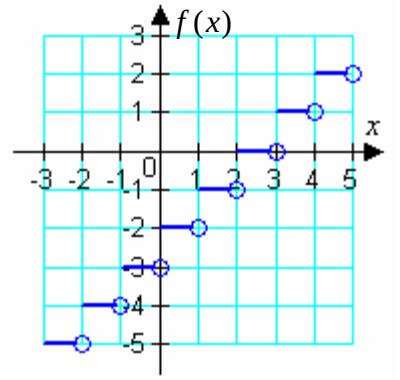
C) $\left(-\infty, -\sqrt{2}\right] \cup \left[\sqrt{2}, \infty\right)$

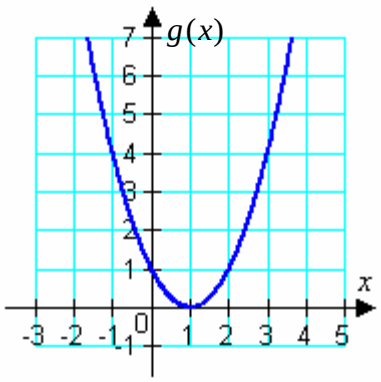
D) $\left[\sqrt{2}, \infty\right)$

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

$C(t) = 90t + 500.$

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

$t(x) = 4x.$

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

A) $C(x) = 360x + 500$

B) $C(x) = 360x + 45,000$

C) $C(x) = 94x + 500$

D) $C(x) = 94x + 590$

E) $C(x) = 90x + 504$

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

$$R_1 = 311 + 11.3t, \quad t = 0, 1, 2, 3, 4, 5, 6, 7, 8$$

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

$$R_2 = 463 - 17.4t, \quad t = 0, 1, 2, 3, 4, 5, 6, 7, 8.$$

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

A) $R_T = -152 - 6.1t,$ total sales have been decreasing.

B) $R_T = 774 + 6.1t,$ total sales have been increasing.

C) $R_T = 774 - 6.1t,$ total sales have been decreasing.

D) $R_T = -152 + 28.7t,$ total sales have been increasing.

E) $R_T = 152 - 28.7t,$ 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

$$r(t) = 1.2t$$

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 area of the circle at time t.

B) $(A \circ r)(t) = 1.2\pi t^2$; $A \circ r$ represents the radius of the circle at time t.

C) $(A \circ r)(t) = 1.44\pi t^2$; $A \circ r$ represents the radius of the circle at time t.

D) $(A \circ r)(t) = 1.44\pi t^2$; $A \circ r$ represents the area of the circle at time t.

E) $(A \circ r)(t) = 1.2\pi t^2$; $A \circ r$ represents the area of the circle at time t.

Ans: D