Test Bank for Single Variable Calculus Early Transcendentals 9th Stewart

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True / False
Indicate whether the statement is true or false.

___ 1. Determine whether the statement is true or false.

If $x_1 > x_2$ and f is a decreasing function, then $f(x_1) > f(x_2)$.

a. True

b. False

Multiple Choice
Indicate the answer choice that best completes the statement or answers the question.

___ 2. At the surface of the ocean, the water pressure is the same as the air pressure above the water, 13 lb/in^2. Below the surface, the water pressure increases by 4.34 lb/in^2 for every 10 ft of descent. At approximately what depth is the pressure 120 lb/in^2?

a. 247 ft

b. 276 ft

c. 30 ft

d. 56 ft

e. 359 ft

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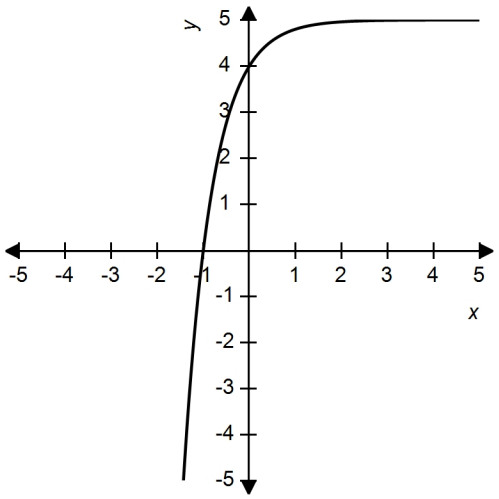
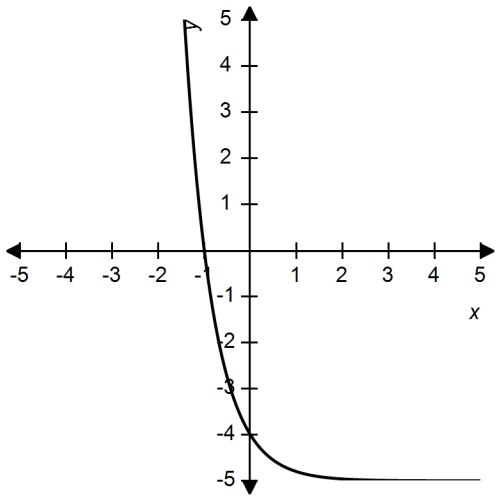
___ 3. Identify the graph of the following function.

$y = 5 - (0.2)^x$

a.



b.



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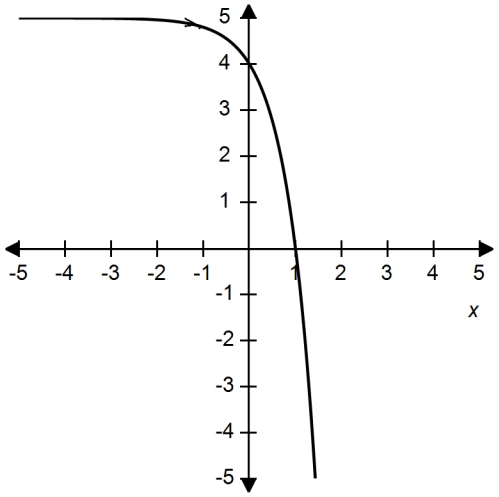

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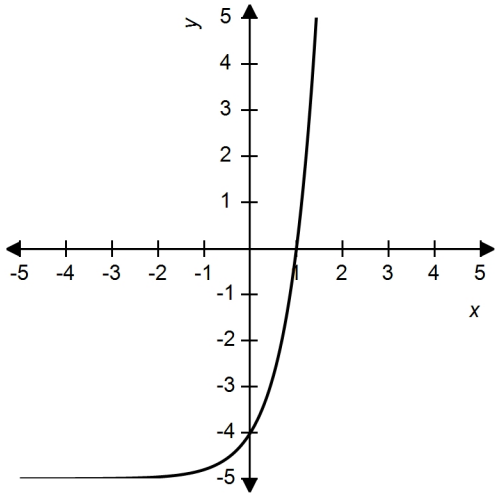

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___ 4. After alcohol is fully absorbed into the body, it is metabolized with a half-life of about 1.25 hours. Suppose you have had three alcoholic drinks and an hour later, at midnight, your blood alcohol concentration (BAC) is 0.6 mg/mL. Find an exponential decay model for your BAC t hours after midnight.

a. $\text{BAC}(t) = 0.6 \cdot (2)^{-\frac{4t}{5}}$

b. $\text{BAC}(t) = 1.25 \cdot (2)^{-\frac{t}{0.6}}$

c. $\text{BAC}(t) = 0.6 \cdot \left(\frac{1}{2}\right)^{1.25t}$

d. $\text{BAC}(t) = 1.25 \cdot \left(\frac{1}{2}\right)^{0.6t}$

e. None of the above

___ 5. The manager of a weekend flea market knows from past experience that if he charges x dollars for a rental space at the market, then the number y of spaces he can rent is given by the equation $y = 560 - 8x$. What does the x-intercept indicate?

a. There will be no spaces occupied when the rental cost is \$70.

b. There will be no spaces occupied when the rental cost is \$560.

c. There will be 560 spaces occupied when there is no rental cost.

d. There will be 8 spaces occupied when there is no rental cost.

e. The number of occupied spaces decreases by 5 for every \$1 increase in rent.

___ 6. Determine the range of the following function.

$g(x) = -2^{-x} - 9$

a. $(-\infty, -9)$

b. $(9, \infty)$

c. $\mathbb{R}$

d. $(-9, \infty)$

e. $(0, -\infty)$

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___ 7. Determine the domain and range of the function $f(x) = 3^x$.

a. Domain: $(-\infty, \infty)$, range: $(0, \infty)$
b. Domain: $(0, \infty)$, range: $(-\infty, \infty)$
c. Domain: $(0, \infty)$, range: $(0, \infty)$
d. Domain: $(-\infty, \infty)$, range: $(-\infty, \infty)$
e. Domain: $(-\infty, \infty)$, range: $(3, \infty)$
f. Domain: $(3, \infty)$, range: $(-\infty, \infty)$

___ 8. Starting with the graph of $y = e^x$, write the equation of the graph that results from shifting 7 units to the left and 6 units upward.

a. $y = e^{x+7} + 6$
b. $y = e^{x+6} + 7$
c. $y = e^{x+7} - 6$
d. $y = e^{x-7} + 6$
e. $y = 6e^{x-7}$

___ 9. Biologists have noticed that the chirping rate of crickets of a certain species is related to temperature, and the relationship appears to be very nearly linear. A cricket produces 108 chirps per minute at 70°F and 228 chirps per minute at 90°F. Find a linear equation that models the temperature T as a function of the number of chirps per minute N.

a. $T(N) = \frac{1}{6}N + \frac{312}{6}$
b. $T(N) = \frac{1}{6}N - \frac{312}{6}$
c. $T(N) = 6N - 648$
d. $N(T) = 6T - 312$
e. $N(T) = -6T + 312$

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___ 10. Find the function $f \circ g$ and its domain if $f(x) = \dfrac{x-1}{x}$ and $g(x) = \dfrac{x}{x+5}$.

a. $\dfrac{x-1}{x+5}, D = (-\infty, -5) \cup (-5, 0) \cup (0, \infty)$

b. $\dfrac{x-1}{x+5}, D = (-\infty, -5) \cup (-5, \infty)$

c. $-\dfrac{5}{x}, D = (-\infty, -5) \cup (-5, 0) \cup (0, \infty)$

d. $-\dfrac{5}{x}, D = (-\infty, 0) \cup (0, \infty)$

___ 11. Classify the following function:
$f(x) = x^6(9x^4 - 4)$

a. Polynomial function

b. Power function

c. Trigonometric function

d. Rational Function

e. Exponential function

___ 12. It makes sense that the larger the area of a region, the larger the number of species that inhabit the region. Many ecologists have modeled the species-area relation with a power function. In particular, the number of species S of bats living in caves in central Mexico has been related to the surface area A of the caves by the equation $S = 0.7A^{0.3}$. If you discover that nine species of bats live in a cave, estimate the area of the cave.

a. $4979\ \text{m}^2$

b. $1.35\ \text{m}^2$

c. $2125\ \text{m}^2$

d. $2.15\ \text{m}^2$

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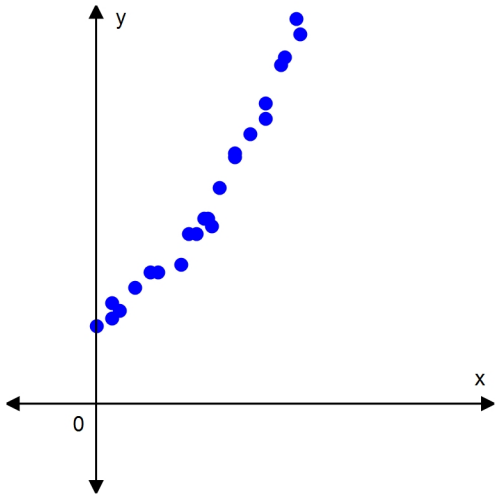
___ 13. Decide what type of function you might choose as a model for the data displayed on the scatter plot.



a. exponential function
b. logarithmic function
c. polynomial
d. rational function
e. trigonometric function

___ 14. Find the function $f \circ g$ and its domain if $f(x) = \sqrt{x+6}$ and $g(x) = \sqrt{x-6}$.

a. $\sqrt{x^2 - 36}$
$D = [6, \infty)$
b. $\sqrt{x^2 - 36}$
$D = [-6, \infty)$
c. $\sqrt{x^2 + 36}$
$D = [-6, \infty)$
d. $\sqrt{x^2 + 36}$
$D = [6, \infty)$

___ 15. The half-life of bismuth-210, ^{210}Bi, is 5 days. If a sample has a mass of 600 mg, find the amount remaining after 4 weeks. Round your answer to one decimal place.

a. 12.4 mg
b. 29,102 mg
c. 0 mg
d. 82.8 mg
e. 6,000 mg

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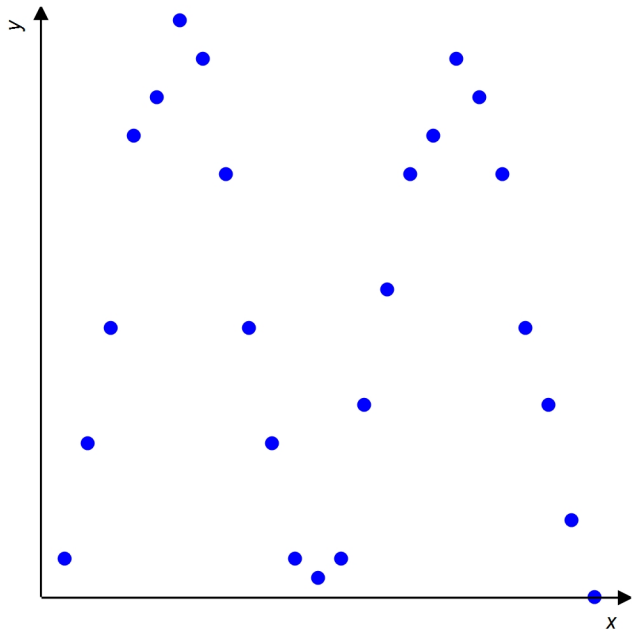
___ 16. If the recommended adult dosage for a drug is D (in mg), then to determine the appropriate dosage c for a child of age a, pharmacists use the equation $c = 0.04D(a + 1)$. Suppose the dosage for an adult is 900 mg. What is the slope of the graph of c and what does it represent?

a. 36 mg/yr; the rate of change of dosage with respect to age
b. 36 yr/mg; the rate of change of age with respect to dosage
c. 0.04 mg/yr; the rate of change of dosage with respect to age
d. 0.04 mg/yr; the rate of change of age with respect to dosage
e. 36 mg; the dosage for a newborn

___ 17. For the scatter plot below, what type of function might you see as a model for the data?



a. Trigonometric function
b. Rational Function
c. Exponential Function
d. Power Function
e. Polynomial Function

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___ 18. Find the domain of the following function.

$$f(x) = \frac{1 - e^{x^2}}{1 - e^{36 - x^2}}$$

a. $\mathbb{R}$

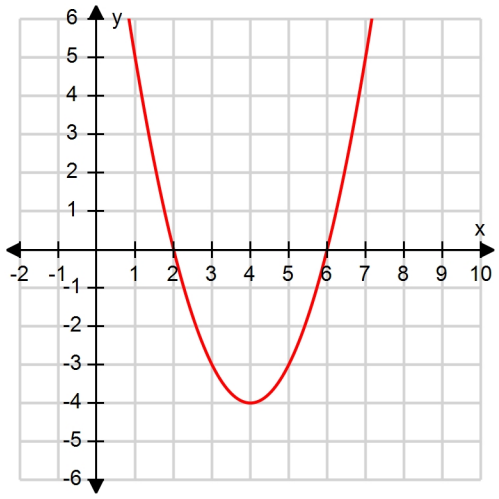
b. $x \neq 0$

c. $0 < x < 6$

d. $x \neq \pm 36$

e. $x \neq \pm 6$

___ 19. Let f be the function whose graph is given. Find the interval where the function is decreasing.



a. $(-\infty, 4)$

b. $(4, \infty)$

c. $[2, 6]$

d. $(-4, \infty)$

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___ 20. Use the Law of Exponents to rewrite and simplify the expression.

$$\frac{\sqrt{a\sqrt{b}}}{\sqrt[6]{ab}}$$

a. $\left(\frac{a}{b}\right)^{\frac{1}{3}}$

b. $\frac{a^{\frac{1}{3}}}{b^{\frac{1}{12}}}$

c. $\frac{a}{b}$

d. $\frac{a}{b^{\frac{1}{12}}}$

e. $a^{\frac{1}{3}} b^{\frac{1}{12}}$

___ 21. Identify the type of the following function.

$h(r) = 3.6^r$

a. power function
b. root function
c. polynomial
d. rational function
e. algebraic function
f. trigonometric function
g. exponential function
h. logarithmic function

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___ 22. Use the Law of Exponents to rewrite and simplify the expression.

$$\frac{(4z^8)^8}{2z^9}$$

a. $32{,}768z^{55}$

b. $65{,}536z^{55}$

c. $32{,}768z^8$

d. $2z^{55}$

e. $2z^8$

___ 23. An isotope of sodium, ^{24}Na, has a half-life of 15 hours. A sample of this isotope has mass 9 g. Estimate the time required for the mass to be reduced to 0.5 g.

a. 62.5 hours

b. 2.1 hours

c. 70.3 hours

d. 47.5 hours

e. 125.1 hours

___ 24. Find the domain of the function

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

a. $x \neq \frac{\pi}{6} + 2\pi n$ and $x \neq \frac{11\pi}{6} + 2\pi n$, where n is any integer

b. $x \neq \frac{11\pi}{6}$ and $x \neq \frac{11\pi}{6}$

c. $x \neq \frac{5\pi}{6} + 2\pi n$ and $x \neq \frac{7\pi}{6} + 2\pi n$, where n is any integer

d. $x \neq \frac{5\pi}{6}$ and $x \neq \frac{7\pi}{6}$

e. $x \neq \frac{\pi}{4} + 2\pi n$ and $x \neq \frac{7\pi}{4} + 2\pi n$, where n is any integer

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___ 25. Find an equation for the family of linear functions such that $f(6) = 5$.

a. $f(x) = 5 + m(x - 6)$

b. $f(x) = m(x - 6) - 5$

c. $f(x) = 6 + m(x - 5)$

d. $f(x) = m(x + 5) - 5$

e. $f(x) = mx + 6m - 5$

___ 26. In the function $f(x) = 8x + d$, what must be the value d, if $f(3) = 1$?

a. $d = 25$

b. $d = 23$

c. $d = -23$

d. $d = -1$

e. $d = -25$

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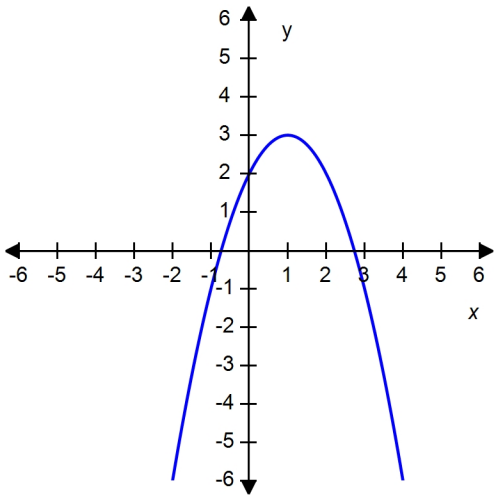
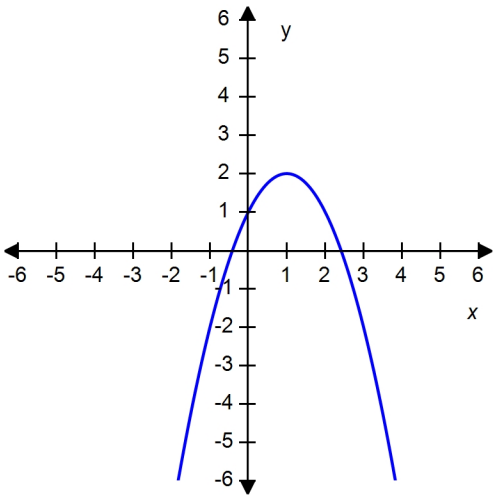
___ 27. Graph the function by hand, not by plotting points, but by starting with the graph of one of the standard functions and then applying the appropriate transformations.

$y = 3 + 2x - x^2$

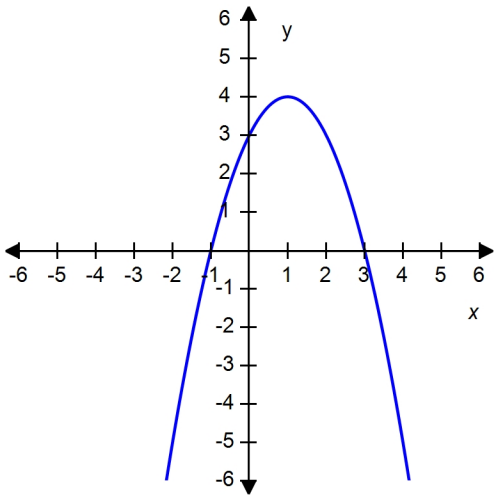
a.



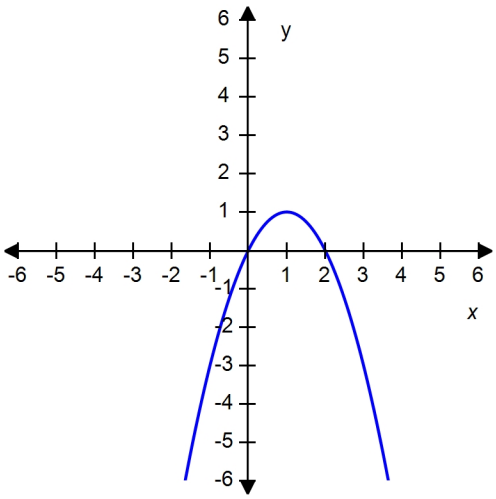
b.



c.



d.



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___ 28. Use the Law of Exponents to rewrite and simplify the expression.

$$\frac{x^{4n} \cdot x^{5n+1}}{x^{n-4}}$$

a. x^{8n+5}

b. x^{8n+6}

c. x^{6n-9}

d. x^{3n+8}

e. x^{4n-7}

___ 29. Starting with the graph of $y = e^x$, find the equation of the graph that results from reflecting about the line $y = 5$.

a. $y = -e^x$

b. $y = -e^x + 10$

c. $y = -e^{-5x} + 10$

d. $y = e^{-x} + 10$

e. $y = -e^{x+10}$

___ 30. If $f(x) = x + 15$ and $h(x) = 4x + 85$, find a function g such that $g \circ f = h$.

a. $g(x) = 4x + 25$

b. $g(x) = 4x$

c. $g(x) = x - 25$

d. $g(x) = 4x - 25$

e. $g(x) = x + 25$

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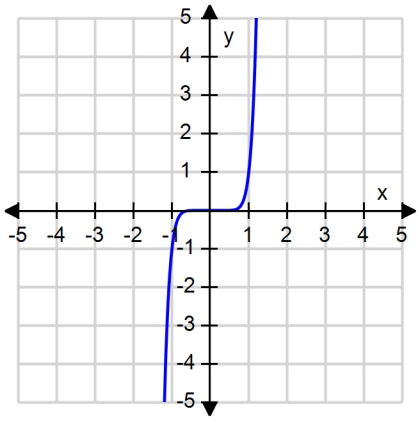
___ 31. What is the equation of this graph?



a. $y = x^4$

b. $y = x^8$

c. $y = x^{10}$

d. $y = \sqrt[3]{x}$

e. $y = x^9$

___ 32. Suppose that the graph of f is given. Describe how the graph of the function $y = f(x - 3) - 3$ can be obtained from the graph of f.

a. Shift the graph 3 units to the left and 3 units down.

b. Shift the graph 3 units to the left and 3 units up.

c. Shift the graph 3 units to the right and 3 units up.

d. Shift the graph 3 units to the right and 3 units down.

e. None of these

___ 33. Find a, such that the function $f(x) = 4x + \sqrt{a - x^2}$ has the domain $[-3, 3]$.

a. $a = -9$

b. $a = \sqrt{3}$

c. $a = -\sqrt{3}$

d. $a = 9$

e. $a = 3$

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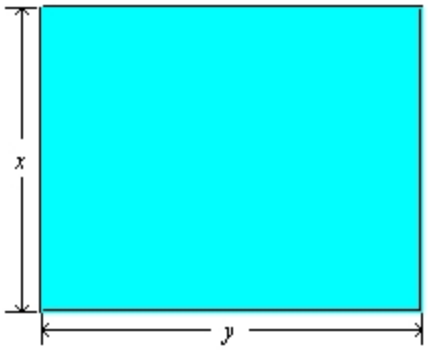
___ 34. Sandy wishes to have a rectangular garden in her backyard. She has 50 ft of fencing with which to enclose her garden. Letting x denote the width of the garden, find a function f in the variable x that gives the area of the garden.



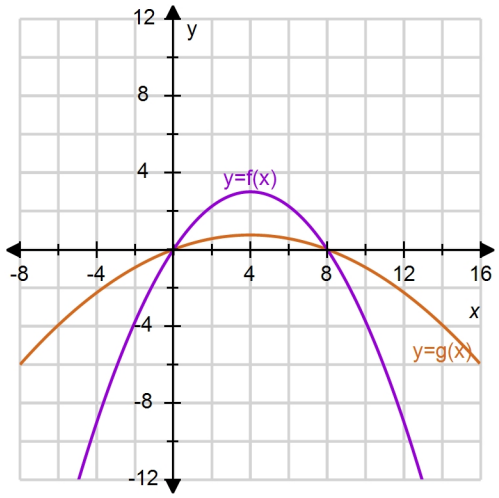
a. $f(x) = 50x - x^2, 0 < x < 25$

b. $f(x) = 25x - x^2, 0 < x < 25$

c. $f(x) = 50x - x^2, 0 < x < 50$

d. $f(x) = 25x - x^2, 0 < x < 50$

___ 35. Which of the following is the equation for the function $g(x)$?



a. $g(x) = 4f(x)$

b. $g(x) = f(x) - 4$

c. $g(x) = -f(x + 4)$

d. $g(x) = \dfrac{f(x)}{4}$

e. $g(x) = -f(x) + 4$

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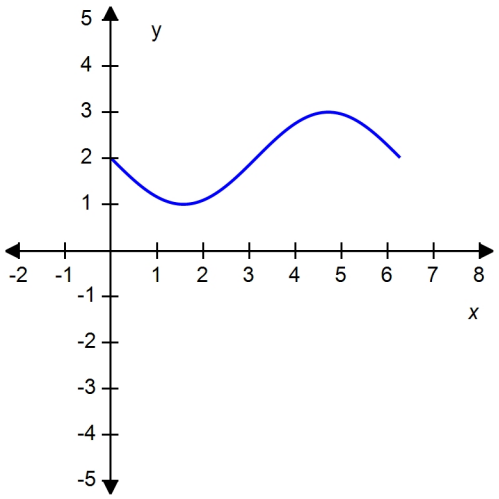
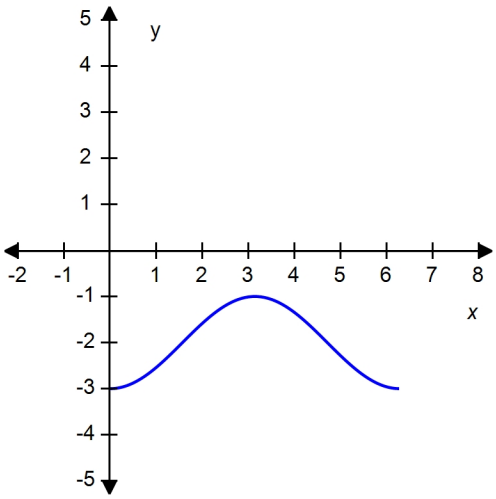
___ 36. Sketch the graph of $y = 2 - \cos x$ over one period.

a.



b.



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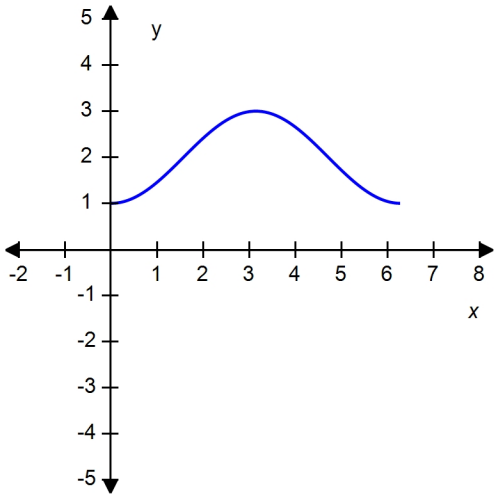
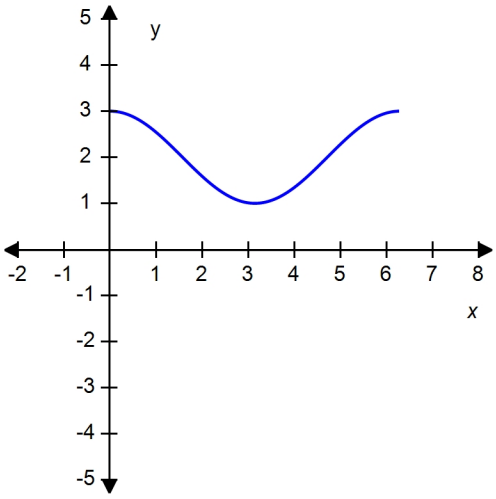


d.



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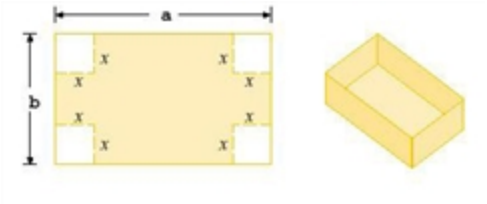
___ 37. A box with an open top is to be constructed from a rectangular piece of card board with dimensions $b = 6$ in. by $a = 25$ in. by cutting out equal squares of side x at each corner and then folding up the sides as in the figure.

Express the volume V of the box as a function of x.



a. $V(x) = x^3 - 62x^2 + 150x$

b. $V(x) = 4x^3 + 31x^2 + 196x$

c. $V(x) = 4x^3 + 62x^2 + 150x$

d. $V(x) = x^3 - 31x^2 + 196x$

e. $V(x) = 4x^3 - 62x^2 + 150x$

___ 38. Use the laws of logarithms to expand the expression.

$$\ln\left(\frac{x+1}{x-2}\right)^{\frac{1}{2}}$$

a. $\frac{1}{2}\ln[(x+1)(x-2)]$

b. $\frac{1}{2}\ln(x+1) - \frac{1}{2}\ln(x-2)$

c. $\frac{1}{2}\ln\left(x - \frac{1}{2}\right)$

d. $\frac{1}{2}\ln\left(\frac{x+1}{x-2}\right)$

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___ 39. The relationship between the Fahrenheit and Celsius temperature scales is given by the linear function.

$$F = \frac{9}{5}C + 32$$

What is the F-intercept and what does it represent?

a. $\frac{9}{5}$, Fahrenheit temperature corresponding to 0°C

b. $\frac{9}{5}$, Celsius temperature corresponding to 32°C

c. 32, Celsius temperature corresponding to 0°F

d. 0, Fahrenheit temperature corresponding to 32°C

e. 32, Fahrenheit temperature corresponding to 0°C

___ 40. Find an expression for the function $y = f(x)$ whose graph is the bottom half of the parabola $x + (10 - y)^2 = 0$.

a. $y = 10 - \sqrt{-x}$

b. $y = 100 - \sqrt{-x}$

c. $y = 10 + \sqrt{x}$

d. $y = 100 - x^2$

e. $y = 10 - x^2$

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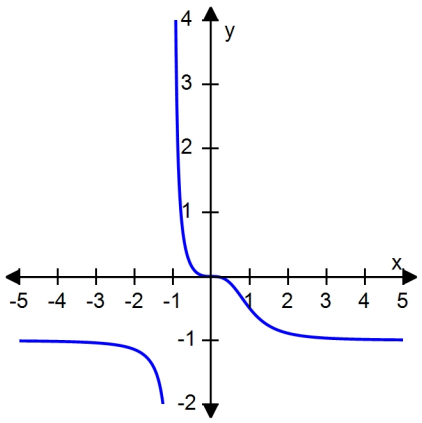
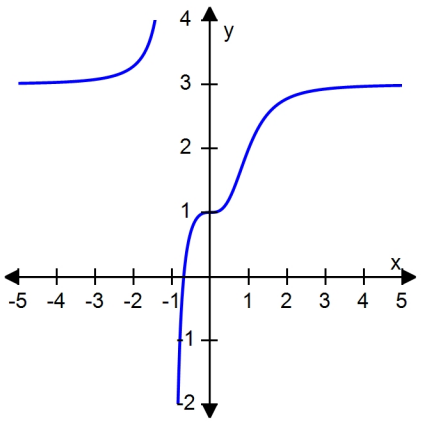
___ 41. Plot the graph of the function f in an appropriate viewing window.

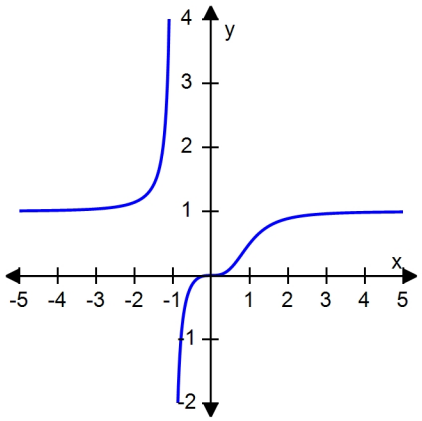
$$f(x) = \frac{x^3}{x^3 + 1}$$



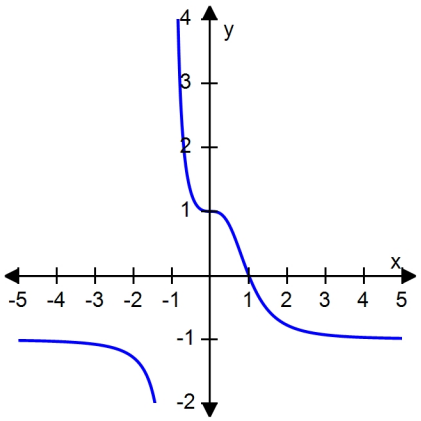
a.



b.



c.



d.

___ 42. Find $f^{-1}(a)$ for the function f and the real number a.

$$f(x) = x^3 + x - 2;\ a = -4$$

a. 0

b. –1

c. –2

d. 1

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___ 43. The monthly cost of driving a car depends on the number of miles driven. Julia found that in October it cost her \$300 to drive 400 mi and in July it cost her \$450 to drive 700 mi. Express the monthly cost C as a function of the distance driven d assuming that a linear relationship gives a suitable model.

a. $C = -100d + 0.5$
b. $C = 100d - 0.5$
c. $C = 0.5d + 100$
d. $C = 2d + 100$
e. $C = 0.5d - 100$

___ 44. Find the exact value of the given expression.

$$\cos\left(\cos^{-1}\left(-\frac{\sqrt{3}}{2}\right)\right)$$

a. 1
b. $-\frac{1}{2}$
c. 0
d. $-\frac{\sqrt{3}}{2}$

___ 45. If $f(x) = 5x^2 + 2$, find and simplify $\dfrac{f(1+h)-f(1)}{h}$, where $h \neq 0$.

a. $2+5h^2$
b. $5+10h$
c. $5h$
d. $10+5h$

___ 46. Find the inverse function of $f(x) = \dfrac{x + 1}{5x + 1}$.

a. $f^{-1}(x) = -(x + 1)(5x + 1)$
b. $f^{-1}(x) = -\dfrac{5x + 1}{x - 1}$
c. $f^{-1}(x) = -\dfrac{x - 1}{5x - 1}$
d. $f^{-1}(x) = \dfrac{x}{5x - 1}$
e. $f^{-1}(x) = (x + 1)(5x + 1)$

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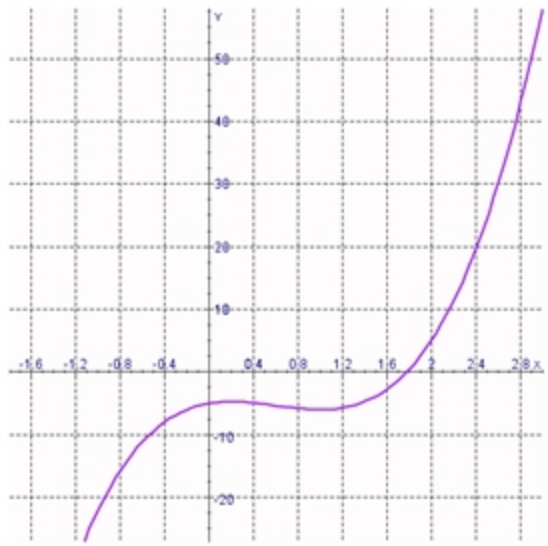
___ 47. The graph of the function f is given. State the value of $f(2.7)$.



a. $f(2.7) = -40$

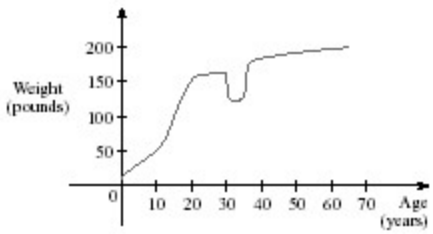
b. $f(2.7) = -10$

c. $f(2.7) = 40$

d. $f(2.7) = 0$

e. $f(2.7) = 10$

___ 48. The graph shown gives the weight of a certain person as a function of age. Find the age at which the person stopped an exercise program.



a. 20

b. 54

c. 38

d. 35

e. 70

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___ 49. If the point $(9, 7)$ is on the graph of an even function, what other point must also be on the graph?

a. $(-9, -7)$

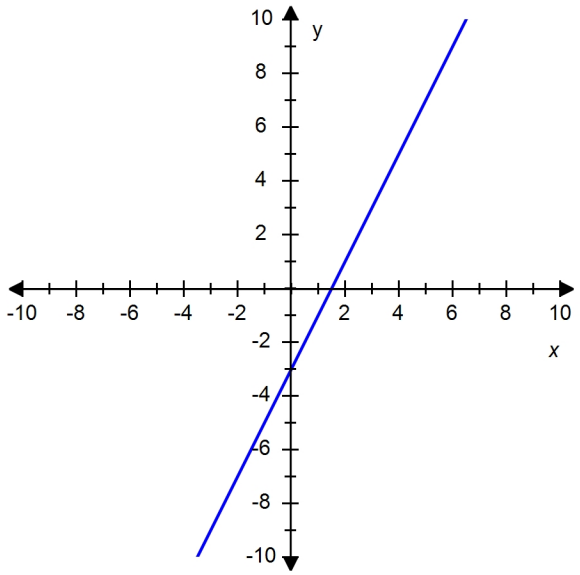
b. $(9, -7)$

c. $(0, 0)$

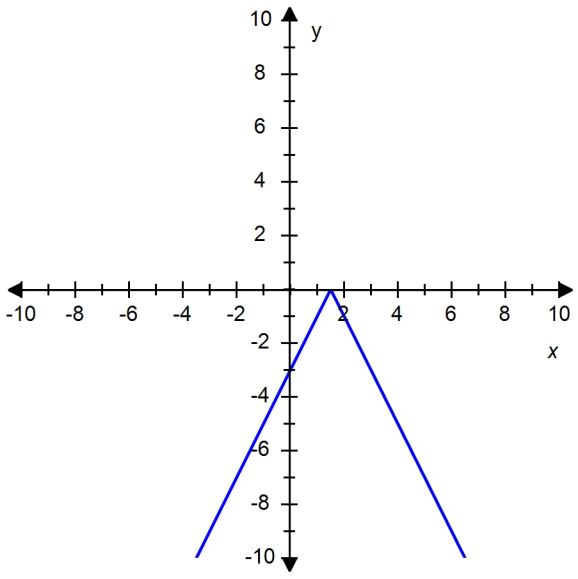
d. $(-9, 7)$

e. None of these

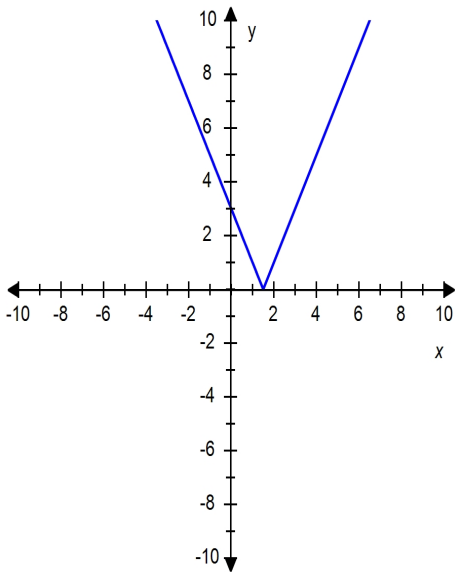
___ 50. The graph of the function f follows. Choose the graph of $y = f(|x|)$.



a.



b.



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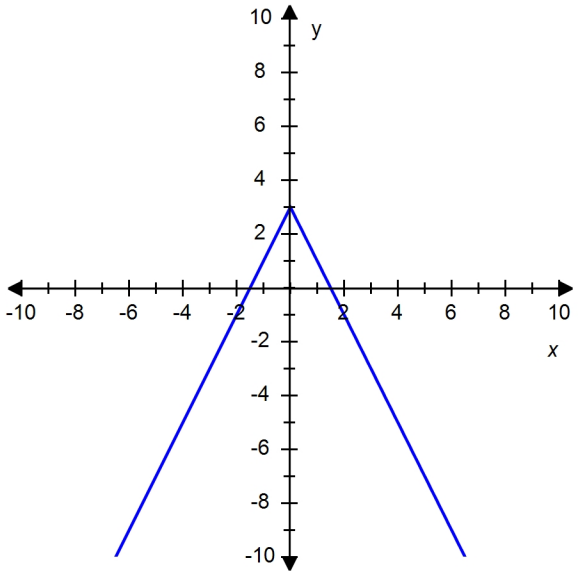
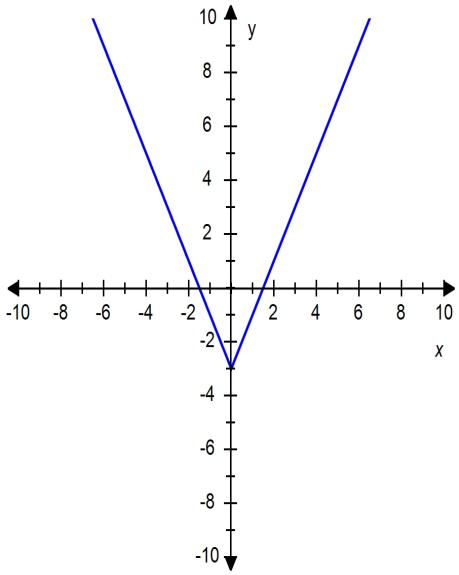
c.



d.



___ 51. Many physical quantities are connected by *inverse square laws*, that is, by power functions of the form:

$$f(x) = kx^{-2}$$

In particular, the illumination of an object by a light source is inversely proportional to the square of the distance from the source. Suppose that after dark you are in a room with just one lamp and you are trying to read a book. The light is too dim and so you move $\frac{2}{3}$ds the distance to the lamp. How much brighter is the light?

a. $\frac{3}{2}$ times

b. $\frac{9}{4}$times

c. $\frac{9}{2}$ times

d. $\frac{4}{9}$ times

e. 3 times

___ 52. The graph of the function f follows. Choose the graph of $y = -f(x) - 1$.

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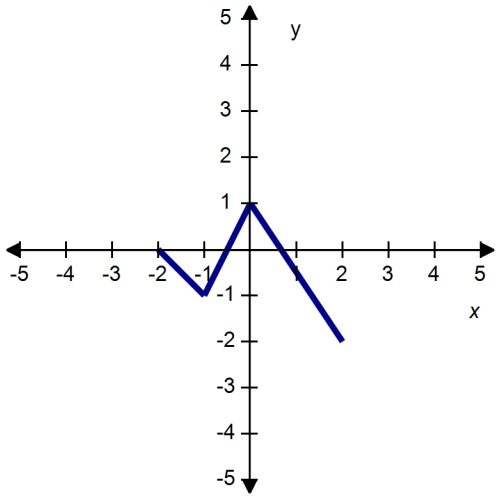
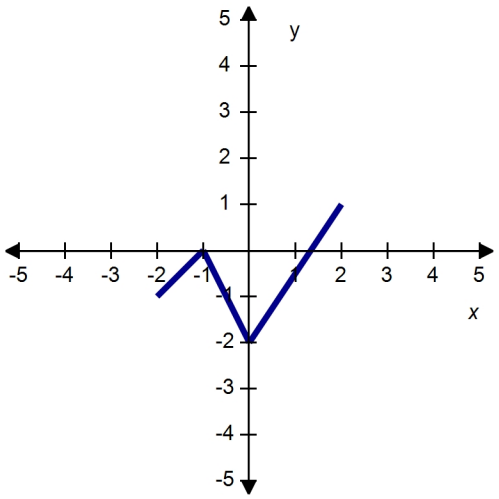
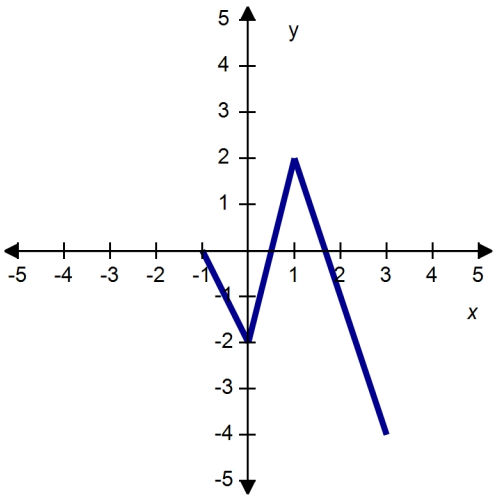




a.



b.

c.

d.

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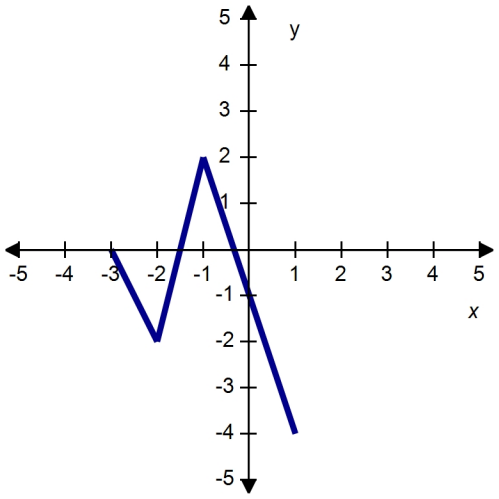

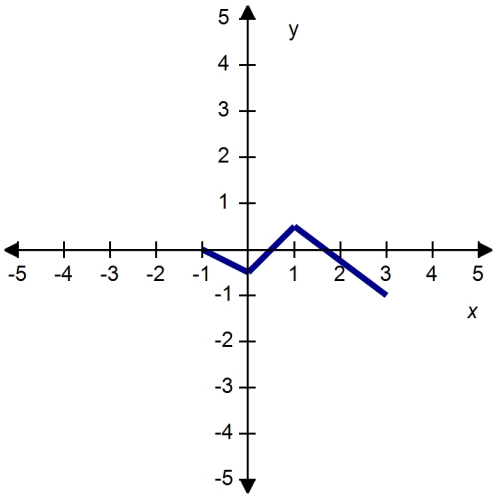

___ 53. Solve the equation.

$3e^{x+2} = 2$

a. $x = \ln\frac{2}{3} - 2$

b. $x = \ln\frac{2}{3} + 2$

c. $x = \ln\frac{3}{2} - 2$

d. $x = \ln\frac{3}{2} + 2$

___ 54. Scientists have discovered that a linear relationship exists between the amount of flobberworm mucus secretions and the air temperature. When the temperature is 45°F, the flobberworms each secrete 8.5 grams of mucus a day; when the temperature is 75°F, they each secrete 11.5 grams of mucus a day. Find a function $M(t)$ that gives the amount of mucus secreted on a given day, where t is the temperature of that day in degrees Fahrenheit.

a. $M(t) = 0.1t + 8.5$

b. $M(t) = 10t + 8.5$

c. $M(t) = 10t + 4$

d. $M(t) = 0.1t + 4$

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___ 55. Starting with the graph of $y = e^x$, write the equation of the graph that results from shifting 6 units right.

a. $y = e^{x+6}$

b. $y = e^x - 6$

c. $y = e^{x-6}$

d. $y = e^x + 6$

e. $y = 6e^{x-6}$

___ 56. An open rectangular box with volume 4 m^3 has a square base. Express the surface area of the box as a function $S(x)$ of the length x of a side of the base.

a. $S(x) = x^2 + \dfrac{16}{x^2}$

b. $S(x) = x^2 + \dfrac{16}{x}$

c. $S(x) = 2x^2 + \dfrac{6}{x^2}$

d. $S(x) = x^2 + \dfrac{6}{x^2}$

e. $S(x) = 2x + \dfrac{6}{x}$

___ 57. Use the table to evaluate the expression $(f \circ g)(4)$.

x	1	2	3	4	5	6
$f(x)$	3	2	1	0	1	2
$g(x)$	6	5	2	3	4	6

a. 4

b. 1

c. 2

d. 3

e. 5

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___ 58. The graph of the function $f(x) = x^2 - 8x + 4$ has been shifted horizontally to the left by 9 units. Find the function for the transformed graph.

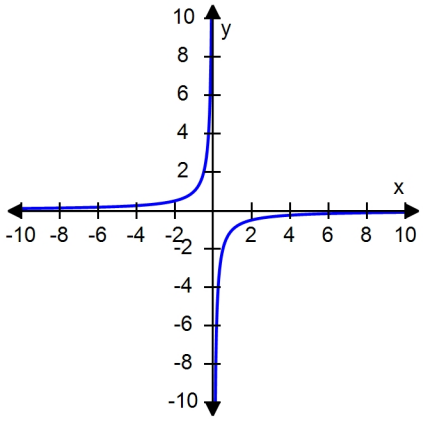
a. $g(x) = x^2 - 8x - 5$

b. $g(x) = x^2 - 8x + 13$

c. $g(x) = x^2 + 10x + 13$

d. $g(x) = x^2 - 26x + 157$

___ 59. Determine whether the function whose graph is given is even, odd, or neither.



a. Even

b. Neither

c. Odd

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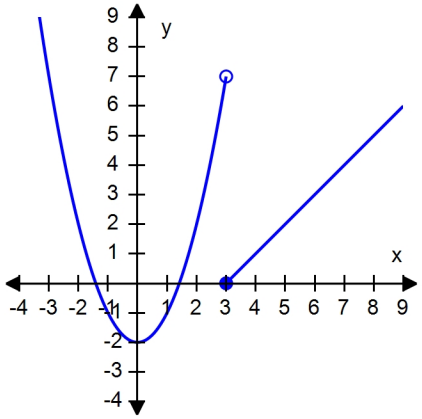
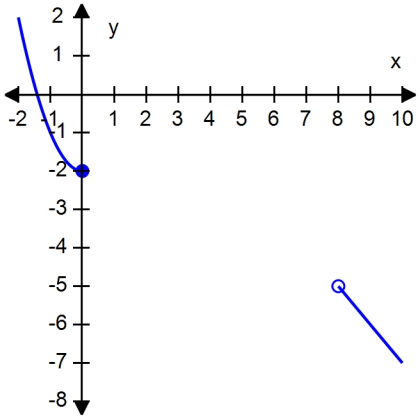
___ 60. Find the domain and sketch the graph of the function. What is its range?

$$f(x) = \begin{cases} -x + 3 & \text{if } x \geq 3 \\ x^2 - 2 & \text{if } x < 3 \end{cases}$$

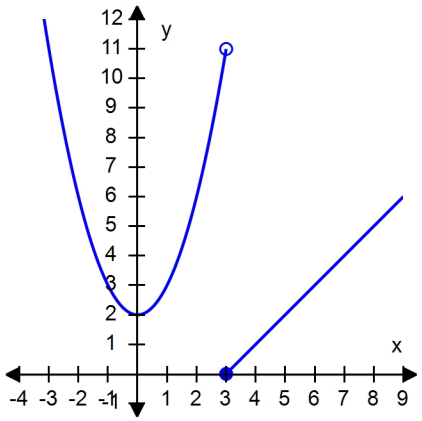
a. ***D***: $(-\infty, \infty)$; ***R***: $[-2, \infty)$



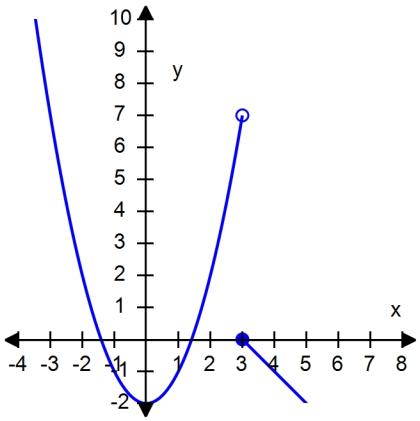
b. ***D***: $(-\infty, \infty)$; ***R***: $(-\infty, 0]$



c. ***D***: $(-\infty, \infty)$; ***R***: $[0, \infty)$



d. ***D***: $(-\infty, \infty)$; ***R***: $(-\infty, \infty)$



___ 61. Determine whether the function is one-to-one.

$$f(x) = \sqrt{4 - x}$$

a. No

b. Yes

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___ 62. A rectangle has perimeter 14 m. Express the area of the rectangle as a function $A(l)$ of the length l of one of its sides.

a. $A(l) = 7l - l^2$

b. $A(l) = l - 7l^2$

c. $A(l) = 14l - l^2$

d. $A(l) = 14l + l^2$

e. $A(l) = 7l + l^2$

___ 63. If a bacteria population starts with 100 bacteria and doubles every three hours, then the number of bacteria after t hours is

$$n = f(t) = 100\left(2^{\frac{t}{3}}\right).$$

When will the population reach 45,000? Round the answer to the nearest tenth.

a. 26.4 hours

b. 16.4 hours

c. 31.4 hours

d. 21.4 hours

e. 36.4 hours

___ 64. Find the range of the function.

$y = 4 + \cos x$

a. $(-\infty, \infty)$

b. $(2, \infty)$

c. $[-1, 1]$

d. $(-1, 3)$

e. $[3, 5]$

___ 65. Classify the function as a Polynomial function, a Rational function, an algebraic function, or other.

$f(x) = x^9 + 4x^6 - 6$

a. Other

b. Algebraic

c. Polynomial

d. Rational

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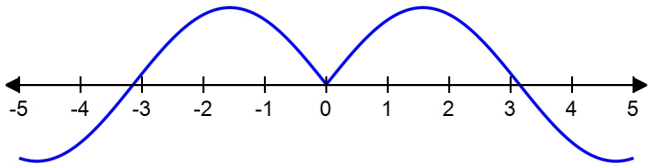
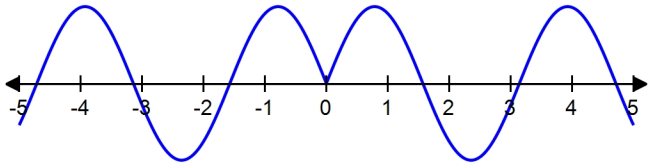
___ 66. Which of the following graphs is the graph of the function?

$f(x) = \sin|2x|$

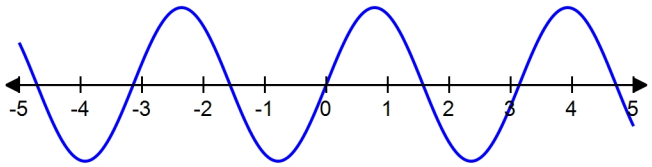
Graph 1



Graph 2



Graph 3



a. Graph 2

b. Graph 1

c. Graph 3

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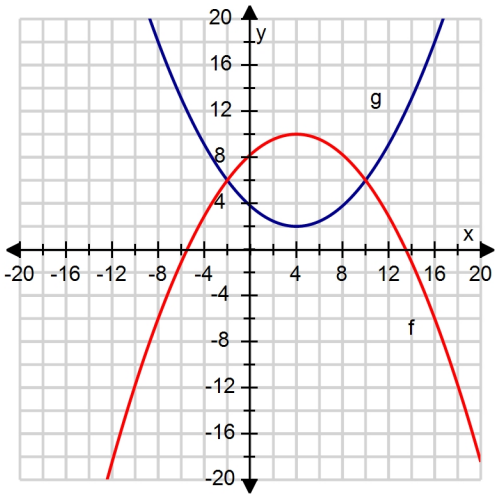
___ 67. The graphs of $f(x)$ and $g(x)$ are given. For what values of x is $f(x) = g(x)$?



a. 2, 3

b. 0

c. –1

d. –2, 5

e. –2, 10

___ 68. Find the domain of the function $f(x) = \dfrac{x}{7\sin x - 8}$

a. $(-\infty, \infty)$

b. $\left[\dfrac{8}{7}, \infty\right)$

c. $[-8, 7]$

d. $[-7, 8]$

___ 69. Find a formula for the inverse of the function.

$y = \ln(x + 8)$

a. $y = e^x - 8$

b. $y = e^x + 8$

c. $y = -8e^x$

d. $y = 8e^x$

e. $y = e^{x+8}$

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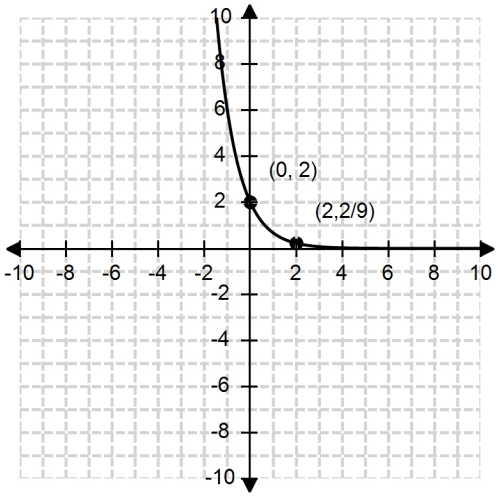
___ 70. Find the exponential function $y = Ca^x$ whose graph is given.



a. $f(x) = 2\left(\frac{1}{3}\right)^x$

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

c. $f(x) = \left(\frac{3}{2}\right)$

d. $f(x) = \frac{1}{3^x}$

e. $f(x) = \left(\frac{3}{4}\right)^x$

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___ 71. Use the laws of logarithms to write the expression as the logarithm of a single quantity.

$$4 \ln 5 - \frac{3}{4}\ln(x + 3)$$

a. $\ln \dfrac{625}{(x + 3)^{3/4}}$

b. $\dfrac{4 \ln 5}{\frac{3}{4}\ln(x + 3)}$

c. $\ln 5^4 - \ln(x + 3)^{3/4}$

d. $\dfrac{3 \ln 625}{4(x + 3)}$

___ 72. Which of the following functions is neither even nor odd?

a. $f(x) = \dfrac{2x^2}{x^4 + 1}$

b. $f(x) = 8x^3 + 10x^2 + 7$

c. $f(x) = x^3 - 3x$

___ 73. Find the domain of the function.

$$f(x) = \frac{7x + 5}{x^2}$$

a. $(-\infty, 0)$

b. $\left(-\infty, -\dfrac{5}{7}\right) \cup \left(-\dfrac{5}{7}, \infty\right)$

c. $\left(-\infty, \dfrac{5}{7}\right) \cup \left(\dfrac{5}{7}, \infty\right)$

d. $(-\infty, 0) \cup (0, \infty)$

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___ 74. Find the exact value of the expression.

$\log_5 100 + \log_5 50 - 3\log_5 2$

a. 7
b. 8
c. 6
d. 4
e. 5

___ 75. Under ideal conditions a certain bacteria population is known to double every three hours. Suppose that there are initially 20 bacteria. What is the size of the population after 15 hours?

a. 1,280 bacteria
b. 80 bacteria
c. 640 bacteria
d. 160 bacteria
e. 320 bacteria

___ 76. If $f(x) = x^2 - x + 8$, evaluate the difference quotient $\dfrac{f(a+h) - f(a)}{h}$.

a. $2a + h - 8$
b. $2a - 8$
c. $2a - h - 8$
d. h
e. none of these

___ 77. The table gives the population of the United States, in millions, for the years 1900 - 2000. Use a graphing calculator with exponential regression capability to model the U.S. population since 1900. Use the model to estimate the population in 1965 and to predict the population in the year 2025.

Year	1900	1910	1920	1930	1940	1950	1960	1970	1980	1990	2000
Population (millions)	76	92	106	123	131	150	179	203	227	250	281

a. 185 million, 400 million
b. 190 million, 405 million
c. 195 million, 410 million
d. 180 million, 395 million
e. 175 million, 390 million

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___ 78. Simplify the expression.

$e^{3\ln 4}$

a. 7
b. 12
c. 64
d. 81

___ 79. Find the exact value of the given expression.

$\tan^{-1} 1$

a. 2π
b. $\frac{\pi}{4}$
c. $\frac{4}{\pi}$
d. 4π

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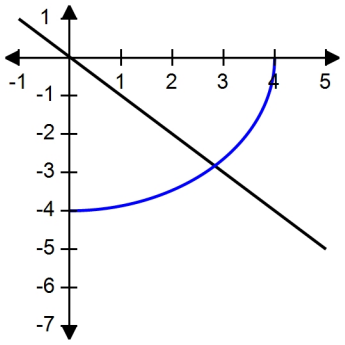
___ 80. Find the inverse of f. Then sketch the graphs of f and f^{-1} on the same set of axes.

$f(x) = \sqrt{16 - x^2}, x \geq 0$

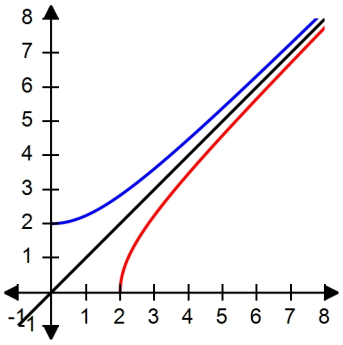
a. $f^{-1}(x) = -\sqrt{16 - x^2}, x \geq 0$

$f = f^{-1}$



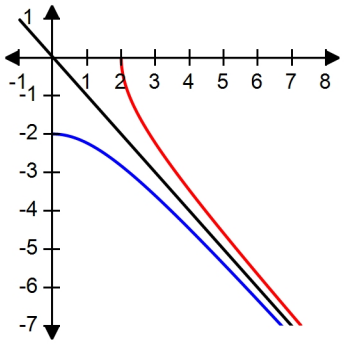
b. $f^{-1}(x) = \sqrt{4 + x^2}, x \geq 0$

$f(blue), f^{-1}(red)$



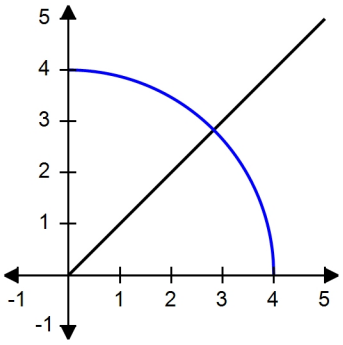
c. $f^{-1}(x) = -\sqrt{4 + x^2}, x \geq 0$

$f(blue), f^{-1}(red)$



d. $f^{-1}(x) = \sqrt{16 - x^2}, x \geq 0$

$f = f^{-1}$



___ 81. Suppose that the graph of $y = \log_2 x$ is drawn on a coordinate grid where the unit of measurement is an inch. How many miles to the right of the origin do we have to move before the height of the curve reaches 3 ft? Rounded to the nearest mile.

a. 5.2 mi

b. 1,084,587.7 mi

c. 103 mi

d. 13,015,052.4 mi

e. –97 mi

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___ 82. Determine whether f is even, odd, or neither.

$$f(x) = \frac{8x^2}{x^4 + 5}$$

a. neither
b. odd
c. even

___ 83. Find the domain.

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

a. $(0, 3)$
b. $(-\infty, 0]$
c. $(-3, \infty]$
d. $[0, 3]$
e. $[0, \infty)$

___ 84. What is $\sqrt[10]{x}$, given that $H = h \circ f \circ g$ and $H(x) = \sqrt[10]{\sqrt{x} - 3}$?

a. $g(x)$
b. $f(x)$
c. $h(x)$

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___ 85. When a camera flash goes off, the batteries immediately begin to recharge the flash's capacitor, which stores electric charge given by

$$Q(t) = Q_0\left(1 - e^{-t/a}\right)$$

(The maximum charge capacity Q_0 is and t is measured in seconds.) How long does it take to recharge the capacitor to 90% of capacity if a = 4?

a. $-4\ln\left(\frac{9}{10}\right)$ seconds

b. $-4\ln\left(\frac{1}{10}\right)$ seconds

c. $-4\ln(10)$ seconds

d. $-4\ln(1)$ seconds

e. $-\ln\left(\frac{4}{9}\right)$ seconds

Numeric Response

Enter the appropriate value to answer the question or solve the problem.

86. Simplify the expression.

$$\sin(2\cos^{-1}4x)$$

87. A spherical balloon with radius r inches has volume $4\frac{\pi r^3}{3}$.

Find a function that represents the amount of air required to inflate the balloon from a radius of r inches to a radius of $r + 2$ inches.

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88. If $f(x) = 3x + \ln x$, find $f^{-1}(3)$. Round to the nearest whole.

89. The relationship between the Fahrenheit and Celsius temperature scales is given by the linear function.

$$F = \frac{9}{5}C + 32$$

Complete the table and find the slope. Round your answers to the nearest whole number.

°C	**°F**
15	
–15	
slope	

90. Express the function in the form of $f \circ g \circ h$.

$$H(x) = 3 - 5^{x^3}$$

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91. Find the domain of the function.

$f(x) = \sqrt{25 - x^2}$

92. Fill in the blanks.

Let $f(x) = 3 + x^2 + \tan\left(\frac{\pi x}{2}\right)$, where $-1 < x < 1$.

$f^{-1}(f(3))$_____ $f(f^{-1}(5))$_____

93. A stone is dropped into a lake, creating a circular ripple that travels outward at a speed of 49 cm/s. Express the radius r of this circle as a function of the time t (in seconds) and find $A \circ r$, if A is the area of this circle as a function of the radius.

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94. It makes sense that the larger the area of a region, the larger the number of species that inhabit the region. Many ecologists have modeled the species-area relation with a power function and, in particular, the number of species S of bats living in caves in central Mexico has been related to the surface area A measured in m^2 of the caves by the equation

$$S = 0.7A^{0.3}$$

(a) The cave called mission impossible near puebla, mexico, has suface area of $A = 80m^2$.

How many species of bats would expect to find in that cave?

(b) If you discover that 2 species of bats live in cave estimate the area of the cave.

95. Express the function in the form of $f \circ g$.

$$v(t) = \tan(t^2)\sin(t^2)$$

96. A spherical balloon with radius r inches has volume $\frac{4}{3}\pi r^3$.

Find a function that represents the amount of air required to inflate the balloon from a radius of r inches to a radius of $r + 7$ inches.

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97. Solve each equation for x.

(a) $\ln x = 3$ (b) $e^{e^x} = 6$

98. Find the range of the function.

$h(x) = \sqrt{36 - x^2}$

99. Find the exact value of the expression.

$\cos\left(\arcsin\frac{1}{2}\right)$

100. Find the domain of the function.

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

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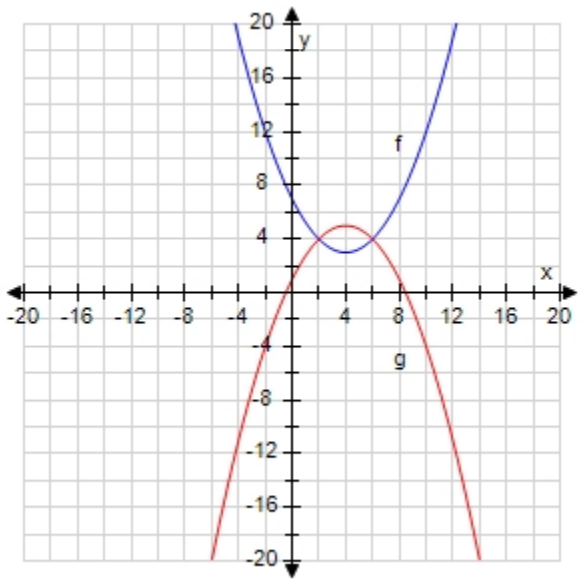
101. The graphs of $f(x)$ and $g(x)$ are given.

a) For what values of x is $f(x) = g(x)$?

b) Find the values of $f(-1)$ and $g(12)$.



102. Find the domain of the function.

$$f(x) = \frac{7}{3x - 1}$$

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103. Determine whether f is even, odd, or neither.

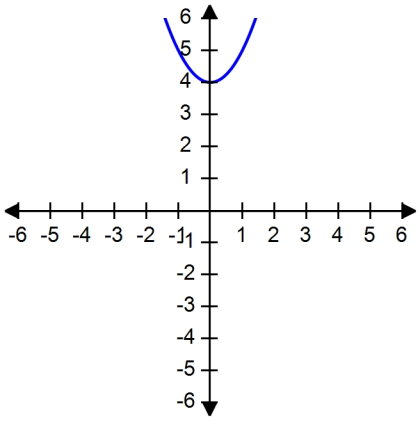
$$f(x) = \frac{2x^2}{x^4 + 1}$$

104. Find the domain, range, and x-intercept(s) of the function.

$$f(x) = \ln(x - 4) - 1$$

Subjective Short Answer

105. Use the vertical line test to determine whether the curve is the graph of a function of x.



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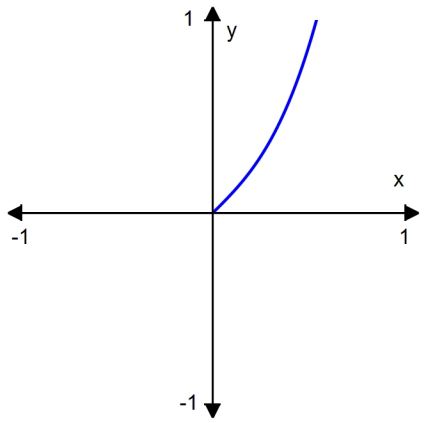
106. The following figure shows a portion of the graph of a function f defined on the interval $[-1, 1]$. Sketch the complete graph of f if it is known f is odd.



107. Find the function g such that $h(x) = (g \circ f)(x)$.

$h(x) = \sin^5 x$ and $f(x) = \sin x$

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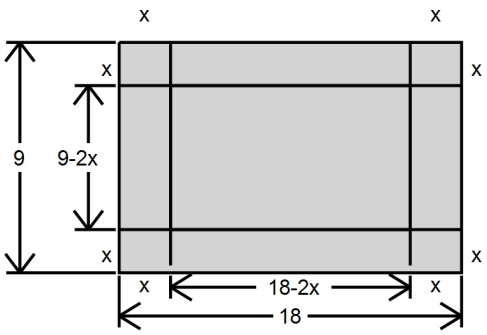
108. By cutting away identical squares from each corner of a rectangular piece of cardboard and folding up the resulting flaps, an open box can be made. If the cardboard is 18 in. long and 9 in. wide and the square cutaways have dimensions of x in. by x in., find a function that gives the volume of the resulting box.



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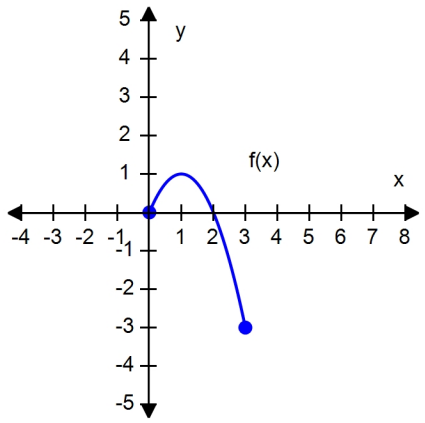
109. Refer to the graph of the function f in the following figure.



a. Find $f(0)$.
b. Find the value of x for which (i) $f(x) = 1$ and (ii) $f(x) = 0$.
c. Find the domain and range of f.

110. Sketch the graph of f.

$f(x) = \ln(x + 5) - 3$

111. Sketch the graph of the function.

$f(x) = |1 - 7x|$

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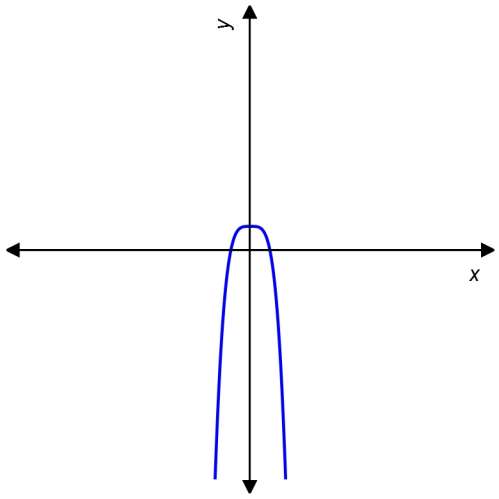
112. Determine whether f is one-to-one.



113. Find the inverse of f. Then use a graphing utility to plot the graphs of f and f^{-1} on the same set of axes.

$$f(x) = \frac{1 - e^{6x}}{1 + e^{6x}}$$

114. If $f(x) = \begin{cases} x^2 + 7 & \text{if } x \le 0 \\ \sqrt{x} & \text{if } x > 0 \end{cases}$

find $f(-3)$, $f(0)$, and $f(4)$.

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115. Find $f \circ g \circ h$ if

$f(x) = \sqrt{x}$, $g(x) = 3x + 1$, and $h(x) = x^2 - 1$

116. Determine whether the function is even, odd, or neither.

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

117. Let $f(x) = x^2 - 18x + 81$ and $g(x) = \sqrt{x + 1}$. Find $(f \circ f)(12)$.

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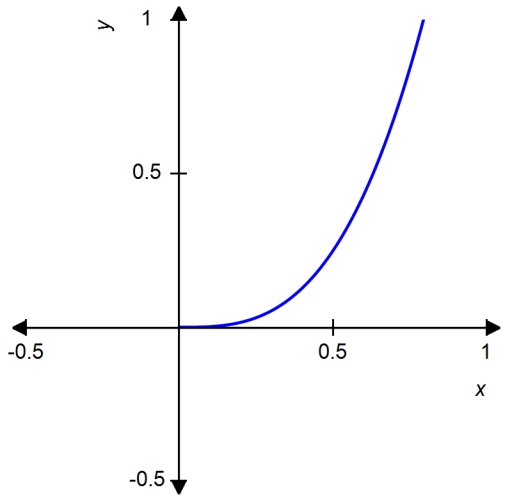
118. The graph of f is given. Sketch the graph of f^{-1} on the same set of axes.

$y = f(x)$



119. Find the inverse of f. Then sketch the graphs of f and f^{-1} on the same set of axes.

$$f(x) = \sin^{-1}\left(\frac{x}{5}\right), \quad -5 \le x \le 5$$

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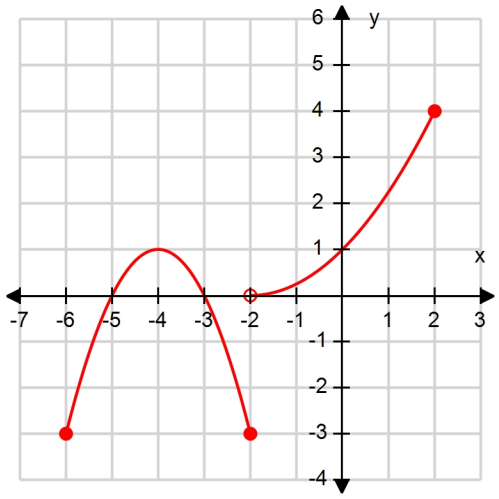
120. The graph of a function g is given. On what interval(s) is g increasing?



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Answer Key

1. False

2. a

3. a

4. a

5. a

6. a

7. a

8. a

9. a

10. c

11. a

12. a

13. a

14. a

15. a

16. a

17. a

18. e

19. a

20. e

21. g

22. a

23. a

24. a

25. a

26. c

27. c

28. a

29. b

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30. a

31. e

32. d

33. d

34. b

35. d

36. c

37. e

38. b

39. e

40. a

41. c

42. b

43. c

44. d

45. d

46. c

47. c

48. d

49. d

50. d

51. b

52. a

53. a

54. d

55. c

56. b

57. b

58. c

59. c

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60. d

61. b

62. a

63. a

64. e

65. c

66. a

67. e

68. a

69. a

70. a

71. a

72. b

73. d

74. d

75. c

76. e

77. a

78. c

79. b

80. d

81. b

82. c

83. d

84. c

85. b

86. $8x\sqrt{1 - 16x^2}$

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87. $\frac{8}{3}\pi(6r^2+12r+8)$

88. $f^{-1}(3) = 1$

89. (15, 59), (–15, 5); slope = 2

90. $h(x)=x^3, g(x)=5^x, f(x)=3-x$

91. [–5, 5]

92. 3, 5

93. $r(t)=49t,\ 2401\pi t^2$

94. a) 3 species
b) 33 m^2

95. $f(t)=\tan(t)\sin(t)$
$g(t)=t^2$

96. $\frac{28}{3}\pi(3r^2+21r+49)$

97. $x = e^3, x = \ln(\ln 6)$

98. $0 \le h(x) \le 6$

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99. $\frac{\sqrt{3}}{2}$

100. $(-\infty, 0) \cup (0, \infty)$

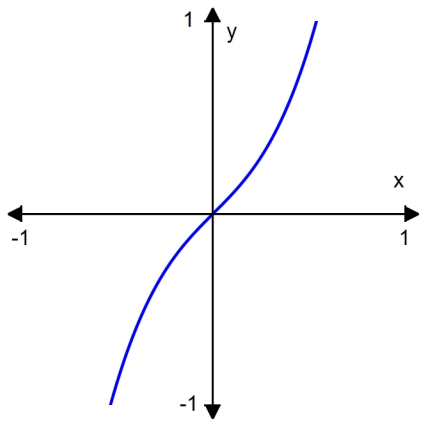
101. a) 2, 6 b) $f(-1) = 12, g(12) = -10$

102. $\left\{x \middle| x \neq \frac{1}{3}\right\}$

103. even

104. Domain: $(4, \infty)$ Range: $(-\infty, \infty)$ x-intercept: $x = e + 4$

105. Yes



106.

107. $g(x) = x^5$

108. $V = 4x^3 - 54x^2 + 162x$

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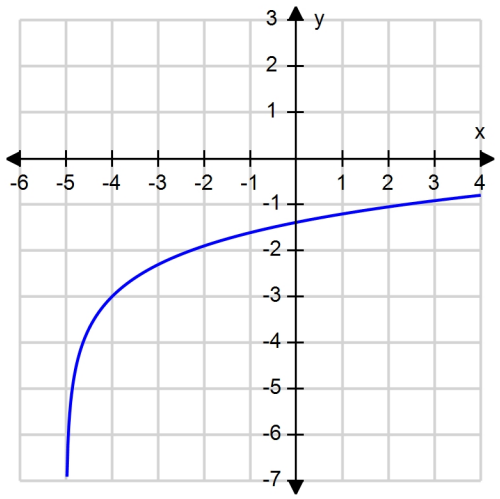
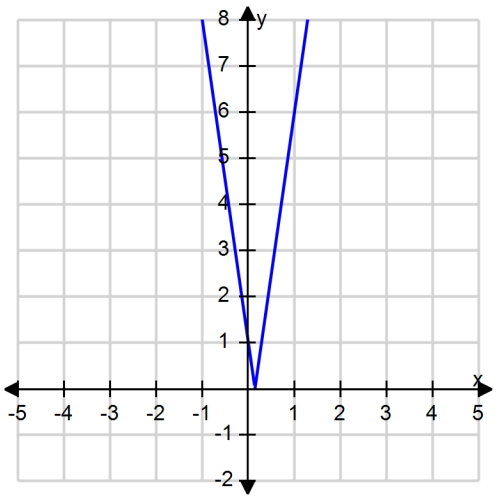
109. **a.** 0

b. (**i**) 1 (**ii**) 0, 2

c. ***D***: [0, 3], ***R***: [–3, 1]



110.



111.

112. No

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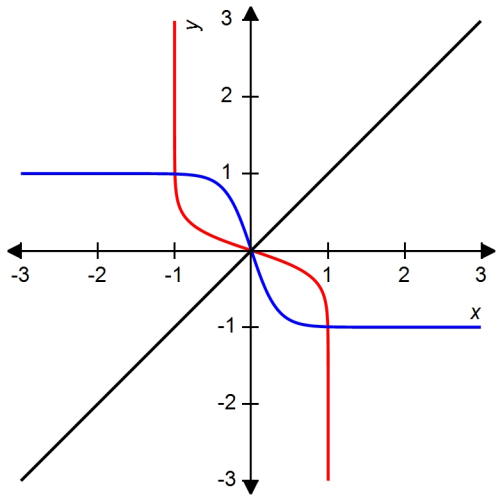
113. $f^{-1}(x) = \frac{1}{6}\ln\left(\frac{1-x}{1+x}\right)$



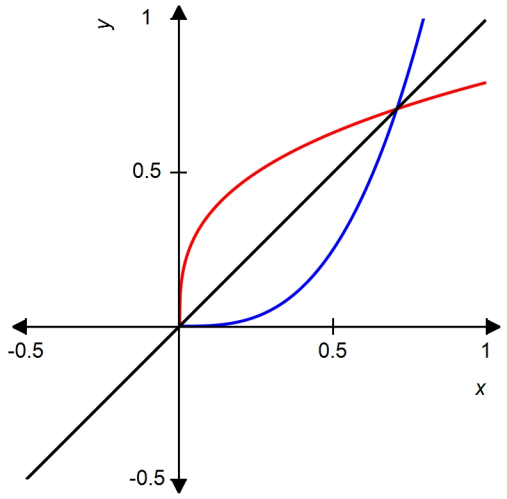
114. $f(-3) = 16,\ f(0) = 7,\ f(4) = 2.$

115. $\sqrt{3x^2 - 2}$

116. Neither

117. 0

118. $y = f(x)$ - blue, $y = f^{-1}(x)$ -red



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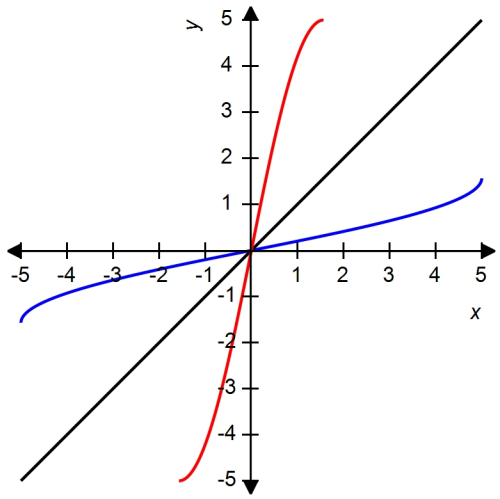
119. $f^{-1}(x) = 5\sin x,\ -\frac{\pi}{2} \le x \le \frac{\pi}{2}$



120. $[-6, -4] \cup (-2, 2]$

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