# *Multivariable Calculus 9th edition Stewart Test Bank*

SKU: 9780357042922-TEST-BANK

Name:_____ Class:_____ Date:_____

**SteCh01**

**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. Given that $\lim_{x \to 7}\left(1 + \frac{1}{7}x\right) = 2$, use the definition of the limit to find the largest value of $\delta$ that to $\varepsilon = 0.5$.

a. 3.5
b. 7
c. 0.07
d. 0.25
e. 1.0

___ 3. Identify the type of the following function.

$s(p) = \log_8 p$

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

___ 4. 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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___ 5. Use the Intermediate Value Theorem to determine the interval where the equation has a solution.

$\cos(x-5)=x-5$

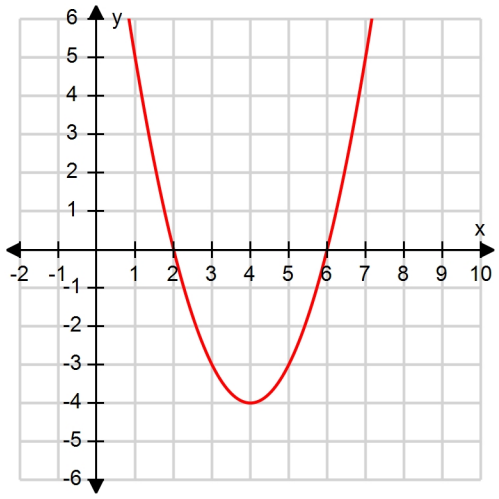
a. (5, 6)

b. (4, 5)

c. (3, 4)

d. (6, 7)

___ 6. 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. $(-4, \infty)$

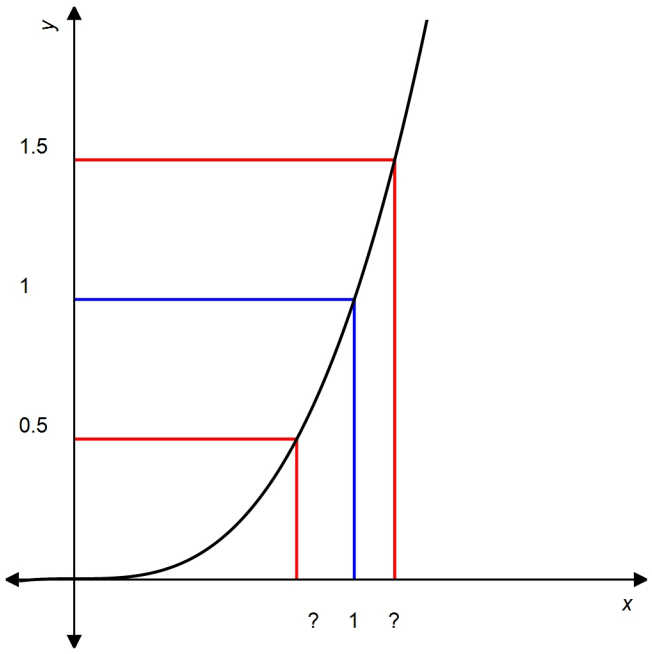
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___ 7. Use the given graph of $f(x) = x^3$ to find a number $\delta$ such that if $|x - 1| < \delta$, then $|x^3 - 1| < 0.5$.




a. 0.14
b. 0.21
c. 0.18
d. 0.50
e. 0.35

___ 8. 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. $f(x) = mx + 6m - 5$

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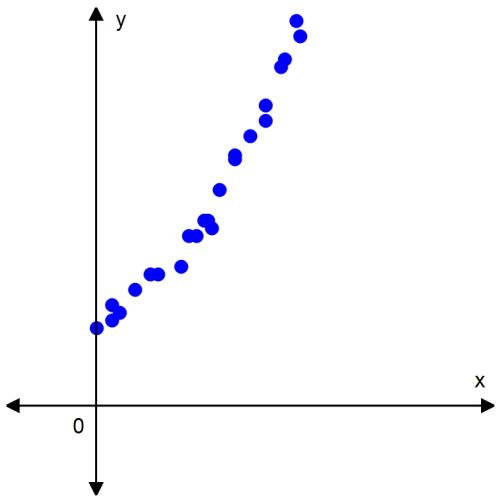
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___ 9. The data below shows Usain Bolt's position during his gold medal winning 100-meter sprint at the 2008 summer Olympics. Find his average velocity between the 60 m and 90 m marks.

| $t$ (seconds) | 1.85 | 2.87 | 3.78 | 4.65 | 5.50 | 6.32 | 7.14 | 7.96 | 8.79 | 9.69 |
|---|---|---|---|---|---|---|---|---|---|---|
| $s$ (meters) | 10 | 20 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 |

a. 12.15 m/s
b. 0.08 m/s
c. 9.12 m/s
d. 8.9 m/s
e. 7.16 m/s

___ 10. 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

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___ 11. Find a number $\delta$ such that if $|x+4|<\delta$, then $|6+3x|<0.27$.

a. 0.09
b. 0.27
c. 0.54
d. 0.90
e. 0.54

___ 12. 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. $\sqrt{x^2+36}$
$D=[6,\ \infty)$

___ 13. The point $P(1,\ 2)$ lies on the curve $y=\dfrac{2}{x^2}$. Estimate the value of the slope of the tangent line to the curve at $P(1,\ 2)$.

a. –4
b. 4
c. 2
d. –6
e. 8

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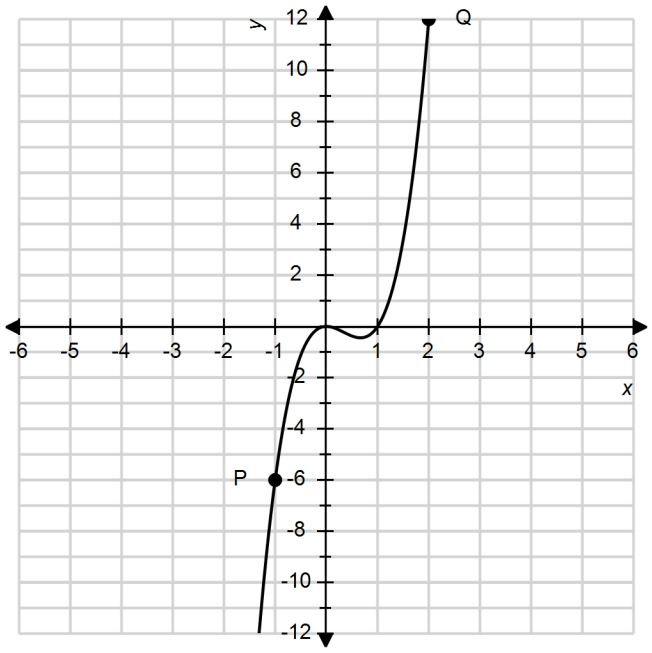

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___ 14. If a rock is thrown upward on the planet Pluto with a velocity of 20 m/s, its height in meters $t$ seconds later is given by $y = 20t - 0.32t^2$. Find the average velocity over the time interval $[3, 3.5]$. Round your answer to 1 decimal place if necessary.

a. 17.9
b. 9
c. 4.5
d. –9
e. 37.9

___ 15. Using the graph below, find the slope of the secant line $PQ$.




a. 6
b. 18
c. 2
d. –1
e. 3

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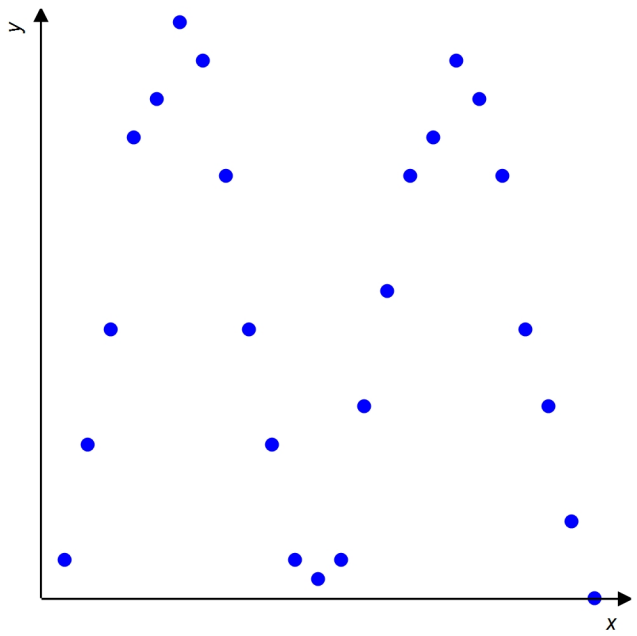

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___ 16. Choose an equation from the following that expresses the fact that a function $f$ is continuous at the number 4.

a. $\lim_{x \to 4} f(x) = -\infty$
b. $\lim_{x \to 4} f(x) = f(4)$
c. $\lim_{x \to 4} f(x) = \infty$
d. $\lim_{x \to 0} f(x) = f(4)$
e. $\lim_{x \to 0} f(x) = 4$

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

___ 19. 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. $T(N) = \dfrac{1}{6}N + \dfrac{312}{6}$

b. $T(N) = \dfrac{1}{6}N - \dfrac{312}{6}$

c. $T(N) = 6N - 648$

d. $N(T) = 6T - 312$

e. $N(T) = -6T + 312$

___ 20. At the surface of the ocean, the water pressure is the same as the air pressure above the water, $13 \text{ lb/in}^2$. Below the surface, the water pressure increases by $4.34 \text{ lb/in}^2$ for every 10 ft of descent. At approximately what depth is the pressure $120 \text{ lb/in}^2$?

a. 247 ft

b. 276 ft

c. 30 ft

d. 56 ft

e. 359 ft

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___ 21. 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: $(-\infty, \infty)$

___ 22. 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.

___ 23. 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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___ 24. 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. $2.15\ \text{m}^2$

___ 25. Given that $\lim_{x \to \frac{\pi}{2}} \tan^2 x = \infty$, find a number $\delta$ such that if $0 < \left| x - \frac{\pi}{2} \right| < \delta$, then $\tan^2 x > 600$.

a. 0.041

b. 1.612

c. 0.002

d. 1.489

e. 0.029

___ 26. 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

___ 27. The point $P(0.5,\ 1)$ lies on the curve $y = \sin(\pi x)$. If $Q$ is the point $(x,\ \sin(\pi x))$ use your calculator to find the slope of the secant line $PQ$ (correct to six decimal places) for the value $x = 0.1$.

a. 1.727458

b. 0.309017

c. 0.276393

d. 0.578885

e. 34.54915

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___ 28. The flash unit on a camera operates by storing charge on a capacitor and releasing it suddenly when the flash is set off. The data in the table describe the charge $Q$ remaining on the capacitor at time $t$ (measured in seconds after the flash goes off). Use the data to estimate the electric current flowing from the capacitor to the flash bulb when $t = 0.06$. Note: The slope of the tangent line represents the electric current flowing from the capacitor to the flash bulb (measured in microamperes).

| $t$ (seconds) | 0.00 | 0.02 | 0.04 | 0.06 | 0.08 | 0.10 |
|---|---|---|---|---|---|---|
| $Q$ (microcoulombs) | 80.00 | 68.00 | 52.29 | 42.70 | 37 | 27.9 |

a. $-382.25\ \mu A$

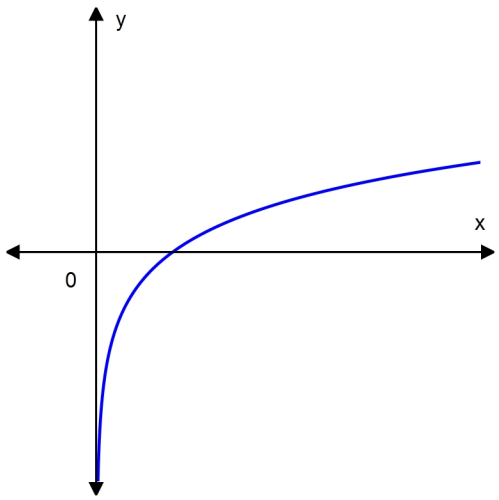
b. $764.5\ \mu A$

c. $-370\ \mu A$

d. $-632.5\ \mu A$

e. $-0.002\ \mu A$

___ 29. Determine the type of function whose graph is shown.




a. logarithmic function

b. root function

c. power function

d. exponential function

e. trigonometric function

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___ 30. 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

___ 31. If a rock is thrown upward on the planet Mars with a velocity of 10 m/s, its height in meters $t$ seconds later is given by

$y = 10t - 1.9t^2$.

Find the average velocity over the time interval [2, 3].

a. –2.5 m/s
b. 2.5 m/s
c. 0.5 m/s
d. 1.5 m/s
e. –0.5 m/s

___ 32. Find the vertical asymptotes of the function.

$$y = \frac{4x^2 + 1}{9x - 4x^2}$$

a. $x = \frac{1}{9}$
b. $x = 4$
c. $x = -\frac{2}{9}$
d. $x = 0, x = \frac{1}{4}$
e. none of these

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___ 33. Evaluate $\lim_{h \to 0} \dfrac{\cot\left(\dfrac{\pi}{4} + h\right) - 1}{h}$.

a. 0

b. 2

c. –2

d. Undefined

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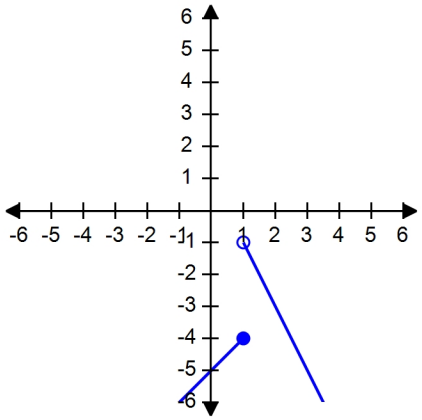
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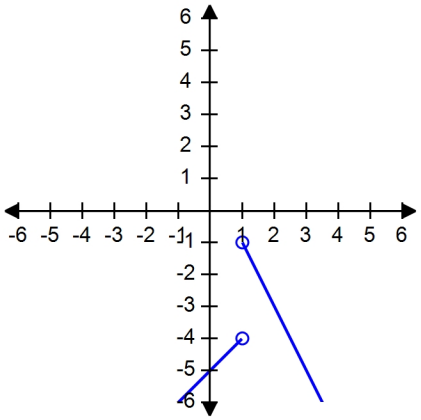
___ 34. Sketch the graph of the function $f$ and evaluate $\lim_{x \to 1^-} f(x)$.

$$f(x) = \begin{cases} x - 5, & \text{if } x \le 1 \\ -2x + 1, & \text{if } x > 1 \end{cases}$$



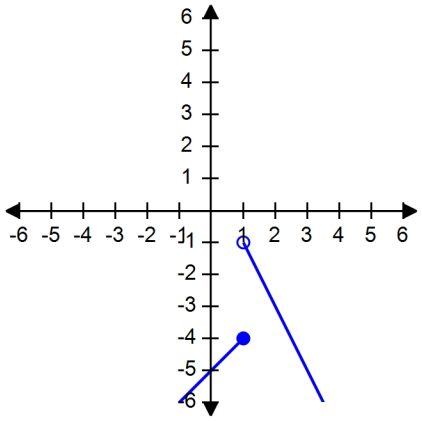
a.

–4



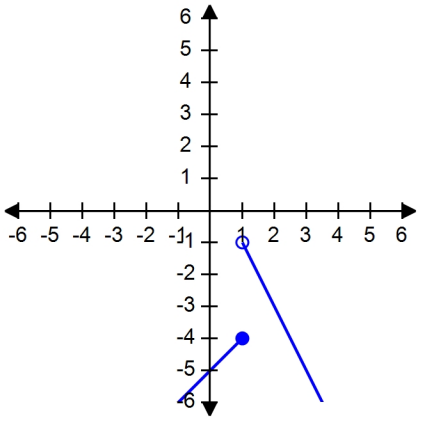
b.

Does not exist



c.

Does not exist



d.

–1

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___ 35. 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. $[-7, 8]$

___ 36. Use the graph of the function to state the value of $\lim\limits_{x \to 0} f(x)$, if it exists.

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

a. $\dfrac{1}{3}$

b. does not exist

c. $-\infty$

d. $\infty$

e. $-\dfrac{1}{3}$

___ 37. 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

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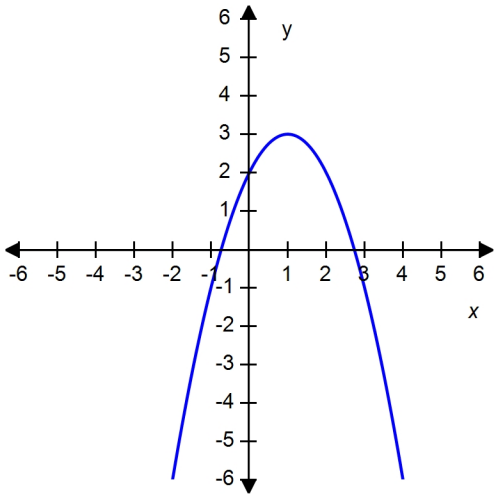


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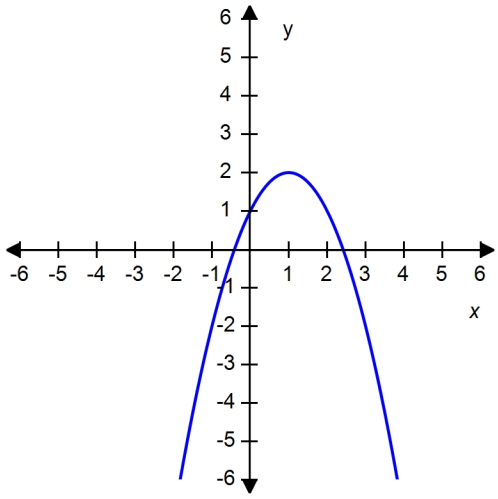
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___ 38. Graph the function by hand, not by plotting points, but by starting with the graph of one of the standard functions and then applying the appropriate transformations.

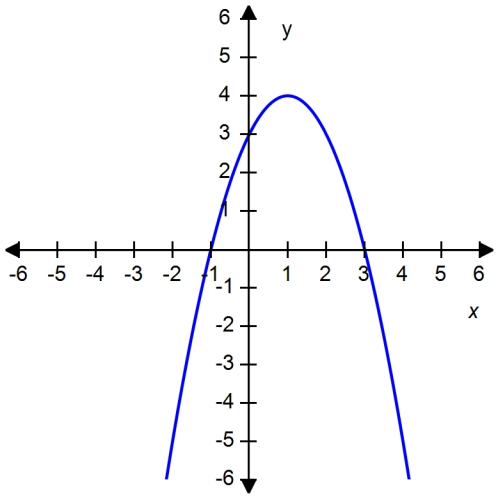
$y = 3 + 2x - x^2$



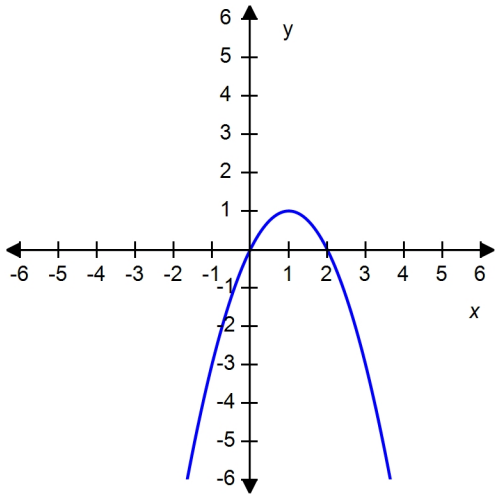

a.




b.




c.




d.

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___ 39. 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. $A(l) = 7l + l^2$

___ 40. The point $P(16, 4)$ lies on the curve $y = \sqrt{x}$. If $Q$ is the point $Q\left(x, \sqrt{x}\right)$, use your calculator to find the slope of the secant line $PQ$ (correct to six decimal places) for the value $x = 3.59$.

a. $m_{PQ} = -0.046643$

b. $m_{PQ} = -0.169643$

c. $m_{PQ} = -0.309643$

d. $m_{PQ} = 0.379643$

e. $m_{PQ} = 0.169643$

___ 41. A machinist is required to manufacture a circular metal disk with area 1000 cm$^2$. If the machinist is allowed an error tolerance of $\pm$ 25 cm$^2$ in the area of the disk, how close to the ideal radius must the machinist control the radius?

Round your answer to the nearest hundred thousandth.

a. $\delta \leq 0.21964$ cm

b. $\delta \leq 0.22114$ cm

c. $\delta \leq 0.22064$ cm

d. $\delta \leq 0.22164$ cm

e. $\delta \leq 0.22264$ cm

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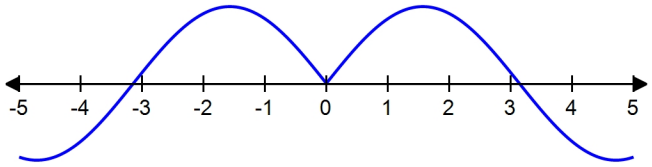
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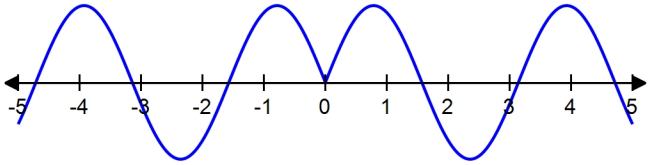
___ 42. Which of the following graphs is the graph of the function?

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

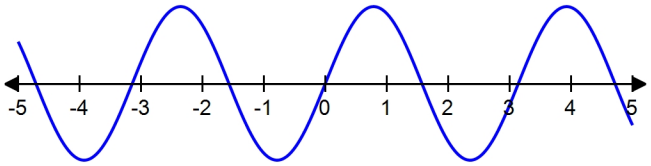
Graph 1




Graph 2




Graph 3

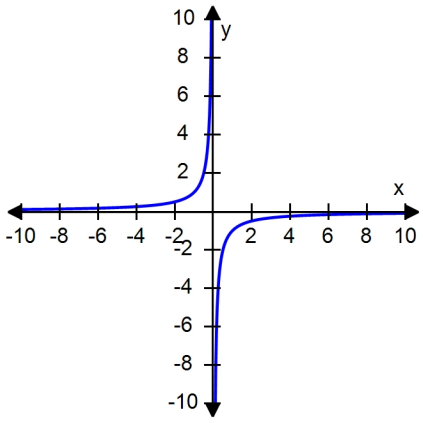



a. Graph 2
b. Graph 1
c. Graph 3

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___ 43. Determine whether the function whose graph is given is even, odd, or neither.




a. Even

b. Neither

c. Odd

___ 44. Find the limit.

$$\lim_{x \to 4^-} \frac{x^2 - 4x}{x^2 - 8x + 16}$$

a. $\infty$

b. 0

c. $-\infty$

d. $-2$

e. 2

___ 45. If $f$ and $g$ are continuous functions with $f(13) = 6$ and $\lim_{x \to 13} [2f(x) - g(x)] = 13$, find $g(13)$.

a. $g(13) = 25$

b. $g(13) = 19$

c. $g(13) = 12$

d. $g(13) = 24$

e. $g(13) = -1$

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___ 46. If $1 \le f(x) \le x^2 + 7x + 7$, for all $x$, find $\lim_{x \to -1} f(x)$.

a. $-\frac{1}{8}$

b. 1

c. $-\frac{1}{16}$

d. 8

e. does not exist

___ 47. 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. $C = 0.5d - 100$

___ 48. Is there a number $a$ such that $\lim_{x \to -3} \frac{3x^2 + ax + a + 3}{x^2 + x - 6}$ exists? If so, find the value of $a$ and the value of the limit.

a. $a = 15$, limit equals $-0.6$

b. $a = 15$, limit equals 0.6

c. $a = -15$, limit equals 0.6

d. $a = -15$, limit equals $-0.6$

e. $a = 15$, limit equals 19

___ 49. Suppose the distance $s$ (in feet) covered by a car moving along a straight road after $t$ sec is given by the function $s = f(t) = 2t^2 + 20t$. Calculate the (instantaneous) velocity of the car when $t = 34$.

a. 156 ft/sec

b. 22 ft/sec

c. 748 ft/sec

d. 2992 ft/sec

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___ 50. 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. $y = 100 - \sqrt{-x}$

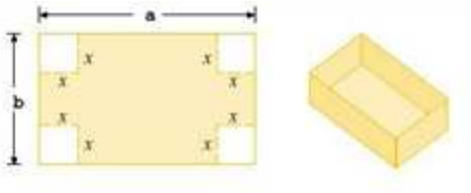
c. $y = 10 + \sqrt{x}$

d. $y = 100 - x^2$

e. $y = 10 - x^2$

___ 51. 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. $V(x) = 4x^3 - 62x^2 + 150x$

___ 52. 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

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___ 53. If $\lim_{x \to 2^+} f(x) = 5.6$, then if $\lim_{x \to 2} f(x)$ exists, to what value does it converge?

a. 4.6
b. 6.6
c. 7.6
d. 5.6
e. 3.6

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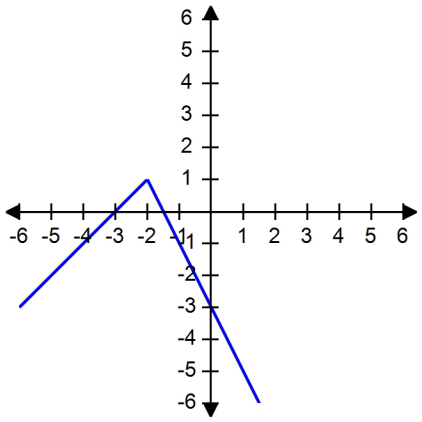
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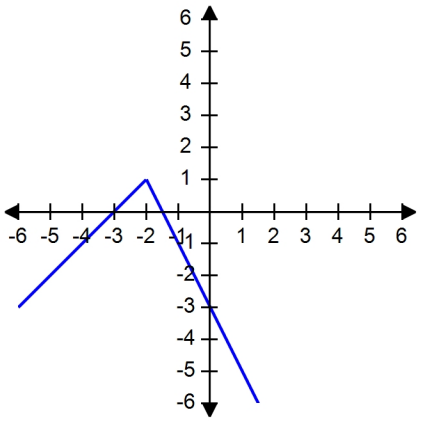
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___ 54. Sketch the graph of the function $f$ and evaluate $\lim_{x \to -2} f(x)$.

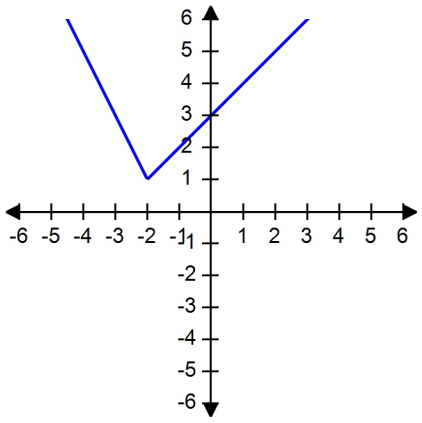
$$f(x) = \begin{cases} x+3, \text{ if } x \le -2 \\ -2x-3, \text{ if } x > -2 \end{cases}$$



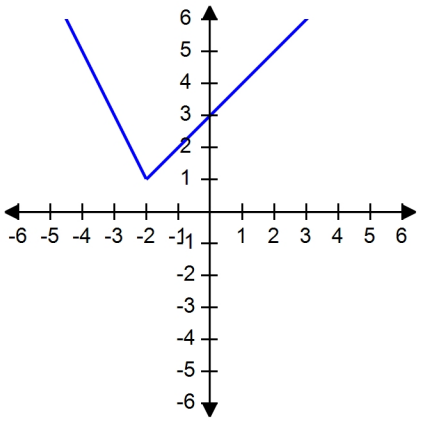

a.




b.




c.




d.

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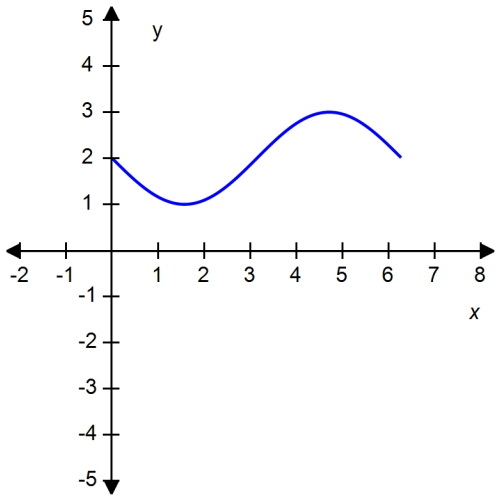
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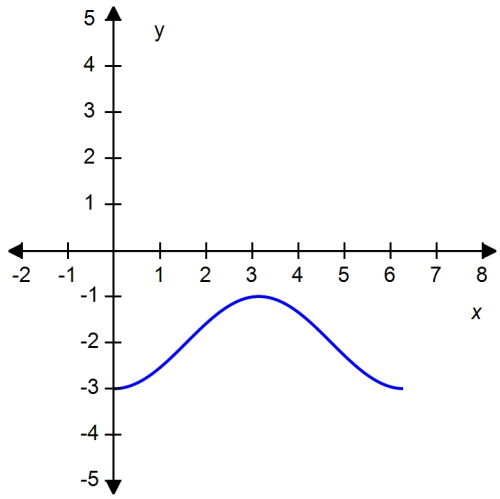
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___ 55. Sketch the graph of $y = 2 - \cos x$ over one period.

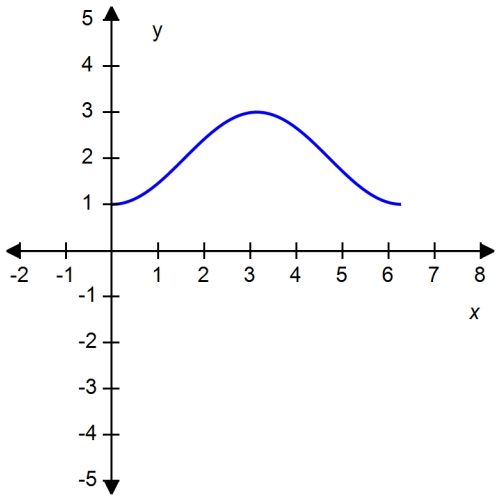
a.



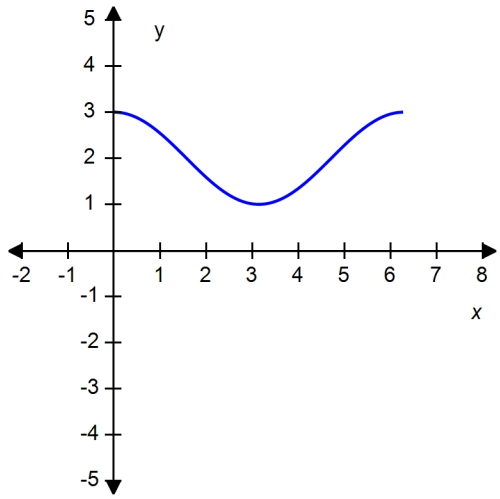

b.




c.




d.




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___ 56. Which of the given functions is discontinuous?

a. $f(x) = \begin{cases} \dfrac{1}{x-11}, & x \neq 11 \\ 9, & x = 11 \end{cases}$

b. $f(x) = \begin{cases} \dfrac{1}{x-2}, & x \geq 11 \\ \dfrac{1}{9}, & x < 11 \end{cases}$

___ 57. You are given $\lim_{x \to a} f(x) = L$ and a tolerance $\varepsilon$. Find a number $\delta$ such that $|f(x) - L| < \varepsilon$ whenever $0 < |x - a| < \delta$

$\lim_{x \to 3} 5x = 15; \ \varepsilon = 0.01$

a. 0.05

b. 0.002

c. 0.03

d. 0.01

___ 58. Estimate the value of the following limit by graphing the function $f(x) = \dfrac{(3\sin x)}{(\sin \pi x)}$.

$\lim_{x \to 0} \dfrac{3\sin x}{\sin \pi x}$

Round your answer correct to two decimal places.

a. 1.15

b. 0.85

c. 1.05

d. 1.91

e. 0.95

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___ 59. 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. $S(x) = x^2 + \dfrac{16}{x^2}$

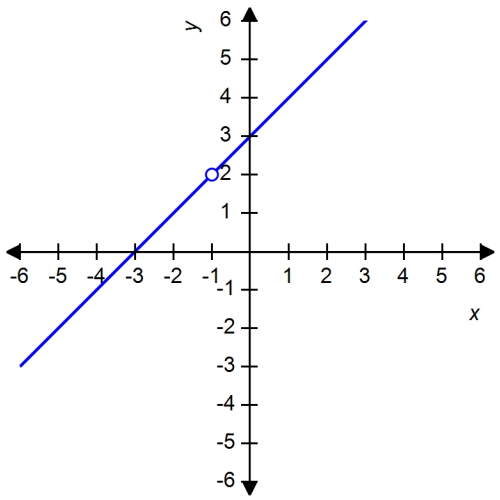
b. $S(x) = x^2 + \dfrac{16}{x}$

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

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

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

___ 60. Use the graph of $f(x) = \dfrac{x^2 + 4x + 3}{x + 1}$ to guess the limit $\lim\limits_{x \to -1} \dfrac{x^2 + 4x + 3}{x + 1}$, if it exists.




a. 2

b. –1

c. 3

d. Does not exist

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___ 61. 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. $10 + 5h$

___ 62. Determine where $f$ is discontinuous.

$$f(x) = \begin{cases} \sqrt{-x} & \text{if } x < 0 \\ 3 - x & \text{if } 0 \le x < 3 \\ (3 - x)^2 & \text{if } x > 3 \end{cases}$$

a. 0 and 3

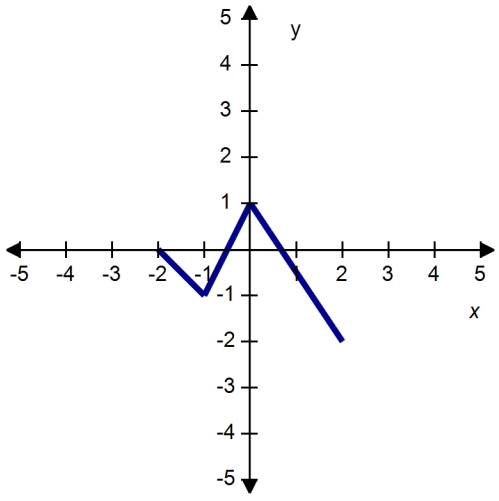
b. 0 and –3

c. 0 only

d. –3 only

e. 3 only

___ 63. The graph of the function $f$ follows. Choose the graph of $y = -f(x) - 1$.



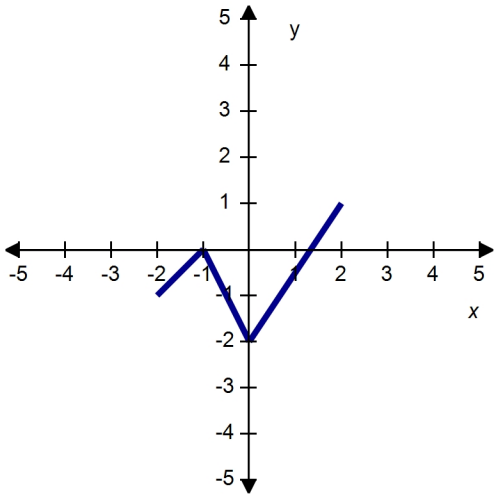

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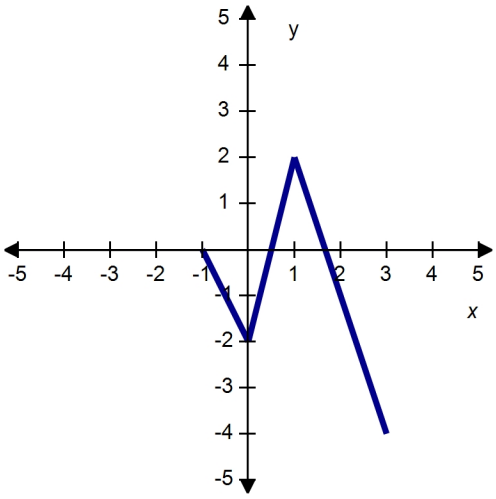
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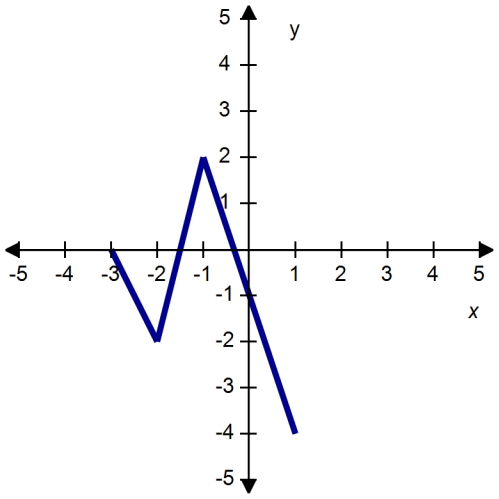



a.

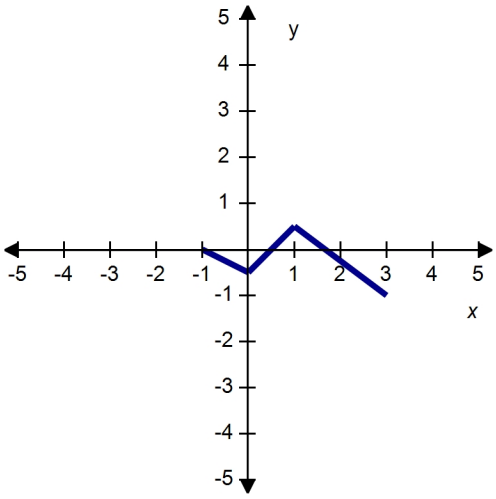



b.

c.




d.




___ 64. The graph of the function $f$ follows. Choose the graph of $y = f(|x|)$.

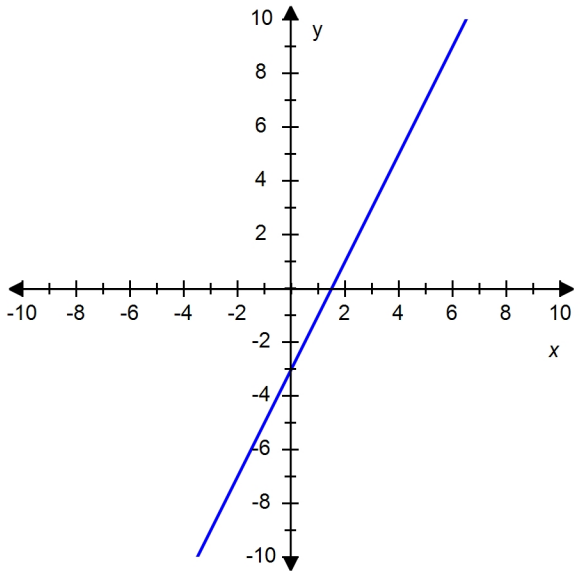
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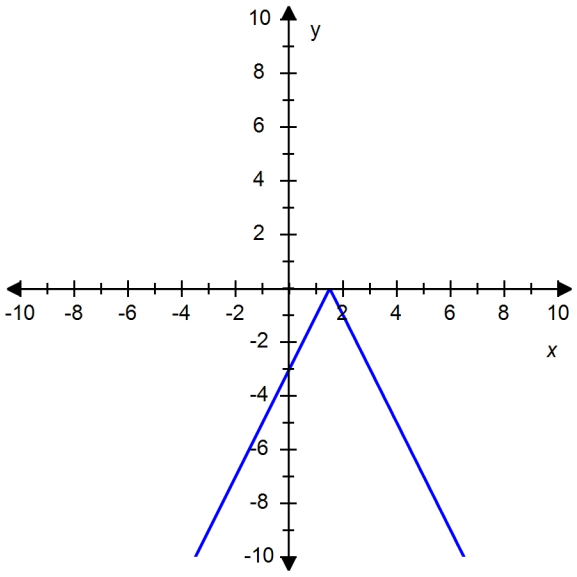
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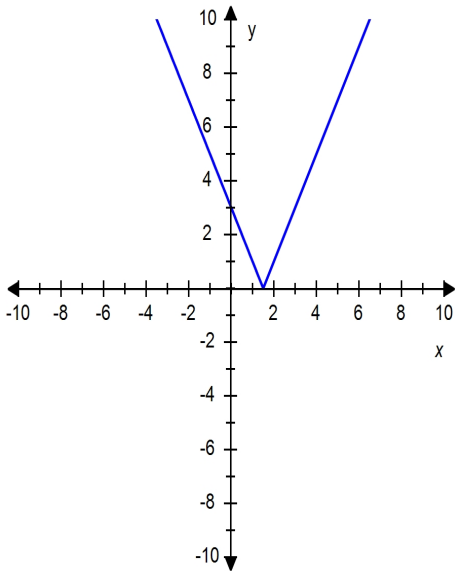



a.

b.




c.



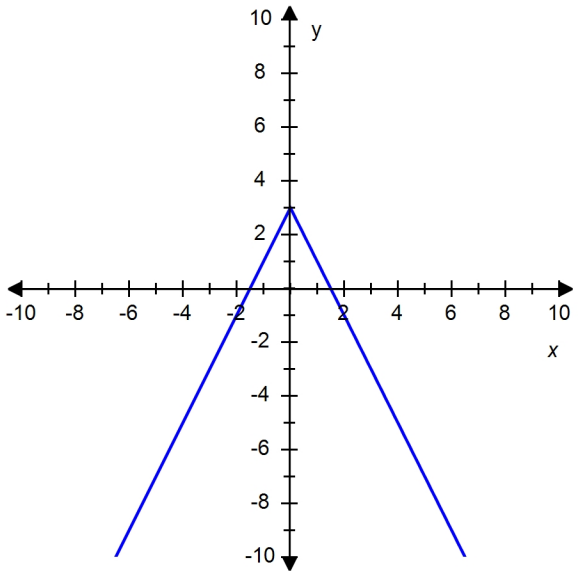

d.

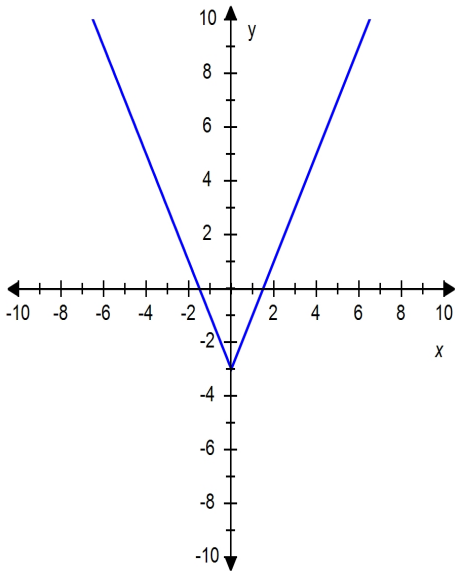
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___ 65. Classify the function as a Polynomial function, a Rational function, an algebraic function, or other.

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

a. Other
b. Algebraic
c. Polynomial
d. Rational

___ 66. Find the limit.

$$\lim_{x \to \infty} \frac{\sqrt{x^2 - 9}}{5x - 15}$$

a. –3
b. 3
c. 15
d. $\frac{1}{5}$
e. does not exist

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___ 67. Find the limit.

$$\lim_{x \to 2} \sqrt{\frac{4x^2 + 1}{3x - 2}}$$

a. 0

b. $-\frac{4}{3}$

c. $\frac{\sqrt{17}}{2}$

d. $\frac{4}{3}$

e. does not exist

___ 68. Evaluate the limit.

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

a. –448

b. –1286

c. –1306

d. –1296

e. 320

___ 69. Let $F(x) = \frac{x - 2}{|x - 2|}$. Find the following limits.

$$\lim_{x \to 2^+} F(x), \quad \lim_{x \to 2^-} F(x)$$

a. both 1

b. 2 and 1

c. 2 and –1

d. 1 and –1

e. both –1

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___ 70. Find the domain of the function.

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

a. $(-\infty, 0)$

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

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

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

___ 71. You are given that $\lim_{x \to a} f(x) = -5$, $\lim_{x \to a} g(x) = 5$, and $\lim_{x \to a} h(x) = 4$. Find the limit $\lim_{x \to a} \{[h(x)]^2 - f(x)g(x)\}$.

a. 5

b. 41

c. 0

d. 45

___ 72. If $4x - 1 \le f(x) \le x^2 - 1$, find $\lim_{x \to 4} f(x)$.

a. 1

b. 15

c. 0

d. – 4

e. – 15

___ 73. 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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___ 74. Find the interval(s) where $f(x) = \sqrt{x^2 - 4x + 7}$ is continuous.

a. $[0, \infty)$
b. $[-7, 7]$
c. $(-\infty, \infty)$
d. $[-4, 7]$

___ 75. 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. $d = -25$

___ 76. Estimate the value of the limit by graphing the function $f(x) = \dfrac{2\sin x}{\sin \pi x}$. State your answer correct to two decimal places.

$$\lim_{x \to 0} \frac{2\sin x}{\sin \pi x}$$

a. 3.14
b. 1.27
c. 3.82
d. 1.57
e. 0.64

___ 77. Find the limit $\lim\limits_{x \to 0} \dfrac{\sqrt{x + 13} - \sqrt{13}}{x}$, if it exists.

a. Does not exist
b. $\dfrac{\sqrt{13}}{26}$
c. $\dfrac{\sqrt{13}}{2}$
d. $\dfrac{\sqrt{13}}{13}$

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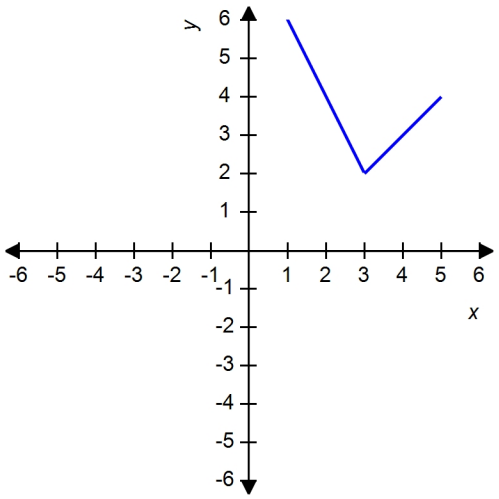
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___ 78. Sketch the graph of the function $f$ and evaluate $\lim_{x \to 3} f(x)$.

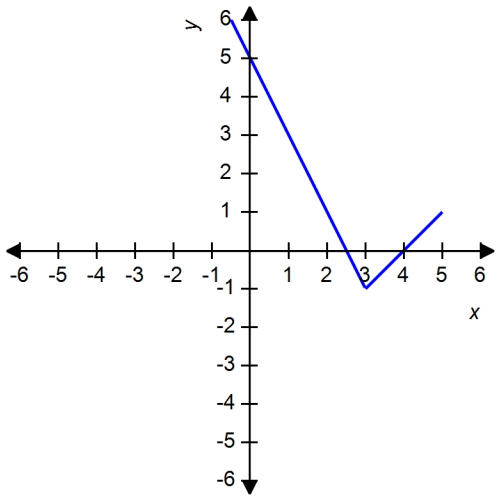
$$f(x) = \begin{cases} x - 1, & \text{if } x \leq ,3 \\ -2x + 8, & \text{if } x > 3 \end{cases}$$

a.



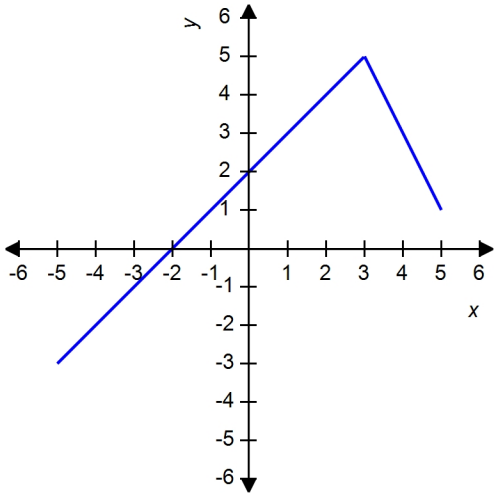

2

b.



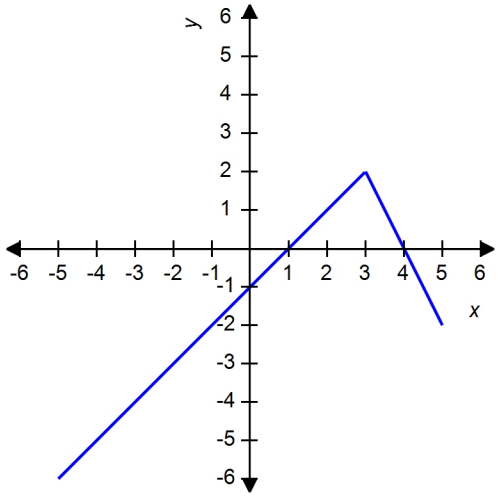

3

c.




3

d.




2

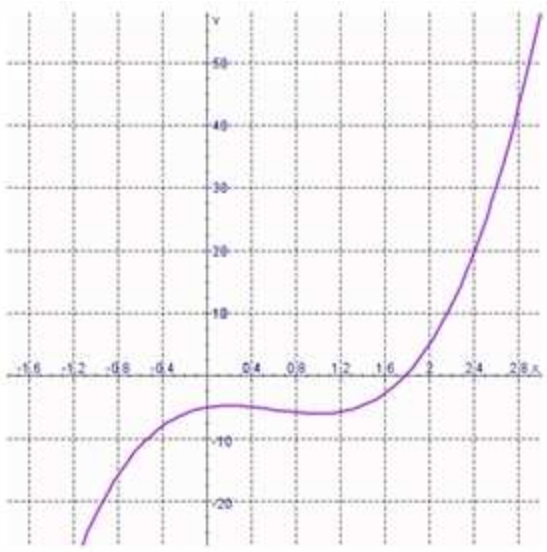
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___ 79. The graph of the function $f$ is given. State the value of $f(2.7)$.



a. $f(2.7) = -40$
b. $f(2.7) = -10$
c. $f(2.7) = 40$
d. $f(2.7) = 0$
e. $f(2.7) = 10$

___ 80. Find the domain.

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

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

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___ 81. Determine whether $f$ is even, odd, or neither.

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

a. neither
b. odd
c. even

___ 82. Find the numbers, if any, where the function $f(x) = \begin{cases} 3x - 5 & \text{if } x \le 1 \\ -3 & \text{if } x > 1 \end{cases}$ is discontinuous.

a. –5
b. 5
c. 1
d. –3

___ 83. A cardiac monitor is used to measure the heart rate of a patient after surgery. It compiles the number of heartbeats after $t$ minutes. When the data in the table are graphed, the slope of the tangent line represents the heart rate in beats per minute. The monitor estimates this value by calculating the slope of a secant line. Use the data to estimate the patient's heart rate after 42 minutes using the secant line between the points with $t$ = 38 and $t$ = 42.

| $t$ (mins) | 36 | 38 | 40 | 42 | 44 |
|---|---|---|---|---|---|
| Heartbeats | 2570 | 2720 | 2840 | 3020 | 3070 |

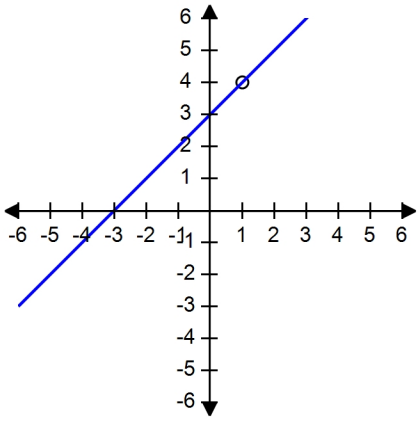
a. 74
b. 80
c. 85
d. 70
e. 76
f. 75

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___ 84. Use the graph of $f(x) = \dfrac{x^2 + 2x - 3}{x - 1}$ to guess the limit $\lim\limits_{x \to 1} \dfrac{x^2 + 2x - 3}{x - 1}$, if it exists.




a. 1

b. 3

c. Does not exist

d. 4

___ 85. The symbol $\lfloor \ \rfloor$ can be used to denote the greatest integer function, which is defined by $\lfloor x \rfloor$ the greatest integer $n$ such that $n \leq x$. Use the graph of the function to find the indicated limit, if it exists.

$$\lim_{x \to -1.5} \lfloor x \rfloor$$

a. –2

b. –1

c. 1.5

d. –1.5

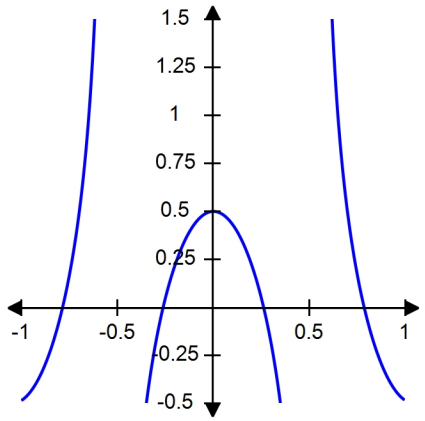
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___ 86. Use the graph of $f(x) = \dfrac{\sin 3x}{\tan 6x}$ to guess the limit $\lim\limits_{x \to 0} \dfrac{\sin 3x}{\tan 6x}$, if it exists.




a. 2.0
b. 0.50
c. 0.17
d. Does not exist

___ 87. Find the range of the function.

$y = 4 + \cos x$

a. $(-\infty, \infty)$
b. $(2, \infty)$
c. $[-1, 1]$
d. $(-1, 3)$
e. $[3, 5]$

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___ 88. Evaluate the limit, if it exists.

$$\lim_{h \to 0} \frac{(x-h)^6 - x^6}{h}$$

a. $6x^5$

b. $-6$

c. 1

d. $-6x^5$

e. does not exist

___ 89. Find the limit.

$$\lim_{x \to -3} \frac{x^2 + 2x - 15}{x + 5}$$

a. 0

b. $\infty$

c. $-\infty$

d. 4

e. $-6$

___ 90. If a ball is thrown into the air with a velocity of 60 ft/s, its height (in feet) after $t$ seconds is given by

$H = 60t - 9t^2$.

Find the velocity when $t = 9$.

a. –99 ft/s

b. –102 ft/s

c. –104 ft/s

d. –101 ft/s

e. –97 ft/s

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**SteCh01**

___ 91. 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

___ 92. Find the limit.

$$\lim_{x \to (\pi/2)^-} \frac{-3}{7\cos(x)}$$

a. $-\infty$

b. $\infty$

c. $-\frac{3}{7}$

d. $\frac{3}{7}$

___ 93. How would you define $f(6)$ in order to make $f$ continuous at 6?

$$f(x) = \frac{x^2 - 3x - 18}{x - 6}$$

a. $f(6) = -5$

b. $f(6) = 9$

c. $f(6) = 0$

d. $f(6) = -9$

e. None of these

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___ 94. Use continuity to evaluate the limit.

$$\lim_{x \to 3\pi} \sin(x + 6 \sin x)$$

a. $3\pi$

b. 1

c. $-1$

d. 0

e. $\infty$

___ 95. Find the value of the limit.

$$\lim_{x \to 0} 3\frac{\tan 6x - 6x}{x^3}$$

a. 36

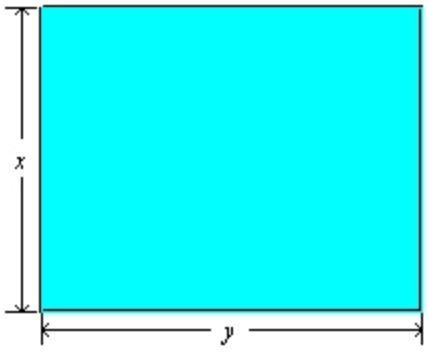
b. 6

c. 1296

d. 7776

e. 216

___ 96. 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. $f(x) = 25x - x^2, 0 < x < 50$

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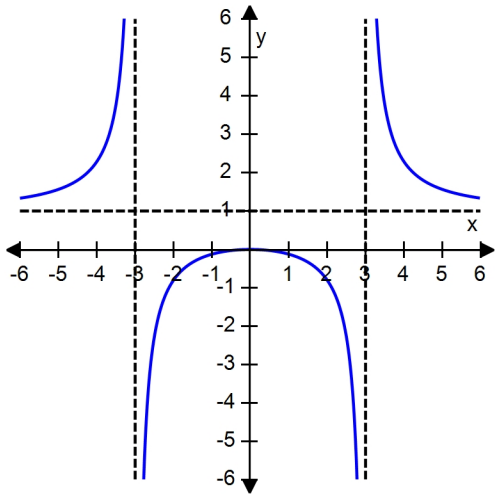
___ 97. Which of the following functions is neither even nor odd?

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

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

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

___ 98. Use the graph to determine where the function is discontinuous.




a. At 0

b. On the interval (0, 1)

c. At ±3

d. At 1

___ 99. 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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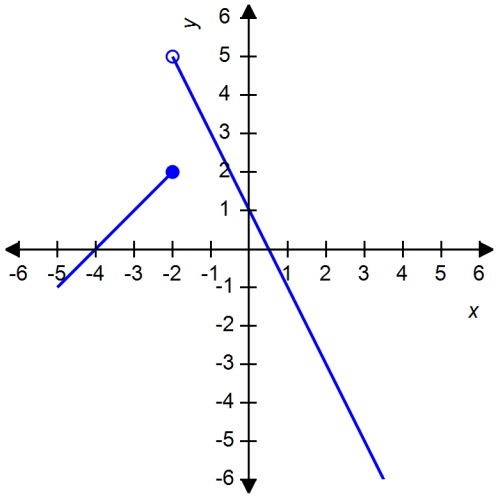
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**SteCh01**

___ 100. Sketch the graph of the function $f$ and evaluate $\lim_{x \to -2^-} f(x)$

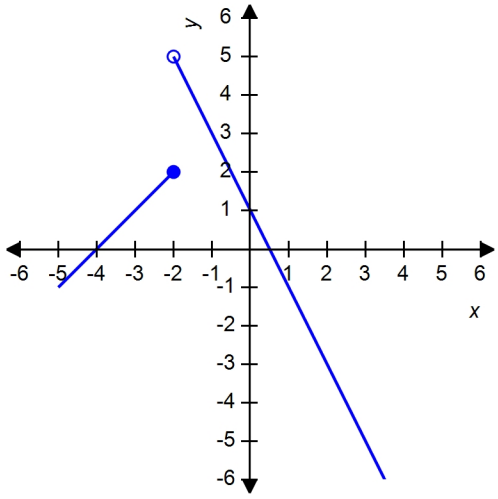
$$f(x) = \begin{cases} x+4, & \text{if } x \le -2 \\ -2x+1, & \text{if } x > -2 \end{cases}$$

a.



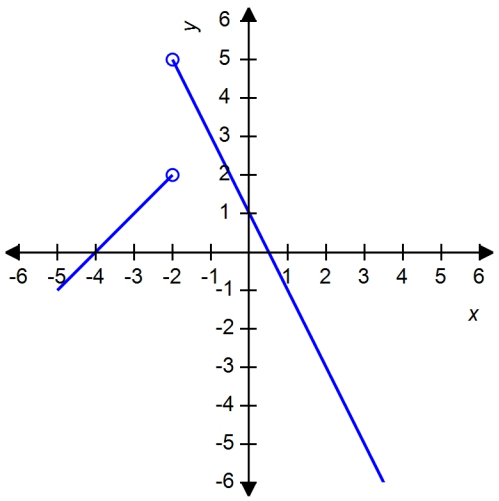

Does not exist

b.



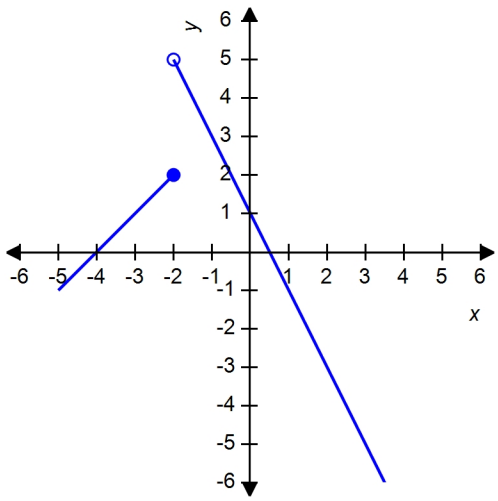

5

c.




Does not exist

d.




2

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___ 101. 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

___ 102. 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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___ 103. Find the limit.

$$\lim_{u \to 9^+} \frac{-8u^2}{u-9}$$

a. $\infty$

b. $-\infty$

c. $-\frac{8}{9}$

d. $\frac{8}{9}$

___ 104. Let

$$f(x) = \begin{cases} x+1 & \text{if } x \le 6 \\ kx^2 - 30x + 79 & \text{if } x > 6 \end{cases}$$

Find the value of $k$ that will make $f$ continuous on $(-\infty, \infty)$.

a. 6

b. 79

c. 1

d. 3

___ 105. Define the function $f(x) = \frac{3x^3 + x}{8x}$ at 0 so as to make it continuous at 0.

a. $f(0) = \frac{3}{8}$

b. $f(0) = \frac{1}{2}$

c. $f(0) = 0$

d. $f(0) = \frac{1}{8}$

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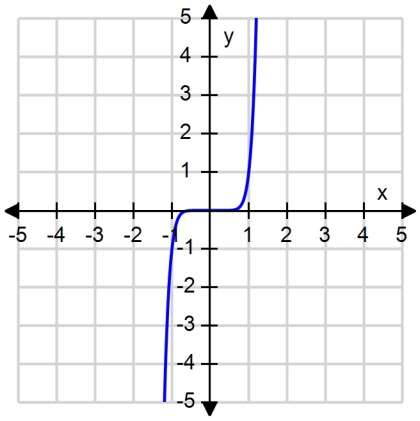
___ 106. The position of a car is given by the values in the following table.

| $t$ (seconds) | 0 | 1 | 2 | 3 | 4 |
|---|---|---|---|---|---|
| $s$ (meters) | 0 | 20.6 | 25.5 | 64.1 | 94.3 |

Find the average velocity for the time period beginning when $t = 2$ and lasting 2 seconds.

a. 47.15 ft/s
b. 30.6 ft/s
c. 33.5 ft/s
d. 33.5 ft/s
e. 34.4 ft/s

___ 107. 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. $y = x^9$

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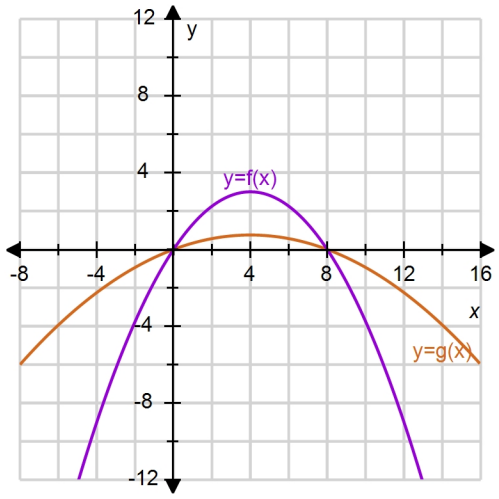
___ 108. Find the limit $\lim_{h \to 1} (h^4 + 4h^3 + 5h + 4)$.

a. –14
b. 1
c. 4
d. 14

___ 109. 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. $g(x) = x + 25$

___ 110. 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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___ 111. Find the limit.

$$\lim_{x \to 5} \frac{x^2 + 5x - 50}{x - 5}$$

a. 15
b. 3
c. 13
d. 50
e. –2

___ 112. If $\lim_{x \to 3^-} f(x) = 3.7$, then if $\lim_{x \to 3} f(x)$ exists, find the value where it exists.

a. 1
b. 5
c. 3.7
d. 2
e. 4

___ 113. 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 $0^\circ$C
b. $\frac{9}{5}$, Celsius temperature corresponding to $32^\circ$C
c. 32, Celsius temperature corresponding to $0^\circ$F
d. 0, Fahrenheit temperature corresponding to $32^\circ$C
e. 32, Fahrenheit temperature corresponding to $0^\circ$C

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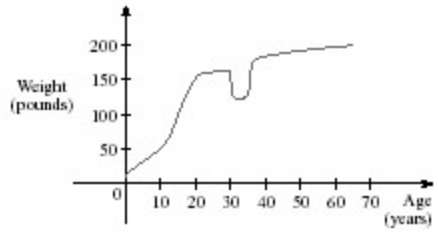

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___ 114. Find $a$, such that the function $f(x) = 4x + \sqrt{a - x^2}$ has the domain $[-3, 3]$.

a. $a = -9$
b. $a = \sqrt{3}$
c. $a = -\sqrt{3}$
d. $a = 9$
e. $a = 3$

___ 115. 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

___ 116. For what value of the constant $c$ is the function $f$ continuous on $(-\infty, \infty)$?

$$f(x) = \begin{cases} cx + 9 & \text{for } x \le 2 \\ cx^2 - 7 & \text{for } x > 2 \end{cases}$$

a. $c = 1$
b. $c = 8$
c. $c = -2$
d. $c = -8$
e. $c = 2$

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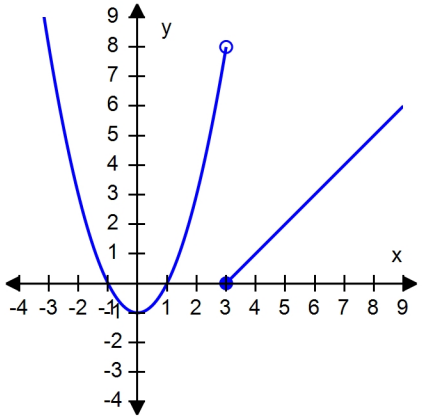

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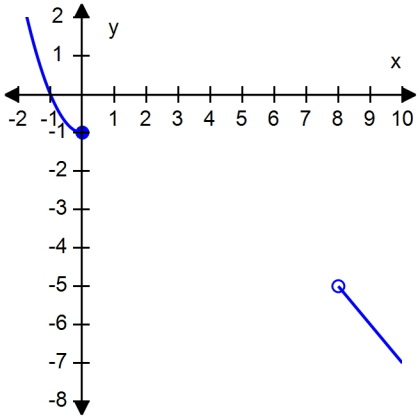
___ 117. Find the domain and sketch the graph of the function. What is its range?

$$f(x)=\begin{cases} -x+3 & \text{if } x \geq 3 \\ x^2-1 & \text{if } x < 3 \end{cases}$$

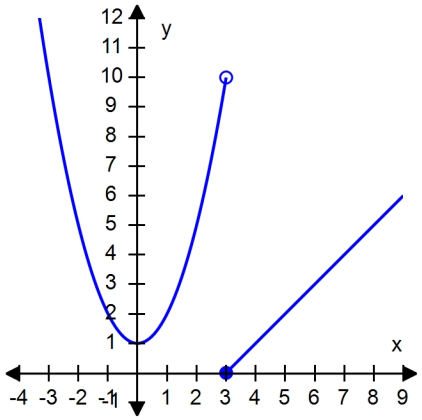
a. ***D***: $(-\infty, \infty)$; ***R***: $[-1, \infty)$



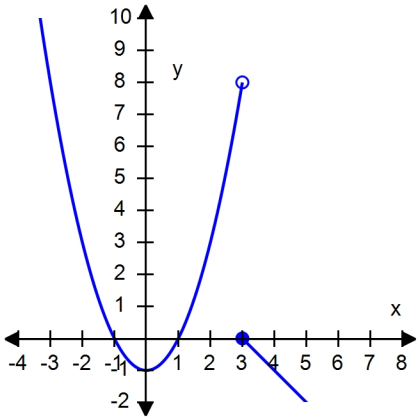

b. ***D***: $(-\infty, \infty)$; ***R***: $(-\infty, 0]$




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




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




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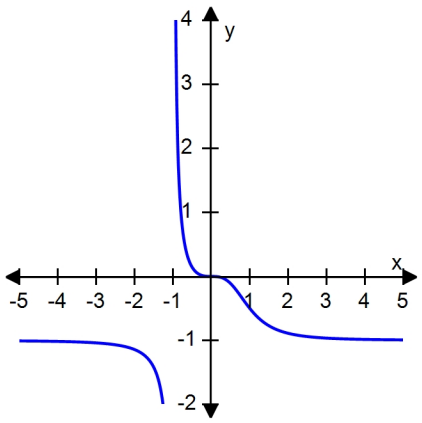
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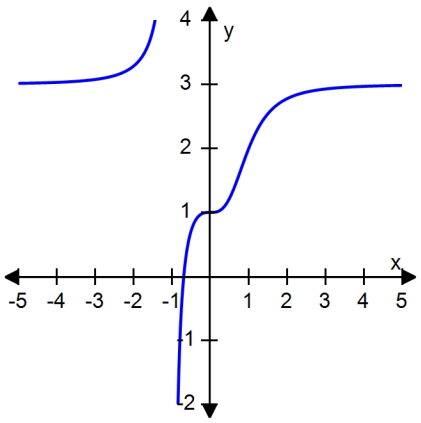
___ 118. Plot the graph of the function $f$ in an appropriate viewing window.

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

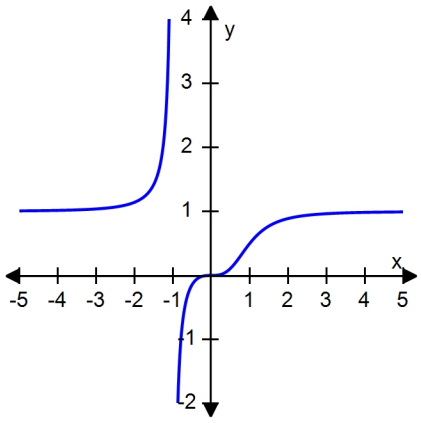
a.



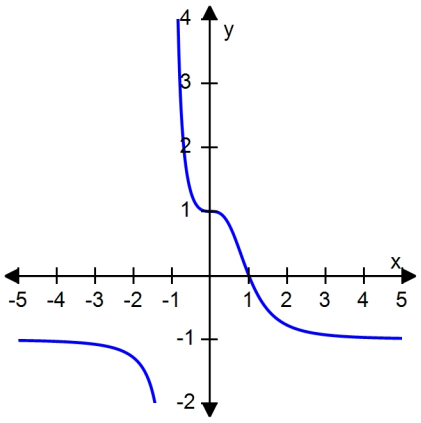

b.




c.




d.




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___ 119. Find the limit $\lim_{x \to 5} \frac{x+3}{x^2 - 3x + 5}$.

a. 8
b. – 8
c. $\frac{3}{5}$
d. $\frac{8}{15}$

___ 120. The displacement (in feet) of a certain particle moving in a straight line is given by

$s = \frac{t^3}{8}$

where $t$ is measured in seconds. Find the average velocity over the interval [1, 1.15].

Round your answer to three decimal places.

a. 0.234
b. 0.350
c. 0.334
d. 0.224
e. 0.534
f. 0.434

___ 121. 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. $g(x) = x^2 - 26x + 157$

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___ 122. Find the limit $\lim_{x \to 2} \frac{x^2 - x - 2}{x - 2}$, if it exists.

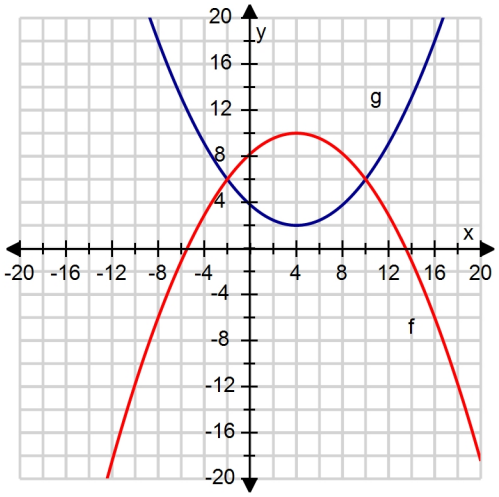
a. 2

b. 3

c. 1

d. Does not exist

___ 123. 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

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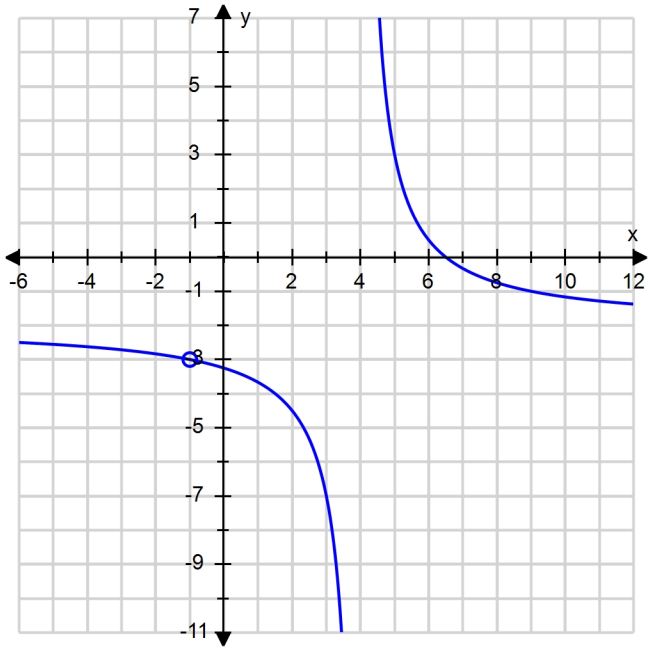
**SteCh01**

**Multiple Response**
*Indicate one or more answer choices that best complete the statement or answer the question.*

___ 124. What are the domain and range of the function $f(x) = \log_3 x$?

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

___ 125. The graph of a function $g$ is given. On which interval(s) is the Intermediate Value Theorem applicable?




a. $[-2,0]$
b. $[0,1]$
c. $[3,5]$
d. $[5,7]$

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**Numeric Response**
*Enter the appropriate value to answer the question or solve the problem.*

126. By graphing the function

$$f(x) = \frac{(\cos x - \cos 5x)}{x^2}$$

and zooming in toward the point where the graph crosses the $y$-axis, estimate the value of $\lim_{x \to 0} f(x)$

127. 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.

128. Consider the following function.

$$f(x) = \begin{cases} 2 - x & x < -1 \\ x & -1 \le x < 2 \\ (x-2)^2 & x \ge 2 \end{cases}$$

Determine the values of $a$ for which $\lim_{x \to a} f(x)$ exists.

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129. Use the definition of the limit to find values of $\delta$ that corresponds to $\varepsilon = 0.75$.

$$\lim_{x \to 1} (4 + x - 3x^3) = 2$$

Round your answer to the nearest thousandth.

130. Find the domain of the function.

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

131. 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.

132. Use a graph to find a number $\delta$ such that $\left|\sqrt{4x + 1} - 3\right| < 0.4$ whenever $|x - 2| < \delta$.

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133. Find the domain of the function.

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

134. The position of a car is given by the values in the following table.

| $t$ (seconds) | 0 | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|---|
| $s$ (feet) | 0 | 17 | 30 | 70 | 115 | 179 |

Estimate the instantaneous velocity when $t = 2$ by averaging the velocities for the periods [1, 2] and [2, 3].

135. Evaluate the limit.

$$\lim_{x \to 0} \frac{(3+x)^{-1} - 3^{-1}}{x}$$

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136. Find a function $g$ that agrees with $f$ for $x \neq 49$ and is continuous on $\mathbb{R}$.

$$f(x) = \frac{7 - \sqrt{x}}{49 - x}$$

137. Find the range of the function.

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

138. A tank holds 1000 gallons of water, which drains from the bottom of the tank in half an hour. The values in the table show the volume $V$ of water remaining in the tank (in gallons) after $t$ minutes. If $P$ is the point (15, 290) on the graph of $V$, fill the table with the slopes of the secant lines $PQ$ where $Q$ is the point on the graph with the corresponding $t$.

| $t$ (min) | 5 | 10 | 15 | 20 | 25 | 30 |
|---|---|---|---|---|---|---|
| $V$ (gal) | 686 | 481 | 263 | 171 | 22 | 0 |

Enter your answer to two decimal places.

| $t$ | Slope |
|---|---|
| 5 | |
| 10 | |
| 20 | |
| 25 | |
| 30 | |

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139. Evaluate the function

$$f(x) = 7\left(\frac{\sqrt{x} - \sqrt{2}}{x - 2}\right)$$

at the given numbers (correct to six decimal places). Use the results to guess the value of the limit $\lim_{x \to 2} f(x)$.

| $x$ | $f(x)$ |
|---|---|
| **1.6** | |
| **1.8** | |
| **1.9** | |
| **1.99** | |
| **1.999** | |
| **2.4** | |
| **2.2** | |
| **2.1** | |
| **2.01** | |
| **2.001** | |
| **Limit** | |

140. Evaluate the limit.

$$\lim_{x \to 0} \frac{4 - \sqrt{4 - x^2}}{x}$$

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141. Find the limit.

$$\lim_{x \to \frac{3}{\pi}} \tan\left(\frac{3}{x}\right)$$

142. How close to 2 do we have to take $x$ so that $5x + 3$ is within a distance of 0.01 from 13?

143. Write an equation that expresses the fact that a function $f$ is continuous at the number 9.

144. Evaluate the limit.

$$\lim_{x \to \infty} \frac{8x^2 - 9x + 1}{9x^2 + 9x - 3}$$

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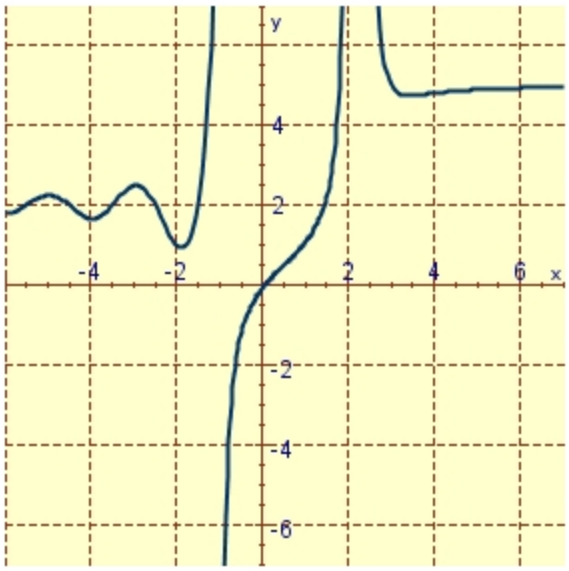
**SteCh01**

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

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

146. For the function f whose graph is given, find the limit.

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




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**SteCh01**

147. 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** | |

148. Find the point at which the given function is discontinuous.

$$f(x) = \begin{cases} \dfrac{1}{x-5}, & x \neq 5 \\ 5, & x = 5 \end{cases}$$

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**SteCh01**

149. Consider the following function.

$$f(x)=\begin{cases} 3-x & x<-1 \\ x & -1\le x<3 \\ (x-3)^2 & x\ge 3 \end{cases}$$

Determine the values of $a$ for which $\lim_{x\to 3} f(x)$ exists.

150. Find the limit.

$$\lim_{t\to 4}\frac{t^2-16}{t^3-64}$$

151. How would you define $f(9)$ in order to make $f$ continuous at 9?

$$f(x)=\frac{x^3-729}{x^2-81}$$

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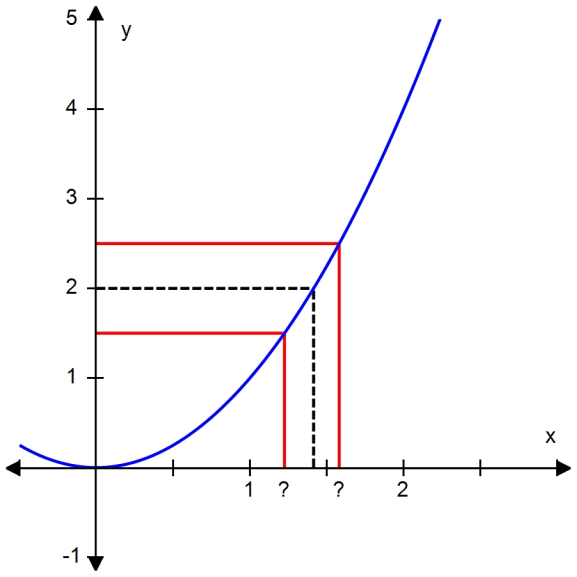
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**SteCh01**

152. Use the given graph of $f(x) = x^2$ to find a number $\delta$ such that $|x^2 - 2| < \frac{1}{2}$ whenever $|x - \sqrt{2}| < \delta$.

Round your answer to two decimal places.



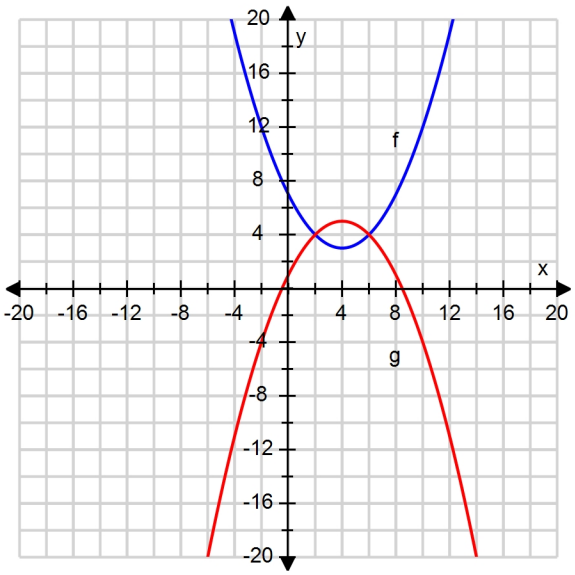

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**SteCh01**

153. 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 $g(12)$.




154. If $f$ and $g$ are continuous functions with $f(5) = 2$ and $\lim_{x \to 5} [2f(x) - g(x)] = 5$, find $g(5)$.

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**SteCh01**

155. Find the limit if $g(x) = x^3$.

$$\lim_{x \to 2} \frac{g(x) - g(2)}{x - 2}$$

156. Evaluate the limit.

$$\lim_{x \to -4} |x + 4|$$

157. 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 $A = 70m^2$.

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

(b) If you discover that 4 species of bats live in cave estimate the area of the cave.

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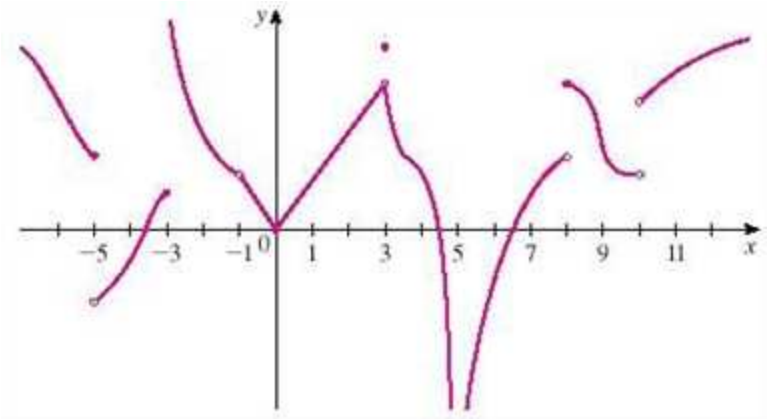


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**SteCh01**

158. For $x = 5$ determine whether $f$ is continuous from the right, from the left, or neither.




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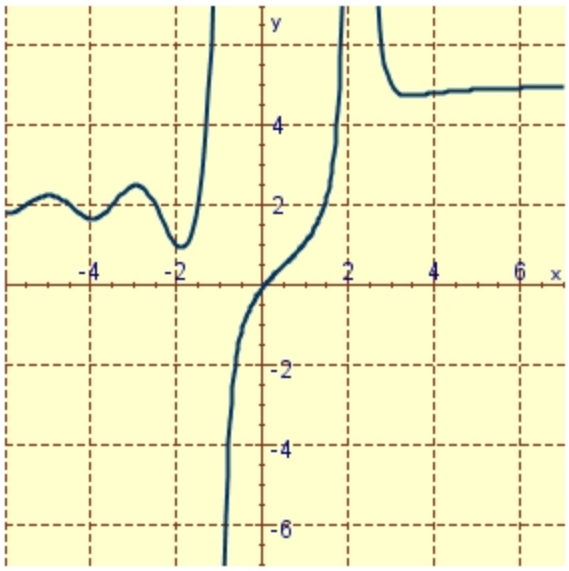


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**SteCh01**

159. For the function $f$ whose graph is given, find the limit.

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




160. Given that $\lim_{x \to 8} f(x) = -10$, and $\lim_{x \to 8} g(x) = 6$, evaluate the limit.

$$\lim_{x \to 8} \left(f(x) + g(x)\right)$$

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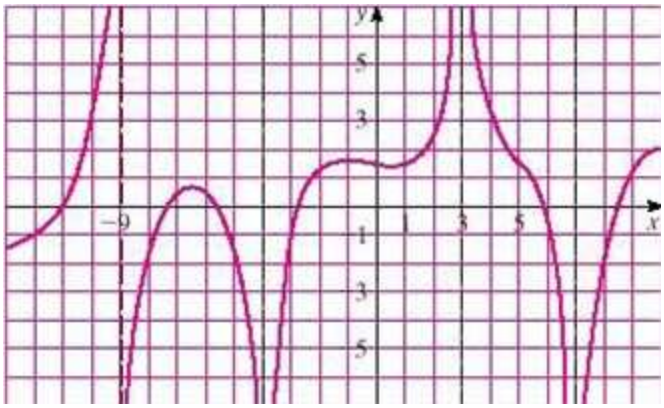
**SteCh01**

161. Evaluate the limit.

$$\lim_{x \to 16} \frac{4 - \sqrt{x}}{x - 16}$$

162. For the function $f$ whose graph is shown, state the following.

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




163. How close to 2 do we have to take $x$ so that $5x+3$ is within a distance of 0.01 from 13?

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**SteCh01**

164. 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.

165. Find the limit if $g(x) = x^8$.

$$\lim_{x \to 5} \frac{g(x) - g(5)}{x - 5}$$

166. How close to –6 do we have to take $x$ so that $\frac{1}{(x+6)^5} > 100{,}000$

167. Find a number $\delta$ such that if $|x - 2| < \delta$, then $|4x - 8| < \varepsilon$, where $\varepsilon = 0.7$.

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168. Evaluate the limit.

$$\lim_{x \to 3} \left( \frac{x^3 - 3}{x^2 - 4} \right)$$

169. Use a graph to find a number $\delta$ such that $\left| \sin x - \frac{1}{2} \right| < 0.4$ whenever $\left| x - \frac{\pi}{6} \right| < \delta$.

Round your answer to the nearest thousandth.

170. Determine whether $f$ is even, odd, or neither.

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

171. Use continuity to evaluate the limit.

$$\lim_{x \to 9} \frac{17 + \sqrt{x}}{\sqrt{16 + x}}$$

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**SteCh01**

**Subjective Short Answer**

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

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

173. Use the Squeeze Theorem to evaluate the limit $\lim_{x \to 0} \sqrt{6x^5 - 7x} \cos\frac{2\pi}{x^2}$.

174. Find the limit $\lim_{x \to \pi} \sqrt{17 + \cos 5x}$.

175. Complete the table by computing $f(x)$ at the given values of $x$, accurate to five decimal places. Use the results to guess the indicated limit, if it exists, to three decimal places.

$\lim_{x \to 0} \frac{x}{\sin 3x}$

| $x$ | -0.1 | -0.01 | -0.001 | 0.001 | 0.01 | 0.1 |
|---|---|---|---|---|---|---|
| $f(x)$ | | | | | | |

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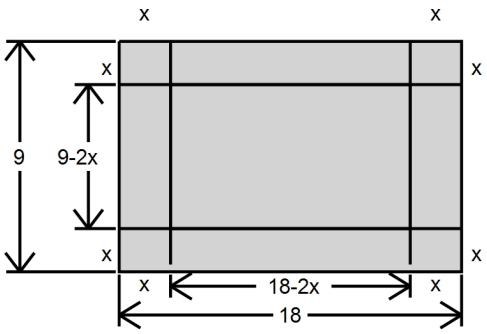


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**SteCh01**

176. 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.

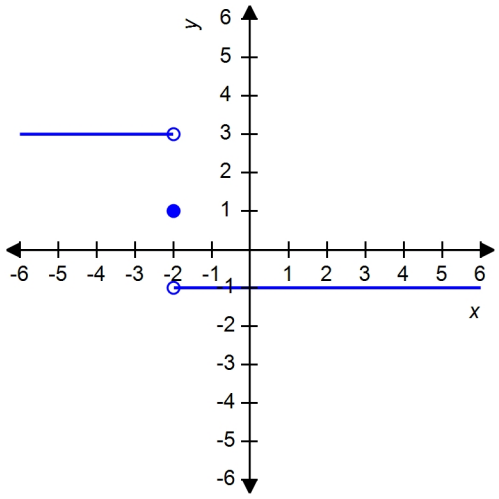



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**SteCh01**

177. Use the graph of the function to find each limit.




$\lim_{x \to -2^-} f(x), \quad \lim_{x \to -2^+} f(x), \quad \lim_{x \to -2} f(x)$

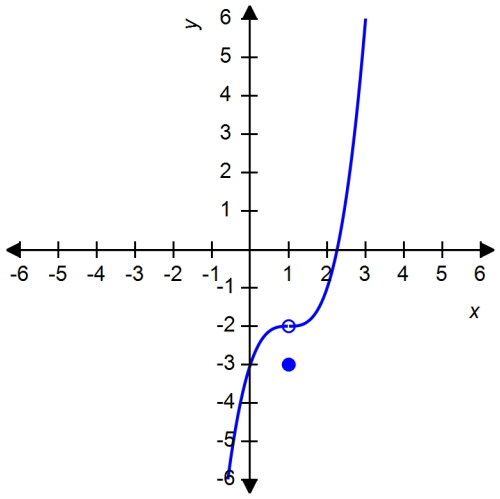
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**SteCh01**

178. Use the graph of the function to find each limit.




$\lim_{x \to 1^-} f(x), \quad \lim_{x \to 1^+} f(x), \quad \lim_{x \to 1} f(x)$

179. Sketch the graph of the function.

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

180. Use the Intermediate Value Theorem to show that there is a solution of the equation $2x^3 - 4x + 1 = 0$ between 1 and 2. Then estimate this solution to one decimal place.

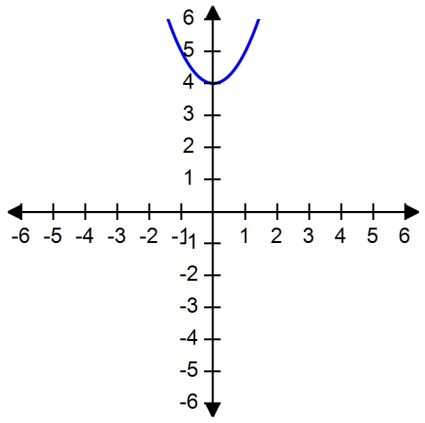
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181. Use the vertical line test to determine whether the curve is the graph of a function of $x$.




182. Find the numbers, if any, where the function $f(x) = 3x^3 - 9x^2 - 4$ is discontinuous.

183. Find the numbers, if any, where the function $f(x) = \dfrac{x - 5}{x^2 - 25}$ is discontinuous.

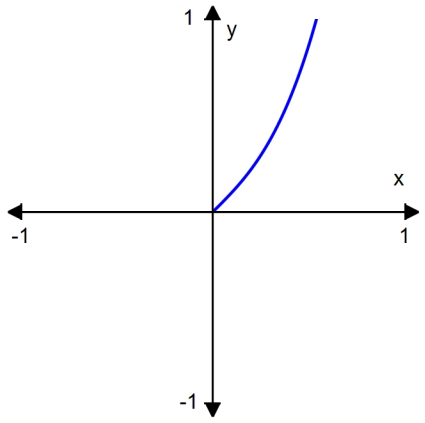
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184. The following figure shows a portion of the graph of a function $f$ defined on the interval [–1, 1]. Sketch the complete graph of $f$ if it is known $f$ is odd.




185. Plot the graph of the function $f$ in an appropriate viewing window.

$f(x) = 3x^4 - 3x^3 + 5x^2 - x + 39$

186. Use the precise definition of a limit to prove that $\lim_{x \to 8} 2 = 2$

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

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

188. Find the limit $\lim_{x \to 2} \dfrac{x^2 + x - 6}{x^2 - 4}$, if it exists.

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

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

190. Use the precise definition of a limit to prove that $\lim_{x \to 8} 5x = 40$

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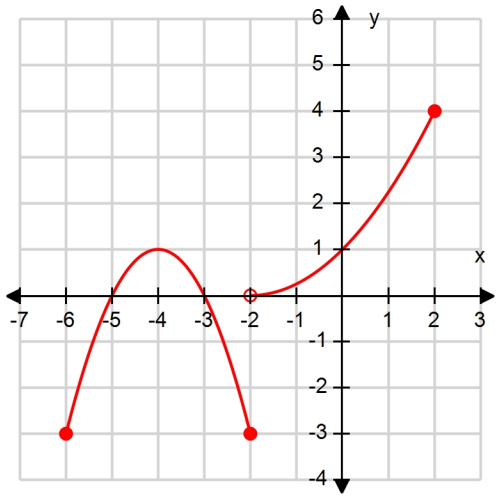
**SteCh01**

191. Find the interval(s) where $f(x) = \dfrac{1}{x} + \dfrac{3\sqrt{x}}{(x-9)^2}$ is continuous.

192. 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 $f(4)$.

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

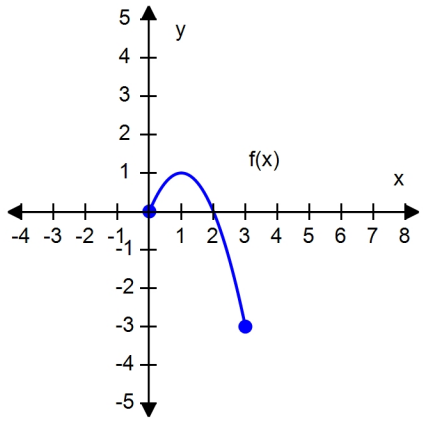



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194. Refer to the graph of the function $f$ in the following figure.




**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 $f$.

195. Complete the table by computing $f(x)$ at the given values of $x$, accurate to five decimal places. Use the results to guess the indicated limit, if it exists, to three decimal places.

$$\lim_{x \to -1} \frac{x+1}{x^2+5x+4}$$

| $x$ | -0.9 | -0.99 | -0.999 | -1.001 | -1.01 | -1.1 |
|---|---|---|---|---|---|---|
| $f(x)$ | | | | | | |

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196. Complete the table by computing $f(x)$ at the given values of $x$, accurate to five decimal places. Use the results to guess the indicated limit, if it exists, to three decimal places.

$$\lim_{x \to -3} \frac{\sqrt{x+12}-3}{x+3}$$

| $x$ | –3.1 | –3.01 | –3.001 | –2.999 | –2.99 | –2.9 |
|---|---|---|---|---|---|---|
| $f(x)$ | | | | | | |

197. Find the limit $\lim_{x \to 0^+} \frac{3+\sqrt{x}}{\sqrt{x+49}}$.

198. Find the interval(s) where $f(x) = \frac{-3}{x\sqrt{64-x^2}}$ is continuous.

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

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**SteCh01**

**Answer Key**

1. False

2. a

3. h

4. g

5. a

6. a

7. a

8. a

9. a

10. a

11. a

12. a

13. a

14. a

15. a

16. b

17. a

18. c

19. a

20. a

21. a

22. a

23. a

24. a

25. a

26. a

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27. a

28. a

29. a

30. a

31. c

32. e

33. c

34. a

35. a

36. b

37. e

38. c

39. a

40. e

41. d

42. a

43. c

44. c

45. e

46. b

47. c

48. b

49. a

50. a

51. e

52. d

53. d

54. b

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55. c

56. a

57. b

58. e

59. b

60. a

61. d

62. a

63. a

64. d

65. c

66. d

67. c

68. d

69. d

70. d

71. b

72. b

73. c

74. c

75. c

76. e

77. b

78. d

79. c

80. d

81. c

82. c

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83. f

84. d

85. a

86. b

87. e

88. d

89. e

90. b

91. d

92. a

93. b

94. d

95. e

96. b

97. b

98. c

99. b

100. d

101. b

102. d

103. b

104. d

105. d

106. e

107. e

108. d

109. a

110. d

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111. a

112. c

113. e

114. d

115. d

116. b

117. d

118. c

119. d

120. f

121. c

122. b

123. e

124. a, d

125. b, d

126. 12

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

128. $(-\infty, -1) \cup (-1, 2) \cup (2, \infty)$

129. $\delta \leq 0.085$

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

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

132. $\delta \leq 0.56$

133. [–5, 5]

134. 26.5 ft/s

135. $-\frac{1}{9}$

136. $g(x) = \frac{1}{7 + \sqrt{x}}$

137. $0 \leq h(x) \leq 6$

138. (5, –39.60); (10, –38.20); (20, –23.80); (25, –26.80); (30, –19.33)

139. 2.612794, 2.540047, 2.506608, 2.477975, 2.475183, 2.362146, 2.415915, 2.444688, 2.471788, 2.474564, *Limit*: 2.474874

140. ∞

141. 0

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142. $|x-2|<0.002$

143. $\lim_{x\to 9} f(x) = f(9)$

144. $\frac{8}{9}$

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

146. $+\infty$

147. (15, 59), (–15, 5); slope = 2

148. 5

149. $(-\infty, -1) \cup (-1, 3) \cup (3, \infty)$

150. $\frac{1}{6}$

151. $f(9) = \frac{27}{2}$

152. $\delta \le 0.17$

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

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154. $-1$

155. 12

156. 0

157. a) 3 species
b) 334 $m^2$

158. neither

159. $\infty$

160. $-4$

161. $-1/8$

162. $-\infty$

163. $|x-2|<0.002$

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

165. 625,000

166. $|x+6|<0.1$

167. $\delta = 0.175$

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168. $\frac{24}{5}$

169. $\delta \leq 0.424$

170. even

171. $\frac{20}{5}$

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

173. 0

174. 4

175.

| $x$ | -0.1 | -0.01 | -0.001 | 0.001 | 0.01 | 0.1 |
|---|---|---|---|---|---|---|
| $f(x)$ | 0.33839 | 0.33338 | 0.33333 | 0.33333 | 0.33338 | 0.33839 |

0.333

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

177. $\lim_{x \to -2^-} f(x) = 3$, $\lim_{x \to -2^+} f(x) = -1$, $\lim_{x \to -2} f(x)$ Does not exist

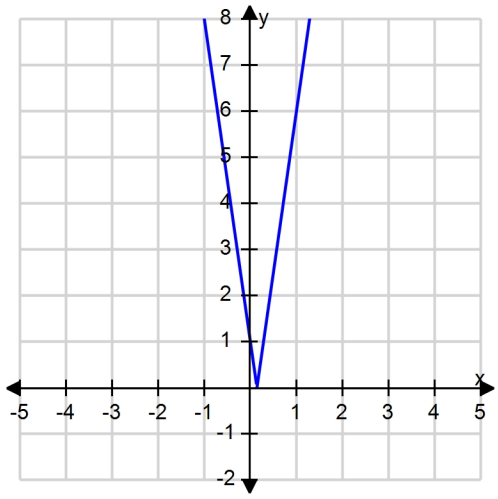
178. $\lim_{x \to 1^-} f(x) = -2$, $\lim_{x \to 1^+} f(x) = -2$, $\lim_{x \to 1} f(x) = -2$

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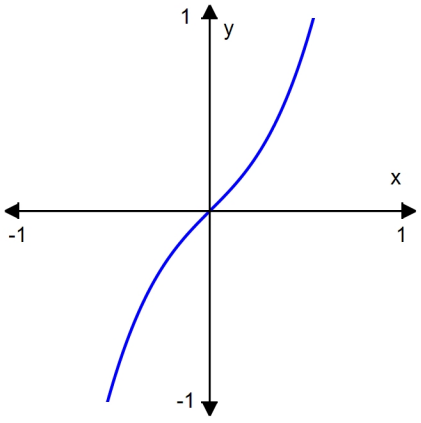

179.

180. $x = 1.3$

181. Yes

182. None

183. $\pm 5$



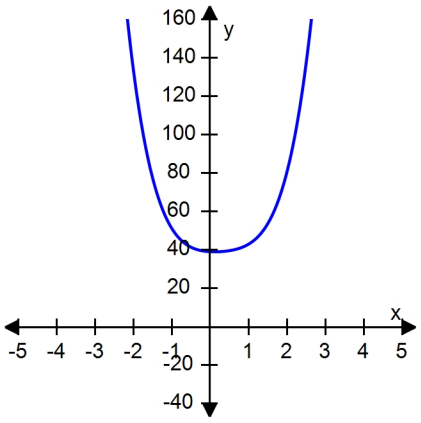

184.

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185.

186. The function is $f(x) = 2$ and $L = 2$

Let $\varepsilon > 0$ be given. Choose $\delta$ to be any real number greater than 0.

We see that for any $x$ such that $|x - 8| < \delta$ (actually for any $x$ whatsoever), we have $|f(x) - 2| = |2 - 2| = 0 < \varepsilon$

This proves the assertion.

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

188. $\frac{5}{4}$

189. Neither

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**SteCh01**

190. The function is $f(x) = 5x$ and $L = 40$

Let $\varepsilon > 0$ be given. Choose $\delta = \frac{\varepsilon}{5}$.

We see that for any $x$ such that $|x - 8| < \delta$, we have

$|f(x) - 40| = |5x - 40|$

$= 5|x - 8|$

$< 5\delta$

$= 5\frac{\varepsilon}{5}$

$= \varepsilon$

This proves the assertion.

191. $(0, 9)$ and $(9, \infty)$

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

193. $[-6, -4] \cup (-2, 2]$

194. **a.** 0

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

**c.** ***D***: [0, 3], ***R***: [–3, 1]

195.

| $x$ | -0.9 | -0.99 | -0.999 | -1.001 | -1.01 | -1.1 |
|---|---|---|---|---|---|---|
| $f(x)$ | 0.32258 | 0.33223 | 0.33322 | 0.33344 | 0.33445 | 0.34483 |

0.333

196.

| $x$ | –3.1 | –3.01 | –3.001 | –2.999 | –2.99 | –2.9 |
|---|---|---|---|---|---|---|
| $f(x)$ | 0.16713 | 0.16671 | 0.16667 | 0.16666 | 0.16662 | 0.16621 |

0.167

197. $\frac{3}{7}$

198. $(-8, 0)$ and $(0, 8)$

199. 0

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