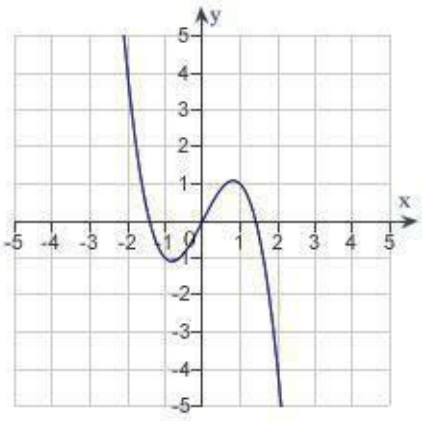
1.1 Graphs and Models

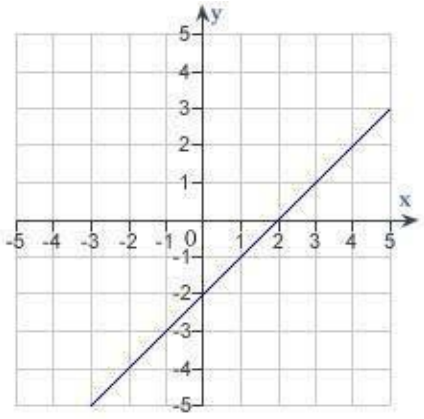
Multiple Choice
Identify the choice that best completes the statement or answers the question.

____ 1. Which of the following is the correct graph of $y = 2 - x$?

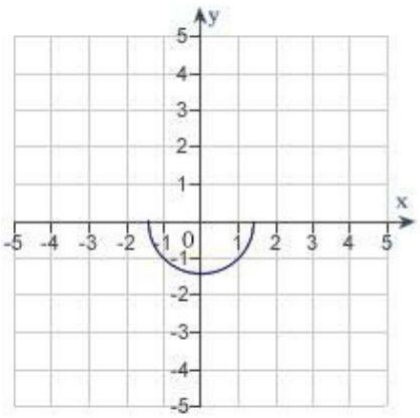
a.



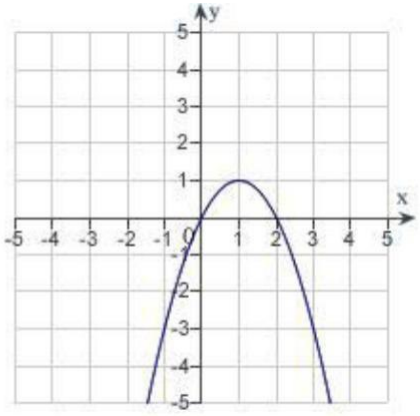
d.



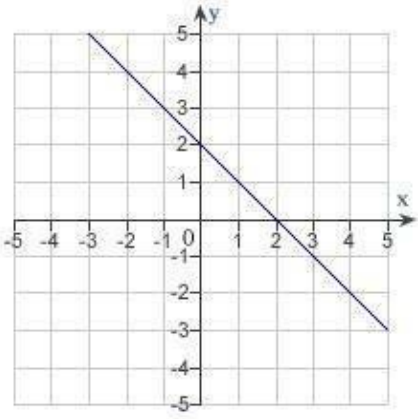
b.



e.

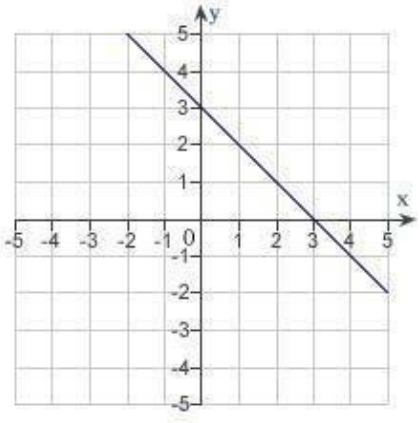


c.

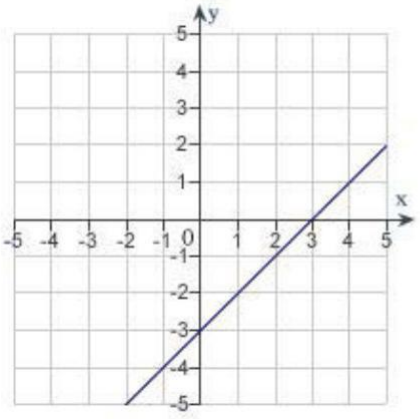


____ 2. Which of the following is the correct graph $y = -\sqrt{3 - x^2}$?

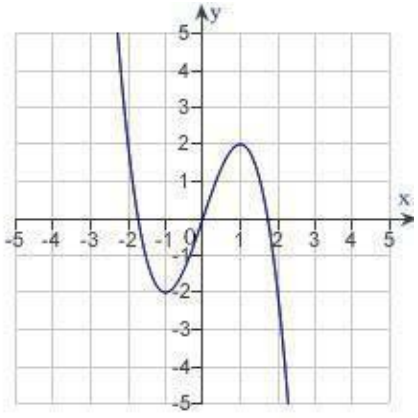
a.



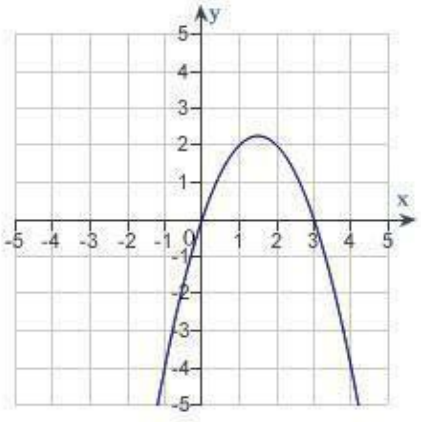
b.



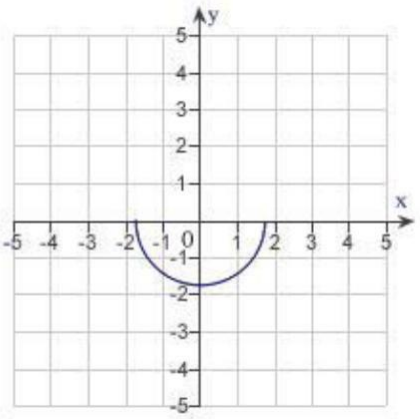
c.



of d.

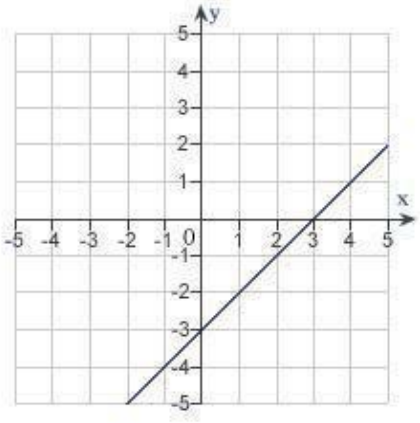


e.

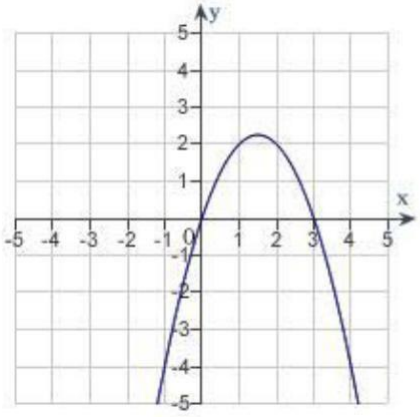


____ 3. Which of the following is the correct graph of $y = 3x - x^2$?

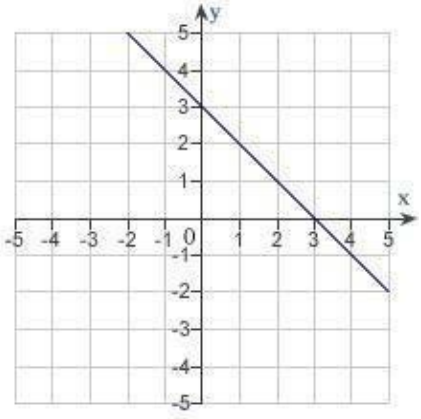
a.



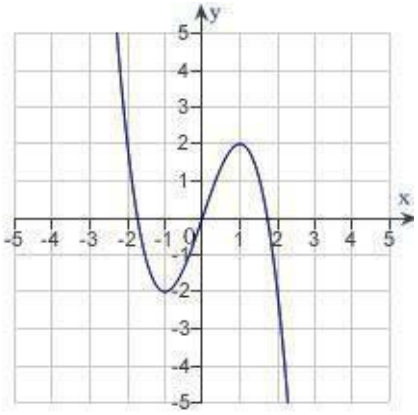
b.



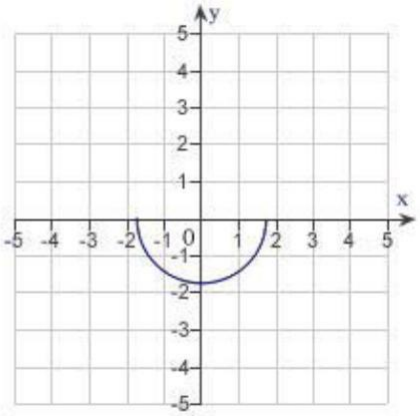
c.



d.

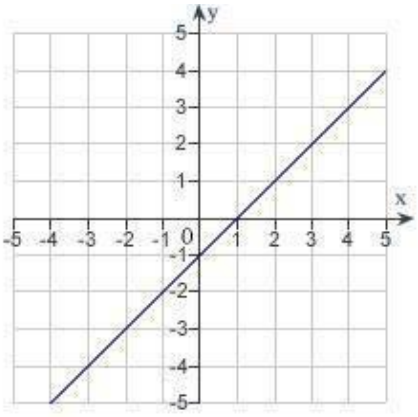


e.

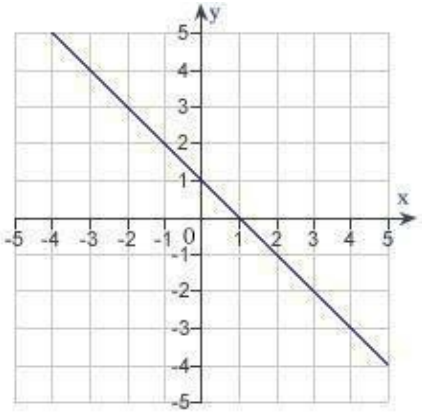


____ 4. Which of the following is the correct graph of $y = x - x^3$?

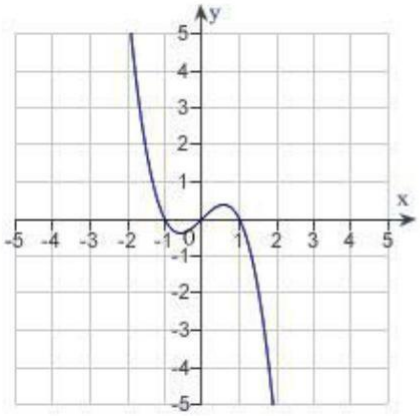
a.



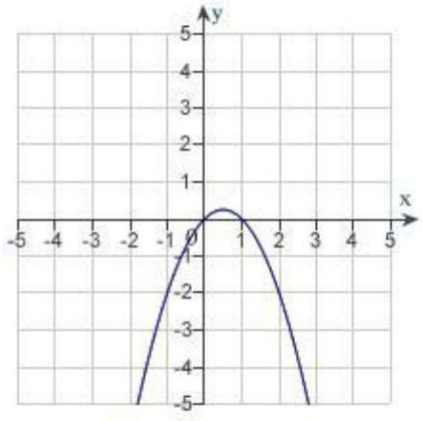
d.



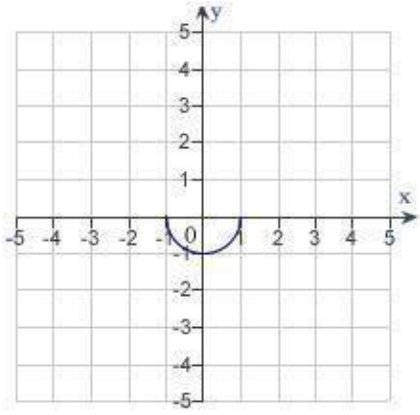
b.



e.



c.



____ 5. Find all intercepts:

$y = x^2 - x - 12$

a. x-intercepts: $(4,0)$, $(-3,0)$; y-intercepts: $(0, 4)$, $(0, 3)$
b. x-intercept: $(12, 0)$; y-intercepts: $(0, 4)$, $(0, 3)$
c. x-intercepts: $(4, 0)$, $(–3,0)$; y-intercept: $(0, -12)$
d. x-intercepts: $(4, 0)$, $(-3,0)$; y-intercepts: $(0, –12)$, $(0, 12)$
e. x-intercept: $(-3, 0)$; y-intercept: $(0, –12)$

____ 6. Find all intercepts:

$y = 64x - x^3$

a. x-intercepts: $(–8, 0)$, $(8, 0)$; no y-intercept
b. x-intercept: $(0, 0)$; y-intercepts: $(0, 0)$, $(0, –8)$, $(0, 8)$
c. x-intercepts: $(0, 0)$, $(–8, 0)$, $(8, 0)$; y-intercept: $(0, 0)$
d. x-intercepts: $(0, 0)$, $(–8, 0)$, $(8, 0)$; no y-intercept e. x-intercepts: $(–8, 0)$, 8; y-intercept: $(0, 0)$

____ 7. Find all intercepts:

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

a. x-intercepts: $(–5, 0)$, $(–2, 0)$, $(2, 0)$; y-intercepts: $(0, 0)$, $(0, 10)$
b. x-intercepts: $(–5, 0)$, $(2, 0)$; y-intercept: $(0, 10)$
c. x-intercepts: $(–5, 0)$, $(2, 0)$; y-intercept: $(0, –10)$
d. x-intercepts: $(–5, 0)$, $(–2, 0)$, $(2, 0)$; y-intercept: $(0, 10)$
e. x-intercepts: $(–5, 0)$, $(–2, 0)$, $(2, 0)$; y-intercept: $(0, –10)$

____ 8. Test for symmetry with respect to each axis and to the origin.

$x^2y^2 = 8$

a. symmetric with respect to the origin
b. symmetric with respect to the x-axis
c. symmetric with respect to the y-axis
d. no symmetry
e. A, B, and C

____ 9. Test for symmetry with respect to each axis and to the origin.

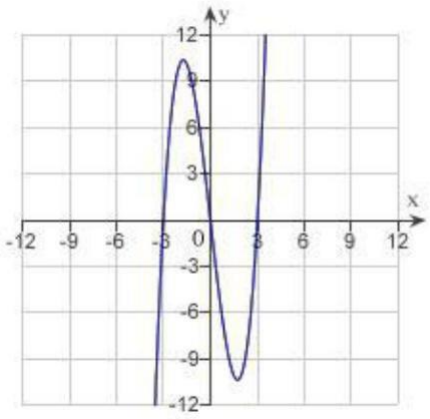
$y = \dfrac{x^2 + 2}{x}$

a. symmetric with respect to the origin
b. symmetric with respect to the y-axis
c. symmetric with respect to the x-axis
d. both B and C
e. no symmetry

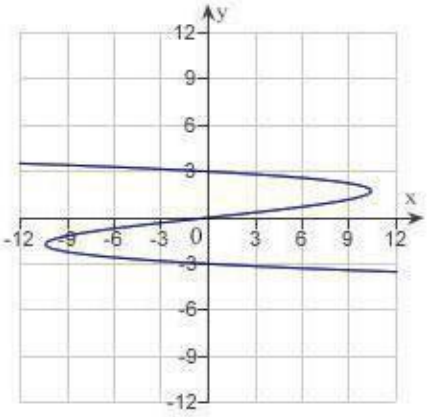
____ 10. Sketch the graph of the equation:

$x = y^3 - 9y$

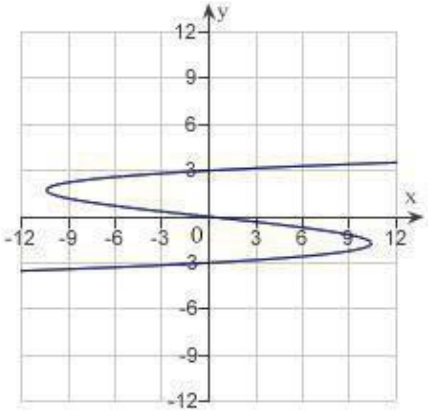
a.



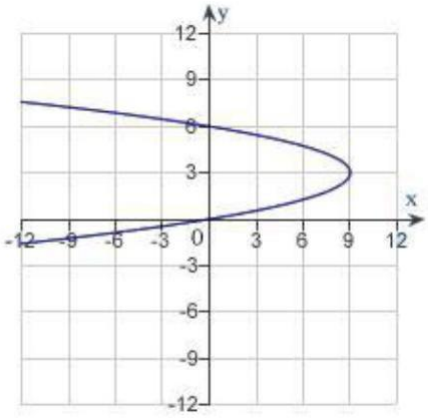
b.



c.



d.

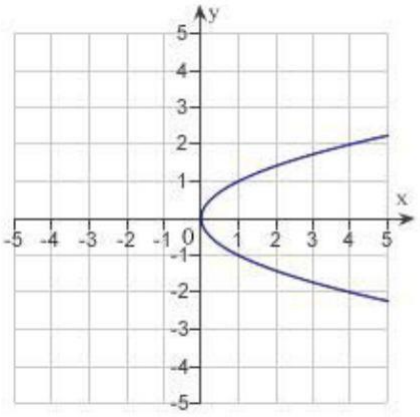


e. none of the above

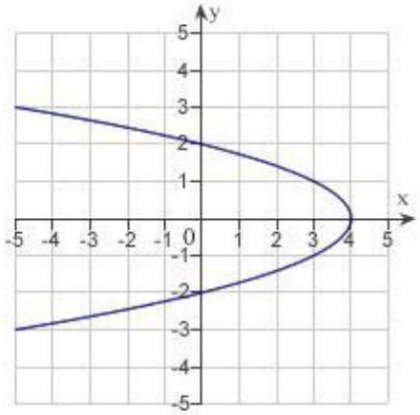
____ 11. Sketch the graph of the equation:

$x = 4 - y^2$

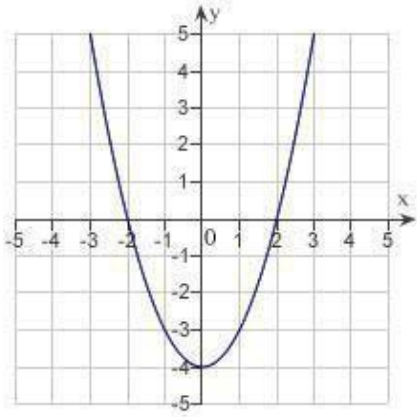
a.



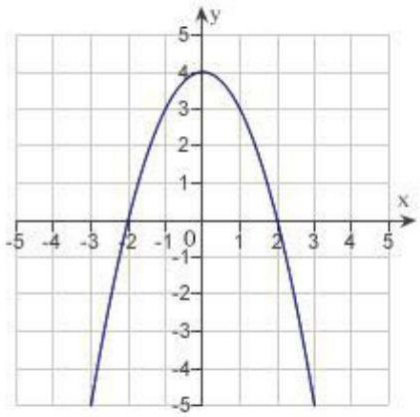
b.



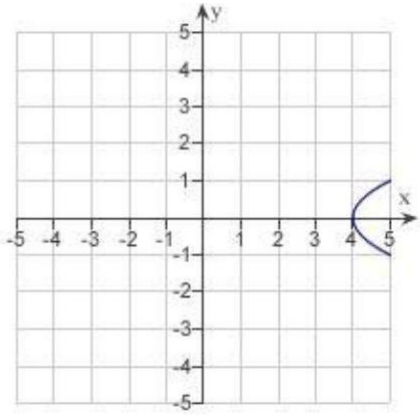
c.



d.



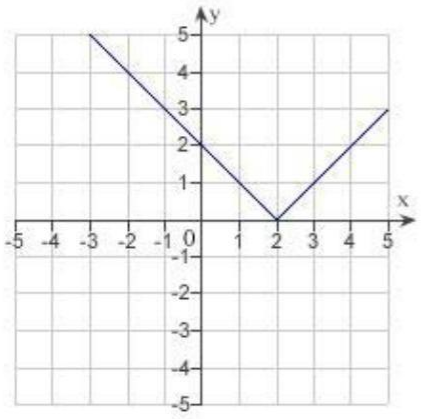
e.



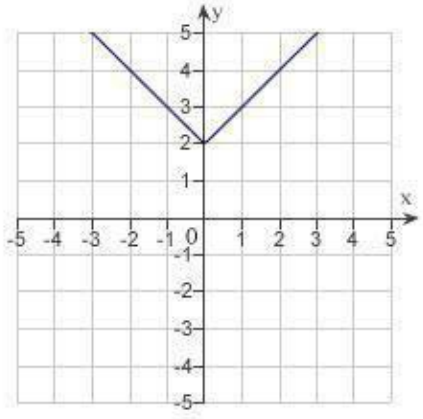
____ 12. Sketch the graph of the equation:

$y = |x + 2|$

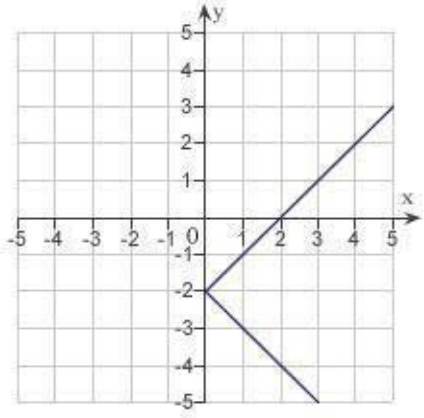
a.



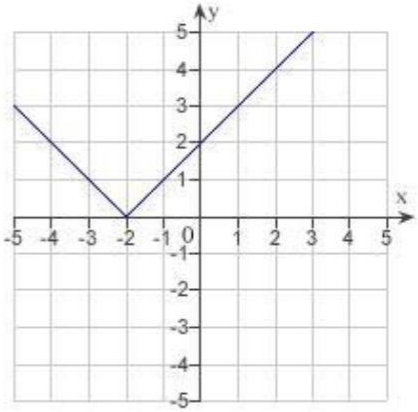
b.



c.



d.



e. none of the above

____ 13. Find the points of intersection of the graphs of the equations:

$x = y^2 - 3$

$y = x + 1$

a. $(-2, 1), (-1, 2)$
b. $(-2, 0), (1, 2)$
c. $(-2, -1), (1, 2)$
d. $(2, -1), (-1, 2)$
e. $(-2, -3), (-1, 2)$

____ 14. The table given below shows the Consumer Price Index (CPI) for selected years. Use the regression capabilities of a graphing utility to find a mathematical model of the form $y = at^2 + bt + c$ for the data. In the model, *y* represents the CPI and *t* represents the year, with $t = 5$ corresponding to 1975. Round all numerical values in your answer to three decimal places.

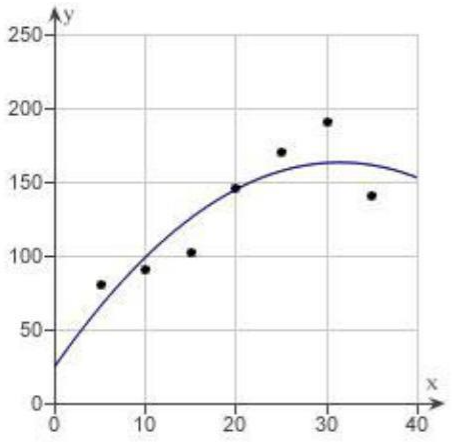
ear	975	980	985	990	995	000	005
PI	7.8	0.6	03.6	30.7	52.4	70.5	92.5

a. $y = -0.019t^2 + 5.268t + 30.871$
b. $y = -0.019t^2 - 5.957t + 30.871$
c. $y = -0.016t^2 - 5.957t - 30.871$
d. $y = -0.019t^2 + 5.957t + 40.871$
e. $y = -0.016t^2 + 5.268t + 40.871$

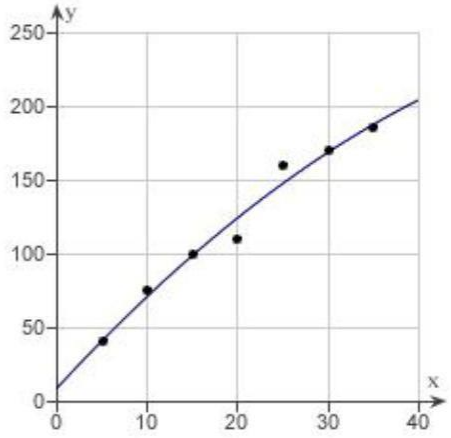
____ 15. The table given below shows the Consumer Price Index (CPI) for selected years. Use a graphing utility to plot the data and graph the model $y = -0.1476t^2 + 9.6462t + 3.8286$.

ear	975	980	985	990	995	000	005
PI	5.5	0.6	05.5	35.5	60.5	72.5	50.5

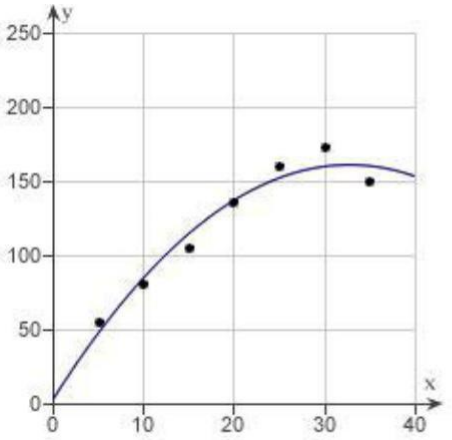
a.



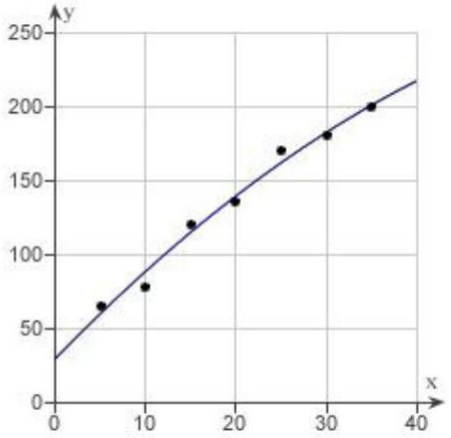
d.



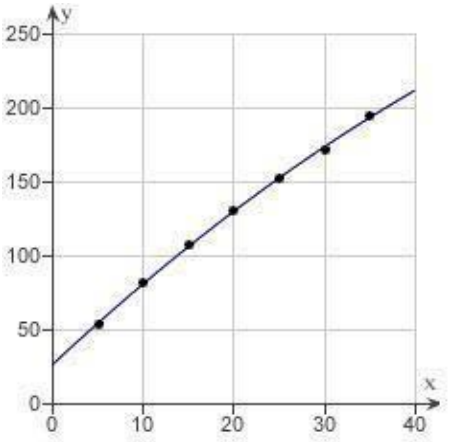
b.



e.



c.



____ 16. The table given below shows the Consumer Price Index (CPI) for selected years. The mathematical model for the data given below is $y = -0.031t^2 + 5.887t + 24.429$, where *y* represents the CPI and *t* represents the year, with $t = 5$ corresponding to 1975. Use the model to predict the CPI for the year 2010. Round your answer to the nearest integer.

ear	975	980	985	990	995	000	005
PI	2.8	0	06.6	30.7	52.4	71.2	94.3

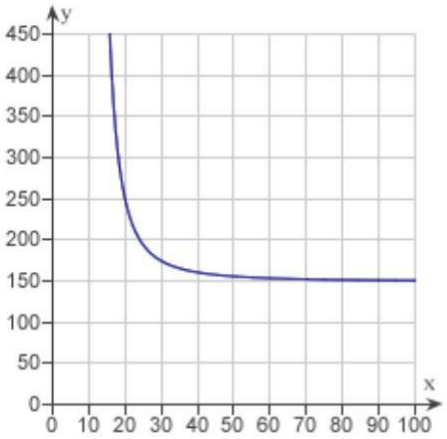
a. $y = 211$
b. $y = 209$
c. $y = 192$
d. $y = 173$
e. $y = 210$

17. Find the sales necessary to break even $(R = C)$ if the cost *C* of producing *x* units is $C = 5.3\sqrt{x} + 40,000$ and the revenue *R* for selling *x* units is $R = 3.3x$. Round your answer to the nearest integer.

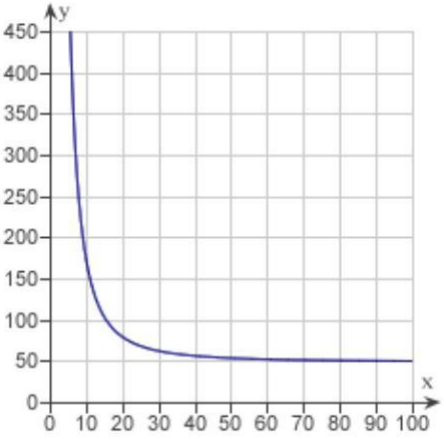
a. $x \approx 6,244$ units
b. $x \approx 12,334$ units
c. $x \approx 12,305$ units
d. $x \approx 12,299$ units
e. $x \approx 6,239$ units

____ 18. The resistance y in ohms of 1000 feet of solid metal wire at can be approximated by the model $y = \frac{10,000}{x^2} - 0.57,\ 5 \le x \le 100,$ where x is the diameter of the wire in mils (0.001 in). Use a graphing utility to graph the model $y = \frac{10,000}{x^2} - 0.57,\ 5 \le x \le 100.$

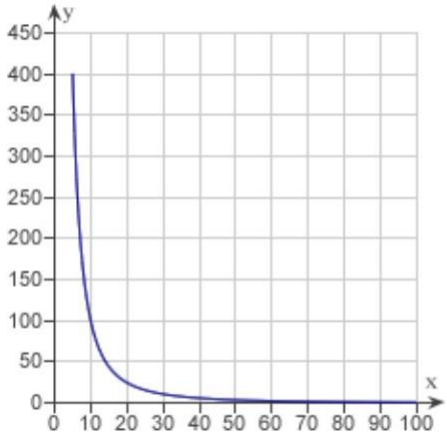
a.



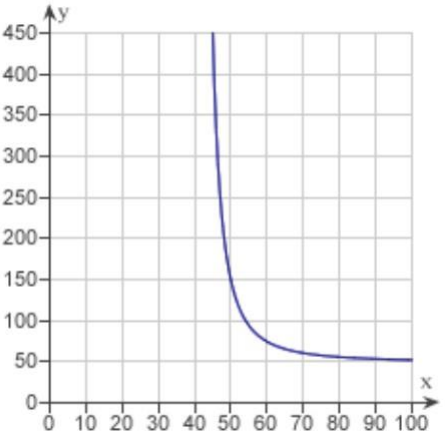
d.



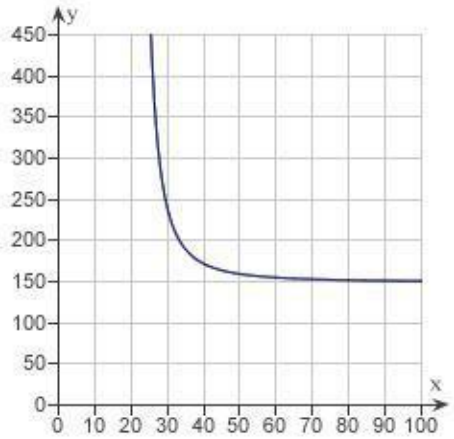
b.



e.



c.



____ 19. The resistance *y* in ohms of 1000 feet of solid metal wire at $77°F$ can be approximated by the model $y = \frac{12,750}{x^2} - 0.37,\ 5 \le x \le 100,$ where *x* is the diameter of the wire in mils (0.001 in). If the diameter of the wire is doubled, the resistance is changed by approximately what factor? In determining your answer, you can ignore the constant –0.37.

a. 3
b. $\frac{1}{2}$
c. 4
d. $\frac{1}{4}$
e. $\frac{1}{3}$

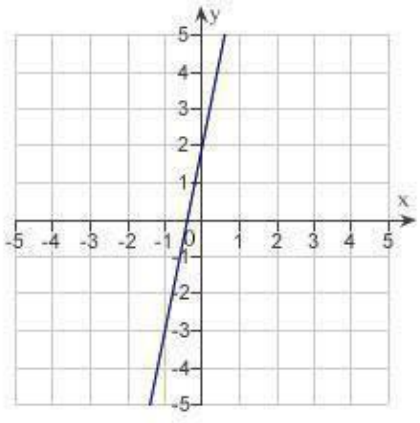
1.1 Graphs and Models
Answer Section

1. ANS: C PTS: 1 DIF: Easy REF: Section 1.1
OBJ: Identify the graph of a linear equation MSC: Skill
2. ANS: E PTS: 1 DIF: Easy REF: Section 1.1
OBJ: Identify the graph of a semicircle MSC: Skill
3. ANS: B PTS: 1 DIF: Easy REF: Section 1.1
OBJ: Identify the graph of a quadratic equation MSC: Skill
4. ANS: B PTS: 1 DIF: Easy REF: Section 1.1
OBJ: Identify the graph of a cubic equation MSC: Skill
5. ANS: C PTS: 1 DIF: Easy REF: Section 1.1
OBJ: Calculate the intercepts of an equation MSC: Skill
6. ANS: C PTS: 1 DIF: Easy REF: Section 1.1
OBJ: Calculate the intercepts of an equation MSC: Skill
7. ANS: D PTS: 1 DIF: Easy REF: Section 1.1
OBJ: Calculate the intercepts of an equation MSC: Skill
8. ANS: E PTS: 1 DIF: Easy REF: Section 1.1
OBJ: Identify the type of symmetry of the graph of an equation MSC: Skill
9. ANS: A PTS: 1 DIF: Easy REF: Section 1.1
OBJ: Identify the type of symmetry of the graph of an equation MSC: Skill
10. ANS: C PTS: 1 DIF: Med REF: Section 1.1
OBJ: Graph a cubic equation in y MSC: Skill
11. ANS: B PTS: 1 DIF: Easy REF: Section 1.1
OBJ: Graph a quadratic equation in y MSC: Skill
12. ANS: D PTS: 1 DIF: Med REF: Section 1.1
OBJ: Graph an absolute value equation MSC: Skill
13. ANS: C PTS: 1 DIF: Med REF: Section 1.1
OBJ: Calculate the points of intersection of the graphs of equatic ns MSC: Skill
14. ANS: A PTS: 1 DIF: Easy REF: Section 1.1
OBJ: Write a quadratic model for data using the regression capabilities of a graphing utility
MSC: Application
15. ANS: B PTS: 1 DIF: Easy REF: Section 1.1
OBJ: Plot a quadratic model for data using the regression capabilities of a graphing utility
MSC: Application
16. ANS: E PTS: 1 DIF: Easy REF: Section 1.1
OBJ: Evaluate a quadratic model in applications MSC: Application
17. ANS: D PTS: 1 DIF: Med REF: Section 1.1
OBJ: Solve for the break-even point in applications MSC: Application
18. ANS: B PTS: 1 DIF: Med REF: Section 1.1
OBJ: Plot a rational model using the capabilities of a graphing utility MSC: Application
19. ANS: D PTS: 1 DIF: Med REF: Section 1.1
OBJ: Interpret a rational model MSC: Application

1.2 Linear Models and Rates of Change

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

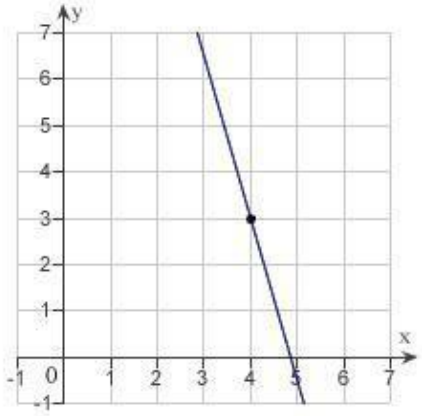
____ 1. Estimate the slope of the line from the graph.



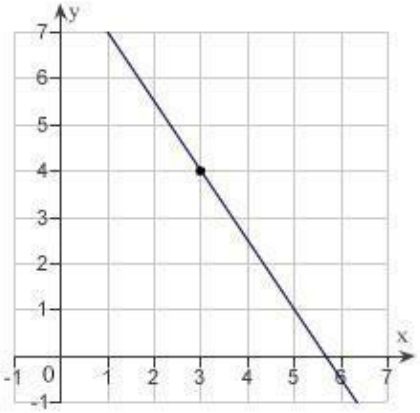
a. $-\frac{1}{5}$
b. 5
c. 2
d. $-\frac{1}{2}$
e. $\frac{1}{5}$

____ 2. Sketch the line passing through the $(3, 4)$ with the slope $-\frac{3}{2}$

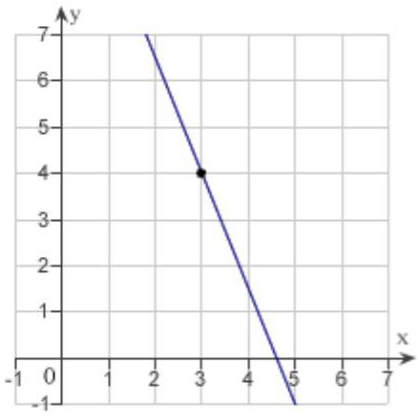
a.



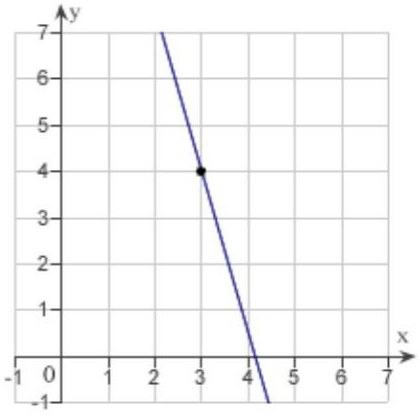
point d.



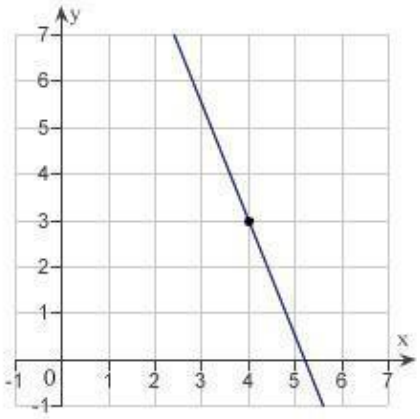
b.



e.



c.



____ 3. Find the slope of the line passing through the pair of points.

$(-3,-6),(0,-11)$

a. $\frac{3}{5}$

b. $-\frac{5}{3}$

c. $\frac{5}{3}$

d. 0

e. $-\frac{3}{5}$

____ 4. Find the slope of the line passing through the points $\left(-\frac{1}{8}, \frac{8}{3}\right)$ and $\left(-\frac{3}{16}, \frac{1}{24}\right)$.

a. 63
b. –21
c. 42
d. 21
e. _42

____ 5. If a line has slope m and passes through the point $(4, 8)$, through which of the following points does the line also pass?

a. $(1, 20)$
b. $(1, 12)$
c. $(1, 0)$
d. $(8, -16)$
e. $(8, -24)$

____ 6. A moving conveyor is built to rise 5 meters for every 7 meters of horizontal change. Find the slope of the conveyor.

a. 0
b. $\frac{5}{7}$
c. $\frac{7}{5}$
d. $-\frac{7}{5}$
e. $-\frac{5}{7}$

____ 7. A moving conveyor is built to rise 1 meter for every 5 meters of horizontal change. Suppose the conveyor runs between two floors in a factory. Find the length of the conveyor if the vertical distance between floors is 10 meters. Round your answer to the nearest meter.

a. 61 meters
b. 39 meters
c. 51 meters
d. 50 meters
e. 41 meters

____ 8. Find the slope of the line $x + 3y = 15$.

a. $\frac{1}{3}$
b. $-\frac{1}{5}$
c. $\frac{1}{5}$
d. $-\frac{1}{15}$
e. $-\frac{1}{3}$

____ 9. Find the *y*-intercept of the line $x + 4y = 8$.

a. $(0, 2)$
b. $(0, 4)$
c. $(0, 8)$
d. $(4, 0)$
e. $(2, 0)$

____ 10. Find an equation of the line that passes through the point $(7, 2)$ that is and has the slope *m* undefined.

a. $y = 7$
b. $x = 7$
c. $y = 2$
d. $x = 2$
e. $y = 7x$

____ 11. Find an equation of the line that passes through the point $(-11, -9)$ and has the slope $m = \frac{9}{2}$.

a. $y = \frac{9}{2}x - \frac{81}{2}$
b. $y = \frac{9}{2}x + \frac{81}{2}$
c. $y = \frac{9}{2}x + 162$
d. $y = \frac{9}{2}x$
e. $y = -\frac{9}{2}x$

____ 12. Find an equation of the line that passes through the points $(18, -7)$ and $(-18, 23)$.

a. $y = -\frac{5}{6}x - 8$
b. $y = \frac{5}{6}x - 8$
c. $y = \frac{5}{6}x + 8$
d. $y = -\frac{5}{6}x + 8$
e. $y = -\frac{5}{6}x$

____ 13. Find an equation of the line that passes through the points $\left(-\frac{8}{11}, -\frac{70}{11}\right)$ and $\left(\frac{3}{2}, -\frac{21}{4}\right)$.

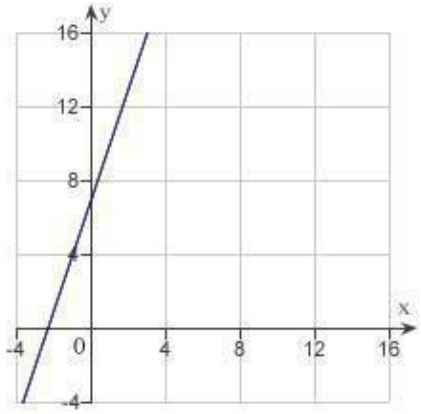
a. $y = \frac{1}{2}x$
b. $y = \frac{1}{2}x + 6$
c. $y = \frac{1}{2}x + 12$
d. $y = \frac{1}{2}x - 12$
e. $y = \frac{1}{2}x - 6$

___ 14. Use the result, "the line with intercepts has the equation $\frac{x}{a} + \frac{y}{b} = 1$ $a \neq 0, b \neq 0$", to write an equation of the line with *x*-intercept: $(8, 0)$ and *y*-intercept: $(0, 7)$.

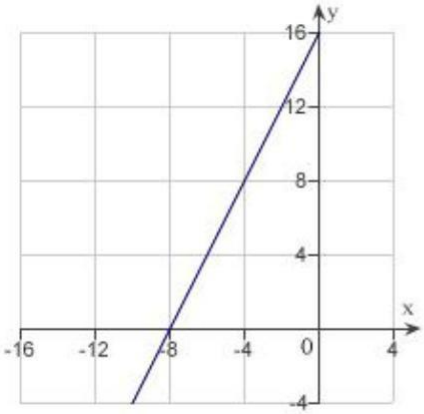
a. $8x - 7y - 8 = 0$
b. $7x - 8y + 7 = 0$
c. $8x + 7y + 8 = 0$
d. $7x + 8y + 56 = 0$
e. $7x + 8y - 56 = 0$

____ 15. Sketch a graph of the equation $y - 8 = 2(x + 4)$.

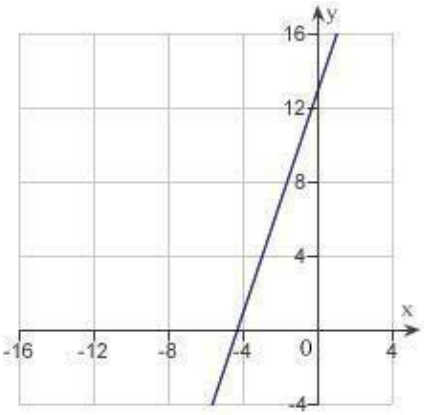
a.



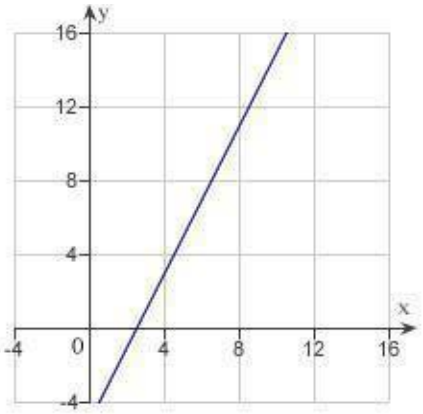
b.



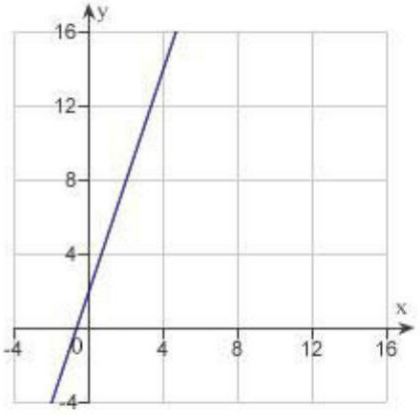
c.



d.



e.



____ 16. Write an equation of the line that passes through the given point and is perpendicular to the given line.

Point	Line
$(-1,-7)$	$x=6$

a. $y=7$
b. $y=-7$
c. $y=-1$
d. $x=-1$
e. $x=1$

____ 17. Write an equation of the line that passes through the given point and is parallel to the given line.

Point	Line
$(3,-4)$	$-2x-5y=9$

a. $-2x-5y=14$
b. $-2x-5y=23$
c. $2x-5y=14$
d. $-2x+5y=-26$
e. $2x-5y=23$

____ 18. Write an equation of the line that passes through the point $(-6,4)$ and is perpendicular to the line $x+y=5$.

a. $x-y+10=0$
b. $x-y+2=0$
c. $x+y-2=0$
d. $x+y+10=0$
e. $x+y-5=0$

____ 19. Write an equation of the line that passes through the point $\left(\frac{5}{4},\frac{5}{8}\right)$ and is parallel to the line $7x-3y=0$.

a. $56x-24y-55=0$
b. $56x+12y-55=0$
c. $56x-8y+55=0$
d. $56x+6y+55=0$
e. $56x+4y-55=0$

____ 20. Suppose that the dollar value of a product in 2008 is $\$174$ and the rate at which the value of the product is expected to increase per year during the next 5 years is $\$7.50$. Write a linear equation that gives the dollar value V of the product in terms of the year t. (Let $t = 0$ represent 2000.) Round the numerical values in your answer to one decimal place, where applicable.

a. $V = 7.5t - 159$
b. $V = -7.5t - 114$
c. $V = -7.5t + 174$
d. $V = 7.5t + 114$
e. $V = 7.5t - 144$

____ 21. Find an equation of the line through the points of intersection of $y = x^2$ and .

a. $y = x - 6$
b. $y = 6x$
c. $y = -6x$
d. $y = 3x$
e. $y = x + 3$

____ 22. A company reimburses its sales representatives $\$175$ per day for lodging and meals plus $45¢$ per mile driven. Write a linear equation giving the daily cost C to the company in terms of x, the number of miles driven. Round the numerical values in your answer to two decimal places, where applicable.

a. $C = -1.75x + 45$
b. $C = 0.45x + 175$
c. $C = -0.45x - 175$
d. $C = 0.45x - 175$
e. $C = 1.75x - 45$

____ 23. A company reimburses its sales representatives $\$160$ per day for lodging and meals plus $42¢$ per mile driven. How much does it cost the company if a sales representative drives 135 miles on a given day? Round your answer to the nearest cent.

a. 227.20
b. 216.70
c. 136.35
d. 161.35
e. 191.70

____ 24. A real estate office handles an apartment complex with 50 units. When the rent is $800 per month, all 50 units are occupied. However, when the rent is $845, the average number of occupied units drops to 47. Assume that the relationship between the monthly rent and the demand x is linear. Write a linear equation giving the demand x in terms of the rent p.

a. $x = \frac{1}{15}(1595 - p)$

b. $x = \frac{1}{15}(1505 + p)$

c. $x = \frac{1}{45}(1550 + p)$

d. $x = \frac{1}{15}(1550 - p)$

e. $x = \frac{1}{45}(1595 - p)$

____ 25. A real estate office handles an apartment complex with units. When the rent is $600 per month, all 50 units are occupied. However, when the rent is $645, the average number of occupied units drops to 47. Assume that the relationship between the monthly rent p and the demand x is linear. Predict the number of units occupied if the rent is raised to $660

a. 43 units
b. 54 units
c. 57 units
d. 49 units
e. 46 units

____ 26. Find the distance between the point $(-4, 7)$ and line using the formula,

Distance $= \frac{|Ax_1 + By_1 + C|}{\sqrt{A^2 + B^2}}$ for the distance between the point (x_1, y_1) and the line $Ax + By + C = 0$

a. $\frac{11\sqrt{2}}{2}$

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

c. $\frac{13\sqrt{2}}{2}$

d. $\frac{9\sqrt{2}}{2}$

e. $\frac{6\sqrt{3}}{3}$

1.2 Linear Models and Rates of Change
Answer Section

1. ANS: B PTS: 1 DIF: Easy REF: Section 1.2
OBJ: Estimate the slope of a line from its graph MSC: Skill
2. ANS: D PTS: 1 DIF: Easy REF: Section 1.2
OBJ: Sketch the line passing through a point with specified slope MSC: Skill
3. ANS: B PTS: 1 DIF: Easy REF: Section 1.2
OBJ: Calculate the slope of a line passing through two points MSC: Skill
4. ANS: C PTS: 1 DIF: Med REF: Section 1.2
OBJ: Calculate the slope of a line passing through two points MSC: Skill
5. ANS: A PTS: 1 DIF: Med REF: Section 1.2
OBJ: Identify a point on a line with specified properties MSC: Skill
6. ANS: B PTS: 1 DIF: Easy REF: Section 1.2
OBJ: Calculate slopes in applications MSC: Application
7. ANS: C PTS: 1 DIF: Med REF: Section 1.2
OBJ: Calculate slopes in applications MSC: Application
8. ANS: E PTS: 1 DIF: Med REF: Section 1.2
OBJ: Manipulate a linear equation to determine its slope MSC: Skill
9. ANS: A PTS: 1 DIF: Med REF: Section 1.2
OBJ: Manipulate a linear equation to determine its y-intercept MSC: Skill
10. ANS: B PTS: 1 DIF: Easy REF: Section 1.2
OBJ: Write an equation of a line given a point on the line and its slope MSC: Skill
11. ANS: B PTS: 1 DIF: Easy REF: Section 1.2
OBJ: Write an equation of a line given a point on the line and its slope MSC: Skill
12. ANS: D PTS: 1 DIF: Easy REF: Section 1.2
OBJ: Write an equation of a line given two points on the line MSC: Skill
13. ANS: E PTS: 1 DIF: Med REF: Section 1.2
OBJ: Write an equation of a line given two points on the line MSC: Skill
14. ANS: E PTS: 1 DIF: Easy REF: Section 1.2
OBJ: Write an equation of a line given its x- and y-intercepts MSC: Skill
15. ANS: B PTS: 1 DIF: Med REF: Section 1.2
OBJ: Sketch the graph of a linear equation MSC: Skill
16. ANS: C PTS: 1 DIF: Med REF: Section 1.2
OBJ: Write an equation of a line given a point on the line and a line to which it is parallel/perpendicular MSC: Skill
17. ANS: A PTS: 1 DIF: Med REF: Section 1.2
OBJ: Write an equation of a line given a point on the line and a line to which it is parallel/perpendicular MSC: Skill
18. ANS: A PTS: 1 DIF: Med REF: Section 1.2OBJ:Write an equation of a line given a point on the line and a line to which it is perpendicular MSC: Skill
19. ANS: A PTS: 1 DIF: Easy REF: Section 1.2
OBJ: Write an equation of a line given a point on the line and a line to which it is parallel MSC: Skill
20. ANS: D PTS: 1 DIF: Easy REF: Section 1.2
OBJ: Write linear equations in applications MSC: Application

21. ANS: D PTS: 1 DIF: Med REF: Section 1.2
OBJ: Write an equation of a line through the points of intersection of quadratic equations MSC: Skill

22. ANS: B PTS: 1 DIF: Easy REF: Section 1.2
OBJ: Write linear equations in applications MSC: Application

23. ANS: B PTS: 1 DIF: Easy REF: Section 1.2
OBJ: Evaluate linear equations in applications MSC: Application

24. ANS: D PTS: 1 DIF: Med REF: Section 1.2
OBJ: Write linear equations in applications MSC: Application

25. ANS: E PTS: 1 DIF: Easy REF: Section 1.2
OBJ: Evaluate linear equations in applications MSC: Application

26. ANS: C PTS: 1 DIF: Med REF: Section 1.2
OBJ: Calculate the distance between a point and a line MSC: Skill

1.3 Functions and Their Graphs

Multiple Choice

Identify the choice that best completes the statement or answers the question.

____ 1. Evaluate (if possible) the function $f(x) = -6x - 5$ at $x = -2$. Simplify the result.

a. –7
b. 17
c. 3
d. 7
e. undefined

____ 2. Evaluate (if possible) the function $f(x) = \sqrt{x - 5}$ at $x = 9$. Simplify the result.

a. 3
b. 2
c. -2
d. 4
e. undefined

____ 3. Evaluate (if possible) the function $g(x) = x^2(x + 2)$ at $x = t - 6$. Simplify the result.

a. $t^3 - 4t^2 + 12t - 144$
b. $t^3 - 4t^2 + 84t - 144$
c. $t^3 - 16t^2 + 84t - 144$
d. $t^3 - 16t^2 + 12t - 144$
e. none of the above

____ 4. Let $f(x) = 14x + 8$. Then simplify the expression $\dfrac{f(x) - f(9)}{x - 9}$.

a. 15
b. 14
c. 19
d. 11
e. undefined

____ 5. Let $g(x) = \frac{1}{\sqrt{x+15}}$. Evaluate the expression $\frac{g(x) - g(-11)}{x+11}$ and then simplify the result.

$g(x) = \frac{1}{\sqrt{x+15}}, \frac{g(x) - g(-11)}{x+11}$

a. $\frac{2\sqrt{x+15} - x - 15}{2(x+11)(x+15)}$
b. $\frac{2\sqrt{x+15} + x - 15}{2(x-11)(x+15)}$
c. $\frac{2\sqrt{x+15} + x - 15}{2(x+11)(x+15)}$
d. $\frac{2\sqrt{x+15} - x - 15}{2(x-11)(x+15)}$
e. undefined

____ 6. Find the domain and range of the function $f(x) = x^2 - 6$.

a. domain: $[-6, \infty)$
range: $[-6, \infty)$
b. domain: $[-6, \infty)$
range: $(-6, \infty)$
c. domain: range: $(-\infty, \infty)$
$(-6, \infty)$
d. domain: $(-\infty, \infty)$
range: $[0, \infty)$
e. domain: range: $(-\infty, \infty)$
$[-6, \infty)$

____ 7. Find the domain and range of the function $g(t) = \sqrt{t-10}$.

a. domain: $[10, \infty)$
range: $(0, \infty)$
b. domain: $(10, \infty)$
range: $[0, \infty)$
c. domain: $[10, \infty)$
range: $(-\infty, \infty)$
d. domain: $[0, \infty)$
range: $[10, \infty)$
e. none of the above

____ 8. Find the domain and range of the function $h(x) = \dfrac{11}{x+6}$

a. domain: $(-\infty, -6) \cup (-6, \infty)$
range: $(-\infty, \infty)$
b. domain: $(-\infty, -6) \cup (-6, \infty)$
range: $(-\infty, 0) \cup (0, \infty)$
c. domain: $(-\infty, -6] \cup [-6, \infty)$
range: $(-\infty, 0) \cup (0, \infty)$
d. domain: $(-\infty, -6)$
range: $(0, \infty)$
e. domain: $(-6, \infty)$
range: $(0, \infty)$

____ 9. Evaluate the function $f(x) = \begin{cases} 2x+1, & x < 0 \\ 2x+2, & x \geq 0 \end{cases}$ at $f(5)$.

a. $f(5) = 6$
b. $f(5) = 5$
c. $f(5) = 13$
d. $f(5) = 11$
e. $f(5) = 12$

____ 10. Determine the domain and range of the function $f(x) = \begin{cases} 3x+2, & x < 0 \\ 3x+6, & x \geq 0 \end{cases}$.

a. domain: $(-\infty, 2)$
range: $(-\infty, 2) \cup [6, \infty]$
b. domain: $(-\infty, \infty)$
range:
c. domain: $(-\infty, \infty)$
range:
d. domain: $(-\infty, \infty)$
range:
e. domain: $(-\infty, 3)$
range: $(-\infty, 2) \cup [6, \infty)$

____ 11. Determine whether *y* is a function of *x*.

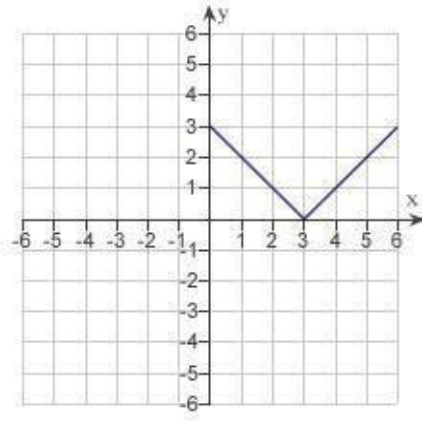
$y - 5x^2 = 6$
a. no
b. yes

____ 12. Determine whether *y* is a function of *x*.

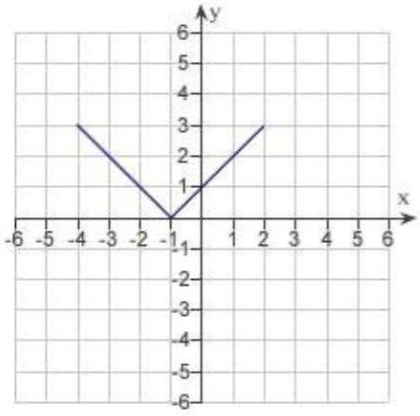
$xy - x^2 = 3y + x$

a. no
b. Yes

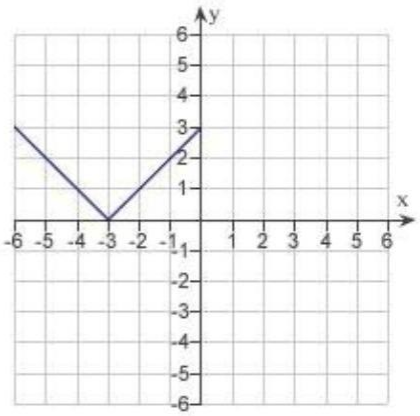
____ 13. Use the graph of $y = f(x)$ given below to find the graph of the function $y = f(x + 5)$.



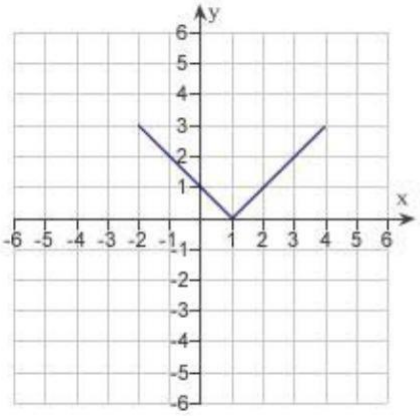
a.



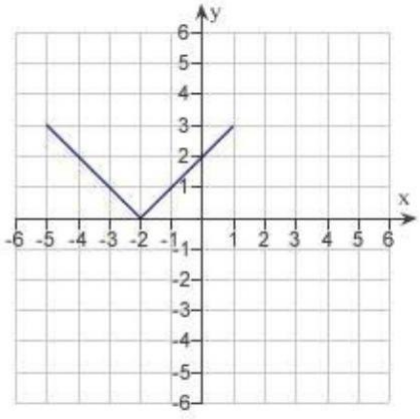
d.



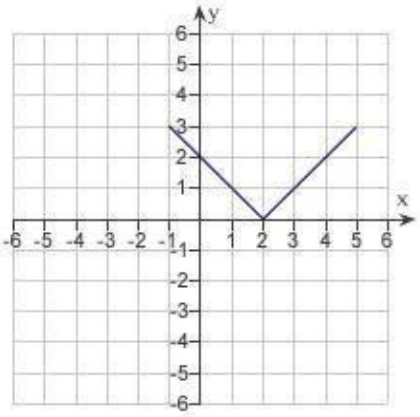
b.



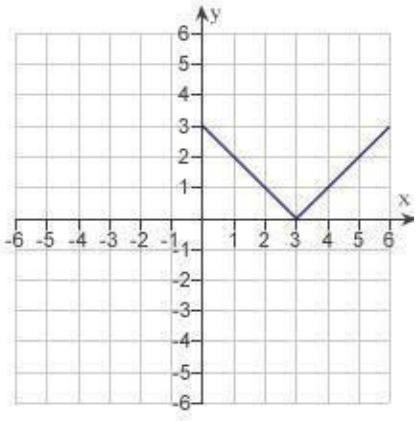
e.



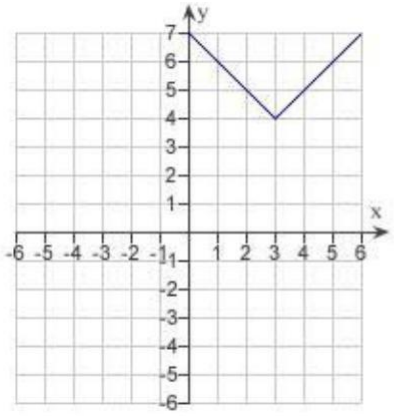
c.



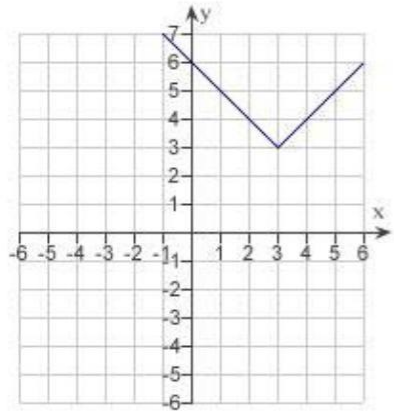
____ 14. Use the graph of $y = f(x)$ given below to find the graph of the function $y = f(x) + 4$.



a.


y
x
7
6
5
4
3
2
1
-1
-2
-3
-4
-5
-6
-6 -5 -4 -3 -2 -1 1 2 3 4 5 6

b.


y
x
7
6
5
4
3
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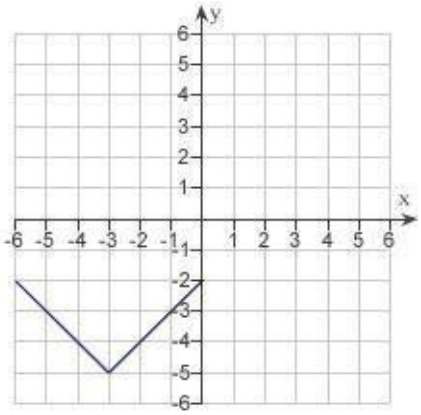
-1
-2
-3
-4
-5
-6
-6 -5 -4 -3 -2 -1 1 2 3 4 5 6

c.


y
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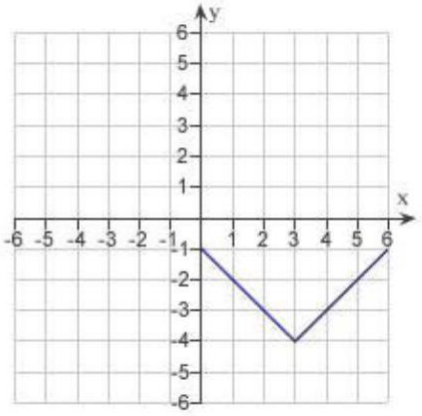
-6 -5 -4 -3 -2 -1 1 2 3 4 5 6

d.


y
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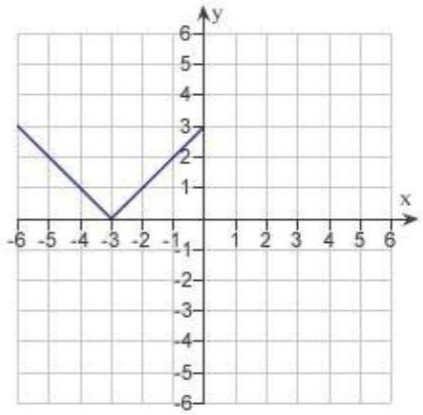
-6 -5 -4 -3 -2 -1 1 2 3 4 5 6

e.


y
x
6
5
4
3
2
1
-1
-2
-3
-4
-5
-6
-6 -5 -4 -3 -2 -1 1 2 3 4 5 6

____ 15. Specify a sequence of transformations for the function $h(x) = \sin\left(x + \frac{\pi}{3}\right) + 7$ that will yield the graph of *h* from the graph of the function $f(x) = \sin x$.

a. The function $h(x) = \sin\left(x + \frac{\pi}{3}\right) + 7$ is a horizontal shift $\frac{\pi}{3}\ units$ to the right, followed by a vertical shift $7\ units$ downwards.

b. The function $h(x) = \sin\left(x + \frac{\pi}{3}\right) + 7$ is a horizontal shift $\frac{\pi}{3}\ units$ to the left, followed by a vertical shift $7\ units$ upwards.

c. The function $h(x) = \sin\left(x + \frac{\pi}{3}\right) + 7$ is a horizontal shift $\frac{\pi}{3}\ units$ to the left, followed by a horizontal shift $7\ units$ to the right.

d. The function $h(x) = \sin\left(x + \frac{\pi}{3}\right) + 7$ is a vertical shift $\frac{\pi}{3}\ units$ downwards, followed by a horizontal shift $7\ units$ to the right.

e. The function $h(x) = \sin\left(x + \frac{\pi}{3}\right) + 7$ is a vertical shift $\frac{\pi}{3}\ units$ upwards, followed by a horizontal shift $7\ units$ to the left.

____ 16. Given $f(x) = \cos x$ and $g(x) = \frac{\pi}{2}x$, evaluate $f(g(2))$.

a. 0
b. $\frac{1}{2}$
c. $\frac{\pi}{2}\sin(2)$
d. -1
e. $\frac{\pi}{2}\cos(2)$

____ 17. Determine whether the function is even, odd, or neither.

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

a. odd
b. even
c. neither

____ 18. Determine whether the function is even, odd, or neither.

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

a. even
b. odd
c. neither

____ 19. Find the coordinates of a second point on the graph of a function *f* if the given point $\left(-\frac{6}{5}, 8\right)$ is on the graph and the function is even.

a. $\left(8, -\frac{6}{5}\right)$
b. $\left(-8, -\frac{6}{5}\right)$
c. $\left(-\frac{6}{5}, -8\right)$
d. $\left(\frac{6}{5}, -8\right)$
e. $\left(\frac{6}{5}, 8\right)$

____ 20. Find the coordinates of a second point on the graph of a function *f* if the given point $\left(-\frac{9}{8}, 5\right)$ is on the graph and the function is odd.

a. $\left(-5, -\frac{9}{8}\right)$
b. $\left(\frac{9}{8}, -5\right)$
c. $\left(-5, \frac{9}{8}\right)$
d. $\left(-\frac{9}{8}, -5\right)$
e. $\left(\frac{9}{8}, 5\right)$

____ 21. The horsepower H required to overcome wind drag on a certain automobile is approximated by $H(x) = 0.002x^2 + 0.005x - 0.027, \ 10 \le x \le 100$ where x is the speed of the car in miles per hour. Find . Round the numerical values in your answer to five decimal places.

a. $H\left(\frac{x}{1.1}\right) = 0.00150x^2 + 0.00455x - 0.02700$

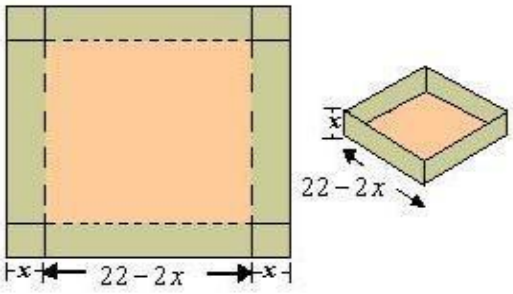
b. $H\left(\frac{x}{1.1}\right) = 0.00150x^2 + 0.00165x - 0.00455$

c. $H\left(\frac{x}{1.1}\right) = 0.00165x^2 + 0.00150x - 0.02700$

d. $H\left(\frac{x}{1.1}\right) = 0.00165x^2 + 0.00455x - 0.02700$

e. $H\left(\frac{x}{1.1}\right) = 0.00455x^2 + 0.00165x - 0.02700$

____ 22. An open box of maximum volume is to be made from a square piece of material 22 centimeters on a side by cutting equal squares from the corners and turning up the sides (see figure). Write the volume V as a function of x, the length of the corner squares.



a. $V = x(22 - 2x)^2$

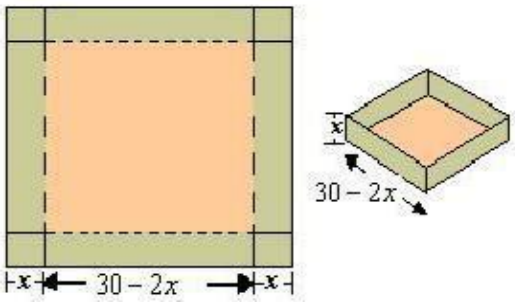
b. $V = x + (22 - x)^2$

c. $V = x^2 + (22 - 2x)$

d. $V = x^2(22 - 2x)$

e. $V = x(22 - 2x)$

____ 23. An open box of maximum volume is to be made from a square piece of material 30 centimeters on a side by cutting equal squares from the corners and turning up the sides(see figure). What is the domain of the function $V = x(30 - 2x)^2$.



a. domain: $0 < x < \infty$
b. domain: 30
c. domain: $0 < x < 15$
d. domain: $0 < x < 30$
e. domain: 15

1.3 Functions and Their Graphs
Answer Section

1. ANS: D PTS: 1 DIF: Easy REF: Section 1.3
OBJ: Evaluate a function and simplify MSC: Skill
2. ANS: B PTS: 1 DIF: Easy REF: Section 1.3
OBJ: Evaluate a function and simplify MSC: Skill
3. ANS: C PTS: 1 DIF: Easy REF: Section 1.3
OBJ: Evaluate a function and simplify MSC: Skill
4. ANS: B PTS: 1 DIF: Med REF: Section 1.3
OBJ: Simplify a difference quotient MSC: Skill
5. ANS: A PTS: 1 DIF: Med REF: Section 1.3
OBJ: Simplify a difference quotient MSC: Skill
6. ANS: E PTS: 1 DIF: Easy REF: Section 1.3
OBJ: Identify the domain and range of a function MSC: Skill
7. ANS: E PTS: 1 DIF: Easy REF: Section 1.3
OBJ: Identify the domain and range of a function MSC: Skill
8. ANS: B PTS: 1 DIF: Easy REF: Section 1.3
OBJ: Identify the domain and range of a function MSC: Skill
9. ANS: E PTS: 1 DIF: Easy REF: Section 1.3
OBJ: Evaluate a piecewise function MSC: Skill
10. ANS: B PTS: 1 DIF: Easy REF: Section 1.3
OBJ: Identify the domain and range of a function MSC: Skill
11. ANS: B PTS: 1 DIF: Easy REF: Section 1.3
OBJ: Identify equations that are functions MSC: Skill
12. ANS: B PTS: 1 DIF: Easy REF: Section 1.3
OBJ: Identify equations that are functions MSC: Skill
13. ANS: E PTS: 1 DIF: Easy REF: Section 1.3
OBJ: Graph transformations of functions MSC: Skill
14. ANS: A PTS: 1 DIF: Med REF: Section 1.3
OBJ: Graph transformations of functions MSC: Skill
15. ANS: B PTS: 1 DIF: Med REF: Section 1.3
OBJ: Describe a transformation of an equation MSC: Skill
16. ANS: D PTS: 1 DIF: Easy REF: Section 1.3
OBJ: Evaluate composite functions MSC: Skill
17. ANS: C PTS: 1 DIF: Easy REF: Section 1.3
OBJ: Identify the type of symmetry of the graph of a function MSC: Skill
18. ANS: A PTS: 1 DIF: Easy REF: Section 1.3
OBJ: Identify the type of symmetry of the graph of a function MSC: Skill
19. ANS: E PTS: 1 DIF: Easy REF: Section 1.3
OBJ: Identify points on a graph using symmetry MSC: Skill
20. ANS: B PTS: 1 DIF: Easy REF: Section 1.3
OBJ: Identify points on a graph using symmetry MSC: Skill
21. ANS: D PTS: 1 DIF: Med REF: Section 1.3
OBJ: Apply composite functions MSC: Application
22. ANS: A PTS: 1 DIF: Med REF: Section 1.3
OBJ: Create functions in applications MSC: Application

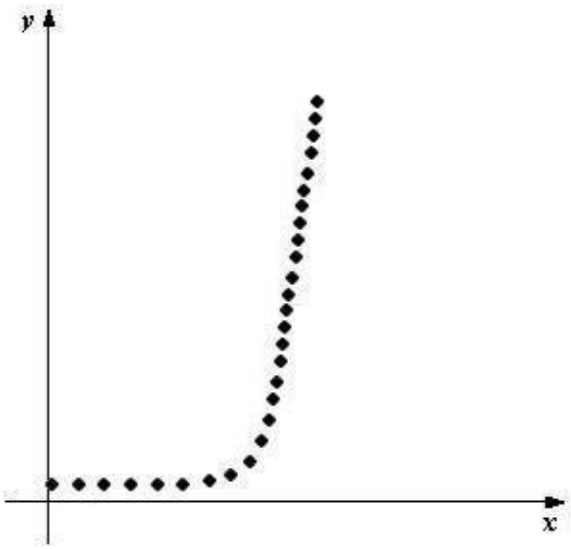
23. ANS: C PTS: 1 DIF: Med REF: Section 1.3
OBJ: Identify domains in applications MSC: Application

1.4 Fitting Models to Data

Multiple Choice

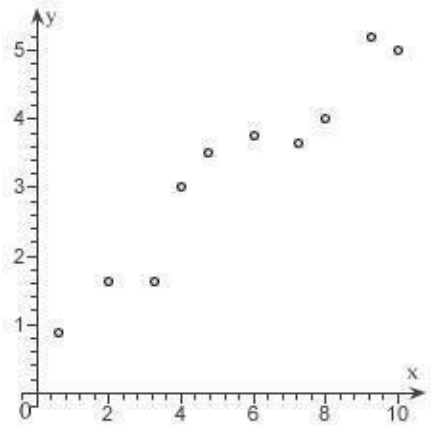
Identify the choice that best completes the statement or answers the question.

____ 1. Determine which type of function would be most appropriate to fit the given data.



a. exponential
b. linear
c. quadratic
d. no relationship
e. trigonometric

____ 2. Which function below would be most appropriate model for the given data?



a. no apparent relationship between x and y
b. trigonometric
c. quadratic
d. linear

____ 3. The following ordered pairs represent temperatures in degrees Fahrenheit taken each hour from 1:00 pm until 5:00 pm. Let T be temperature, and let t be time, where $t = 1$ corresponds to 1:00 pm, $t = 2$ corresponds to 2:00 pm, and so on. Plot the data. Visually find a linear model for the data and find its equation. From the visual linear model that you created, determine which of the models that follow appears to best approximate the data.

(1:00 pm , $67.4°$), (2:00 pm , $71.6°$), (3:00 pm , $73.4°$), (4:00 pm , $77.6°$), (5:00 pm , $79.4°$)

a. $T = 2t + 60$
b. $T = -2t + 70$
c. $T = -4t + 60$
d. $T = 4t + 70$
e. $T = 3t + 65$

____ 4. Each ordered pair gives the exposure index x of a carcinogenic substance and the cancer mortality y per 100,000 people in the population. Use the model to approximate y if $x = 7$. Round your answer to one decimal place. $y = 9.2x + 108.4$

$(3.50, 150.1)$, $(3.58, 133.1)$, $(4.42, 132.9)$, $(2.26, 116.7)$, $(2.36, 140.7)$, $(4.85, 165.5)$,
$(12.65, 210.7)$, $(7.42, 181.0)$, $(9.35, 213.4)$

a. 168.2
b. 163.6
c. 182.0
d. 172.8
e. 177.4

____ 5. Hooke's Law states that the force F required to compress or stretch a spring (within its elastic limits) is proportional to the distance d that the spring is compressed or stretched from its original length. That is, $F = kd$ where k is a measure of the stiffness of the spring and is called the spring constant. The table shows the elongation d in centimeters of a spring when a force of F newtons is applied. Use the regression capabilities of a graphing utility to find a linear model for the data. Round the numerical values in your answer to three decimal places.

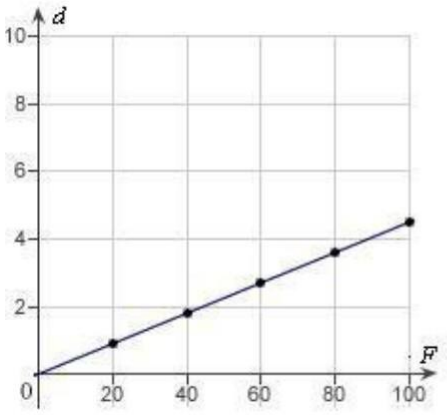
F	20	40	60	80	100
d	1.9	3.8	5.7	7.6	9.5

a. $d = 0.675F$
b. $d = 0.118F$
c. $d = 0.112F$
d. $d = 0.095F$
e. $d = 0.905F$

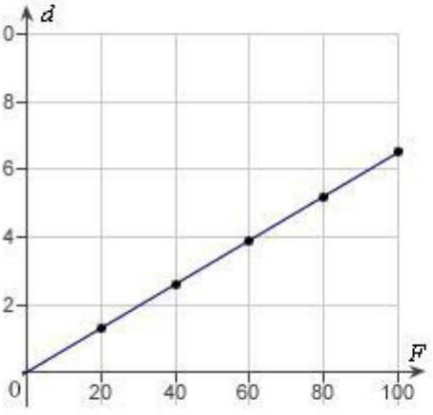
____ 6. Hooke's Law states that the force F required to compress or stretch a spring (within its elastic limits) is proportional to the distance d that the spring is compressed or stretched from its original length. That is, $F = kd$ where k is a measure of the stiffness of the spring and is called the spring constant. The table shows the elongation d in centimeters of a spring when a force of F newtons is applied. Use a graphing utility to plot the data and graph the linear model.

F	20	40	60	80	100
d	1.3	2.6	3.9	5.2	6.5

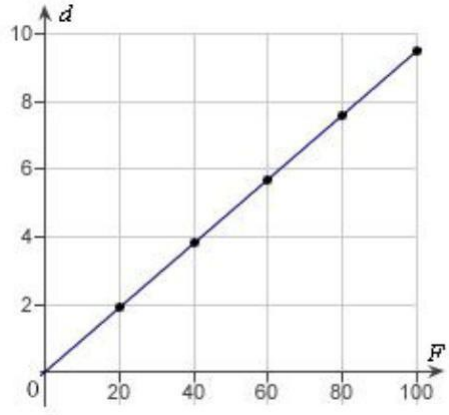
a.



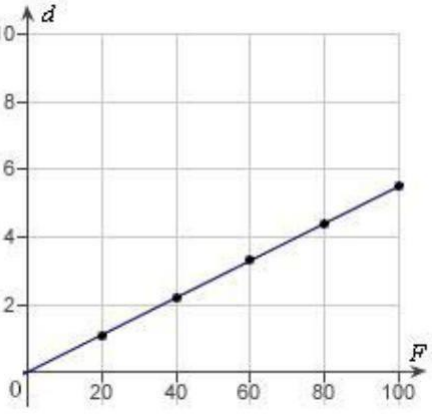
d.



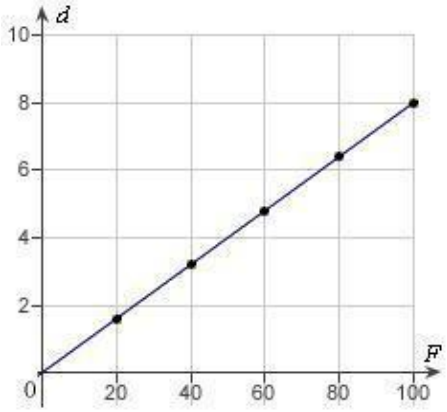
b.



e.



c.



____ 7. Hooke's Law states that the force F required to compress or stretch a spring (within its elastic limits) is proportional to the distance d that the spring is compressed or stretched from its original length. That is, $F = kd$ where k is a measure of the stiffness of the spring and is called the spring constant. The table shows the elongation d in centimeters of a spring when a force of F newtons is applied. Use the model $d = 0.085F$ to estimate the elongation of the spring when a force of 55 newtons is applied. Round your answer to two decimal places.

F	20	40	60	80	100
d	1.7	3.4	5.1	6.8	8.5

a. 8.08 cm
b. 6.38 cm
c. 4.68 cm
d. 2.98 cm
e. 9.78 cm

____ 8. In an experiment, students measured the speed s (in meters per second) of a falling object t seconds after it was released. The results are shown in the table below. Use the regression capabilities of a graphing utility to find a linear model for the data. Round all numerical values in your answer to one decimal place.

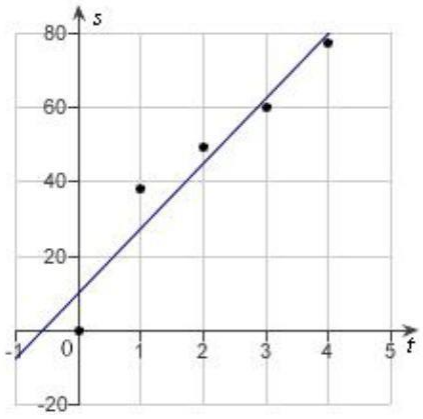
t	0	1	2	3	4
s	0	13.0	21.4	31.2	41.4

a. $s = 10.1t + 1.2$
b. $s = 3.0t - 1.2$
c. $s = 1.2t + 10.1$
d. $s = 10.1t + 3.0$
e. $s = 1.2t - 3.0$

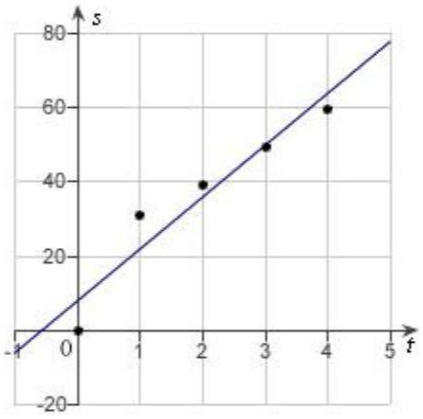
____ 9. In an experiment, students measured the speed s (in meters per second) of a falling object t seconds after it was released. The results are shown in the table below. Use the regression capabilities of a graphing utility to find a linear model for the data. Round all numerical values in your answer to one decimal place.

t	0	1	2	3	4
s	0	40	48.4	58.2	68.4

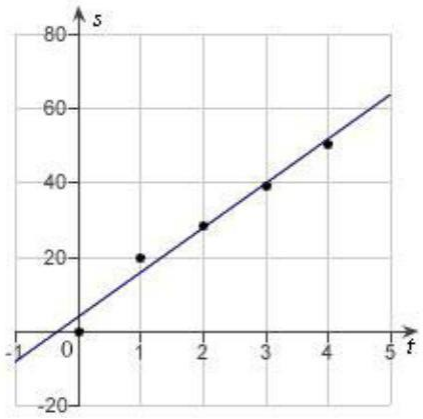
a.



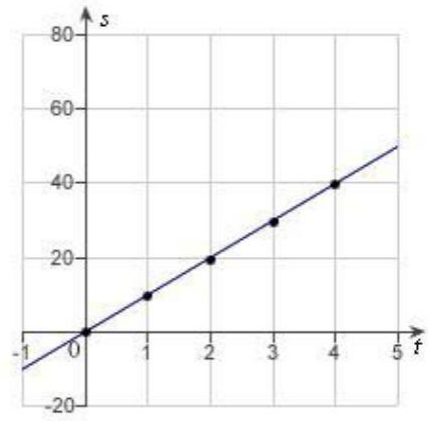
d.



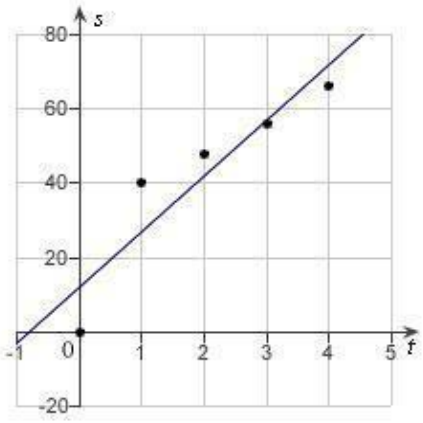
b.



e.



c.



____ 10. In an experiment, students measured the speed *s* (in meters per second) of a falling object *t* seconds after it was released. The results are shown in the table below. Use the model $s = 11.9t + 4.8$ to estimate the speed of the object after 1.5 seconds. Round your answer to two decimal places.

t	0	1	2	3	4
s	0	22.0	30.4	40.2	50.4

a. 21.05 meters/second
b. 20.95 meters/second
c. 24.25 meters/second
d. 23.55 meters/second
e. 22.65 meters/second

____ 11. Students in a lab measured the breaking strength *S* (in pounds) of wood 2 inches thick, *x* inches high, and 12 inches long. The results are shown in the table below. Use the regression capabilities of a graphing utility to fit a quadratic model to the data. Round the numerical values in your answer to two decimal places, where applicable.

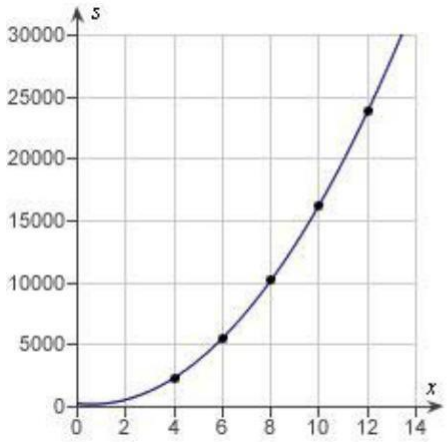
x	4	6	8	10	12
S	2422	5512	10,362	16,302	23,912

a. $S = 170.89x^2 - 209.79x + 324$
b. $S = 180.89x^2 - 205.79x + 324$
c. $S = 190.89x^2 + 201.79x + 331$
d. $S = 170.89x^2 - 209.79x + 327$
e. $S = 180.89x^2 + 203.79x - 331$

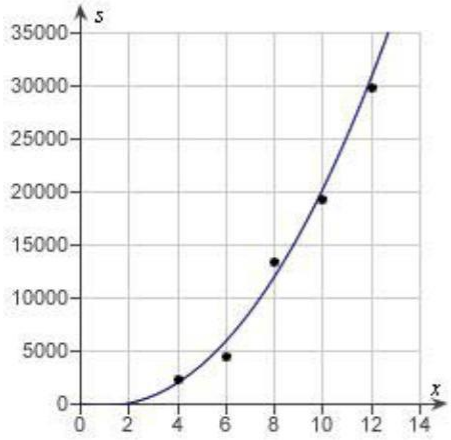
____ 12. Students in a lab measured the breaking strength S (in pounds) of wood 2 inches thick, x inches high, and 12 inches long. The results are shown in the table below. Use a graphing utility to plot the data and graph the quadratic model.

x	4	6	8	10	12
S	2370	4460	13,310	19,250	29,860

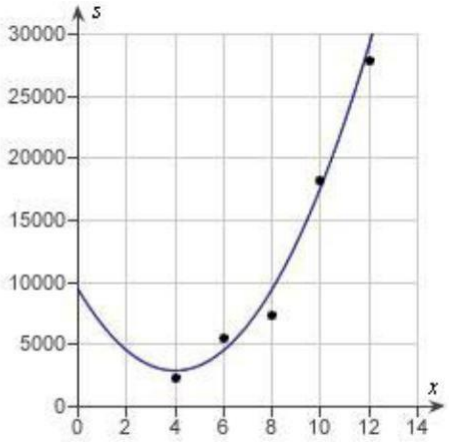
a.



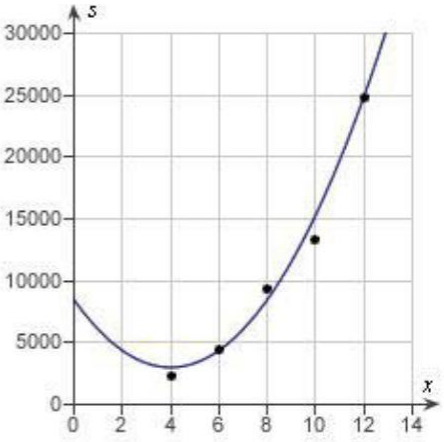
b.



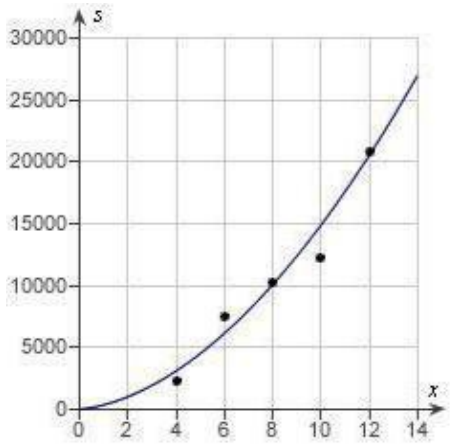
d.



e.



c.



____ 13. Students in a lab measured the breaking strength S (in pounds) of wood 2 inches thick, x inches high, and 12 inches long. The results are shown in the table below. Use the model to approximate the breaking strength when $x = 2$. Round your answer to two decimal places.

x	4	6	8	10	12
S	2382	5472	10,322	16,262	23,872

a. 595.98 pounds
b. 390.19 pounds
c. 957.76 pounds
d. 801.77 pounds
e. 751.97 pounds

____ 14. A V8 car engine is coupled to a dynamometer and the horsepower y is measured at different engine speeds x (in thousands of revolutions per minute) . The results are shown in the table below. Use the regression capabilities of a graphing utility to find a cubic model for the data. Round the numerical values in your answer to three decimal places, where applicable.

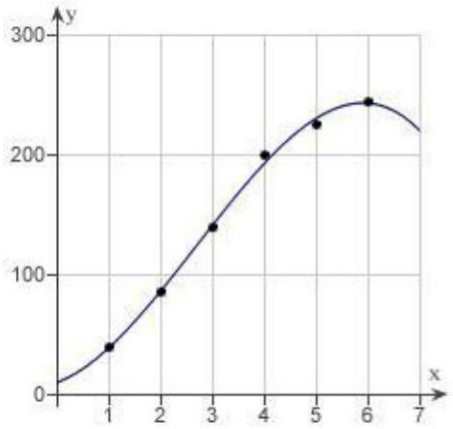
x	1	2	3	4	5	6
y	64	109	164	224	249	269

a. $y = -1.608x^3 - 14.583x^2 + 13.389x - 37$
b. $y = -1.706x^3 - 14.583x^2 - 16.389x + 34$
c. $y = 1.806x^3 + 11.583x^2 + 16.389x - 41$
d. $y = -1.806x^3 + 14.583x^2 + 16.389x + 34$
e. $y = 1.608x^3 + 11.583x^2 - 19.389x + 41$

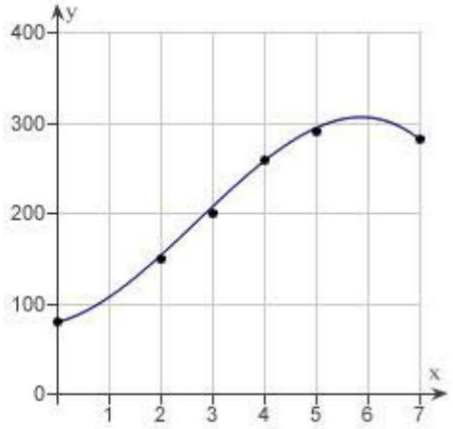
____ 15. A V8 car engine is coupled to a dynamometer and the horsepower y is measured at different engine speeds x (in thousands of revolutions per minute). The results are shown in the table below. Use a graphing utility to plot the data and graph the cubic model.

x	1	2	3	4	5	6
y	110	155	210	270	295	315

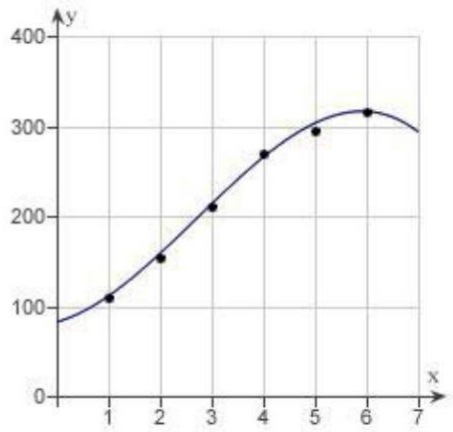
a.



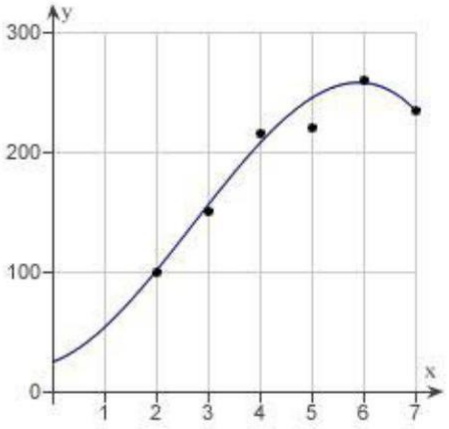
b.



d.



e.



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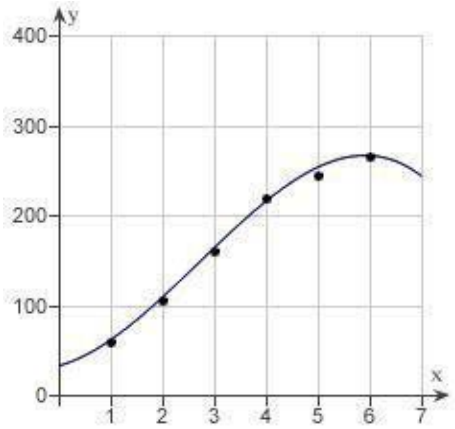


____ 16. A V8 car engine is coupled to a dynamometer and the horsepower y is measured at different engine speeds x (in thousands of revolutions per minute). The results are shown in the table below. Use the model $y = -1.806x^3 + 14.58x^2 + 16.4x + 30$ to approximate the horsepower when the engine is running at 5500 revolutions per minute. Round your answer to two decimal places.

x	1	2	3	4	5	6
y	60	105	160	220	245	265

a. 260.77 hp
b. 262.73 hp
c. 262.36 hp
d. 261.38 hp
e. 261.91 hp

1.4 Fitting Models to Data
Answer Section

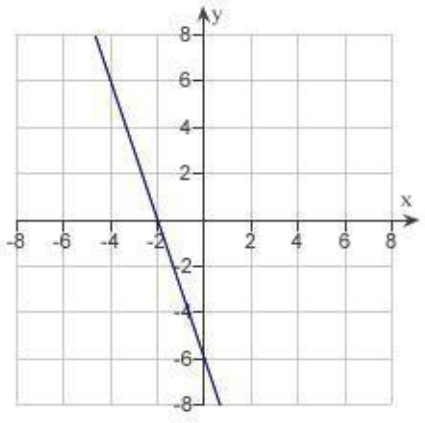
1. ANS: A PTS: 1 DIF: Easy REF: Section 1.4
OBJ: Identify the most appropriate function for a scatter plot MSC: Skill
2. ANS: D PTS: 1 DIF: Easy REF: Section 1.4
OBJ: Identify the most appropriate function for a scatter plot MSC: Skill
3. ANS: E PTS: 1 DIF: Easy REF: Section 1.4
OBJ: Identify the best linear model for given data MSC: Application
4. ANS: D PTS: 1 DIF: Easy REF: Section 1.4
OBJ: Evaluate linear models in applications MSC: Application
5. ANS: D PTS: 1 DIF: Easy REF: Section 1.4
OBJ: Write a linear model for data using the regression capabilities of a graphing utility
MSC: Application
6. ANS: D PTS: 1 DIF: Easy REF: Section 1.4
OBJ: Plot data points and the graph of a linear model MSC: Application
7. ANS: C PTS: 1 DIF: Easy REF: Section 1.4
OBJ: Evaluate linear models in applications MSC: Application
8. ANS: A PTS: 1 DIF: Easy REF: Section 1.4
OBJ: Write a linear model for data using the regression capabilities of a graphing utility
MSC: Application
9. ANS: C PTS: 1 DIF: Easy REF: Section 1.4
OBJ: Plot data points and the graph of a linear model MSC: Application
10. ANS: E PTS: 1 DIF: Easy REF: Section 1.4
OBJ: Evaluate linear models in applications MSC: Application
11. ANS: B PTS: 1 DIF: Med REF: Section 1.4
OBJ: Write a quadratic model for data using the regression capabilities of a graphing utility
MSC: Application
12. ANS: B PTS: 1 DIF: Med REF: Section 1.4
OBJ: Plot data points and the graph of a quadratic model MSC: Application
13. ANS: A PTS: 1 DIF: Med REF: Section 1.4
OBJ: Evaluate quadratic models in applications MSC: Application
14. ANS: D PTS: 1 DIF: Med REF: Section 1.4
OBJ: Evaluate cubic models in applications MSC: Application
15. ANS: D PTS: 1 DIF: Med REF: Section 1.4
OBJ: Plot data points and the graph of a cubic model MSC: Application
16. ANS: A PTS: 1 DIF: Med REF: Section 1.4
OBJ: Write a cubic model for data using the regression capabilities of a graphing utility
MSC: Application

1.5 Inverse Functions

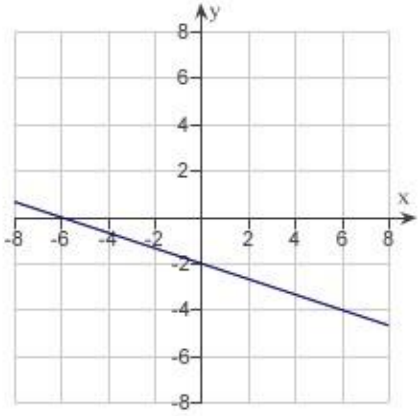
Multiple Choice

Identify the choice that best completes the statement or answers the question.

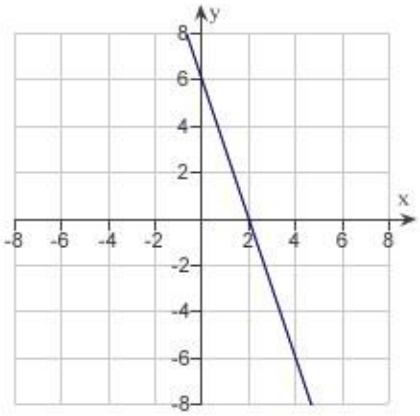
____ 1. Match the graph of the function given below with the graph of its inverse function.



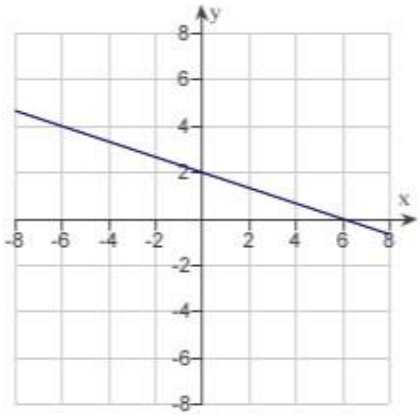
a.



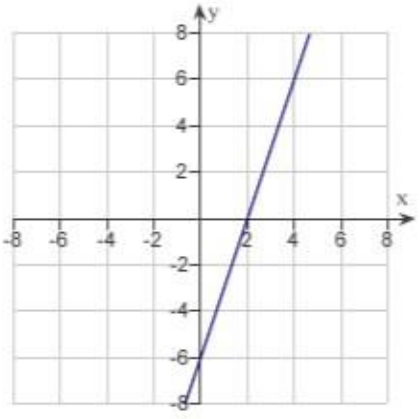
b.



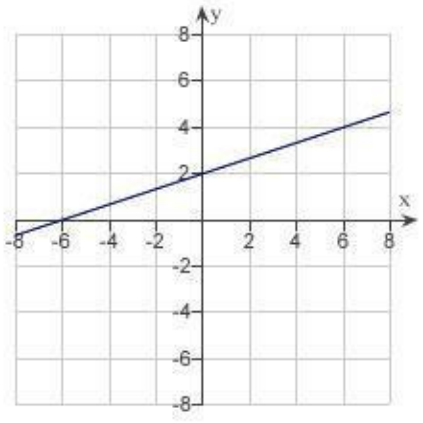
d.



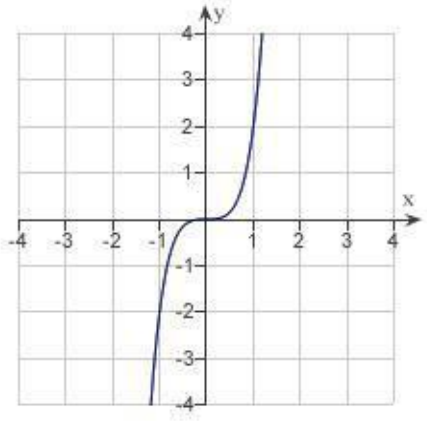
e.



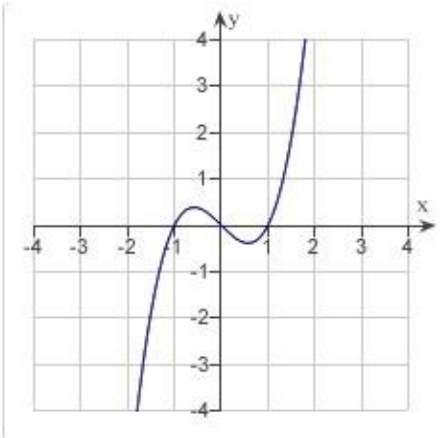
c.



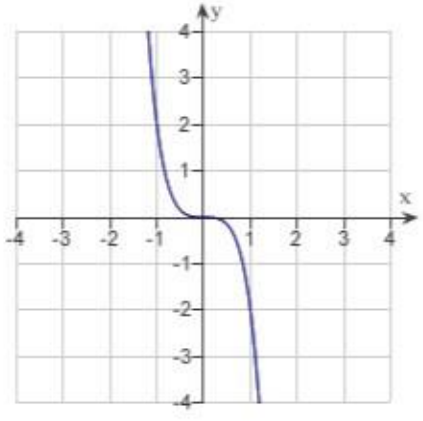
____ 2. Match the graph of the function given below with the graph of its inverse function.



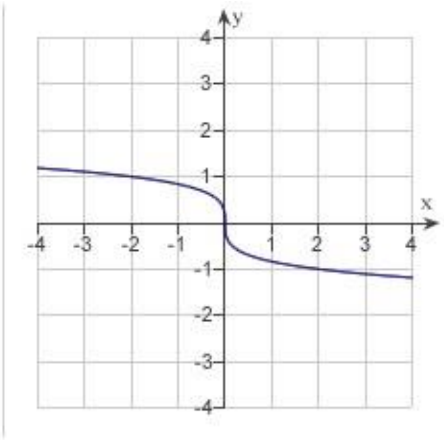
a.



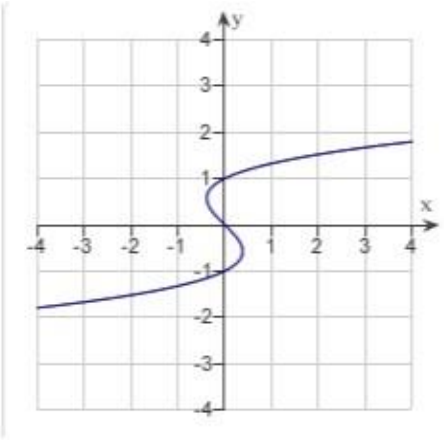
d.



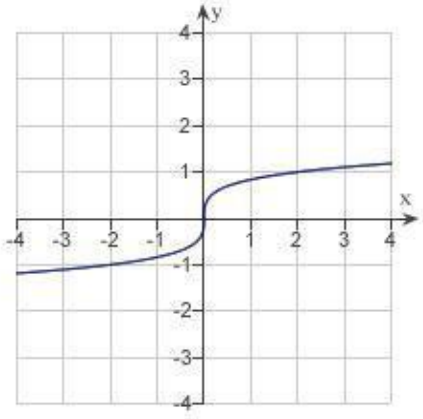
b.



e.



c.



____ 3. Use the Horizontal Line Test to determine whether the following statement is true or false.

The function $f(x) = \frac{3}{19}x + 3$ is one-to-one on its entire domain and therefore has an inverse function.

a. false
b. true

____ 4. Use the Horizontal Line Test to determine whether the following statement is true or false.

The function $f(x) = 14(x - 15) + 15$ is one-to-one on its entire domain and therefore has an inverse function.

a. true
b. false

____ 5. True or False: The function $f(x) = \frac{1}{s-38} - 2$ is one-to-one on its entire domain.

a. false
b. true

____ 6. True or False: The function $f(x) = |x+10| - |x-10|$ is one-to-one on the domain .

a. false
b. true

____ 7. Find $f^{-1}(x)$ if $f(x) = 12x - 10$.

a. $f^{-1}(x) = \ln(12x+10)$
b. $f^{-1}(x) = \frac{1}{12x-10}$
c. $f^{-1}(x) = \frac{1}{12}x + \frac{1}{10}$
d. $f^{-1}(x) = 10x - 12$
e. $f^{-1}(x) = \frac{1}{12}x + \frac{5}{6}$

____ 8. Find $f^{-1}(x)$ if $f(x) = x^7$

a. $f^{-1}(x) = \frac{1}{7}x^{-7}$
b. $f^{-1}(x) = x^{\frac{1}{7}}$
c. $f^{-1}(x) = \frac{1}{8}x^8$
d. $f^{-1}(x) = x^{-7}$
e. $f^{-1}(x) = 7x^6$

____ 9. Find $f^{-1}(x)$ if $f(x) = x^3 - 4$

a. $f^{-1}(x) = x^{\frac{1}{3}} + \frac{1}{4}$

b. $f^{-1}(x) = \frac{1}{3}(x+4)^{-\frac{2}{3}}$

c. $f^{-1}(x) = x^{\frac{1}{3}} + 4^{\frac{1}{3}}$

d. $f^{-1}(x) = (x+4)^{\frac{1}{3}}$

e. $f^{-1}(x) = \frac{1}{x^3 - 4}$

____ 10. Find $f^{-1}(x)$ if $f(x) = 6x^2, x \geq 0$

a. $f^{-1}(x) = \sqrt{\frac{1}{6x}}$

b. $f^{-1}(x) = \frac{1}{6x^2}$

c. $f^{-1}(x) = \sqrt{\frac{6}{x}}$

d. $f^{-1}(x) = \frac{1}{6\sqrt{x}}$

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

____ 11. Find $f^{-1}(x)$ if $f(x) = \sqrt{13 - x^2}, 0 \leq x \leq \sqrt{13}$

a. $f^{-1}(x) = x + \sqrt{13}, 0 \leq x \leq \sqrt{13}$

b. $f^{-1}(x) = \left(13 - x^2\right)^2, 0 \leq x \leq \sqrt{13}$

c. $f^{-1}(x) = \sqrt{13 - x^2}, 0 \leq x \leq \sqrt{13}$

d. $f^{-1}(x) = \sqrt{x^2 - 13}, 0 \leq x \leq \sqrt{13}$

e. $f^{-1}(x) = \frac{1}{\sqrt{13 - x^2}}, 0 \leq x \leq \sqrt{13}$

____ 12. Find $f^{-1}(x)$ if $f(x) = 3\sqrt[5]{8x-9}$

a. $f^{-1}(x) = \frac{1}{3}(8x-9)^5$

b. $f^{-1}(x) = \frac{1}{3}\left(\left(\frac{x}{3}\right)^5 + 9\right)$

c. $f^{-1}(x) = \frac{1}{8}\left(\left(\frac{x}{3}\right)^5 - 9\right)$

d. $f^{-1}(x) = \frac{1}{8}\left(\left(\frac{x}{3}\right)^5 + 9\right)$

e. $f^{-1}(x)$ does not exist

____ 13. Find $f^{-1}(x)$ if $f(x) = x^{\frac{7}{17}}$

a. $f^{-1}(x) = \frac{17}{7}^{\frac{7}{17}}$

b. $f^{-1}(x) = x^{-\frac{7}{17}}$

c. $f^{-1}(x) = x^{119}$

d. $f^{-1}(x) = x^{-\frac{17}{7}}$

e. $f^{-1}(x) = x^{\frac{17}{7}}$

____ 14. You need 50 pounds of two commodities costing \$1.80 and \$2.40 per pound. Find the inverse function of the cost function $y = 1.80x + 2.40(50 - x)$.

a. $y = \frac{5}{3}(240 - x)$

b. $y = \frac{10}{3}(-120 + x)$

c. $y = \frac{5}{3}(-240 - x)$

d. $y = \frac{5}{3}(120 - x)$

e. $y = \frac{10}{3}(120 + x)$

____ 15. You need 50 pounds of two commodities costing \$1.60 and \$1.95 per pound. Determine the number of pounds of the less expensive commodity purchased if the total cost $y = 1.60x + 1.95(50 - x)$ is \$94 .

a. 10 pounds
b. 17 pounds
c. 7 pounds
d. 5 pounds
e. 13 pounds

____ 16. Use the functions $f(x) = x + 2$ and $g(x) = 4x - 7$ to find the function $\left(g^{-1} \circ f^{-1}\right)(x)$.

a. $\frac{x-5}{7}$
b. $4x + 5$
c. $4x - 1$
d. $\frac{x+5}{4}$
e. $\frac{x-1}{4}$

____ 17. Use the functions $f(x) = x + 2$ and $g(x) = 4x - 3$ to find the function $\left(f \circ g\right)^{-1}(x)$.

a. $4x - 5$
b. $\frac{x-5}{4}$
c. $\frac{x+1}{4}$
d. $\frac{x-1}{3}$
e.

____ 18. Evaluate the expression $\arcsin\left(\frac{1}{2}\right)$ without using a calculator.

a. 0
b. $\frac{3\pi}{2}$
c. $\frac{7\pi}{2}$
d. $\frac{\pi}{6}$
e. $\frac{4\pi}{5}$

____ 19. Evaluate the expression $\arccos\left(\frac{\sqrt{2}}{2}\right)$ without using a calculator.

a. $\frac{5\pi}{4}$
b. $\frac{\pi}{6}$
c. $\frac{3\pi}{2}$
d. $\frac{\pi}{4}$
e. $\frac{2\pi}{3}$

____ 20. Evaluate the expression $\cos\left(\arcsin\frac{3}{5}\right)$ without using a calculator.

a. $\frac{3}{5}$
b. $\frac{4}{5}$
c. 3
d. 5
e. 4

____ 21. Write the following expression in algebraic form.

$\sin\left(\arccos(2x)\right)$

a. $\sqrt{1-4x^2}$
b. $1-2x^2$
c. $1+2x^2$
d. $1+4x^2$
e. $\sqrt{1-2x^2}$

____ 22. Write the following expression in algebraic form.

$\cos\left(\arcsin\left(2x^2\right)\right)$

a. $\sqrt{1-4x^4}$
b. $1+4x^4$
c. $\sqrt{1-2x^2}$
d. $1+2x^2$
e. $1+2x^4$

____ 23. Write the following expression in algebraic form.

$$\tan\left(\operatorname{arcsec}\left(\frac{x}{8}\right)\right)$$

a. $x^2 - 64$
b. $\dfrac{\sqrt{x^2 - 64}}{8}$
c. $1 + 64x^2$
d. $\sqrt{x^2 - 8}$
e. $1 + 8x^2$

____ 24. Solve the following equation for x.

$$\arcsin(7x - \pi) = \frac{1}{10}$$

a. $x = \dfrac{\pi + \sin\left(\frac{1}{10}\right)}{7}$
b. $x = \dfrac{\cos\left(\pi + \frac{1}{10}\right)}{7}$
c. $x = \dfrac{\csc\left(\pi + \frac{1}{10}\right)}{7}$
d. $x = \dfrac{\pi + \csc\left(\frac{1}{10}\right)}{7}$
e. $x = \dfrac{\sin\left(\pi + \frac{1}{10}\right)}{7}$

____ 25. Solve the following equation for x.

$$\arccos(10x - \pi) = \frac{1}{2}$$

a. $x = \dfrac{\sin\left(\pi + \frac{1}{2}\right)}{10}$

b. $x = \dfrac{\pi + \sec\left(\frac{1}{2}\right)}{10}$

c. $x = \dfrac{\sec\left(\pi + \frac{1}{2}\right)}{10}$

d. $x = \dfrac{\cos\left(\pi + \frac{1}{2}\right)}{10}$

e. $x = \dfrac{\pi + \cos\left(\frac{1}{2}\right)}{10}$

1.5 Inverse Functions
Answer Section

1.	ANS:	A	PTS:	1	DIF:	Easy	REF:	Section 1.5	
OBJ:	Identify the graph of the inverse of a function						MSC:	Skill	
2.	ANS:	C	PTS:	1	DIF:	Easy	REF:	Section 1.5	
OBJ:	Identify the graph of the inverse of a function						MSC:	Skill	
3.	ANS:	B	PTS:	1	DIF:	Med	REF:	Section 1.5	
OBJ:	Recognize invertible functions						MSC:	Application	
4.	ANS:	A	PTS:	1	DIF:	Med	REF:	Section 1.5	
OBJ:	Recognize invertible functions						MSC:	Application	
5.	ANS:	B	PTS:	1	DIF:	Med	REF:	Section 1.5	
OBJ:	Recognize invertible functions						MSC:	Application	
6.	ANS:	B	PTS:	1	DIF:	Med	REF:	Section 1.5	
OBJ:	Recognize invertible functions						MSC:	Application	
7.	ANS:	E	PTS:	1	DIF:	Easy	REF:	Section 1.5	
OBJ:	Construct the inverse of a function						MSC:	Skill	
8.	ANS:	B	PTS:	1	DIF:	Easy	REF:	Section 1.5	
OBJ:	Construct the inverse of a function						MSC:	Skill	
9.	ANS:	D	PTS:	1	DIF:	Med	REF:	Section 1.5	
OBJ:	Construct the inverse of a function						MSC:	Skill	
10.	ANS:	E	PTS:	1	DIF:	Med	REF:	Section 1.5	
OBJ:	Construct the inverse of a function						MSC:	Skill	
11.	ANS:	C	PTS:	1	DIF:	Med	REF:	Section 1.5	
OBJ:	Construct the inverse of a function						MSC:	Skill	
12.	ANS:	D	PTS:	1	DIF:	Med	REF:	Section 1.5	
OBJ:	Construct the inverse of a function						MSC:	Skill	
13.	ANS:	E	PTS:	1	DIF:	Med	REF:	Section 1.5	
OBJ:	Construct the inverse of a function						MSC:	Skill	
14.	ANS:	D	PTS:	1	DIF:	Easy	REF:	Section 1.5	
OBJ:	Construct the inverse of a function in applications						MSC:	Application	
15.	ANS:	A	PTS:	1	DIF:	Easy	REF:	Section 1.5	
OBJ:	Solve a linear equation in applications						MSC:	Application	
16.	ANS:	D	PTS:	1	DIF:	Easy	REF:	Section 1.5	
OBJ:	Construct the inverse of a composition of functions						MSC:	Skill	
17.	ANS:	C	PTS:	1	DIF:	Easy	REF:	Section 1.5	
OBJ:	Construct the inverse of a composition of functions						MSC:	Skill	
18.	ANS:	D	PTS:	1	DIF:	Easy	REF:	Section 1.5	
OBJ:	Evaluate an inverse trigonometric expression						MSC:	Skill	
19.	ANS:	D	PTS:	1	DIF:	Easy	REF:	Section 1.5	
OBJ:	Evaluate an inverse trigonometric expression						MSC:	Skill	
20.	ANS:	B	PTS:	1	DIF:	Med	REF:	Section 1.5	
OBJ:	Evaluate an expression involving an inverse trigonometric expression						MSC:	Skill	
21.	ANS:	A	PTS:	1	DIF:	Med	REF:	Section 1.5	
OBJ:	Convert an inverse trigonometric expression to an algebraic expression						MSC:	Skill	
22.	ANS:	A	PTS:	1	DIF:	Med	REF:	Section 1.5	
OBJ:	Convert an inverse trigonometric expression to an algebraic expression						MSC:	Skill	

23. ANS: B PTS: 1 DIF: Med REF: Section 1.5
OBJ: Convert an inverse trigonometric expression to an algebraic expression MSC: Skill
24. ANS: A PTS: 1 DIF: Med REF: Section 1.5
OBJ: Solve an inverse trigonometric equation MSC: Skill
25. ANS: E PTS: 1 DIF: Med REF: Section 1.5
OBJ: Solve an inverse trigonometric equation MSC: Skill

1.6 Exponential and Logarithmic Functions

Multiple Choice

Identify the choice that best completes the statement or answers the question.

____ 1. What is the domain of the function $f(x) = 6\ln(4x)$?

a. $(0, \infty)$
b. $\left(\frac{1}{4}, \infty\right)$
c. $(0, 1)$
d. $(1, e)$
e. (e, ∞)

____ 2. What is the domain of the function $f(x) = 4 + \ln(x - 6)$?

a. $(1, \infty)$
b. $(6, \infty)$
c. $(0, \infty)$
d. $(0, 6)$
e. $(1, 6)$

____ 3. Write the following expression as a logarithm of a single quantity.

$\ln x - 4\ln\left(x^2 + 1\right)$

a. $\ln\left(\frac{x}{\left(x^2 + 1\right)^{-4}}\right)$
b. $\ln\left(x - 4\left(x^2 + 1\right)\right)$
c. $\ln\left(\frac{x}{4\left(x^2 + 1\right)}\right)$
d. $\ln\left(\frac{-4x}{x^2 + 1}\right)$
e. $\ln\left(\frac{x}{\left(x^2 + 1\right)^4}\right)$

____ 4. Write the following expression as a logarithm of a single quantity.

$13\ln x - 12\ln\left(x^2+16\right)$

a. $\ln\left(13x - 12\left(x^2+16\right)\right)$

b. $\ln\left(\dfrac{x^{13}}{\left(x^2+16\right)^{12}}\right)$

c. $\ln\left(x^{13}\left(x^2+16\right)^{12}\right)$

d. $\ln\left(x^{13} - \left(x^2+16\right)^{12}\right)$

e. $\ln\left(\dfrac{x^{13}}{12\left(x^2+16\right)}\right)$

____ 5. Solve the following equation for x.

$e^{\ln(13x)} = 3$

a. $x = \dfrac{\ln(3)}{\ln(13)}$

b. $x = \dfrac{3}{13}$

c. $x = 39$

d. $x = \dfrac{3}{\ln(13)}$

e. $x = \dfrac{3}{e\ln(13)}$

____ 6. Solve the following equation for x.

$\ln(x-5)^5 = 3$

a. $x = 8$
b. $x = e^{\sqrt[5]{3}} + 5$
c. $x = \dfrac{3}{\ln(5)^5}$
d. $x = e^{\frac{3}{5}} + 5$
e. no solution

____ 7. Solve the following equation for x.

$\ln x^{-10} = 6$

a. $x = \sqrt[10]{\ln(6)}$
b. $x = \dfrac{6}{\ln(10)}$
c. $x = \sqrt[10]{e^{-6}}$
d. $x = \sqrt[10]{e^{6}}$
e. $x = \ln(10)\ln(6)$

____ 8. Solve the following equation for x.

$-5 + 7e^{3x} = 10$

a. $x = \dfrac{1}{3}\ln\dfrac{15}{7}$
b. $x = -\dfrac{1}{3}\ln\dfrac{15}{7}$
c. $x = \dfrac{15}{7e^3}$
d. $x = -\dfrac{1}{3}\ln\dfrac{50}{7}$
e. $x = \dfrac{1}{3}\ln\dfrac{50}{7}$

1.6 Exponential and Logarithmic Functions

Answer Section

1.	ANS:	A	PTS:	1	DIF:	Easy	REF:	Section 1.6
OBJ:	Identify the domain of a logarithmic function						MSC:	Skill
2.	ANS:	B	PTS:	1	DIF:	Easy	REF:	Section 1.6
OBJ:	Identify the domain of a logarithmic function						MSC:	Skill
3.	ANS:	E	PTS:	1	DIF:	Med	REF:	Section 1.6
OBJ:	Write a logarithmic expression as a single quantity						MSC:	Skill
4.	ANS:	B	PTS:	1	DIF:	Med	REF:	Section 1.6
OBJ:	Write a logarithmic expression as a single quantity						MSC:	Skill
5.	ANS:	B	PTS:	1	DIF:	Easy	REF:	Section 1.6
OBJ:	Solve an exponential equation						MSC:	Skill
6.	ANS:	D	PTS:	1	DIF:	Med	REF:	Section 1.6
OBJ:	Solve a logarithmic equation						MSC:	Skill
7.	ANS:	C	PTS:	1	DIF:	Med	REF:	Section 1.6
OBJ:	Solve a logarithmic equation						MSC:	Skill
8.	ANS:	A	PTS:	1	DIF:	Med	REF:	Section 1.6
OBJ:	Solve an exponential equation						MSC:	Skill

2.1 A Preview of Calculus

Multiple Choice

Identify the choice that best completes the statement or answers the question.

____ 1. Decide whether the following problem can be solved using precalculus, or whether calculus is required. If the problem can be solved using precalculus, solve it. If the problem seems to require calculus, use a graphical or numerical approach to estimate the solution.

Find the distance traveled in 16 seconds by an object traveling at a constant velocity of 20 feet per second.

a. calculus, 320 ft
b. calculus, 340 ft
c. precalculus, 320 ft
d. calculus, 640 ft
e. precalculus, 640 ft

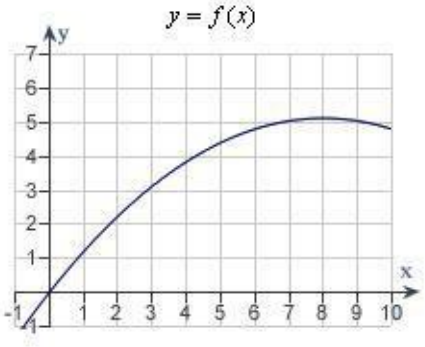
____ 2. Decide whether the following problem can be solved using precalculus, or whether calculus is required. If the problem can be solved using precalculus, solve it. If the problem seems to require calculus, use a graphical or numerical approach to estimate the solution.

Find the distance traveled in 20 seconds by an object moving with a velocity of $v(t) = 8 + 6\cos t$ feet per second.

a. calculus, 162.4485 ft
b. precalculus, 163.7985 ft
c. calculus, 165.4777 ft
d. precalculus, 165.4777 ft
e. precalculus, 162.4485 ft

____ 3. Decide whether the following problem can be solved using precalculus, or whether calculus is required. If the problem can be solved using precalculus, solve it. If the problem seems to require calculus, use a graphical or numerical approach to estimate the solution.

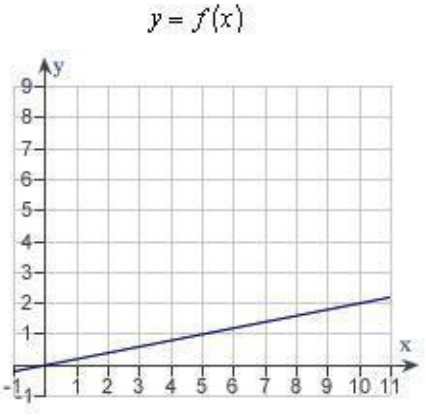
A cyclist is riding on a path whose elevation is modeled by the function $f(x) = 0.08\left(16x - x^2\right)$ where x and $f(x)$ are measured in miles. Find the rate of change of elevation when $x = 4$.



a. precalculus, 0.08
b. calculus, 0.2
c. calculus, 0.64
d. calculus, 0.08
e. precalculus, 0.2

____ 4. Decide whether the following problem can be solved using precalculus, or whether calculus is required. If the problem can be solved using precalculus, solve it. If the problem seems to require calculus, use a graphical or numerical approach to estimate the solution.

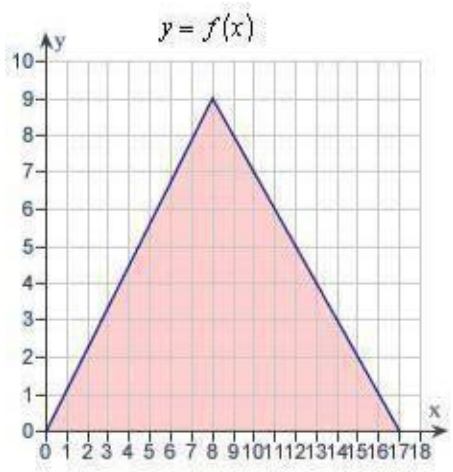
A cyclist is riding on a path whose elevation is modeled by the function $f(x) = 0.2x$ where x and $f(x)$ are measured in miles. Find the rate of change of elevation when $x = 5$.



a. calculus, 2
b. precalculus, 0.2
c. calculus, 0.2
d. precalculus, 2
e. precalculus, 0.45

____ 5. Decide whether the following problem can be solved using precalculus, or whether calculus is required. If the problem can be solved using precalculus, solve it. If the problem seems to require calculus, use a graphical or numerical approach to estimate the solution.

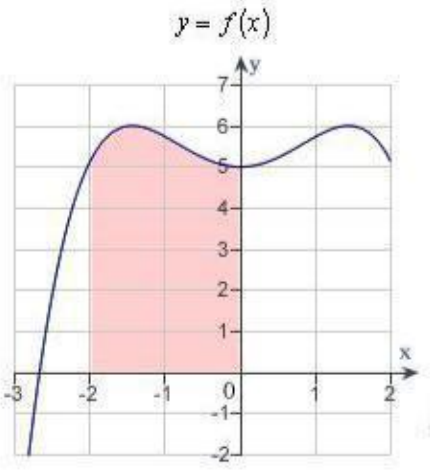
Find the area of the shaded region bounded by the triangle with vertices (0,0), (8,9), (17,0).



a. precalculus , 153
b. calculus , 229.5
c. precalculus , 76.5
d. precalculus , 229.5
e. calculus , 153

____ 6. Decide whether the following problem can be solved using precalculus, or whether calculus is required. If the problem can be solved using precalculus, solve it. If the problem seems to require calculus, use a graphical or numerical approach to estimate the solution.

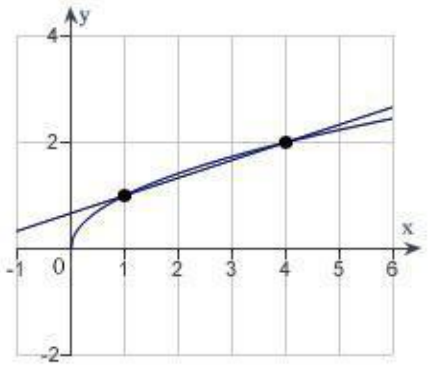
Find the area of the shaded region.



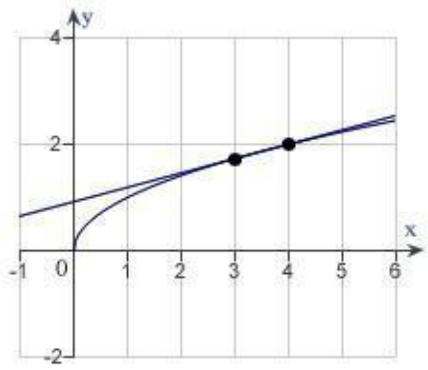
a. calculus , 11
b. precalculus , 11
c. precalculus , 13
d. calculus , 16
e. precalculus , 16

____ 7. Consider the function $f(x) = \sqrt{x}$ and the point $P(4, 2)$ on the graph of *f*. Graph *f* and the secant line passing through $P(4, 2)$ and $Q\left(x, f(x)\right)$ for $x = 3$

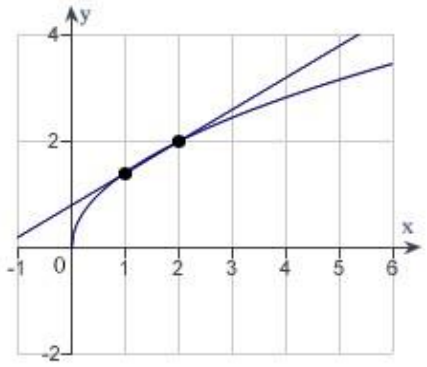
a.



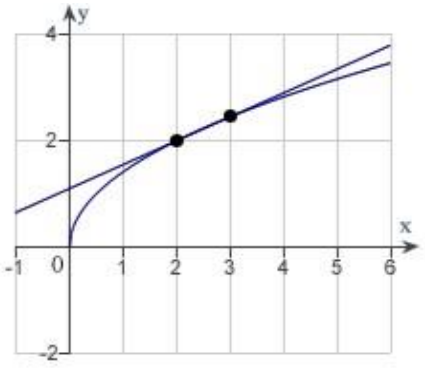
d.



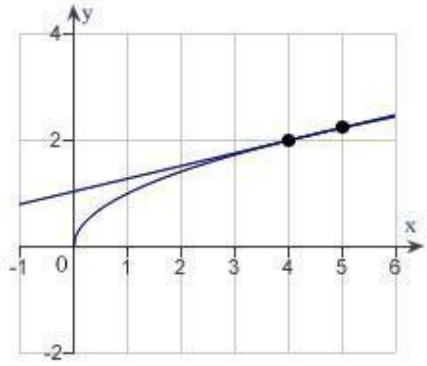
b.



e.



c.



____ 8. Consider the function $f(x) = \sqrt{x}$ and the point $P(81, 9)$ on the graph of *f*. Find the slope of the secant line passing through $P(81, 9)$ and $Q\left(x, f(x)\right)$ for $x = 1$. Round your answer to four decimal places.

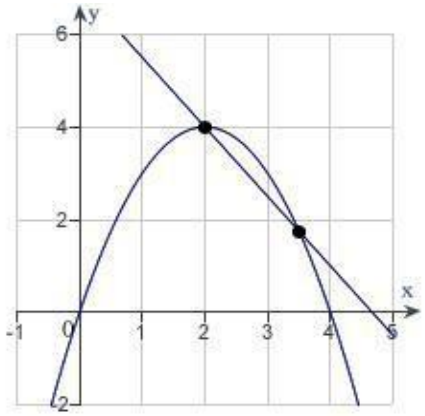
a. m=0.1000
b. m=0.0122
c. m=0.0122
d. m=0.3133
e. m=0.1000

____ 9. Consider the function $f(x) = \sqrt{x}$ and the point $P(9, 3)$ on the graph of *f*. Estimate the slope *m* of the tangent line of *f* at $P(9, 3)$. Round your answer to four decimal places.

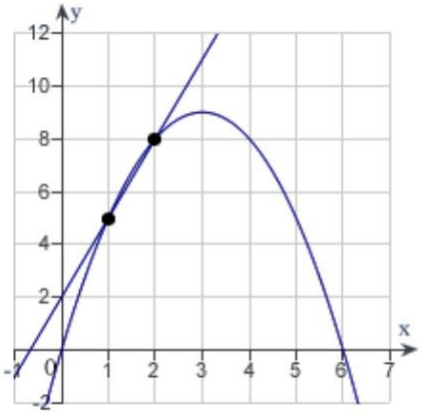
a. m=0.1667
b. m=0.0832
c. m=0.3800
d. m=0.0556
e. m=0.0833

____ 10. Consider the function Graph $ff(x) = 6x - x^2$ and the point on the graph of *f*. and the secant line passing through $P(2,8)$ and $Q(x,f(x))$ for $x = 3$.

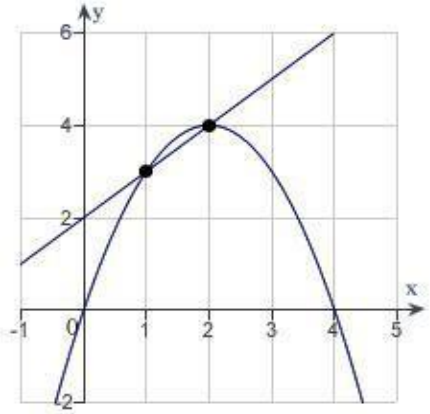
a.



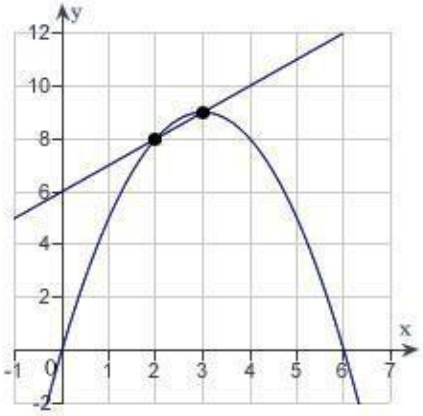
b.



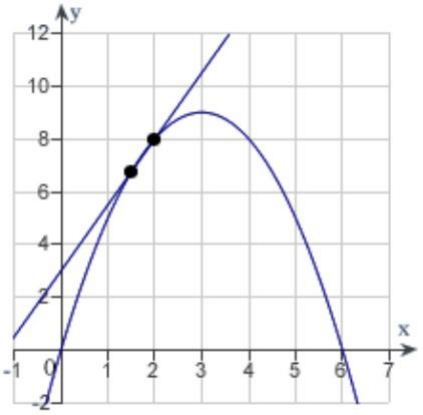
c.



d.



e.



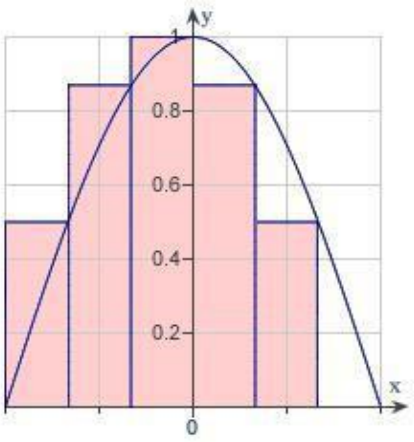
____ 11. Consider the function $f(x) = 11x - x^2$ and the point $P(4, 28)$ on the graph of *f*. Find the slope of the secant line passing through $P(4, 28)$ and ' for $x = 5$. Round your answer to one decimal place.

a. 3.5
b. 2.0
c. 3.0
d. 4.5
e. 9.0

____ 12. Consider the function $f(x) = 8x - x^2$ and the point $P(3, 15)$ on the graph of *f*. Estimate the slope of the tangent line of *f* at $P(3, 15)$.

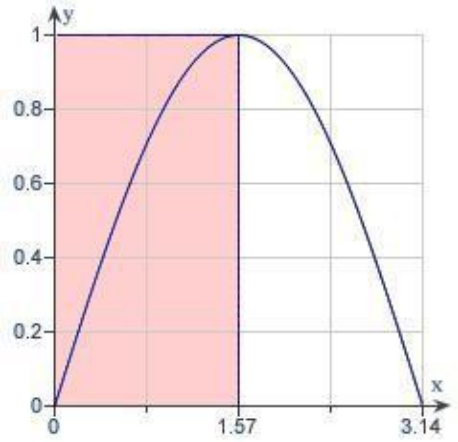
a. 10
b. 3
c. 8
d. 2
e. 9

____ 13. Use the rectangles in the following graph to approximate the area of the region bounded by $y = \cos x, y = 0, x = -\frac{\pi}{2}$, and $x = \frac{\pi}{2}$.



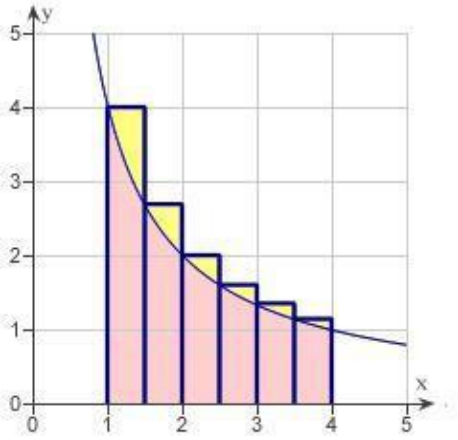
a. 3.9082
b. 2.6055
c. 1.9541
d. 1.4656
e. 0.9770

____ 14. Use the rectangles in the following graph to approximate the area of the region bounded by $y = \sin x, y = 0, x = 0,$ and $x = \pi$.



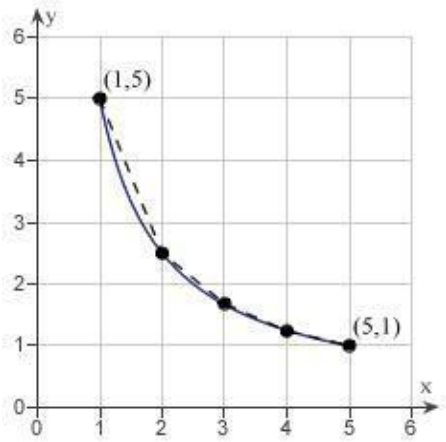
a. 0.7850
b. 1.5700
c. 3.1400
d. 1.1775
e. 1.0519

____ 15. Use the rectangles in the graph given below to approximate the area of the region bounded by $y = 4 / x, y = 0, x = 1,$ and $x = 4$ Round your answer to three decimal places.



a. 2.481 units^2
b. 6.371 units^2
c. 3.585 units^2
d. 6.872 units^2
e. 6.903 units^2

____ 16. Consider the length of the graph of $f(x) = 5/x$ from $(1,5)$ to $(5,1)$. Approximate the length of the curve by finding the sum of the lengths of four line segments, as shown in following figure. Round your answer to two decimal places.



a. 6.11
b. 8.12
c. 5.66
d. 8.49
e. 7.11

2.1 A Preview of Calculus
Answer Section

1.	ANS:	C	PTS:	1	DIF:	Easy	REF:	Section 2.1
OBJ:	Recognize problems requiring precalculus and find the solution						MSC:	Skill
2.	ANS:	C	PTS:	1	DIF:	Med	REF:	Section 2.1
OBJ:	Recognize problems requiring calculus and estimate solutions						MSC:	Skill
3.	ANS:	C	PTS:	1	DIF:	Med	REF:	Section 2.1
OBJ:	Recognize problems requiring calculus and estimate solutions						MSC:	Skill
4.	ANS:	B	PTS:	1	DIF:	Easy	REF:	Section 2.1
OBJ:	Recognize problems requiring precalculus and find the solution						MSC:	Skill
5.	ANS:	C	PTS:	1	DIF:	Easy	REF:	Section 2.1
OBJ:	Recognize problems requiring precalculus and find the solution						MSC:	Skill
6.	ANS:	A	PTS:	1	DIF:	Med	REF:	Section 2.1
OBJ:	Recognize problems requiring calculus and estimate solution						MSC:	Skill
7.	ANS:	D	PTS:	1	DIF:	Easy	REF:	Section 2.1
OBJ:	Graph a function and the secant line passing through given points						MSC:	Skill
8.	ANS:	A	PTS:	1	DIF:	Easy	REF:	Section 2.1
OBJ:	Calculate the slope of a secant line passing through given points						MSC:	Skill
9.	ANS:	A	PTS:	1	DIF:	Med	REF:	Section 2.1
OBJ:	Estimate the slope of a tangent line						MSC:	Skill
10.	ANS:	D	PTS:	1	DIF:	Easy	REF:	Section 2.1
OBJ:	Graph a function and the secant line passing through given points						MSC:	Skill
11.	ANS:	B	PTS:	1	DIF:	Easy	REF:	Section 2.1
OBJ:	Calculate the slope of a secant line passing through given points						MSC:	Skill
12.	ANS:	D	PTS:	1	DIF:	Med	REF:	Section 2.1
OBJ:	Calculate the slope of secant line passing through the given points						MSC:	Skill
13.	ANS:	C	PTS:	1	DIF:	Med	REF:	Section 2.1
OBJ:	Estimate the area of a region using rectangles						MSC:	Skill
14.	ANS:	B	PTS:	1	DIF:	Med	REF:	Section 2.1
OBJ:	Estimate the area of a region using rectangles						MSC:	Skill
15.	ANS:	B	PTS:	1	DIF:	Med	REF:	Section 2.1
OBJ:	Estimate the area of a region using rectangles						MSC:	Skill
16.	ANS:	A	PTS:	1	DIF:	Med	REF:	Section 2.1
OBJ:	Estimate the length of the curve using a piecewise linear function						MSC:	Skill

2.2 Finding Limits Graphically and Numerically

Multiple Choice

Identify the choice that best completes the statement or answers the question.

____ 1. Complete the table and use the result to estimate the limit.

$$\lim_{x \to 3} \frac{x-3}{x^2 - 16x + 39}$$

x	2. 9	2.99	2.999	3.001	3.01	3. 1
$f(x)$						

a. 0.525000
b. 0.275000
c. –0.100000
d. 0.400000
e. –0.475000

____ 2. Complete the table and use the result to estimate the limit.

$$\lim_{x \to 7} \frac{\frac{1}{x-3} - \frac{1}{4}}{x-7}$$

x	6. 9	6.99	6.999	7.001	7.01	7. 1
$f(x)$						

a. –0.062500
b. 0.067500
c. –0.192500
d. 0.047500
e. –0.172500

____ 3. Complete the table and use the result to estimate the limit.

$$\lim_{x \to -10} \frac{\sqrt{-6x - 54} - \sqrt{6}}{x + 10}$$

x	–10.1	–10.01	–10.001	–9.999	–9.99	–9.9
$f(x)$						

a. 0.974745
b. –1.099745
c. –1.224745
d. 1.058078
e. 1.224745

____ 4. Complete the table and use the result to estimate the limit.

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

x	–0.1	–0.01	–0.001	0.001	0.01	0. 1
$f(x)$						

a. -0.5
b. 0
c. 1
d. 0.5
e. -1

____ 5. Complete the table and use the result to estimate the limit.

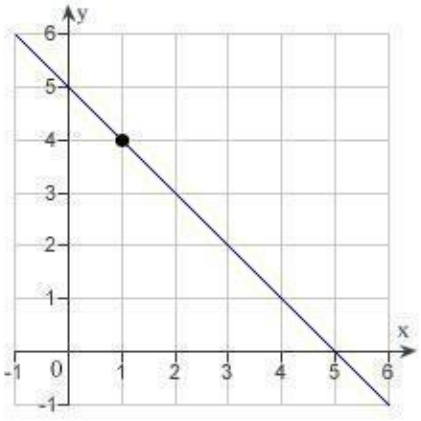
$$\lim_{x \to 0} \frac{\cos(3x) - 1}{3x}$$

x	–0.1	–0.01	–0.001	0.001	0.01	0. 1
$f(x)$						

a. -1
b. -0.5
c. 0
d. 0.5
e. 1

____ 6. Determine the following limit. (Hint: Use the graph to calculate the limit.)

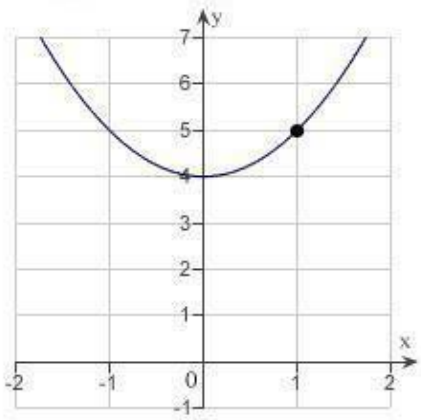
$\lim_{x \to 1} (5 - x)$



a. 6
b. 1
c. 5
d. 4
e. does not exist

____ 7. Determine the following limit. (Hint: Use the graph to calculate the limit.)

$\lim_{x \to 1} \left(x^2 + 4 \right)$

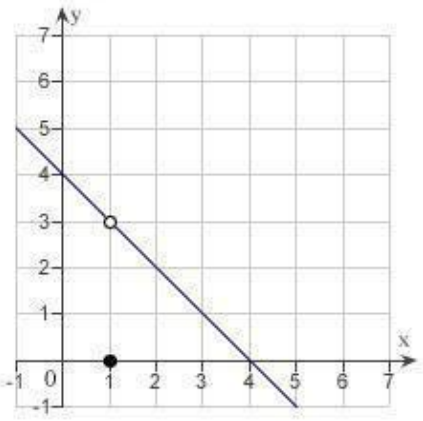


a. 5
b. 1
c. 0
d. 4
e. does not exist

____ 8. Let $f(x) = \begin{cases} 4 - x, & x \neq 1 \\ 0, & x = 1 \end{cases}$.

Determine the following limit. (Hint: Use the graph to calculate the limit.)

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

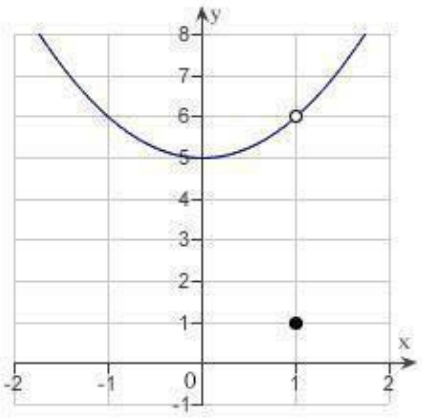


a. 5
b. 4
c. 3
d. 0
e. does not exist

____ 9. Let $f(x) = \begin{cases} x^2 + 5, & x \neq 1 \\ 1, & x = 1 \end{cases}$.

Determine the following limit. (Hint: Use the graph to calculate the limit.)

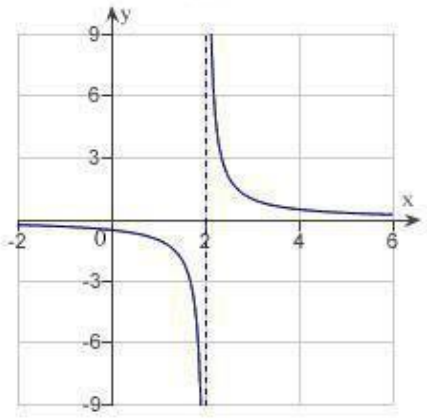
$\lim_{x \to 1} f(x)$



a. 6
b. 25
c. 1
d. 5
e. does not exist.

____ 10. Determine the following limit. (Hint: Use the graph to calculate the limit.)

$\lim_{x \to 2} \frac{1}{x - 2}$



a. –2
b. 0
c. –4
d. 2
e. does not exist

____ 11. A ring has a inner circumference of 10 centimeters. What is the radius of the ring? Round your answer to four decimal places.

a. 0.7958 centimeter b.
3.1831 centimeters c.
1.5915 centimeters d.
1.7841 centimeters e.
10.1321 centimeters

____ 12. A ring has a inner circumference of 9 centimeters. If the ring's inner circumference can vary between 8 centimeters and 10 centimeters how can the radius vary? Round your answer to five decimal places.

a. Radius can vary between 6.48456 centimeters and 10.13212 centimeters.
b. Radius can vary between 1.59577 centimeters and 1.78412 centimeters.
c. Radius can vary between 1.27324 centimeters and 1.59155 centimeters.
d. Radius can vary between 2.54648 centimeters and 3.18310 centimeters.
e. Radius can vary between 0.43239 centimeter and 2.43239 centimeters.

____ 13. A sphere has a volume of 4.76 cubic inches. What is the radius of the sphere? Round your answer to four decimal places.

a. 1.0435 inches
b. 1.6565 inches
c. 1.0660 inches
d. 2.1320 inches
e. 1.9335 inches

____ 14. A sphere has a volume of 5.2 cubic inches. If the sphere's volume can vary between 4.4 cubic inches and 6.1 cubic inches , how can the radius vary? Round your answer to five decimal places.

a. Radius can vary between 1.01653 inches and 1.13348 inches.
b. Radius can vary between 1.61365 inches and 1.79929 inches.
c. Radius can vary between 0.27474 inch and 1.97474 inches.
d. Radius can vary between 1.85897 inches and 2.18882 inches.
e. Radius can vary between 1.02490 inches and 1.20676 inches.

2.2 Finding Limits Graphically and Numerically

Answer Section

1.	ANS:	C	PTS:	1	DIF:	Med	REF:	Section 2.1
OBJ:	Estimate a limit from a table of values						MSC:	Skill
2.	ANS:	A	PTS:	1	DIF:	Med	REF:	Section 2.1
OBJ:	Estimate a limit from a table of values						MSC:	Skill
3.	ANS:	C	PTS:	1	DIF:	Med	REF:	Section 2.1
OBJ:	Estimate a limit from a table of values						MSC:	Skill
4.	ANS:	C	PTS:	1	DIF:	Med	REF:	Section 2.1
OBJ:	Estimate a limit from a table of values						MSC:	Skill
5.	ANS:	C	PTS:	1	DIF:	Med	REF:	Section 2.1
OBJ:	Estimate a limit from a table of values						MSC:	Skill
6.	ANS:	D	PTS:	1	DIF:	Easy	REF:	Section 2.1
OBJ:	Estimate the limit of a function from its graph						MSC:	Skill
7.	ANS:	A	PTS:	1	DIF:	Med	REF:	Section 2.1
OBJ:	Estimate the limit of a function from its graph						MSC:	Skill
8.	ANS:	C	PTS:	1	DIF:	Med	REF:	Section 2.1
OBJ:	Estimate the limit of a function from its graph						MSC:	Skill
9.	ANS:	A	PTS:	1	DIF:	Med	REF:	Section 2.1
OBJ:	Estimate the limit of a function from its graph						MSC:	Skill
10.	ANS:	E	PTS:	1	DIF:	Med	REF:	Section 2.1
OBJ:	Estimate the limit of a function from its graph						MSC:	Skill
11.	ANS:	C	PTS:	1	DIF:	Easy	REF:	Section 2.1
OBJ:	Solve a linear equation in applications						MSC:	Application
12.	ANS:	C	PTS:	1	DIF:	Med	REF:	Section 2.1
OBJ:	Solve a linear equation in applications						MSC:	Application
13.	ANS:	A	PTS:	1	DIF:	Easy	REF:	Section 2.1
OBJ:	Solve a cubic equation in applications						MSC:	Application
14.	ANS:	A	PTS:	1	DIF:	Med	REF:	Section 2.1
OBJ:	Solve a linear equation in applications						MSC:	Application

2.3 Evaluating Limits Analytically

Multiple Choice

Identify the choice that best completes the statement or answers the question.

____ 1. Find the limit.

$$\lim_{x \to -4} 9x^2 + 36x$$

a. 108
b. −108
c. 288
d. −288
e. 0

____ 2. Find the limit.

$$\lim_{x \to 6} \frac{x}{x^2 + 8}$$

a. $\frac{1}{14}$
b. $\frac{1}{10}$
c. $\frac{3}{22}$
d. $\frac{3}{7}$
e. $\frac{3}{10}$

____ 3. Find the limit.

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

a. 3
b. −1
c. −3
d. 1
e. 9

____ 4. Find the limit.

$$\lim_{x \to \frac{3\pi}{4}} \sin x$$

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

____ 5. Find the limit.

$$\lim_{x \to 2} \cos \frac{\pi x}{3}$$

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

____ 6. Find the limit.

$$\lim_{x \to 5} \cos\left(\frac{\pi x}{6}\right)$$

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

____ 7. Find the lmit.

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

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

____ 8. Let $f(x) = -x^2 - 5$ and $g(x) = 2x$. Find the limit.

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

a. –18
b. 25
c. 21
d. 8
e. 9

____ 9. Let $f(x) = 4x - 2$ and $g(x) = x^3$. Find the limit.

$\lim_{x \to 1} g(f(x))$

a. 2
b. 1
c. 8
d. –8
e. −4

____ 10. Let $f(x) = 3 + 2x^2$ and $g(x) = \sqrt{x+3}$. Find the limit.

$\lim_{x \to 2} g(f(x))$

a. $\sqrt{6}$
b. $\sqrt{14}$
c. $\sqrt{11}$
d. $\sqrt{10}$
e. $\sqrt{2}$

____ 11. Let $f(x) = x^2 - x - 5$ and $g(x) = \sqrt[3]{x + 14}$. Find the limits.

$$\lim_{x \to 3} g\big(f(x)\big)$$

a. $-\sqrt[3]{1}$
b. $\sqrt[3]{29}$
c. $-\sqrt[3]{15}$
d. $\sqrt[3]{15}$
e. $\sqrt[3]{1}$

____ 12. Suppose that $\lim_{x \to c} f(x) = -13$ and $\lim_{x \to c} g(x) = -10$. Find the following limit.

$$\lim_{x \to c} \big[f(x) + g(x)\big]$$

a. 0
b. –10
c. –3
d. –23
e. 130

____ 13. Suppose that $\lim_{x \to c} f(x) = -15$ and $\lim_{x \to c} g(x) = -10$. Find the following limit.

$$\lim_{x \to c} \big[f(x)g(x)\big]$$

a. 10
b. –5
c. –25
d. –15
e. 150

____ 14. Suppose that $\lim_{x \to c} f(x) = 7$ and $\lim_{x \to c} g(x) = 3$. Find the following limit.

$$\lim_{x \to c} \frac{f(x)}{g(x)}$$

a. 21
b. $\frac{3}{7}$
c. –21
d. $\frac{7}{3}$
e. does not exist

____ 15. Suppose that $\lim_{x \to c} f(x) = -11$ and $\lim_{x \to c} g(x) = -3$. Find the following limit.

$$\lim_{x \to c} \left[f(x) - g(x) \right]$$

a. –11
b. –8
c. 33
d. –14
e. 0

____ 16. Suppose that $\lim_{x \to c} f(x) = 5$. Find the following limit.

$$\lim_{x \to c} \left[f(x)^3 \right]$$

a. 2
b. 125
c. 8
d. 0
e. 15

____ 17. Suppose that $\lim_{x \to c} f(x) = -5$. Find the following limit.

$$\lim_{x \to c} 3f(x)$$

a. –5
b. 15
c. –15
d. $3c$
e. 3

____ 18. Find the following limit (if it exists). Write a simpler function that agrees with the given function at all but one point.

$$\lim_{x \to -4} \frac{8x^2 + 40x + 32}{x + 4}$$

a. 40
b. –24
c. 24
d. –40
e. does not exist

____ 19. Find the limit (if it exists).

$$\lim_{x \to -8} \frac{x+8}{x^2-64}$$

a. $-\frac{1}{16}$
b. $-\frac{1}{32}$
c. -32
d. -8
e. $\frac{1}{16}$

____ 20. Find the limit (if it exists).

$$\lim_{x \to 5} \frac{\sqrt{x+4}-3}{x-5}$$

a. 6
b. 1
c. 0
d. $\frac{1}{6}$
e. Limit does not exist

____ 21. Find the limit (if it exists).

$$\lim_{\Delta x \to 0} \frac{(x+\Delta x)^2 - 9(x+\Delta x) + 2 - \left(x^2 - 9x + 2\right)}{\Delta x}$$

a. $\frac{1}{3}x^3 - \frac{9}{2}x^2 + 2x$
b. $2x - 9$
c. $x^3 - 9x^2 + 2x$
d. $x^2 - 9x + 2$
e. does not exist

____ 22. Determine the limit (if it exists).

$$\lim_{x \to 0} \frac{12(1 - \cos x)}{x^2}$$

a. 6
b. 48
c. 10
d. 24
e. does not exist

____ 23. Determine the limit (if it exists).

$$\lim_{x \to 0} \frac{\sin x(1 - \cos x)}{2x^8}$$

a. 8
b. 1
c. 0
d. 2
e. does not exist

____ 24. Determine the limit (if it exists).

$$\lim_{x \to 0} \frac{\sin^4 x}{x^3}$$

a. 1
b. 0
c. 2
d. ∞
e. does not exist

____ 25. Find $\lim_{\Delta x \to 0} \frac{f(x + \Delta x) - f(x)}{\Delta x}$ where $f(x) = 4x - 3$.

a. 1
b. 4
c. –3
d. 0
e. Limit does not exist.

2.3 Evaluating Limits Analytically
Answer Section

1. ANS: E PTS: 1 DIF: Easy REF: Section 2.3
OBJ: Evaluate a limit using properties of limits MSC: Skill
2. ANS: C PTS: 1 DIF: Easy REF: Section 2.3
OBJ: Evaluate a limit using properties of limits MSC: Skill
3. ANS: D PTS: 1 DIF: Med REF: Section 2.3
OBJ: Evaluate a limit using properties of limits MSC: Skill
4. ANS: D PTS: 1 DIF: Med REF: Section 2.3
OBJ: Evaluate a limit using properties of limits MSC: Skill
5. ANS: B PTS: 1 DIF: Easy REF: Section 2.3
OBJ: Evaluate a limit using properties of limits MSC: Skill
6. ANS: D PTS: 1 DIF: Med REF: Section 2.3
OBJ: Evaluate a limit using properties of limits MSC: Skill
7. ANS: B PTS: 1 DIF: Med REF: Section 2.3
OBJ: Evaluate the limit of the function MSC: Skill
8. ANS: A PTS: 1 DIF: Med REF: Section 2.3
OBJ: Evaluate the limit of composite functions MSC: Skill
9. ANS: C PTS: 1 DIF: Med REF: Section 2.3
OBJ: Evaluate the limit of composite functions MSC: Skill
10. ANS: B PTS: 1 DIF: Med REF: Section 2.3
OBJ: Evaluate the limit of composite functions MSC: Skill
11. ANS: D PTS: 1 DIF: Med REF: Section 2.3
OBJ: Evaluate the limit of composite functions MSC: Skill
12. ANS: D PTS: 1 DIF: Med REF: Section 2.3
OBJ: Evaluate the limit of a function using properties of limits MSC: Skill
13. ANS: E PTS: 1 DIF: Med REF: Section 2.3
OBJ: Evaluate the limit of a function using properties of limits MSC: Skill
14. ANS: D PTS: 1 DIF: Med REF: Section 2.3
OBJ: Evaluate the limit of a function using properties of limits MSC: Skill
15. ANS: B PTS: 1 DIF: Med REF: Section 2.3
OBJ: Evaluate the limit of a function using properties of limits MSC: Skill
16. ANS: B PTS: 1 DIF: Med REF: Section 2.3
OBJ: Evaluate the limit of a function using properties of limits MSC: Skill
17. ANS: C PTS: 1 DIF: Med REF: Section 2.3
OBJ: Evaluate the limit of a function using properties of limits MSC: Skill
18. ANS: B PTS: 1 DIF: Med REF: Section 2.3
OBJ: Evaluate the limit of the function and simplify it to an identical function except at the discontinuity point MSC: Skill
19. ANS: A PTS: 1 DIF: Med REF: Section 2.3
OBJ: Evaluate the limit of a function analytically MSC: Skill
20. ANS: D PTS: 1 DIF: Med REF: Section 2.3
OBJ: Evaluate the limit of a function analytically MSC: Skill
21. ANS: B PTS: 1 DIF: Med REF: Section 2.3
OBJ: Evaluate the limit of a function analytically MSC: Skill
22. ANS: A PTS: 1 DIF: Med REF: Section 2.3
OBJ: Evaluate the limit of a function analytically MSC: Skill

23. ANS: E PTS: 1 DIF: Med REF: Section 2.3
OBJ: Evaluate the limit of a function analytically MSC: Skill
24. ANS: B PTS: 1 DIF: Med REF: Section 2.3
OBJ: Evaluate the limit of a function analytically MSC: Skill
25. ANS: B PTS: 1 DIF: Med REF: Section 2.3
OBJ: Evaluate the limit of a difference quotient MSC: Skill

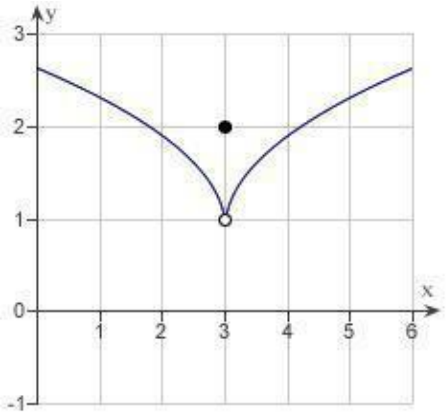
2.4 Continuity and One-Sided Limits

Multiple Choice

Identify the choice that best completes the statement or answers the question.

____ 1. Use the graph as shown to determine the following limits, and discuss the continuity of the function at $x = 3$.

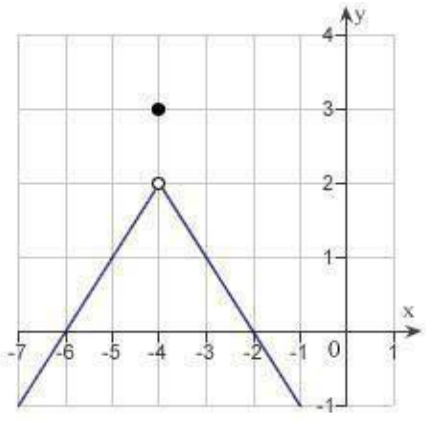
(i) (ii) $\lim_{x \to 3^-} f(x)$ (iii) $\lim_{x \to 3} f(x)$



a. 1 , 1 , 1 , not continuous
b. 2,2,2, continuous
c. 4 , 4 , 4 , not continuous
d. 2,2,2, not continuous
e. 1 , 1 , 1 , continuous

____ 2. Use the graph as shown to determine the following limits, and discuss the continuity of the function at $x = -4$.

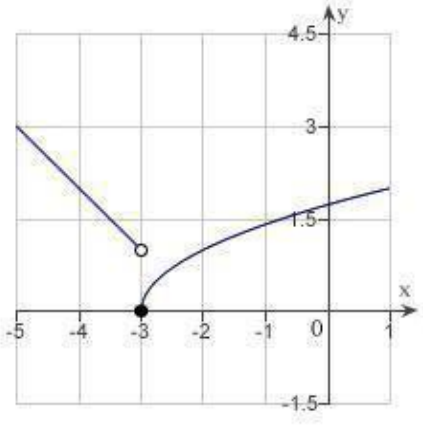
(i) $\lim_{x \to -4} f(x)$ (ii) $\lim_{x \to -4^-} f(x)$ (iii) $\lim_{x \to -4^+} f(x)$



a. 3, 3, 3, continuous
b. 2, 2, 2, not continuous
c. 3, 3, 3, not continuous
d. $-4, -4, -4$, continuous
e. 2, 2, 2, continuous

____ 3. Use the graph to determine the following limits, and discuss the continuity of the function $x = -3$.

at (i) (ii) (iii)



a. 1, − 1, does not exist, not continuous
b. 1, 0, does not exist, not continuous
c. 0, 1, does not exist, not continuous
d. −3, 0, does not exist, not continuous
e. 0, 1, 0, continuous

____ 4. Find the limit (if it exists).

$$\lim_{x \to 11^+} \frac{11 - x}{x^2 - 121}$$

a. $\frac{1}{22}$
b. 0
c. Limit does not exist.
d. $-\frac{1}{22}$
e. $\frac{1}{242}$

____ 5. Find the limit (if it exists).

$$\lim_{x \to 36^-} \frac{\sqrt{x} - 6}{x - 36}$$

a. 0
b. $-\frac{1}{12}$
c. $\frac{1}{72}$
d. $\frac{1}{12}$
e. Limit does not exist.

____ 6. Find the limit (if it exists).

$$\lim_{x \to 1^-} f(x), \text{ where } f(x) = \begin{cases} x^3 + 10, & x < 1 \\ x + 10, & x \geq 1 \end{cases}$$

a. Limit does not exist.
b. 0
c. 10
d. 11
e. 30

____ 7. Find the limit (if it exists). Note that $f(x) = \left[|x| \right]$ represents the greatest integer function.

$$\lim_{x \to -6^+} \left(-3\left[|x| \right] - 8 \right)$$

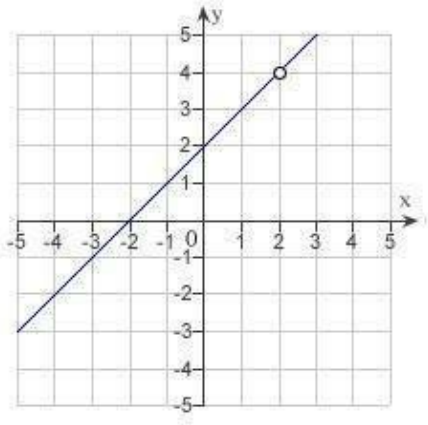
a. 13
b. -10
c. 10
d. -13
e. does not exist

____ 8. Find the limit (if it exists). Note that $f(x) = \left[|x| \right]$ represents the greatest integer function.

$$\lim_{x \to 5^+} \left(2x - \left[|x| \right] \right)$$

a. 6
b. Limit does not exist.
c. 5
d. 0
e. 4

____ 9. Discuss the continuity of the function $f(x) = \dfrac{x^2 - 4}{x - 2}$.



a. $f(x)$ is discontinuous at $x = -2$.
b. $f(x)$ is discontinuous at $x = -2, 2$.
c. $f(x)$ is discontinuous at $x = 2$.
d. $f(x)$ is continuous for all real x.
e. $f(x)$ is continuous at $x = 4$.

____ 10. Find the *x*-values (if any) at which the function $f(x) = 13x^2 - 15x - 15$ is not continuous. Which of the discontinuities are removable?

a. $x = 4$, removable
b. $x = 0$, removable
c. $x = \dfrac{15}{26}$, not removable.
d. continuous everywhere
e. $x = \dfrac{15}{26}$, removable.

____ 11. Find the *x*-values (if any) at which $f(x) = \dfrac{x}{x^2 - 2x}$ is not continuous.

a. $f(x)$ is not continuous at $x = 0$ and $f(x)$ has a removable discontinuity at $x = 0$.
b. $f(x)$ is not continuous at $x = 0, 2$ and both the discontinuities are nonremovable.
c. $f(x)$ is not continuous at $x = 2$ and $f(x)$ has a removable discontinuity at $x = 2$.
d. $f(x)$ is not continuous at $x = 0, 2$ and $f(x)$ has a removable discontinuity at $x = 0$.
e. $f(x)$ is continuous for all real x.

____ 12. Find the *x*-values (if any) at which the function $f(x) = \dfrac{x}{x^2 - 100}$ is not continuous.

Which of the discontinuities are removable?

a. 10 and -10, removable
b. discontinuous everywhere
c. continuous everywhere
d. 10 and -10, not removable
e. 0, removable

____ 13. Find the *x*-values (if any) at which the function $f(x) = \dfrac{x+2}{x^2 + 6x + 8}$ is not continuous.

Which of the discontinuities are removable?

a. no points of discontinuity
b. $x = -2$ (not removable), $x = -4$ (removable)
c. $x = -2$ (removable), $x = -4$ (not removable)
d. no points of continuity
e. $x = -2$ (not removable), $x = -4$ (not removable)

____ 14. Find the *x*-values (if any) at which $f(x) = \dfrac{|x-3|}{x-3}$ is not continuous.

a. $f(x)$ is not continuous at $x = 3$ and the discontinuity is nonremovable.
b. $f(x)$ is not continuous at $x = 0$ and the discontinuity is removable.
c. $f(x)$ is continuous for all real x.
d. $f(x)$ is not continuous at $x = 3$ and the discontinuity is removable.
e. $f(x)$ is not continuous at $x = 0, -3$ and $x = 0$ is a removable discontinuity.

____ 15. Find the constant *a* such that the function

$$f(x) = \begin{cases} -4 \cdot \dfrac{\sin x}{x}, & x < 0 \\ a + 7x, & x \geq 0 \end{cases}$$

is continuous on the entire real line.

a. 1
b. -7
c. 7
d. 4
e. -4

____ 16. Find the constant *a* such that the function

$$f(x) = \begin{cases} 6, & x \leq -5 \\ ax + b, & -5 < x < 1 \\ -6, & x \geq 1 \end{cases}$$

is continuous on the entire real line.

a. $a = 2, b = 0$
b. $a = 2, b = -4$
c. $a = -2, b = -4$
d. $a = -2, b = 4$
e. $a = 2, b = 4$

____ 17. Find the value of *c* guaranteed by the Intermediate Value Theorem.

$f(x) = x^2 - 2x + 8, [2, 6], f(c) = 11$

a. 0
b. 3
c. 5
d. 1
e. 4

____ 18. Find the value of c guaranteed by the Intermediate Value Theorem.

$$f(x) = \frac{x^2 - 5x}{x - 3}, \left[\frac{9}{2}, 18\right], f(c) = 6$$

a. 11
b. 2
c. 1
d. 9
e. 10

____ 19. A long distance phone service charges $0.35 for the first 10 minutes and $0.1 for each additional minute or fraction thereof. Use the greatest integer function to write the cost C of a call in terms of time t (in minutes).

a.
$$C = \begin{cases} 0.35 & 0 < t \le 10 \\ 0.35 + 0.1\left[\left|t - 10\right|\right] & t > 10, t \text{ is not an integer} \\ 0.35 + 0.1(t - 9) & t > 10, t \text{ is an integer} \end{cases}$$

b.
$$C = \begin{cases} 0.35 & 0 < t \le 10 \\ 0.35 + 0.1(t - 10) & t > 10 \end{cases}$$

c.
$$C = \begin{cases} 0.35 & 0 < t \le 10 \\ 0.35 + 0.1\left[\left|t - 9\right|\right] & t > 10 \end{cases}$$

d.
$$C = \begin{cases} 0.35 & 0 < t \le 10 \\ 0.35 + 0.1\left[\left|t - 10\right|\right] & t > 10 \end{cases}$$

e.
$$C = \begin{cases} 0.35 & 0 < t \le 10 \\ 0.35 + 0.1\left[\left|t - 9\right|\right] & t > 10, t \text{ is not an integer} \\ 0.35 + 0.1(t - 10) & t > 10, t \text{ is an integer} \end{cases}$$

____ 20. Find all values of *c* such that f is continuous on $(-\infty, \infty)$.

$$f(x) = \begin{cases} 4 - x^2, & x \le c \\ x, & x > c \end{cases}$$

a. $c = 3$
b. $c = 0$
c. $\dfrac{-1 + \sqrt{17}}{2}$
d. $\dfrac{1 + \sqrt{17}}{2}, \dfrac{1 - \sqrt{17}}{2}$
e. $\dfrac{-1 + \sqrt{17}}{2}, \dfrac{-1 - \sqrt{17}}{2}$

2.4 Continuity and One-Sided Limits
Answer Section

1. ANS: A PTS: 1 DIF: Med REF: Section 2.4
OBJ: Estimate a limit and points of discontinuity from a graph MSC: Skill
2. ANS: B PTS: 1 DIF: Med REF: Section 2.4
OBJ: Estimate a limit and points of discontinuity from a graph MSC: Skill
3. ANS: C PTS: 1 DIF: Med REF: Section 2.4
OBJ: Estimate a limit and points of discontinuity from a graph MSC: Skill
4. ANS: D PTS: 1 DIF: Easy REF: Section 2.4
OBJ: Evaluate one-sided limits MSC: Skill
5. ANS: D PTS: 1 DIF: Med REF: Section 2.4
OBJ: Evaluate one-sided limits MSC: Skill
6. ANS: D PTS: 1 DIF: Med REF: Section 2.4
OBJ: Evaluate one-sided limits MSC: Skill
7. ANS: A PTS: 1 DIF: Med REF: Section 2.4
OBJ: Evaluate one-sided limits MSC: Skill
8. ANS: C PTS: 1 DIF: Med REF: Section 2.4
OBJ: Evaluate one-sided limits MSC: Skill
9. ANS: C PTS: 1 DIF: Easy REF: Section 2.4
OBJ: Identify the discontinuities of a function if any exist MSC: Skill
10. ANS: D PTS: 1 DIF: Med REF: Section 2.4
OBJ: Identify the removable discontinuities of a function MSC: Skill
11. ANS: D PTS: 1 DIF: Easy REF: Section 2.4
OBJ: Identify the removable discontinuities of a function MSC: Skill
12. ANS: D PTS: 1 DIF: Med REF: Section 2.4
OBJ: Identify the removable discontinuities of a function MSC: Skill
13. ANS: C PTS: 1 DIF: Med REF: Section 2.4
OBJ: Identify the removable discontinuities of a function MSC: Skill
14. ANS: A PTS: 1 DIF: Med REF: Section 2.4
OBJ: Identify the removable discontinuities of a function MSC: Skill
15. ANS: E PTS: 1 DIF: Med REF: Section 2.4
OBJ: Identify the value of a parameter to ensure a function is continuous MSC: Skill
16. ANS: C PTS: 1 DIF: Med REF: Section 2.4
OBJ: Identify the value of a parameter to ensure a function is continuous MSC: Skill
17. ANS: B PTS: 1 DIF: Easy REF: Section 2.4
OBJ: Identify the value of c guaranteed by the Intermediate Value Theorem MSC: Skill
18. ANS: D PTS: 1 DIF: Med REF: Section 2.4
OBJ: Identify the value of c guaranteed by the Intermediate Value Theorem MSC: Skill
19. ANS: E PTS: 1 DIF: Med REF: Section 2.4
OBJ: Create functions in applications MSC: pplication
20. ANS: E PTS: 1 DIF: Med REF: Section 2.4
OBJ: Identify the value of a parameter to ensure a function is continuous MSC: Skill

2.5 Infinite Limits

Multiple Choice

Identify the choice that best completes the statement or answers the question.

____ 1. Determine whether $f(x) = \dfrac{x^{10}}{x^2 - 9}$ approaches ∞ or $-\infty$ as x approaches -3 from the left and from the right by completing the tables below.

x	-3.5	–3.1	–3.01	–3.001
$f(x)$				

x	–2.999	–2.99	–2.9	–2.5

a. $\lim_{x \to -3^-} f(x) = -\infty, \lim_{x \to -3^+} f(x) = \infty$

b. $\lim_{x \to -3^-} f(x) = \infty, \lim_{x \to -3^+} f(x) = -\infty$

c. $\lim_{x \to -3^-} f(x) = \infty, \lim_{x \to -3^+} f(x) = \infty$

d. $\lim_{x \to -3^-} f(x) = -\infty, \lim_{x \to -3^+} f(x) = -\infty$

____ 2. Find all the vertical asymptotes (if any) of the graph of the function $f(x) = \dfrac{5}{(x-3)^2}$.

a. $x = -3$
b. $x = 5$
c. $x = 3, -3$
d. $x = 3$
e. no vertical asymptotes

____ 3. Find the vertical asymptotes (if any) of the function $f(x) = \dfrac{x^2 - 4}{x^2 + 3x + 2}$.

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

____ 4. Find all the vertical asymptotes (if any) of the graph of the function $f(x) = \dfrac{1+x}{x^2(1-x)}$.

a. $x = -1$
b. $x = 1$
c. $x = 0$
d. $x = 1,\ x = 0$
e. no vertical asymptotes

____ 5. Find all the vertical asymptotes (if any) of the graph of the function $f(x) = \dfrac{x^3+8}{x+2}$.

a. $x = -2$
b. $x = 8$
c. $x = 2$
d. $x = 2, -2$
e. no vertical asymptotes

____ 6. Find all vertical asymptotes (if any) of the function $f(x) = \dfrac{x^2+4x+3}{x^3-4x^2-x+4}$.

a. $x = 4, 1$
b. $x = 4,\ 1,\ -1$
c. $x = -4, -1$
d. $x = 1$
e. $x = -1$

____ 7. Find the vertical asymptotes (if any) of the function $f(x) = \tan(15x)$.

a. $x = \dfrac{k}{15}\pi \quad \left(k = 0, \pm 1,\ \pm 2, \ldots\right)$
b. $x = \dfrac{2k+1}{30}\pi \quad \left(k = 0, \pm 1,\ \pm 2, \ldots\right)$
c. $x = \dfrac{2k}{15}\pi \quad \left(k = 0, \pm 1,\ \pm 2, \ldots\right)$
d. $x = \dfrac{2k+1}{15}\pi \quad \left(k = 0, \pm 1, \pm 2, \ldots\right)$
e. no vertical asymptotes

____ 8. Find the limit.

$$\lim_{x \to 14^+} \frac{x-3}{x-14}$$

a. 1
b. $-\infty$
c. 0
d. ∞
e. -1

____ 9. Find the limit.

$$\lim_{x \to -10} \frac{x^2 + 10x}{\left(x^2 + 100\right)(x+10)}$$

a. $\frac{1}{20}$
b. $-\frac{1}{20}$
c. 20
d. -10
e. -20

____ 10. Find the limit.

$$\lim_{x \to 0^-} \left(x^2 - \frac{1}{x}\right)$$

a. 1
b. 0
c. -1
d. $-\infty$
e. ∞

____ 11. Find the following limit if it exists: $\lim_{x \to 3^+} \ln(x-3)$. Use $\pm\infty$ when appropriate.

a. ∞
b. 3
c. 1
d. $-\infty$
e. does not exist

____ 12. Find the limit (if it exists).

$$\lim_{x \to \frac{1}{2}} x \tan \pi x$$

a. $-\infty$
b. $\frac{1}{2}$
c. 0
d. ∞
e. Limit does not exist

____ 13. Use a graphing utility to graph the function $f(x) = \dfrac{x^2 - 2x + 4}{x^3 + 8}$ and determine the one-sided limit $\lim_{x \to -2^+} f(x)$.

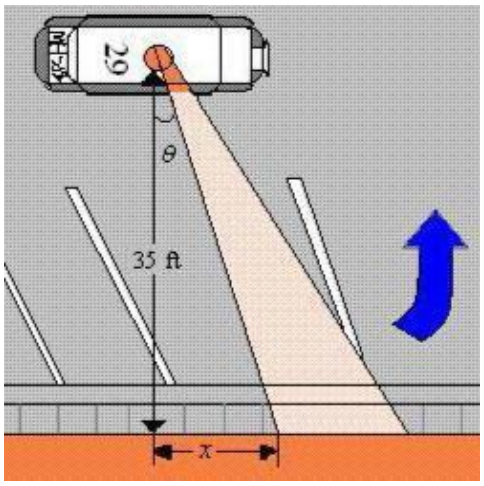
a. $-\infty$
b. ∞
c. 0
d. 12
e. 8

____ 14. Use a graphing utility to graph the function $f(x) = \csc \dfrac{\pi x}{2}$ and determine the following one-sided limit.

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

a. $-\infty$
b. 2
c. -2
d. ∞
e. 0

____ 15. A petrol car is parked 35 feet from a long warehouse (see figure). The revolving light on top of the car turns at a rate of $\frac{1}{2}$ revolution per second. The rate at which the light beam moves along the wall is $r = 35\pi \sec^2 \theta$ ft/sec. Find the rate r when θ is $\frac{\pi}{6}$.



a. $r = \frac{140}{3}$ ft / sec

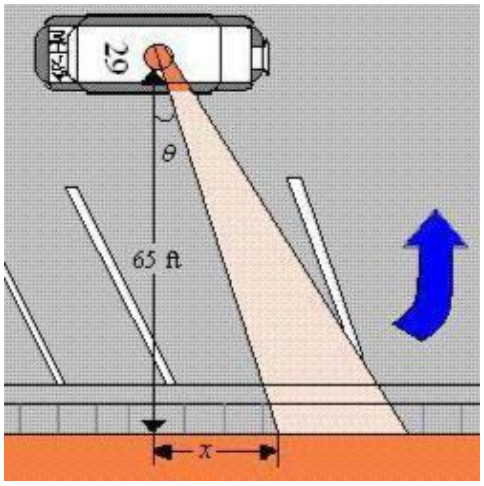
b. $r = \frac{70\sqrt{3}\,\pi}{3}$ ft / sec

c. $r = \frac{70\sqrt{3}}{3}$ ft / sec

d. $r = \frac{140\pi}{3}$ ft / sec

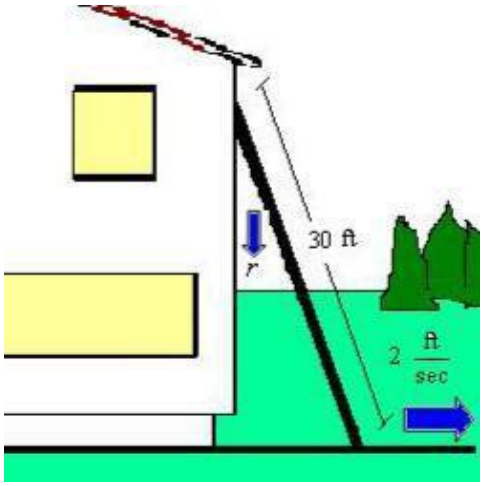
e. $r = \frac{70\pi}{3}$ ft / sec

____ 16. A petrol car is parked 65 feet from a long warehouse (see figure). The revolving light on top of the car turns at a rate of $\frac{1}{2}$ revolution per second. The rate at which the light beam moves along the wall is $r = 65\pi \sec^2 \theta \text{ ft/sec}$. Find the limit of r as $\theta \to (\pi/2)^-$



a. ∞
b. 65π
c. 0
d. 65
e. $-\infty$

____ 17. A 30-foot ladder is leaning against a house (see figure). If the base of the ladder is pulled away from the house at a rate of 2 feet per second, the top will move down the wall at a rate of $r = \frac{2x}{\sqrt{900 - x^2}}$ ft/sec, where x is the distance between the base of the ladder and the house. Find the rate r when x is feet.



a. $r = \frac{3}{2}$ ft/sec

b. $r = \frac{4}{3}$ ft/sec

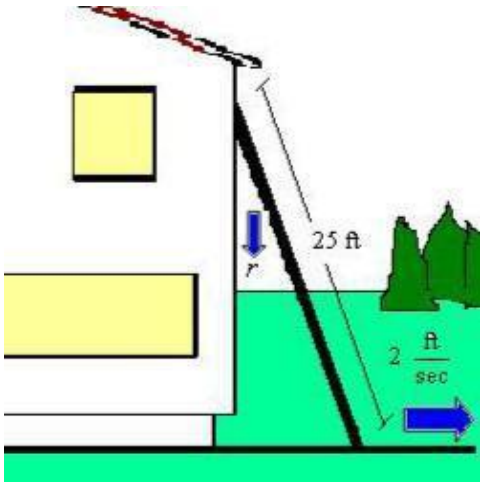
$r = \frac{48}{5}$ ft/sec

c.

d. $r = \frac{2}{3}$ ft/sec

e. $r = \frac{3}{4}$ ft/sec

____ 18. A 25-foot ladder is leaning against a house (see figure). If the base of the ladder is pulled away from the house at a rate of 2 feet per second, the top will move down the wall at a rate of $r = \frac{2x}{\sqrt{625 - x^2}}$ ft / sec where x is the distance between the base of the ladder and the house. Find the limit of r as .



a. $-\infty$
b. 50
c. 0
d. ∞
e. 25

2.5 Infinite Limits
Answer Section

1. ANS: B PTS: 1 DIF: Med REF: Section 2.5
OBJ: Evaluate an infinite limit from a table of values MSC: Skill
2. ANS: D PTS: 1 DIF: Easy REF: Section 2.5
OBJ: Identify the vertical asymptotes (if any) of the graph of a function MSC: Skill
3. ANS: B PTS: 1 DIF: Med REF: Section 2.5
OBJ: Identify the vertical asymptotes (if any) of the graph of a function MSC: Skill
4. ANS: D PTS: 1 DIF: Med REF: Section 2.5
OBJ: Identify the vertical asymptotes (if any) of the graph of a function MSC: Skill
5. ANS: E PTS: 1 DIF: Med REF: Section 2.5
OBJ: Identify the vertical asymptotes (if any) of the graph of a function MSC: Skill
6. ANS: A PTS: 1 DIF: Med REF: Section 2.5
OBJ: Identify the vertical asymptotes (if any) of the graph of a function MSC: Skill
7. ANS: B PTS: 1 DIF: Med REF: Section 2.5
OBJ: Identify the vertical asymptotes (if any) of the graph of a function MSC: Skill
8. ANS: D PTS: 1 DIF: Med REF: Section 2.5
OBJ: Evaluate one-sided limits MSC: Skill
9. ANS: B PTS: 1 DIF: Med REF: Section 2.5
OBJ: Evaluate the limit of a function MSC: Skill
10. ANS: E PTS: 1 DIF: Med REF: Section 2.5
OBJ: Evaluate one-sided limits MSC: Skill
11. ANS: D PTS: 1 DIF: Med REF: Section 2.5
OBJ: Evaluate limits involving logarithmic functions MSC: Skill
12. ANS: E PTS: 1 DIF: Med REF: Section 2.5
OBJ: Identify a limit that does not exist MSC: Skill
13. ANS: B PTS: 1 DIF: Med REF: Section
2.OBJ: Estimate one-sided limits from a graph MSC: Skill
14. ANS: D PTS: 1 DIF: Med REF: Section 2.5
OBJ: Estimate one-sided limits from a graph MSC: Skill
15. ANS: D PTS: 1 DIF: Easy REF: Section 2.5
OBJ: Evaluate functions in applications MSC: Application
16. ANS: A PTS: 1 DIF: Med REF: Section 2.5
OBJ: Evaluate limits in applications MSC: Application
17. ANS: A PTS: 1 DIF: Easy REF: Section 2.5
OBJ: Evaluate functions in applications MSC: Application
18. ANS: D PTS: 1 DIF: Med REF: Section 2.5
OBJ: Evaluate limits in applications MSC: Application

3.1 The Derivative and the Tangent Line Problem

Multiple Choice

Identify the choice that best completes the statement or answers the question.

____ 1. Find the slope m of the line tangent to the graph of the function $f(x) = 2 - 7x$ at the point $(-1, 9)$.

a. $m = -7$
b. $m = -2$
c. $m = 2$
d. $m = 7$
e. $m = -9$

____ 2. Find the slope m of the line tangent to the graph of the function $g(x) = 9 - x^2$ at the point $(4, -7)$.

a. $m = 4$
b. $m = 9$
c. $m = -8$
d. $m = -7$
e. $m = -18$

____ 3. Find the derivative of the function $g(x) = -2$ by the limit process.

a. $g'(x) = 2$
b. $g'(x) = 2x$
c. $g'(x) = -2x$
d. $g'(x) = 0$
e. $g'(x) = -2$

____ 4. Find the derivative of the function $h(s) = 7 + \frac{6}{7}s$ by the limit process.

a. $h'(s) = 7$
b. $h'(s) = 7s + \frac{6}{7}s^2$
c. $h'(s) = \frac{6}{7}$
d. $h'(s) = \frac{55}{7}$
e. $h'(s) = 7s + \frac{6}{7}$