Test Bank

Calculus

TENTH EDITION

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Contents

P.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 $y = -\sqrt{2-x^2}$?

a.

d.

b.

e.

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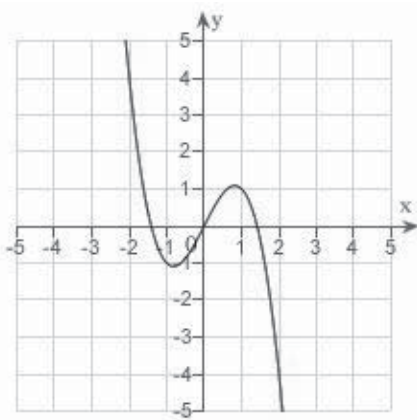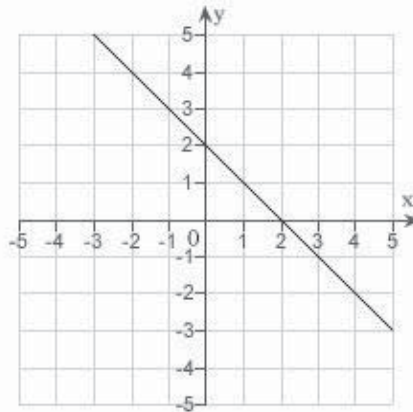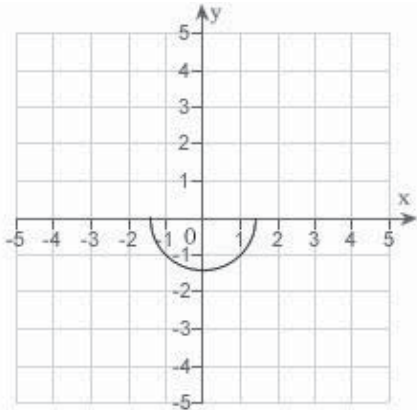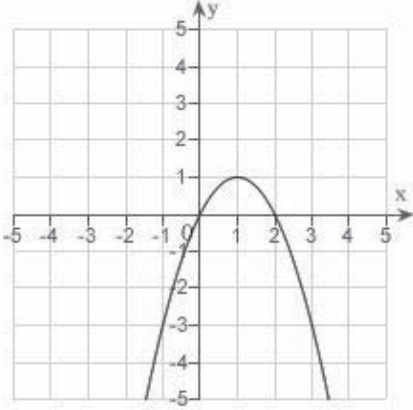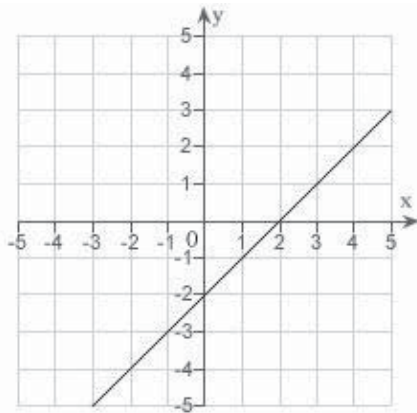
_____   2.   Which of the following is the correct graph of $y = x - x^3$?

a.
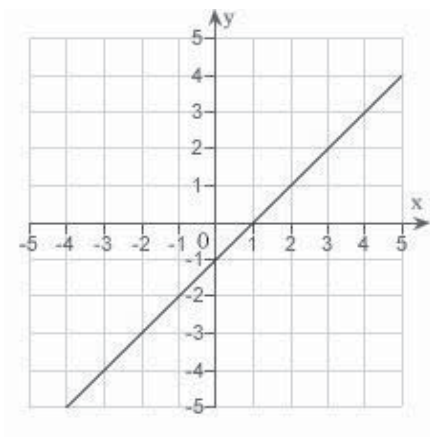
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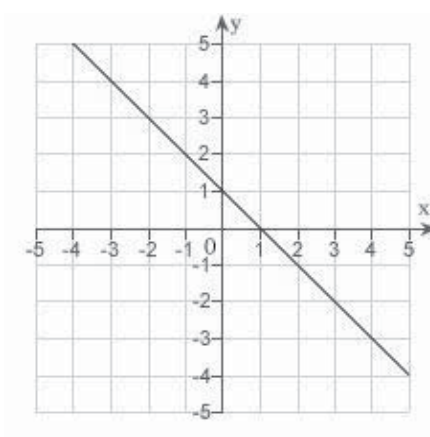
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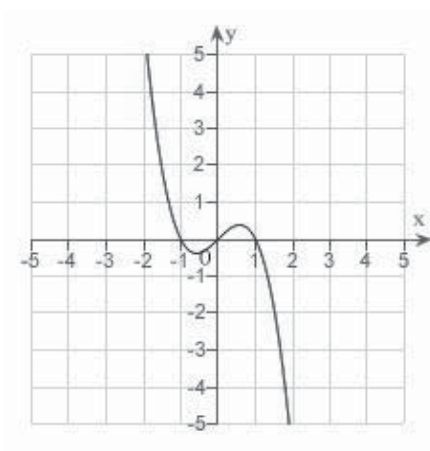
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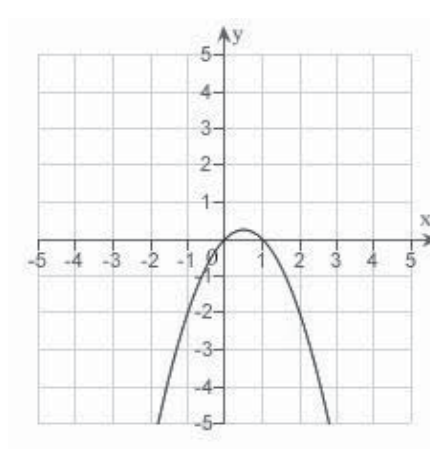
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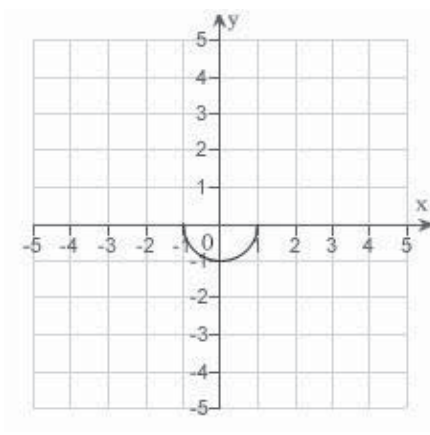
_____   3.   Find all intercepts:

$$y = x^2 - x - 12$$

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: $(0, -12)$

_____   4.   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: $(0, -10)$

_____   5.   Test for symmetry with respect to each axis and to the origin.

$$x^2 y^2 = 8$$

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

_____   6.   Test for symmetry with respect to each axis and to the origin.

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

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

_____   7.   Sketch the graph of the equation:

$x = 4 - y^2$

a.
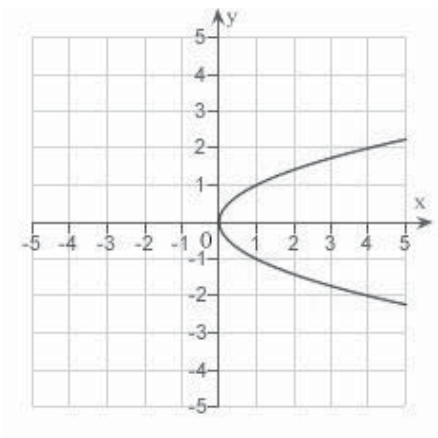
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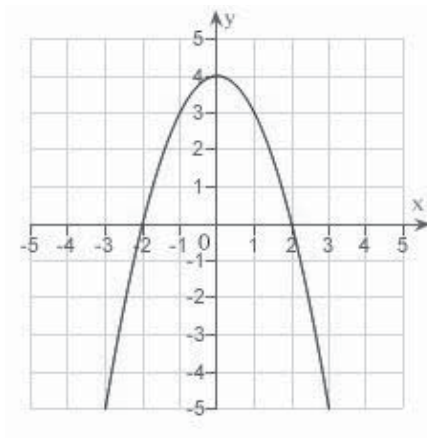
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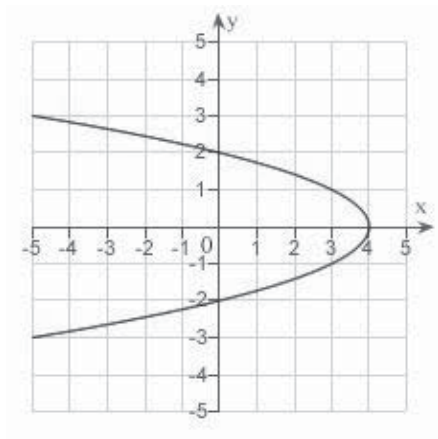
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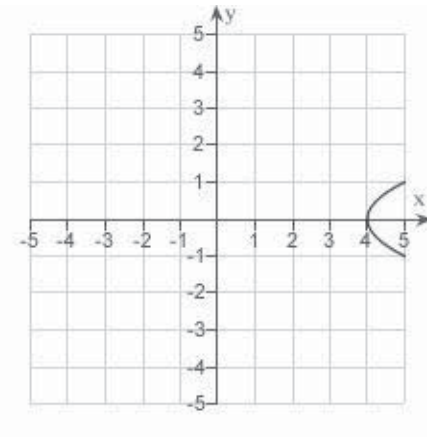
c.
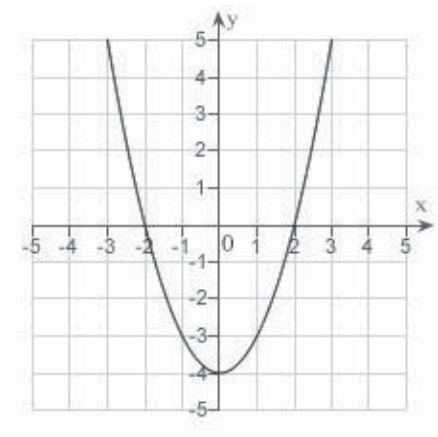
_____   8.   Sketch the graph of the equation:

$y = |x + 2|$

a.

d.

b.
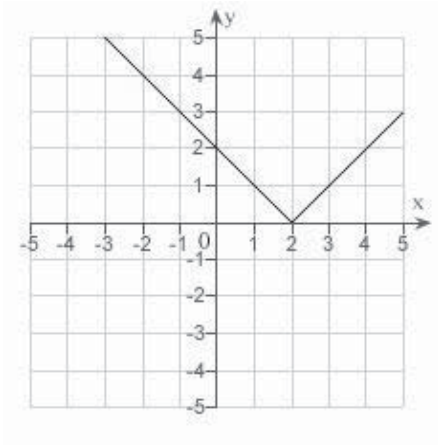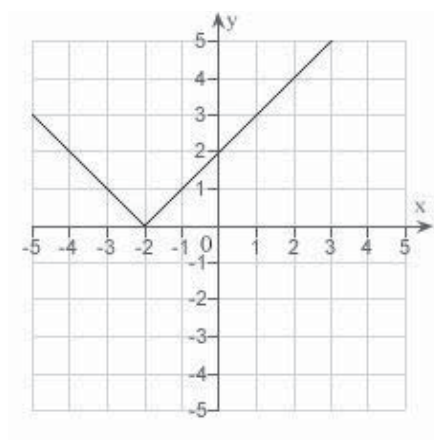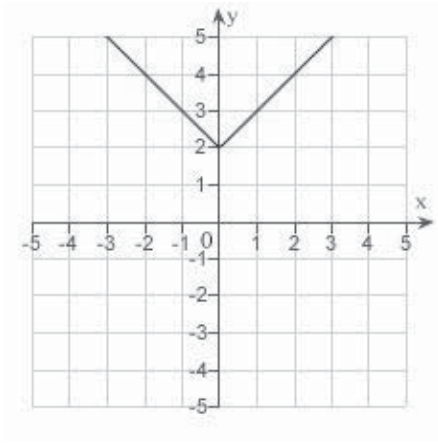
e.   none of the above

c.
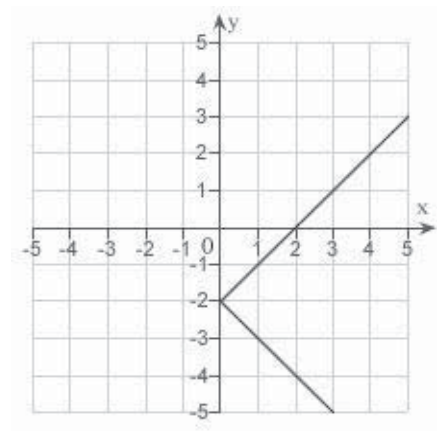
_____   9.   Find the points of intersection of the graphs of the equations:

$x = y^2 - 3$

$y = x + 1$

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

_____   10.   The resistance y in ohms of 1000 feet of solid metal wire at $77°F$ can be approximated by the model $y = \dfrac{10,000}{x^2} - 0.57,\ 5 \le x \le 100$, where x is the diameter of the wire in mils (0.001 in). Use a graphing utility to graph the model $y = \dfrac{10,000}{x^2} - 0.57,\ 5 \le x \le 100$.

a.

d.

b.

e.

c.
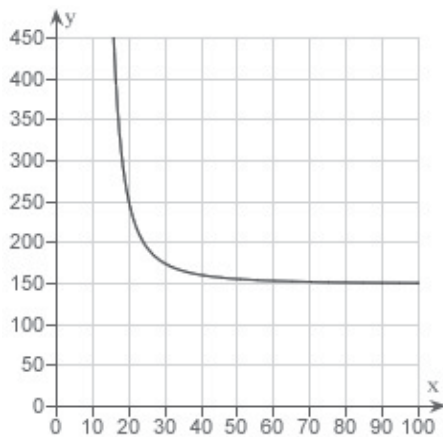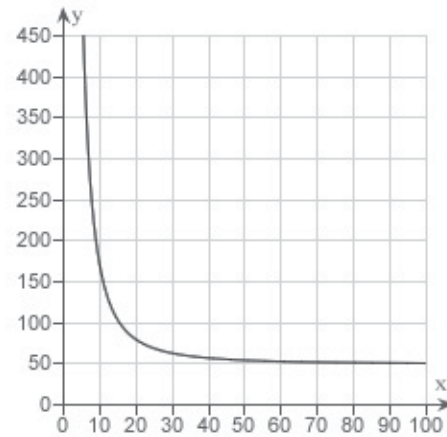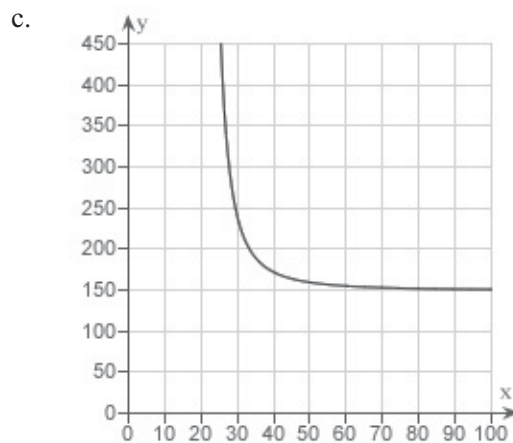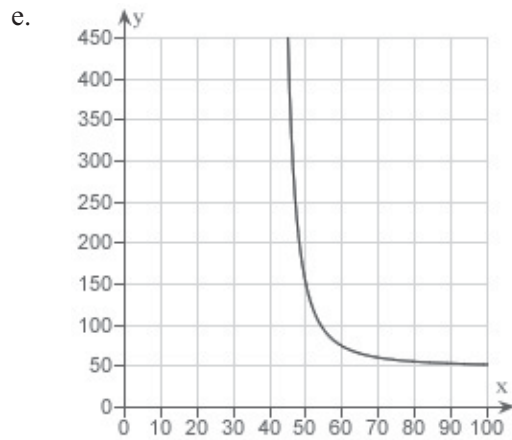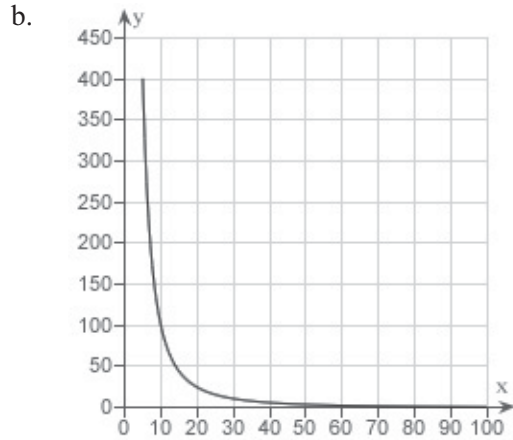
_____   11.   The resistance y in ohms of 1000 feet of solid metal wire at $77°F$ can be approximated by the model $y = \dfrac{12,000}{x^2} - 0.46,\ 5 \le x \le 100,$ where x is the diameter of the wire in mils (0.001 in). If the diameter of the wire is doubled, the resistance is changed by approximately what factor? In determining your answer, you can ignore the constant –0.46.

a. $\dfrac{1}{2}$

b. $\dfrac{1}{5}$

c.   4

d.   5

e. $\dfrac{1}{4}$

_____   12.   Test for symmetry with respect to each axis and to the origin.

$y = x^2 - 8$

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

_____   13.   Test for symmetry with respect to each axis and to the origin.

$|y| - x = 6$

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

_____   14.   Find all intercepts:

$y^2 = x^3 - 25x$

a. x-intercepts: (0,0), (5,0), (-5,0); y-intercept: (0, -25)
b. x-intercepts: (0,0), (5,0); y-intercept: (0, 0)
c. x-intercepts: (0,0), (5,0), (-5,0); y-intercept: (0, 0)
d. x-intercepts: (0,0), (5,0); y-intercept: (0, 5)
e. x-intercepts: (0,0), (5,0), (25,0); y-intercept: (0, 0)

_____   15.   Sketch the graph of the equation:

$$y = x^3 - 3x$$

a.

d.

b.
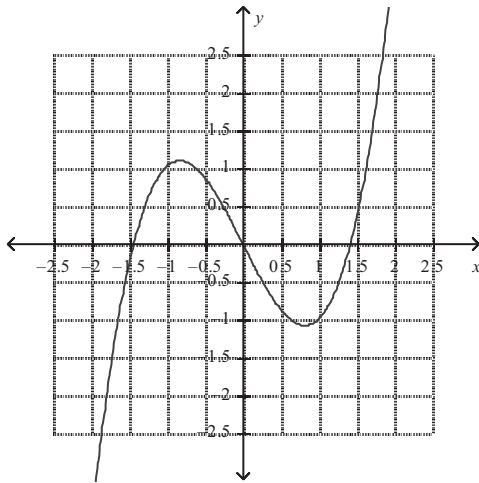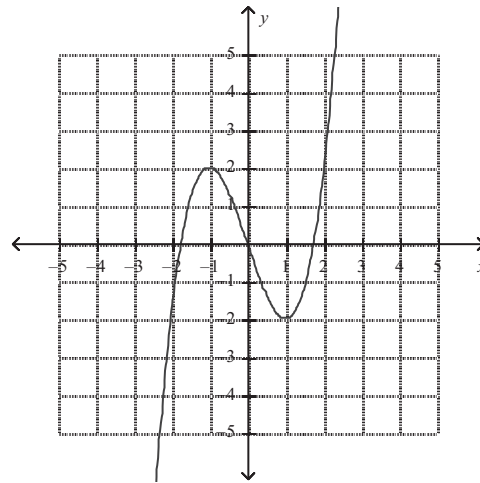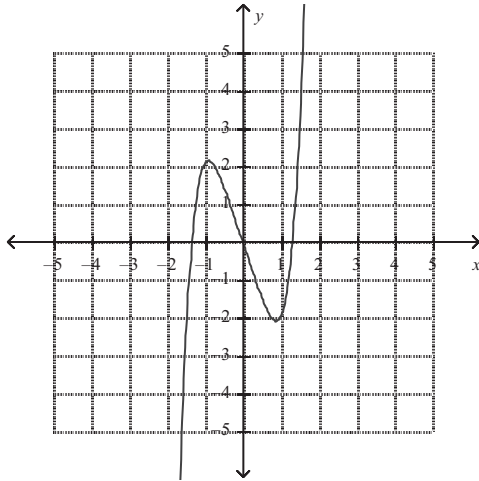
e.   none of the above

c.
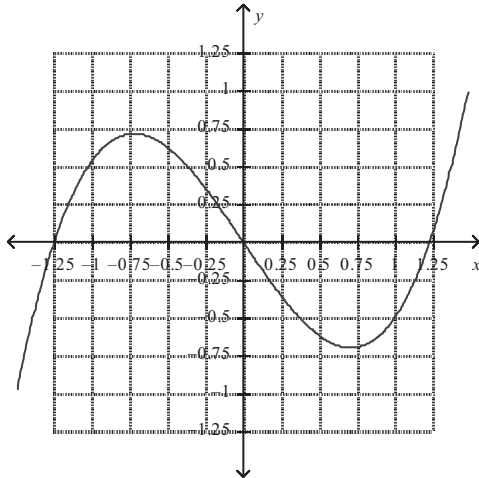
P.1 Graphs and Models
Answer Section

MULTIPLE CHOICE

1.   ANS: B   PTS: 1   DIF: Easy   REF: Section 0.1
OBJ: Identify the graph of a semicircle   MSC: Skill
2.   ANS: B   PTS: 1   DIF: Easy   REF: Section 0.1
OBJ: Identify the graph of a cubic equation   MSC: Skill
3.   ANS: C   PTS: 1   DIF: Easy   REF: Section 0.1
OBJ: Calculate the intercepts of an equation   MSC: Skill
4.   ANS: D   PTS: 1   DIF: Easy   REF: Section 0.1
OBJ: Calculate the intercepts of an equation   MSC: Skill
5.   ANS: E   PTS: 1   DIF: Easy   REF: Section 0.1
OBJ: Identify the type of symmetry of the graph of an equation   MSC: Skill
6.   ANS: A   PTS: 1   DIF: Easy   REF: Section 0.1
OBJ: Identify the type of symmetry of the graph of an equation   MSC: Skill
7.   ANS: B   PTS: 1   DIF: Easy   REF: Section 0.1
OBJ: Graph a quadratic equation in y   MSC: Skill
8.   ANS: D   PTS: 1   DIF: Med   REF: Section 0.1
OBJ: Graph an absolute value equation   MSC: Skill
9.   ANS: C   PTS: 1   DIF: Med   REF: Section 0.1
OBJ: Calculate the points of intersection of the graphs of equations   MSC: Skill
10.   ANS: B   PTS: 1   DIF: Med   REF: Section 0.1
OBJ: Plot a rational model using the capabilities of a graphing utility   MSC: Application
11.   ANS: E   PTS: 1   DIF: Med   REF: Section 0.1
OBJ: Interpret a rational model   MSC: Application
12.   ANS: B   PTS: 1   DIF: Easy   REF: Section 0.1
OBJ: Identify the type of symmetry of the graph of an equation   MSC: Skill
13.   ANS: B   PTS: 1   DIF: Easy   REF: Section 0.1
OBJ: Identify the type of symmetry of the graph of an equation   MSC: Skill
14.   ANS: C   PTS: 1   DIF: Easy   REF: Section 0.1
OBJ: Calculate the intercepts of an equation   MSC: Skill
15.   ANS: D   PTS: 1   DIF: Easy   REF: Section 0.1
OBJ: Graph an equation in y   MSC: Skill

P.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.
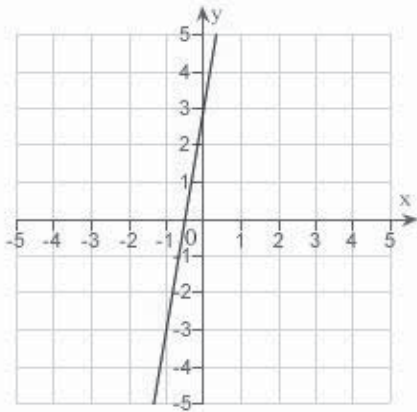
a.   3
b. $-\dfrac{1}{3}$
c. $-\dfrac{1}{6}$
d. $\dfrac{1}{6}$
e.   6

_____   2.   Sketch the line passing through the point $(3, 4)$ with the slope $-\dfrac{3}{2}$.

a.
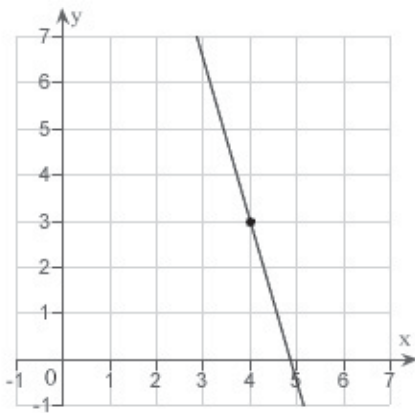
d.
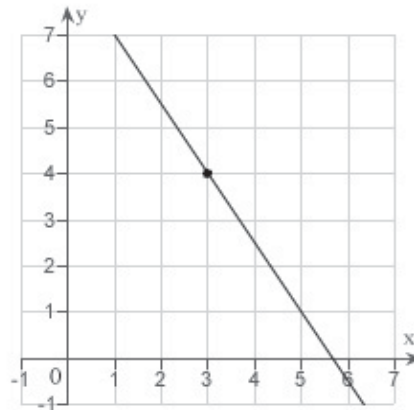
b.
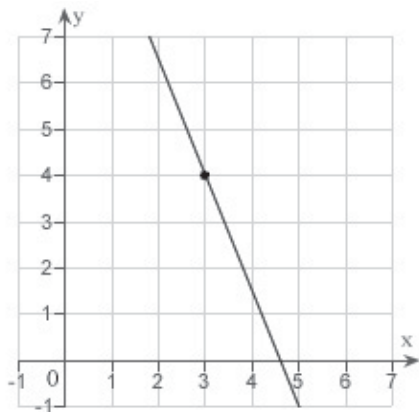
e.
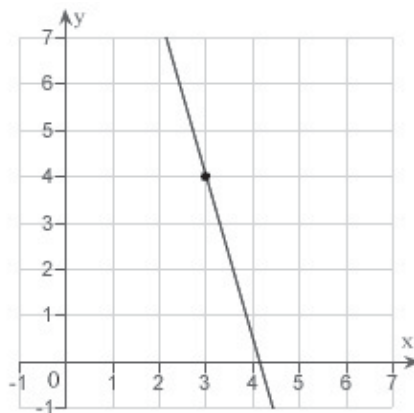
c.
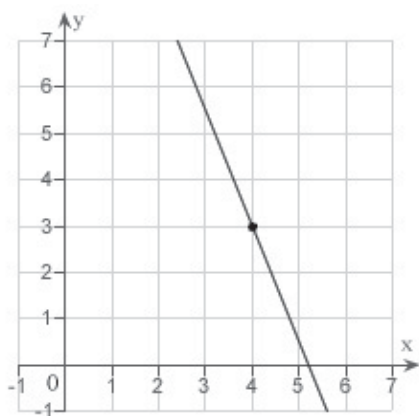
_____   3.   Find the slope of the line passing through the pair of points.

$$\left(-3,-6\right),\left(0,-11\right)$$

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

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

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

d. 0

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

_____   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 $m = -4$ 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. $\dfrac{1}{3}$

b. $-\dfrac{1}{5}$

c. $\dfrac{1}{5}$

d. $-\dfrac{1}{15}$

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

_____   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 $(7, 2)$ and has the slope m that is 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 $m = \dfrac{9}{2}$.

a. $y = \dfrac{9}{2}x - \dfrac{81}{2}$

b. $y = \dfrac{9}{2}x + \dfrac{81}{2}$

c. $y = \dfrac{9}{2}x + 162$

d. $y = \dfrac{9}{2}x$

e. $y = -\dfrac{9}{2}x$

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

a. $y = -\dfrac{5}{6}x - 8$

b. $y = \dfrac{5}{6}x - 8$

c. $y = \dfrac{5}{6}x + 8$

d. $y = -\dfrac{5}{6}x + 8$

e. $y = -\dfrac{5}{6}x$

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

a. $y = \dfrac{1}{2}x$

b. $y = \dfrac{1}{2}x + 6$

c. $y = \dfrac{1}{2}x + 12$

d. $y = \dfrac{1}{2}x - 12$

e. $y = \dfrac{1}{2}x - 6$

_____   14.   Use the result, "the line with intercepts $(a, 0)$ and $(0, b)$ has the equation $\dfrac{x}{a} + \dfrac{y}{b} = 1$, $a \neq 0, b \neq 0$", 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.
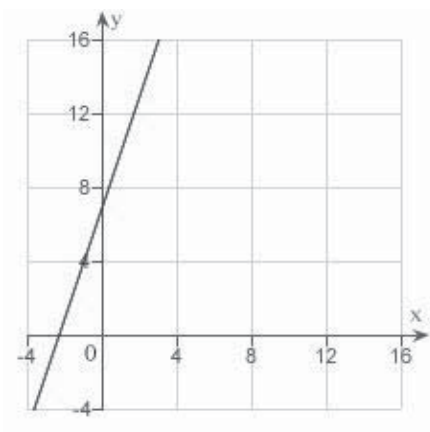
d.
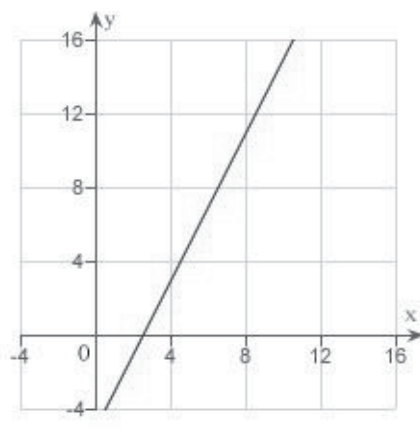
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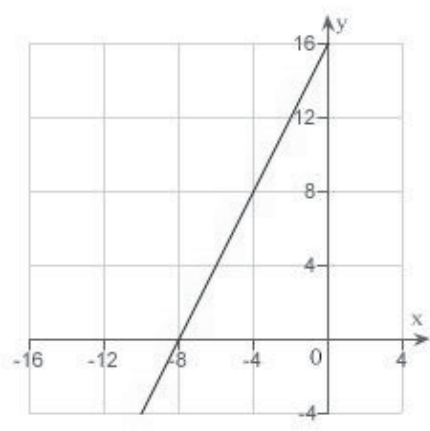
e.
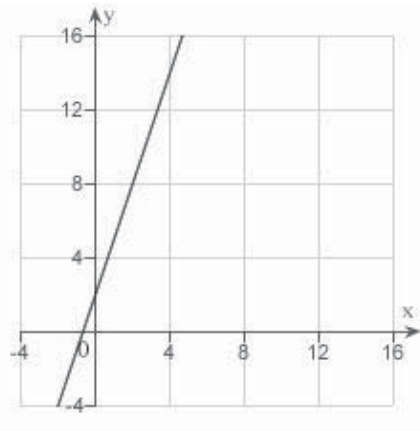
c.
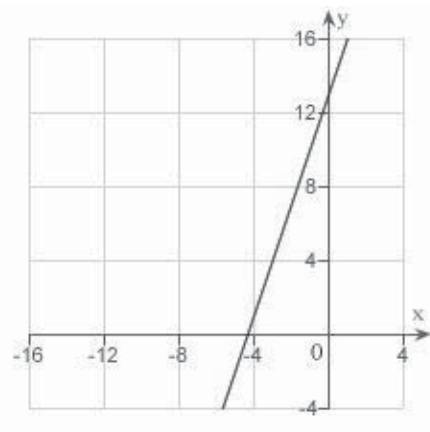
_____   16.   Write an equation of the line that passes through the given point and is perpendicular to the given line.

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 $\left(\dfrac{5}{4}, \dfrac{5}{8}\right)$ 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. 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 p and the demand x is linear. Write a linear equation giving the demand x in terms of the rent p.

a. $x = \dfrac{1}{15}\left(1595 - p\right)$

b. $x = \dfrac{1}{15}\left(1505 + p\right)$

c. $x = \dfrac{1}{45}\left(1550 + p\right)$

d. $x = \dfrac{1}{15}\left(1550 - p\right)$

e. $x = \dfrac{1}{45}\left(1595 - p\right)$

_____ 21. A real estate office handles an apartment complex with 50 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

_____ 22. Find the distance between the point $\left(-4, 7\right)$ and line $x - y - 2 = 0$ using the formula,

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

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

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

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

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

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

_____   23.   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. $V = 7.5t - 144$

_____   24.   A company reimburses its sales representatives $\$175$ per day for lodging and meals plus $45\cancel{c}$ 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. $C = 1.75x - 45$

_____   25.   A company reimburses its sales representatives $\$160$ per day for lodging and meals plus $42\cancel{c}$ 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

P.2 Linear Models and Rates of Change
Answer Section

MULTIPLE CHOICE

1.   ANS: E   PTS: 1   DIF: Easy   REF: Section 0.2
OBJ: Estimate the slope of a line from its graph   MSC: Skill
2.   ANS: D   PTS: 1   DIF: Easy   REF: Section 0.2
OBJ: Sketch the line passing through a point with specified slope   MSC: Skill
3.   ANS: B   PTS: 1   DIF: Easy   REF: Section 0.2
OBJ: Calculate the slope of a line passing through two points   MSC: Skill
4.   ANS: C   PTS: 1   DIF: Med   REF: Section 0.2
OBJ: Calculate the slope of a line passing through two points   MSC: Skill
5.   ANS: A   PTS: 1   DIF: Med   REF: Section 0.2
OBJ: Identify a point on a line with specified properties   MSC: Skill
6.   ANS: B   PTS: 1   DIF: Easy   REF: Section 0.2
MSC: Application
7.   ANS: C   PTS: 1   DIF: Med   REF: Section 0.2
OBJ: Calculate slopes in applications   MSC: Application
8.   ANS: E   PTS: 1   DIF: Med   REF: Section 0.2
OBJ: Manipulate a linear equation to determine its slope   MSC: Skill
9.   ANS: A   PTS: 1   DIF: Med   REF: Section 0.2
OBJ: Manipulate a linear equation to determine its y-intercept   MSC: Skill
10.   ANS: B   PTS: 1   DIF: Easy   REF: Section 0.2
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 0.2
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 0.2
OBJ: Write an equation of a line given two points on the line   MSC: Skill
13.   ANS: E   PTS: 1   DIF: Med   REF: Section 0.2
OBJ: Write an equation of a line given two points on the line   MSC: Skill
14.   ANS: E   PTS: 1   DIF: Easy   REF: Section 0.2
OBJ: Write an equation of a line given its x- and y-intercepts   MSC: Skill
15.   ANS: B   PTS: 1   DIF: Med   REF: Section 0.2
OBJ: Sketch the graph of a linear equation   MSC: Skill
16.   ANS: C   PTS: 1   DIF: Med   REF: Section 0.2
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 0.2
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 0.2
OBJ: 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 0.2
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: Med   REF: Section 0.2
OBJ: Write linear equations in applications   MSC: Application
21.   ANS: E   PTS: 1   DIF: Easy   REF: Section 0.2
OBJ: Evaluate linear equations in applications   MSC: Application
22.   ANS: C   PTS: 1   DIF: Med   REF: Section 0.2
OBJ: Calculate the distance between a point and a line   MSC: Skill
23.   ANS: D   PTS: 1   DIF: Easy   REF: Section 0.2
OBJ: Write linear equations in applications   MSC: Application
24.   ANS: B   PTS: 1   DIF: Easy   REF: Section 0.2
OBJ: Write linear equations in applications   MSC: Application
25.   ANS: B   PTS: 1   DIF: Easy   REF: Section 0.2
OBJ: Evaluate linear equations in applications   MSC: Application

P.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 $g(x) = \dfrac{1}{\sqrt{x+15}}$. Evaluate the expression $\dfrac{g(x) - g(-11)}{x+11}$ and then simplify the result.

a. $\dfrac{2\sqrt{x+15} - x - 15}{2(x+11)(x+15)}$

b. $\dfrac{2\sqrt{x+15} + x - 15}{2(x-11)(x+15)}$

c. $\dfrac{2\sqrt{x+15} + x - 15}{2(x+11)(x+15)}$

d. $\dfrac{2\sqrt{x+15} - x - 15}{2(x-11)(x+15)}$

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: $(-\infty, \infty)$
       range: $(-6, \infty)$
d.   domain: $(-\infty, \infty)$
       range: $[6, \infty)$
e.   domain: $(-\infty, \infty)$
       range: $[-6, \infty)$

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

_____   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 $y = f(x + 5)$.
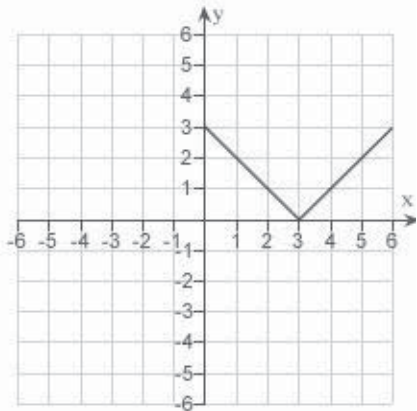
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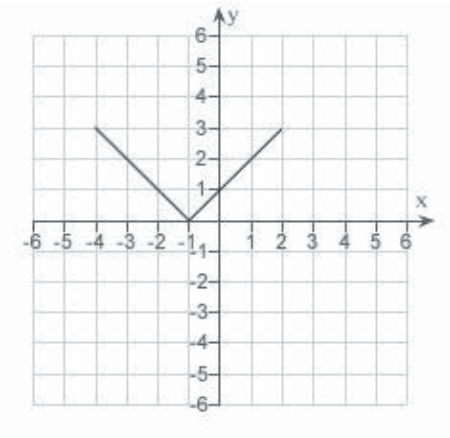
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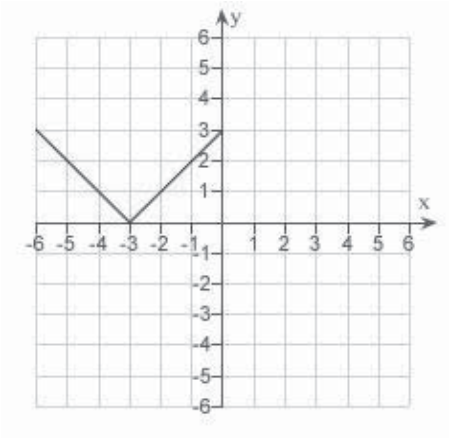
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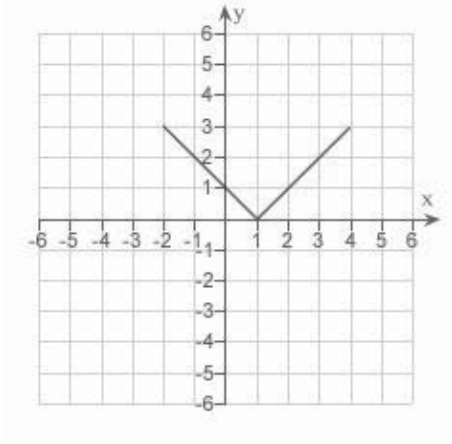
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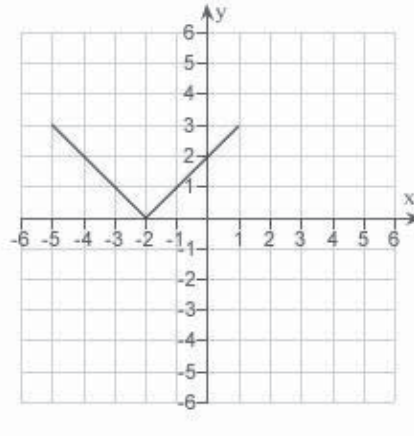
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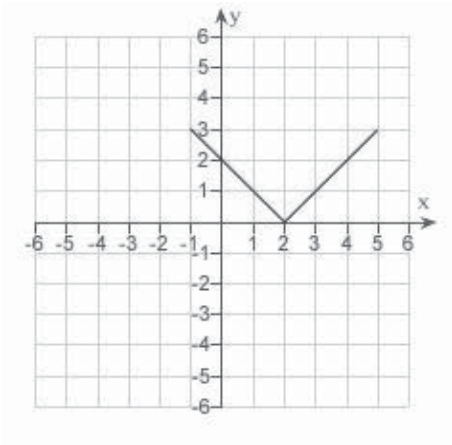
_____   14.   Use the graph of $y = f(x)$ given below to find the graph of the function $y = f(x) + 4$.
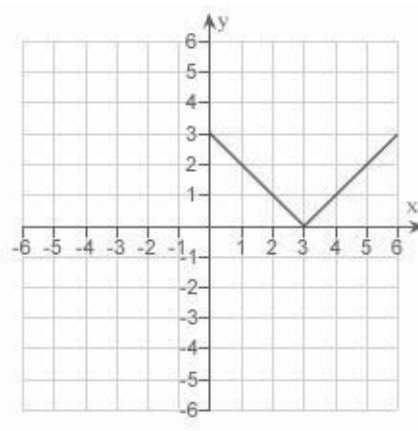
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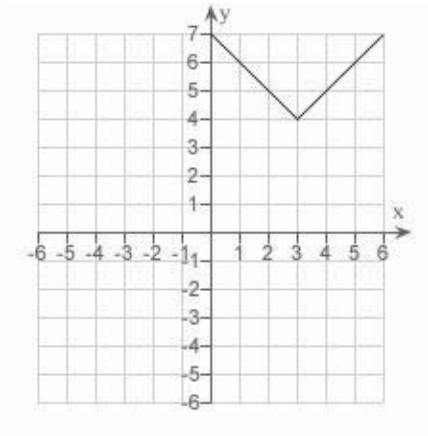
d.
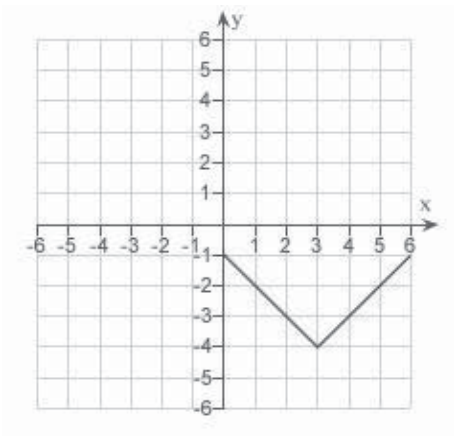
b.
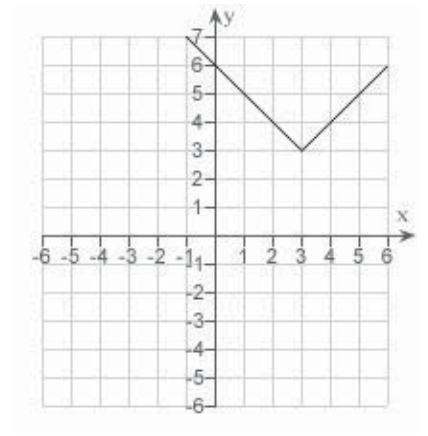
e.
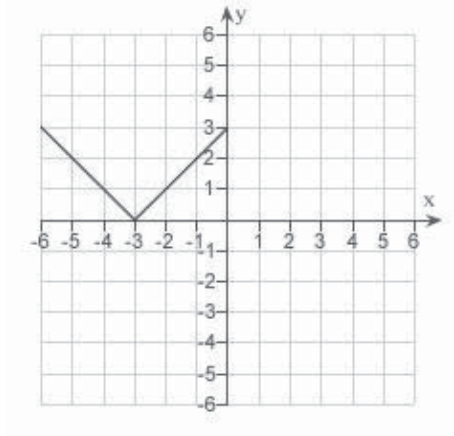
c.
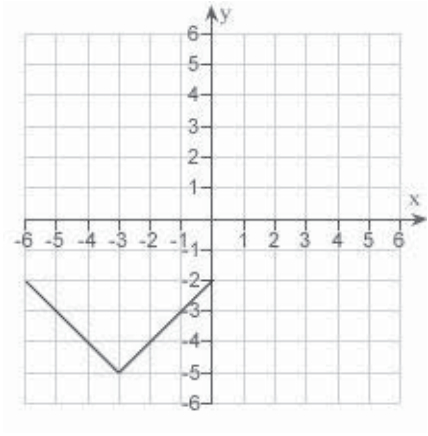
_____   15.   Given $f(x) = \cos x$ and $g(x) = \frac{\pi}{2}x$, evaluate $f(g(2))$.

a. 0

b. $\frac{1}{2}$

c. $\frac{\pi}{2}\sin(2)$

d. −1

e. $\frac{\pi}{2}\cos(2)$

_____   16.   Determine whether the function is even, odd, or neither.

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

a. odd

b. even

c. neither

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

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

a. even

b. odd

c. neither

_____   18.   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. $\left(\frac{6}{5}, 8\right)$

_____   19.   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. $\left(\frac{9}{8}, 5\right)$

_____   20.   The horsepower H required to overcome wind drag on a certain automobile is approximated by $H(x) = 0.002x^2 + 0.005x - 0.027, \ 10 \leq x \leq 100$ where x is the speed of the car in miles per hour. Find $H\left(\frac{x}{1.1}\right)$. 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. $H\left(\frac{x}{1.1}\right) = 0.00455x^2 + 0.00165x - 0.02700$

_____   21.   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.
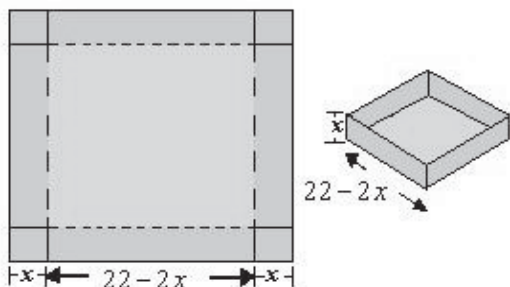
a. $V = x(22 - 2x)^2$

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

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

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

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

_____   22.   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 $V = x(30 - 2x)^2$.
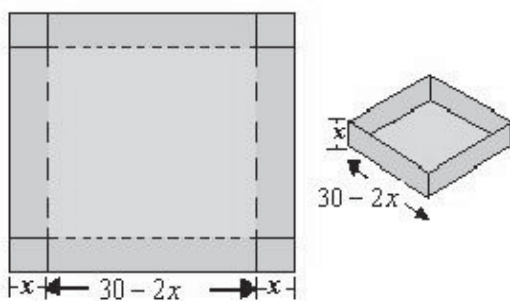
a.   domain: $0 < x < \infty$

b.   domain: 30

c.   domain: $0 < x < 15$

d.   domain: $0 < x < 30$

e.   domain: 15

P.3 Functions and Their Graphs
Answer Section

1.   ANS: D   PTS: 1   DIF: Easy   REF: Section 0.3
OBJ: Evaluate a function and simplify   MSC: Skill
2.   ANS: B   PTS: 1   DIF: Easy   REF: Section 0.3
OBJ: Evaluate a function and simplify   MSC: Skill
3.   ANS: C   PTS: 1   DIF: Easy   REF: Section 0.3
OBJ: Evaluate a function and simplify   MSC: Skill
4.   ANS: B   PTS: 1   DIF: Med   REF: Section 0.3
OBJ: Simplify a difference quotient   MSC: Skill
5.   ANS: A   PTS: 1   DIF: Med   REF: Section 0.3
OBJ: Simplify a difference quotient   MSC: Skill
6.   ANS: E   PTS: 1   DIF: Easy   REF: Section 0.3
OBJ: Identify the domain and range of a function   MSC: Skill
7.   ANS: E   PTS: 1   DIF: Easy   REF: Section 0.3
OBJ: Identify the domain and range of a function   MSC: Skill
8.   ANS: B   PTS: 1   DIF: Easy   REF: Section 0.3
OBJ: Identify the domain and range of a function   MSC: Skill
9.   ANS: E   PTS: 1   DIF: Easy   REF: Section 0.3
OBJ: Evaluate a piecewise function   MSC: Skill
10.   ANS: B   PTS: 1   DIF: Easy   REF: Section 0.3
OBJ: Identify the domain and range of a function   MSC: Skill
11.   ANS: B   PTS: 1   DIF: Easy   REF: Section 0.3
OBJ: Identify equations that are functions   MSC: Skill
12.   ANS: B   PTS: 1   DIF: Easy   REF: Section 0.3
OBJ: Identify equations that are functions   MSC: Skill
13.   ANS: E   PTS: 1   DIF: Easy   REF: Section 0.3
OBJ: Graph transformations of functions   MSC: Skill
14.   ANS: A   PTS: 1   DIF: Med   REF: Section 0.3
OBJ: Graph transformations of functions   MSC: Skill
15.   ANS: D   PTS: 1   DIF: Easy   REF: Section 0.3
OBJ: Evaluate composite functions   MSC: Skill
16.   ANS: C   PTS: 1   DIF: Easy   REF: Section 0.3
OBJ: Identify the type of symmetry of the graph of a function   MSC: Skill
17.   ANS: A   PTS: 1   DIF: Easy   REF: Section 0.3
OBJ: Identify the type of symmetry of the graph of a function   MSC: Skill
18.   ANS: E   PTS: 1   DIF: Easy   REF: Section 0.3
OBJ: Identify points on a graph using symmetry   MSC: Skill
19.   ANS: B   PTS: 1   DIF: Easy   REF: Section 0.3
OBJ: Identify points on a graph using symmetry   MSC: Skill
20.   ANS: D   PTS: 1   DIF: Med   REF: Section 0.3
OBJ: Apply composite functions   MSC: Application
21.   ANS: A   PTS: 1   DIF: Med   REF: Section 0.3
OBJ: Create functions in applications   MSC: Application
22.   ANS: C   PTS: 1   DIF: Med   REF: Section 0.3
OBJ: Identify domains in applications   MSC: Application

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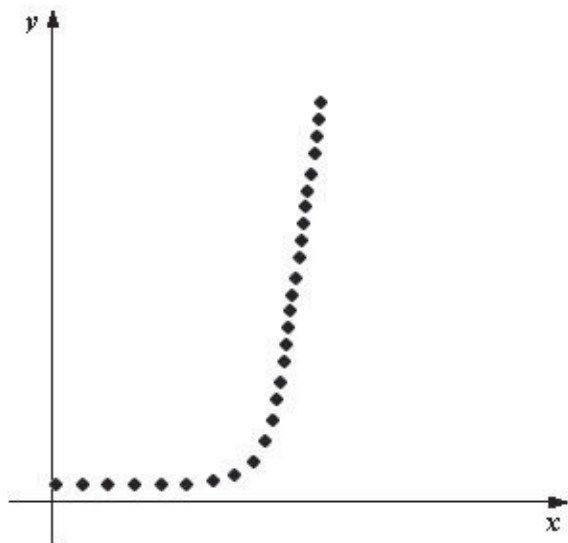
a.   exponential
b.   linear
c.   quadratic
d.   no relationship
e.   trigonometric

_____   2.   Which function below would be most appropriate model for the given data?
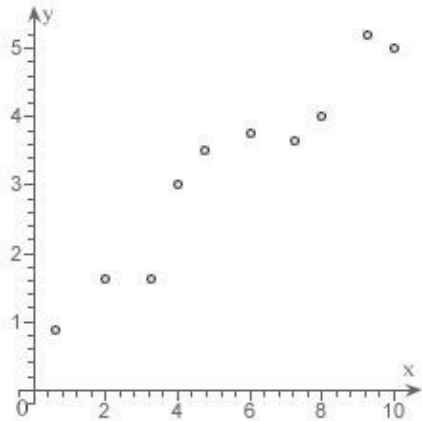
a.   no apparent relationship between x and y
b.   trigonometric
c.   quadratic
d.   linear

_____   3.   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. $d = 0.905F$

_____   4.   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.
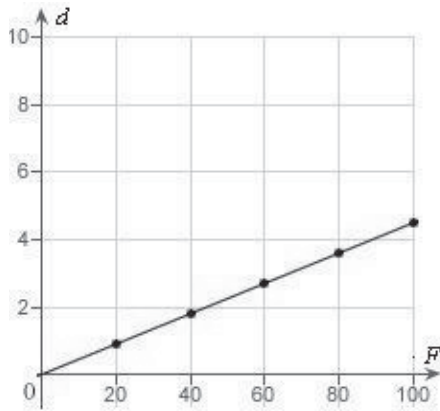
d.
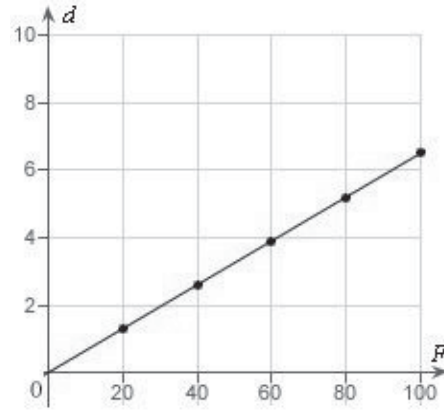
b.
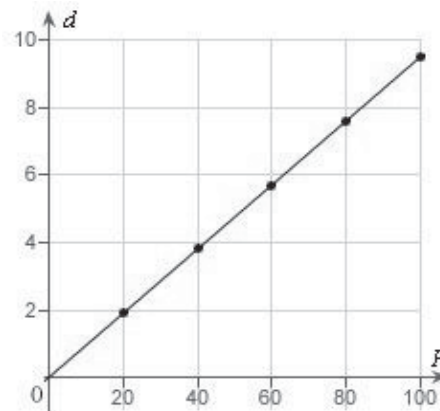
e.
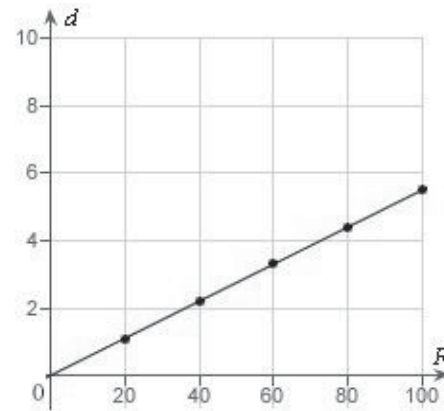
c.
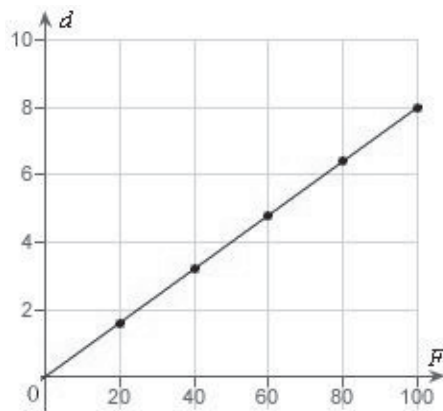
_____   5.   Hooke's Law states that the force F required to compress or stretch a spring (within its elastic limits) is proportional to the distance d that the spring is compressed or stretched from its original length. That is, $F = kd$ where k is a measure of the stiffness of the spring and is called the spring constant. The table shows the elongation d in centimeters of a spring when a force of F newtons is applied. Use the model $d = 0.085\,F$ 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

_____   6.   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. $s = 1.2t - 3.0$

_____   7.   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.
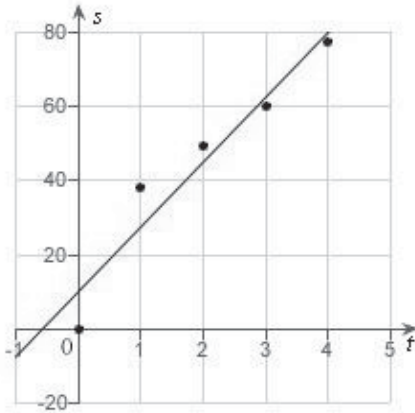
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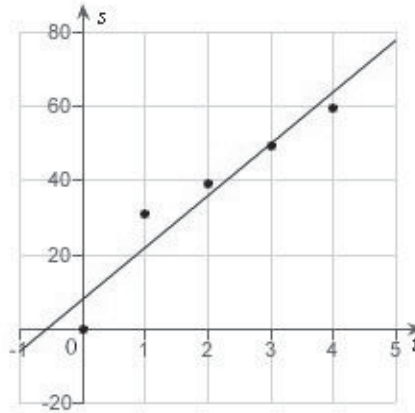
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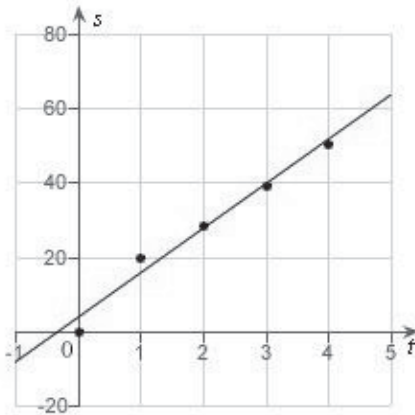
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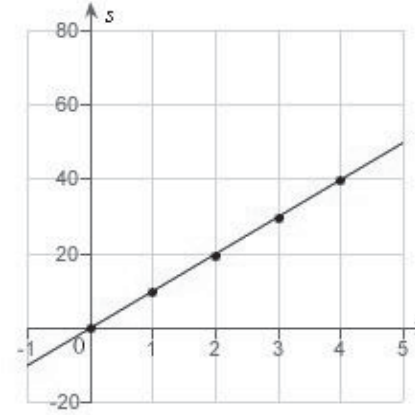
c.
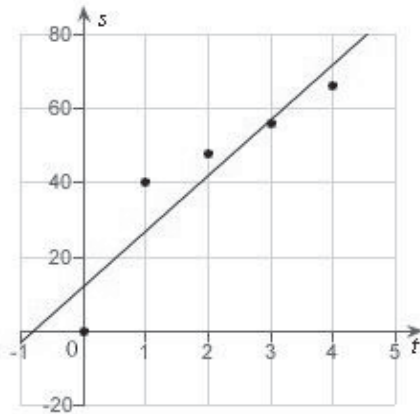
_____   8.   In an experiment, students measured the speed s (in meters per second) of a falling object t seconds after it was released. The results are shown in the table below. Use the model $s = 11.9t + 4.8$ to estimate the speed of the object after 1.5 seconds. Round your answer to two decimal places.

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

_____   9.   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. $S = 180.89x^2 + 203.79x - 331$

_____   10.   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.

d.

b.

e.

c.
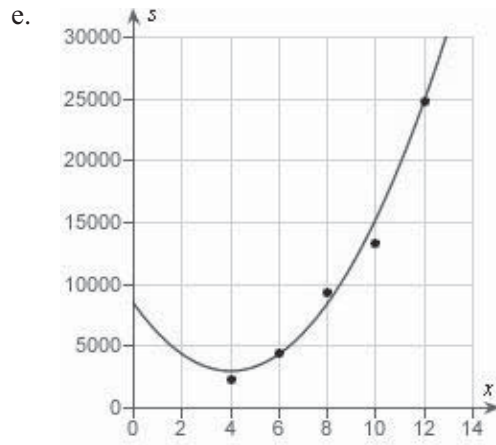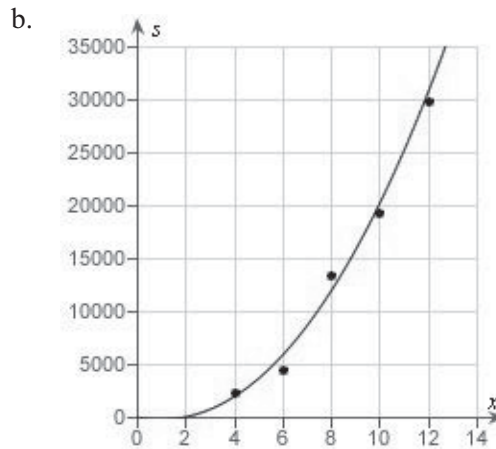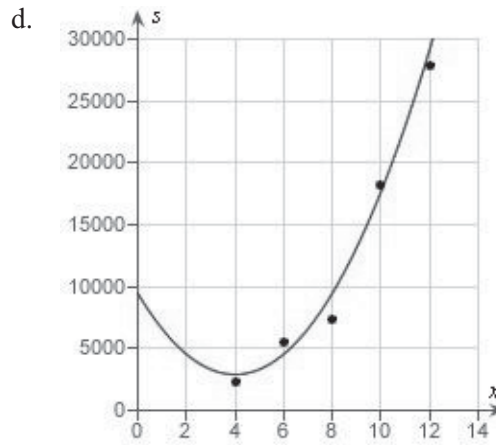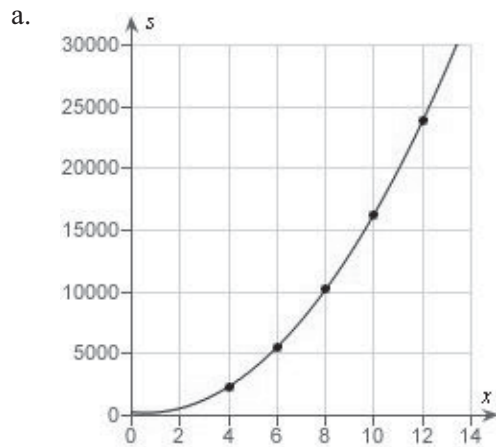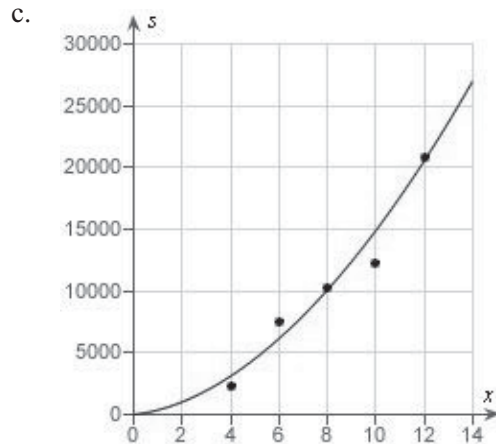
_____   11.   Students in a lab measured the breaking strength S (in pounds) of wood 2 inches thick, x inches high, and 12 inches long. The results are shown in the table below. Use the model $S = 180.89x^2 - 205.79x + 284$ to approximate the breaking strength when $x = 2$. Round your answer to two decimal 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

_____   12.   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. $y = 1.608x^3 + 11.583x^2 - 19.389x + 41$

_____   13.   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.

d.

b.

e.

c.
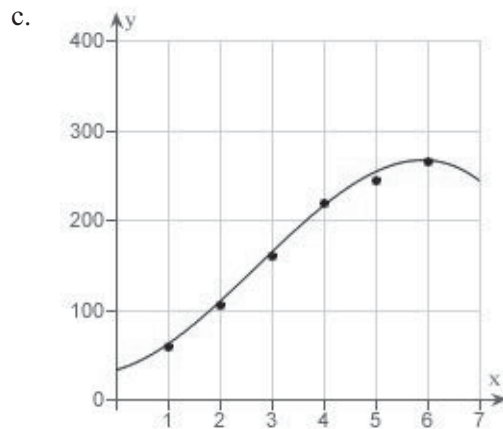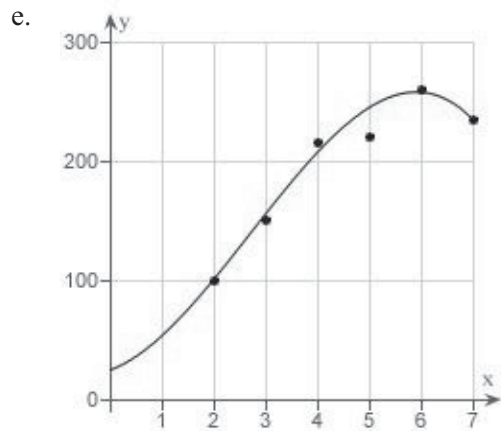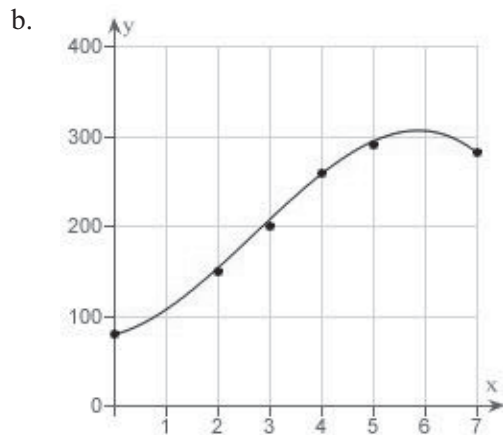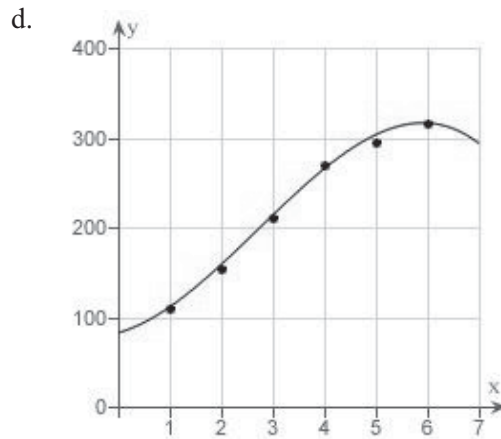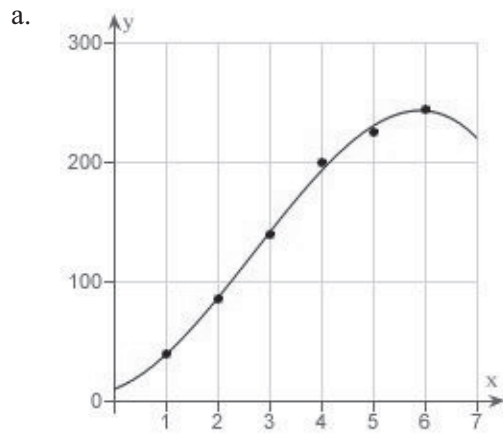
_____   14.   A V8 car engine is coupled to a dynamometer and the horsepower y is measured at different engine speeds x (in thousands of revolutions per minute). The results are shown in the table below. Use the model $y = -1.806x^3 + 14.58x^2 + 16.4x + 30$ to approximate the horsepower when the engine 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

_____   15.   The motion of an oscillating weight suspended by a spring was measured by a motion detector. The data collected and the approximate maximum (positive and negative) displacements from equilibrium are shown in the figure. The displacement is measured in centimeters, and the time is measured in seconds. Take $A(0.133,2.49)$ and $B(0.343,1.78)$. Approximate the amplitude and period of the oscillations.
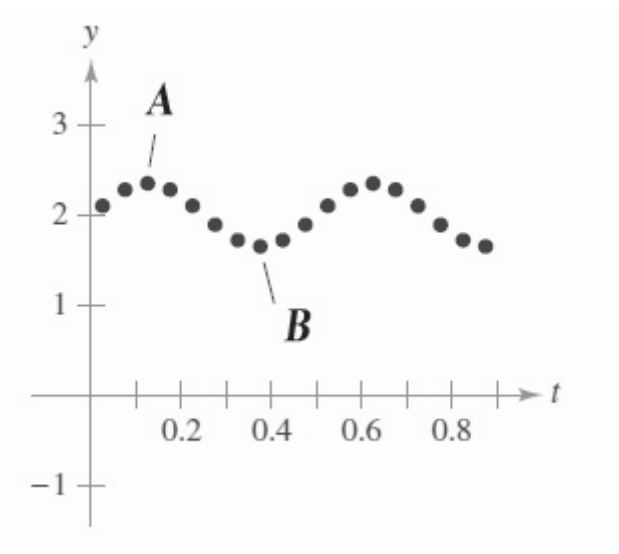
a.   Amplitude = 0.335. Period = 4.3.
b.   Amplitude = 0.71. Period = 2.1.
c.   Amplitude = 0.355. Period = 4.2.
d.   Amplitude = 4.2. Period = 0.355.
e.   Amplitude = 2.1. Period = 0.71.

P.4 Fitting Models to Data
Answer Section

MULTIPLE CHOICE

1.   ANS: A   PTS: 1   DIF: Easy   REF: Section 0.4
OBJ: Identify the most appropriate function for a scatter plot   MSC: Skill
2.   ANS: D   PTS: 1   DIF: Easy   REF: Section 0.4
OBJ: Identify the most appropriate function for a scatter plot   MSC: Skill
3.   ANS: D   PTS: 1   DIF: Easy   REF: Section 0.4
OBJ: Write a linear model for data using the regression capabilities of a graphing utility
MSC: Application
4.   ANS: D   PTS: 1   DIF: Easy   REF: Section 0.4
OBJ: Plot data points and the graph of a linear model   MSC: Application
5.   ANS: C   PTS: 1   DIF: Easy   REF: Section 0.4
OBJ: Evaluate linear models in applications   MSC: Application
6.   ANS: A   PTS: 1   DIF: Easy   REF: Section 0.4
OBJ: Write a linear model for data using the regression capabilities of a graphing utility
MSC: Application
7.   ANS: C   PTS: 1   DIF: Easy   REF: Section 0.4
OBJ: Plot data points and the graph of a linear model   MSC: Application
8.   ANS: E   PTS: 1   DIF: Easy   REF: Section 0.4
OBJ: Evaluate linear models in applications   MSC: Application
9.   ANS: B   PTS: 1   DIF: Med   REF: Section 0.4
OBJ: Write a quadratic model for data using the regression capabilities of a graphing utility
MSC: Application
10.   ANS: B   PTS: 1   DIF: Med   REF: Section 0.4
OBJ: Plot data points and the graph of a quadratic model   MSC: Application
11.   ANS: A   PTS: 1   DIF: Med   REF: Section 0.4
OBJ: Evaluate quadratic models in applications   MSC: Application
12.   ANS: D   PTS: 1   DIF: Med   REF: Section 0.4
OBJ: Evaluate cubic models in applications   MSC: Application
13.   ANS: D   PTS: 1   DIF: Med   REF: Section 0.4
OBJ: Plot data points and the graph of a cubic model   MSC: Application
14.   ANS: A   PTS: 1   DIF: Med   REF: Section 0.4
OBJ: Write a cubic model for data using the regression capabilities of a graphing utility
MSC: Application
15.   ANS: C   PTS: 1   DIF: Easy   REF: Section 0.4
OBJ: Fit a trigonometric model to a real-life data set.   MSC: Application

1.1 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 $x = 4$.

$y = f(x)$
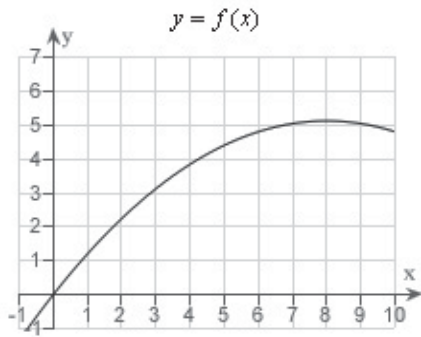
a. precalculus, 0.08
b. calculus, 0.2
c. calculus, 0.64
d. calculus, 0.08
e. precalculus, 0.2

_____   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 $x = 5$.

$y = f(x)$
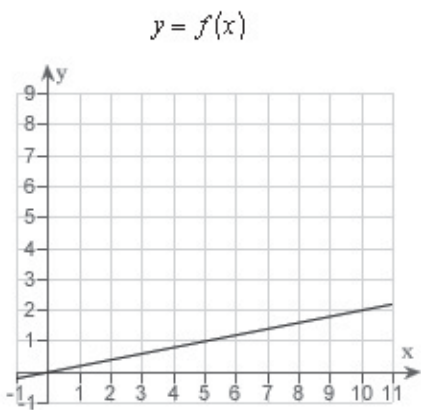
a. calculus, 2
b. precalculus, 0.2
c. calculus, 0.2
d. precalculus, 2
e. precalculus, 0.45

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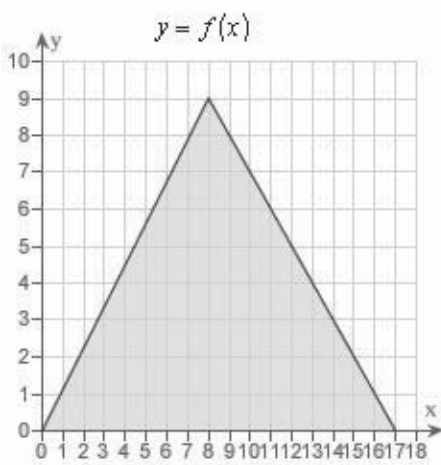
a.   precalculus , 153
b.   calculus , 229.5
c.   precalculus , 76.5
d.   precalculus , 229.5
e.   calculus , 153

_____   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.
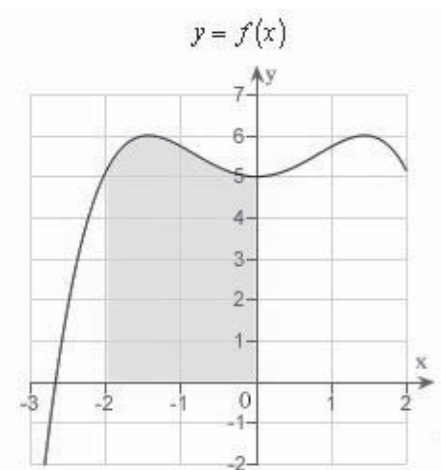
a.   calculus , 11
b.   precalculus , 11
c.   precalculus , 13

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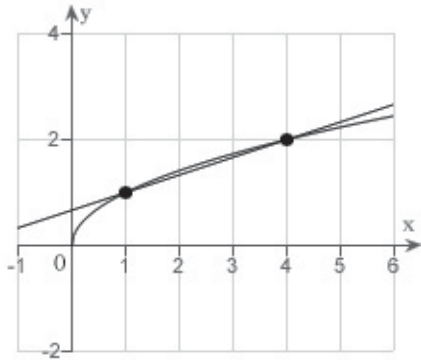
d.
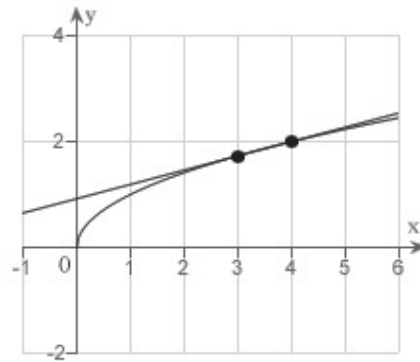
b.
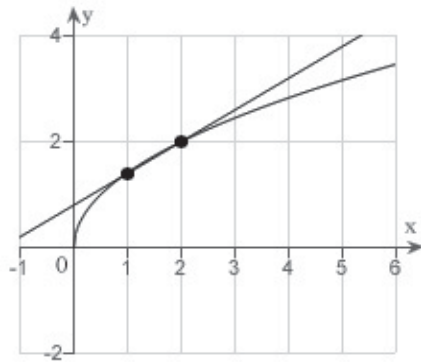
e.
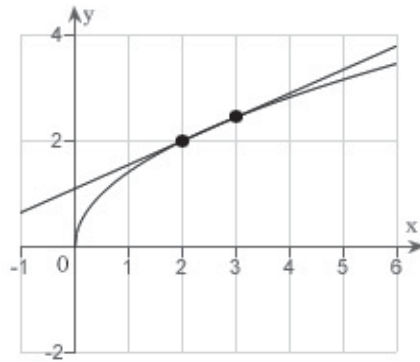
c.
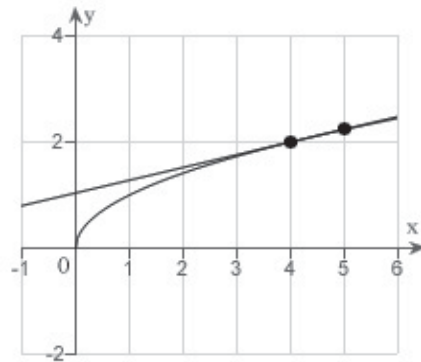
_____ 8.   Consider the function $f(x) = \sqrt{x}$ and the point $P(81,9)$ on the graph of f. Find the slope of the secant line passing through $P(81,9)$ and $Q\left(x, f(x)\right)$ for $x = 1$. Round your answer to four decimal places.

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 $P(64,8)$ on the graph of f.

Consider the secant lines passing through $P(64,8)$ and $Q(x, f(x))$ for x values of 61, 63, and 65. Find the slope of each secant line to four decimal places.

(Think about how you could use your results to estimate the slope of the tangent line of f at $P(64,8)$, and how to improve your approximation of the slope.)

a. 0.0633 , –0.0627 , 0.0623
b. 0.0633 , 0.0627 , 0.0623
c. 0.0317 , 0.0314 , 0.0312
d. 0.0633 , –0.0627 , –0.0623
e. –0.0317 , –0.0314 , –0.0312

_____ 10.   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

_____   11.   Consider the function $f(x) = 6x - x^2$ and the point $P(2, 8)$ on the graph of f. Graph f and the secant line passing through $P(2, 8)$ and $Q(x, f(x))$ for $x = 3$.

a.
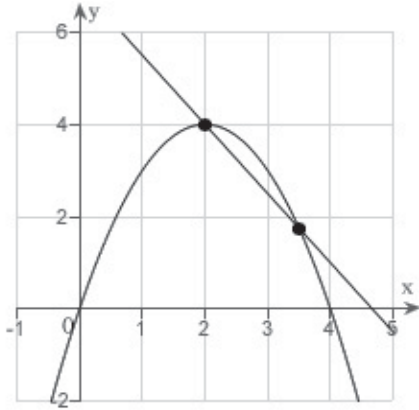
d.
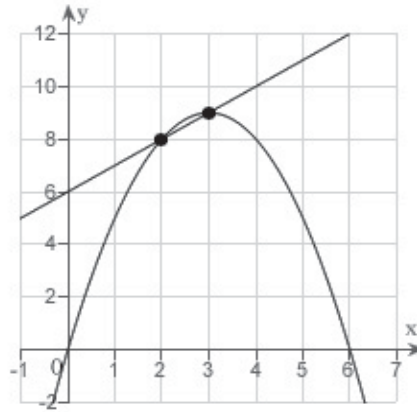
b.
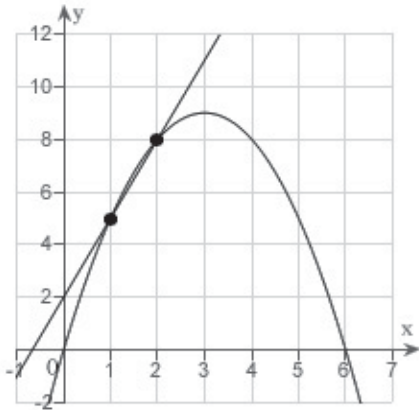
e.
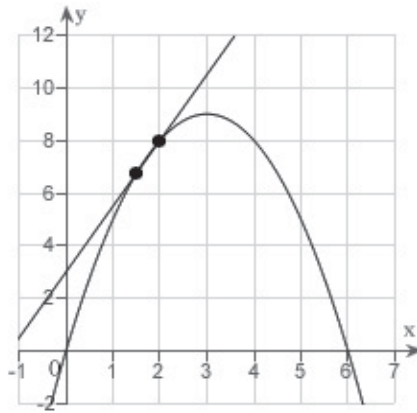
c.
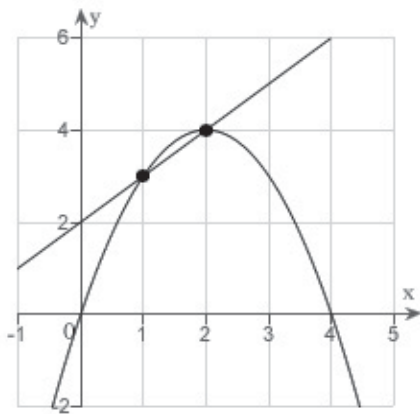
_____ 12.   Consider the function $f(x) = 11x - x^2$ and the point $P(4, 28)$ on the graph of f. Find the slope of the secant line passing through $P(4, 28)$ and $Q\left(x, f(x)\right)$ for $x = 5$. Round your answer to one decimal place.

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

_____ 13.   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

_____ 14.   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.
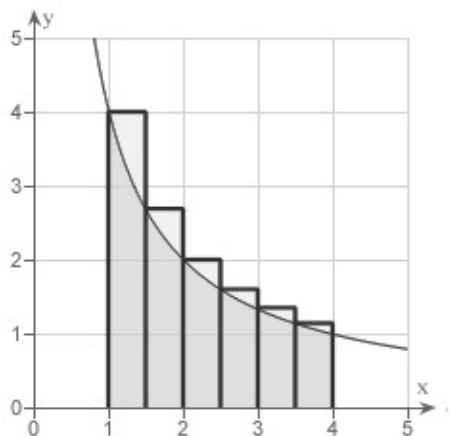
a. 2.481 units^2
b. 6.371 units^2
c. 3.585 units^2
d. 6.872 units^2
e. 6.903 units^2

_____   15.   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.
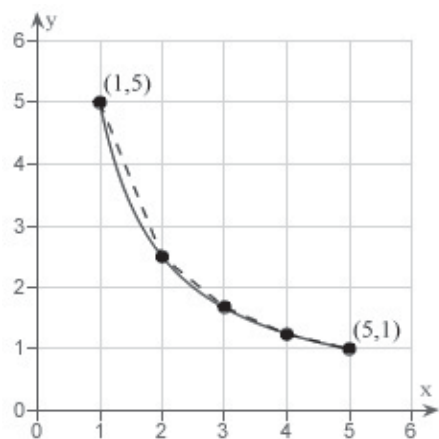
a.   6.11
b.   8.12
c.   5.66
d.   8.49
e.   7.11

1.1 A Preview of Calculus
Answer Section

MULTIPLE CHOICE

1.   ANS: C   PTS: 1   DIF: Easy   REF: Section 1.1
OBJ: Recognize problems requiring precalculus and find the solution   MSC: Skill
2.   ANS: C   PTS: 1   DIF: Med   REF: Section 1.1
OBJ: Recognize problems requiring calculus and estimate solutions   MSC: Skill
3.   ANS: C   PTS: 1   DIF: Med   REF: Section 1.1
OBJ: Recognize problems requiring calculus and estimate solutions   MSC: Skill
4.   ANS: B   PTS: 1   DIF: Easy   REF: Section 1.1
OBJ: Recognize problems requiring precalculus and find the solution   MSC: Skill
5.   ANS: C   PTS: 1   DIF: Easy   REF: Section 1.1
OBJ: Recognize problems requiring precalculus and find the solution   MSC: Skill
6.   ANS: A   PTS: 1   DIF: Med   REF: Section 1.1
OBJ: Recognize problems requiring calculus and estimate solution   MSC: Skill
7.   ANS: D   PTS: 1   DIF: Easy   REF: Section 1.1
OBJ: Graph a function and the secant line passing through given points   MSC: Skill
8.   ANS: A   PTS: 1   DIF: Easy   REF: Section 1.1
OBJ: Calculate the slope of a secant line passing through given points   MSC: Skill
9.   ANS: D   PTS: 1   DIF: Med   REF: Section 1.1
OBJ: Calculate the slopes of secant lines   MSC: Skill
10.   ANS: A   PTS: 1   DIF: Med   REF: Section 1.1
OBJ: Estimate the slope of a tangent line   MSC: Skill
11.   ANS: D   PTS: 1   DIF: Easy   REF: Section 1.1
OBJ: Graph a function and the secant line passing through given points   MSC: Skill
12.   ANS: B   PTS: 1   DIF: Easy   REF: Section 1.1
OBJ: Calculate the slope of a secant line passing through given points   MSC: Skill
13.   ANS: D   PTS: 1   DIF: Med   REF: Section 1.1
OBJ: Calculate the slope of secant line passing through the given points   MSC: Skill
14.   ANS: B   PTS: 1   DIF: Med   REF: Section 1.1
OBJ: Estimate the area of a region using rectangles   MSC: Skill
15.   ANS: A   PTS: 1   DIF: Med   REF: Section 1.1
OBJ: Estimate the length of the curve using a piecewise linear function   MSC: Skill

1.2 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.

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

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

_____   4.   Determine the following limit. (Hint: Use the graph to calculate the limit.)

$$\lim_{x \to 1} (5 - x)$$
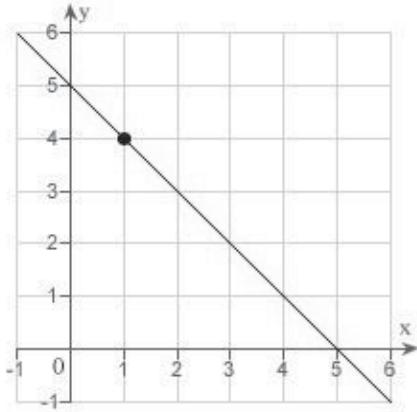
a.   6
b.   1
c.   5
d.   4
e.   does not exist

_____   5.   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.)
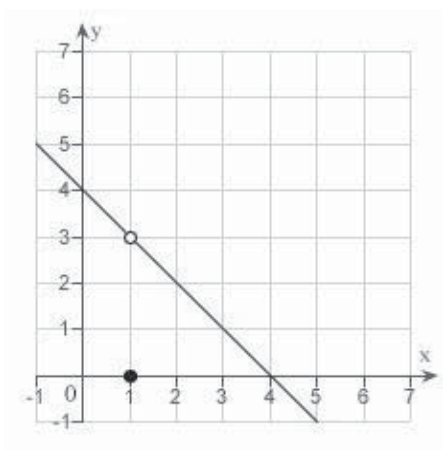
$$\lim_{x \to 1} f(x)$$

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

_____ 6.   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.)

$$\lim_{x \to 1} f(x)$$
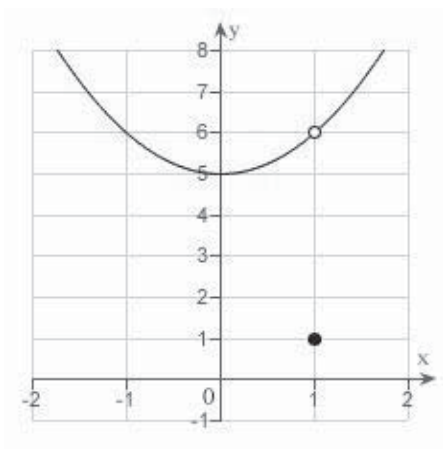
a. 6
b. 25
c. 1
d. 5
e. does not exist.

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

$$\lim_{x \to 2} \frac{1}{x-2}$$
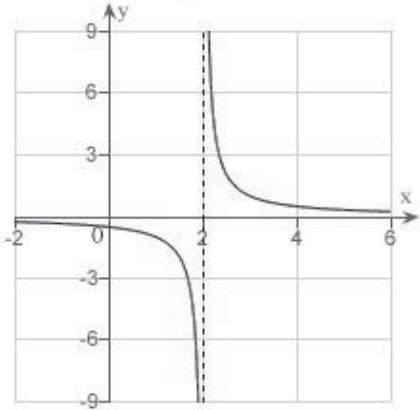
a. –2
b. 0
c. –4
d. 2
e. does not exist

_____ 8. 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

_____ 9. 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.

_____   10.   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

_____   11.   A sphere has a volume of 4.44 cubic inches. If the sphere's volume can vary between 3.64 cubic inches and 5.04 cubic inches , how can the radius vary? Round your answer to five decimal places.

a.   Radius can vary between 0.93219 inch and 1.09691 inches.
b.   Radius can vary between 0.21960 inch and 1.61960 inches.
c.   Radius can vary between 1.69081 inches and 1.98957 inches.
d.   Radius can vary between 1.51481 inches and 1.68837 inches.
e.   Radius can vary between 0.95427 inch and 1.06361 inches.

_____   12.   Find the limit L.

$$\lim_{x \to 7} (x + 2)$$

a.   L = 9
b.   L = 2
c.   L = 7
d.   L = 16
e.   none of the above

_____   13.   Find the limit L.

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

a.   L = 12
b.   L = 6
c.   L = 2
d.   L = –4
e.   none of the above

_____   14.   What is the limit of $f(x) = 4$ as x approaches π?

a. $\lim_{x \to \pi} (4) = \pi$

b. $\lim_{x \to \pi} (4) = 4$

c. $\lim_{x \to \pi} (4) = \dfrac{\pi}{4}$

d. $\lim_{x \to \pi} (4) = 4\pi$

e.   none of the above

_____   15.   The graph of $f(x) = x^2 - 2$ is shown in the figure. Find δ such that if $0 < |x - 3| < \delta$, then $|f(x) - 7| < 0.2$.

a. $\delta = \sqrt{9.2} - 3$

b. $\delta = \sqrt{9.2} + 3$

c. $\delta = \sqrt{7} - 3$

d. $\delta = \sqrt{7} - 2$
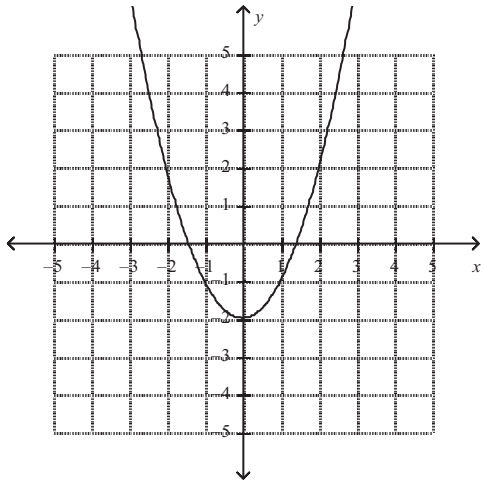
e.   None of the above

1.2 Finding Limits Graphically and Numerically
Answer Section

MULTIPLE CHOICE

1.   ANS: C   PTS: 1   DIF: Med   REF: Section 1.2
OBJ: Estimate a limit from a table of values   MSC: Skill
2.   ANS: A   PTS: 1   DIF: Med   REF: Section 1.2
OBJ: Estimate a limit from a table of values   MSC: Skill
3.   ANS: C   PTS: 1   DIF: Med   REF: Section 1.2
OBJ: Estimate a limit from a table of values   MSC: Skill
4.   ANS: D   PTS: 1   DIF: Easy   REF: Section 1.2
OBJ: Estimate the limit of a function from its graph   MSC: Skill
5.   ANS: C   PTS: 1   DIF: Med   REF: Section 1.2
OBJ: Estimate the limit of a function from its graph   MSC: Skill
6.   ANS: A   PTS: 1   DIF: Med   REF: Section 1.2
OBJ: Estimate the limit of a function from its graph   MSC: Skill
7.   ANS: E   PTS: 1   DIF: Med   REF: Section 1.2
OBJ: Estimate the limit of a function from its graph   MSC: Skill
8.   ANS: C   PTS: 1   DIF: Easy   REF: Section 1.2
OBJ: Solve a linear equation in applications   MSC: Application
9.   ANS: C   PTS: 1   DIF: Med   REF: Section 1.2
OBJ: Solve a linear equation in applications   MSC: Application
10.   ANS: A   PTS: 1   DIF: Easy   REF: Section 1.2
OBJ: Solve a cubic equation in applications   MSC: Application
11.   ANS: E   PTS: 1   DIF: Med   REF: Section 1.2
OBJ: Solve a linear equation in applications   MSC: Application
12.   ANS: A   PTS: 1   DIF: Easy   REF: Section 1.2
OBJ: Estimate a limit using a numerical or graphical approach   MSC: Skill
13.   ANS: D   PTS: 1   DIF: Easy   REF: Section 1.2
OBJ: Estimate a limit using a numerical or graphical approach   MSC: Skill
14.   ANS: B   PTS: 1   DIF: Easy   REF: Section 1.2
OBJ: Estimate a limit using a numerical or graphical approach   MSC: Skill
15.   ANS: A   PTS: 1   DIF: Med   REF: Section 1.2
OBJ: Estimate a limit using a numerical or graphical approach   MSC: Skill

1.3 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. $\dfrac{1}{14}$

b. $\dfrac{1}{10}$

c. $\dfrac{3}{22}$

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

e. $\dfrac{3}{10}$

_____   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.   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

_____   5.   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. $\sqrt{2}$

_____   6.   Let $f(x) = x^2 - x - 5$ and $g(x) = \sqrt[3]{x + 14}$. Find the limits.

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

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

_____   7.   Find the limit.

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

a. $\dfrac{-1}{\sqrt{3}}$
b. $\sqrt{3}$
c. $-\sqrt{3}$
d. $\dfrac{1}{\sqrt{3}}$
e. does not exixt

_____   8.   Find the limit.

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

a. $\dfrac{1}{2}$

b. $-\dfrac{1}{2}$

c. $-\dfrac{\sqrt{3}}{2}$

d. $\dfrac{\sqrt{3}}{2}$

e.   0

_____   9.   Find the limit.

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

a. $-\dfrac{1}{2}$

b.   0

c. $\dfrac{1}{2}$

d. $-\dfrac{\sqrt{3}}{2}$

e. $\dfrac{\sqrt{3}}{2}$

_____   10.   Find the limit.

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

a. $\dfrac{\sqrt{3}}{2}$

b. $-\dfrac{\sqrt{2}}{2}$

c. $-\dfrac{1}{2}$

d. $\dfrac{\sqrt{2}}{2}$

e.   does not exist

_____ 11.   Suppose that $\lim\limits_{x \to c} f(x) = -13$ and $\lim\limits_{x \to c} g(x) = -10$. Find the following limit.

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

a. 0
b. −10
c. −3
d. −23
e. 130

_____ 12.   Suppose that $\lim\limits_{x \to c} f(x) = -11$ and $\lim\limits_{x \to c} g(x) = -3$. Find the following limit.

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

a. −11
b. −8
c. 33
d. −14
e. 0

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

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

a. 10
b. −5
c. −25
d. −15
e. 150

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

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

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

_____ 15.   Suppose that $\lim\limits_{x \to c} f(x) = 5$. Find the following limit.

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

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

_____ 16.   Suppose that $\lim\limits_{x \to c} f(x) = -5$. Find the following limit.

$$\lim\limits_{x \to c} 3f(x)$$

a. −5
b. 15
c. −15
d. 3c
e. 3

_____ 17.   Find the following limit (if it exists). Write a simpler function that agrees with the given function at all but one point.

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

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

_____ 18.   Find the limit (if it exists).

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

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

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

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

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

_____   20.   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. $\dfrac{1}{3}x^3 - \dfrac{9}{2}x^2 + 2x$
b. $2x - 9$
c. $x^3 - 9x^2 + 2x$
d. $x^2 - 9x + 2$
e.   does not exist

_____   21.   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

_____   22.   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

_____   23.   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

_____   24.   Find $\lim_{\Delta x \to 0} \dfrac{f(x + \Delta x) - f(x)}{\Delta x}$ where $f(x) = 4x - 3$.

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

1.3 Evaluating Limits Analytically
Answer Section

1.   ANS: E   PTS: 1   DIF: Easy   REF: Section 1.3
OBJ: Evaluate a limit using properties of limits   MSC: Skill
2.   ANS: C   PTS: 1   DIF: Easy   REF: Section 1.3
OBJ: Evaluate a limit using properties of limits   MSC: Skill
3.   ANS: D   PTS: 1   DIF: Med   REF: Section 1.3
OBJ: Evaluate a limit using properties of limits   MSC: Skill
4.   ANS: C   PTS: 1   DIF: Med   REF: Section 1.3
OBJ: Evaluate the limit of composite functions   MSC: Skill
5.   ANS: B   PTS: 1   DIF: Med   REF: Section 1.3
OBJ: Evaluate the limit of composite functions   MSC: Skill
6.   ANS: D   PTS: 1   DIF: Med   REF: Section 1.3
OBJ: Evaluate the limit of composite functions   MSC: Skill
7.   ANS: B   PTS: 1   DIF: Med   REF: Section 1.3
OBJ: Evaluate the limit of the function   MSC: Skill
8.   ANS: B   PTS: 1   DIF: Easy   REF: Section 1.3
OBJ: Evaluate a limit using properties of limits   MSC: Skill
9.   ANS: D   PTS: 1   DIF: Med   REF: Section 1.3
OBJ: Evaluate a limit using properties of limits   MSC: Skill
10.   ANS: D   PTS: 1   DIF: Med   REF: Section 1.3
OBJ: Evaluate a limit using properties of limits   MSC: Skill
11.   ANS: D   PTS: 1   DIF: Med   REF: Section 1.3
OBJ: Evaluate the limit of a function using properties of limits MSC: Skill
12.   ANS: B   PTS: 1   DIF: Med   REF: Section 1.3
OBJ: Evaluate the limit of a function using properties of limits MSC: Skill
13.   ANS: E   PTS: 1   DIF: Med   REF: Section 1.3
OBJ: Evaluate the limit of a function using properties of limits MSC: Skill
14.   ANS: D   PTS: 1   DIF: Med   REF: Section 1.3
OBJ: Evaluate the limit of a function using properties of limits MSC: Skill
15.   ANS: B   PTS: 1   DIF: Med   REF: Section 1.3
OBJ: Evaluate the limit of a function using properties of limits MSC: Skill
16.   ANS: C   PTS: 1   DIF: Med   REF: Section 1.3
OBJ: Evaluate the limit of a function using properties of limits MSC: Skill
17.   ANS: B   PTS: 1   DIF: Med   REF: Section 1.3
OBJ: Evaluate the limit of the function and simplify it to an identical function except at the
discontinuity point   MSC: Skill
18.   ANS: A   PTS: 1   DIF: Med   REF: Section 1.3
OBJ: Evaluate the limit of a function analytically   MSC: Skill
19.   ANS: D   PTS: 1   DIF: Med   REF: Section 1.3
OBJ: Evaluate the limit of a function analytically   MSC: Skill
20.   ANS: B   PTS: 1   DIF: Med   REF: Section 1.3
OBJ: Evaluate the limit of a function analytically   MSC: Skill
21.   ANS: A   PTS: 1   DIF: Med   REF: Section 1.3
OBJ: Evaluate the limit of a function analytically   MSC: Skill

22.   ANS: E   PTS: 1   DIF: Med   REF: Section 1.3
OBJ: Evaluate the limit of a function analytically   MSC: Skill
23.   ANS: B   PTS: 1   DIF: Med   REF: Section 1.3
OBJ: Evaluate the limit of a function analytically   MSC: Skill
24.   ANS: B   PTS: 1   DIF: Med   REF: Section 1.3
OBJ: Evaluate the limit of a difference quotient   MSC: Skill

1.4 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) $\lim\limits_{x \to 3^+} f(x)$ (ii) $\lim\limits_{x \to 3^-} f(x)$ (iii) $\lim\limits_{x \to 3} f(x)$
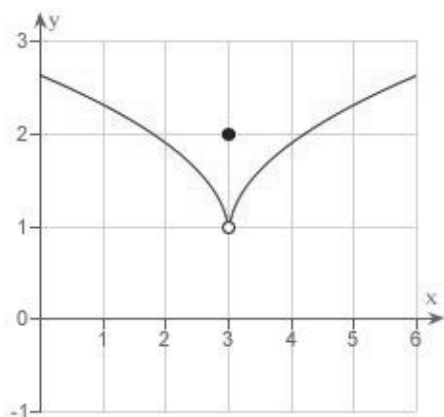
a.   1,1,1 , not continuous
b.   2,2,2 , continuous
c.   4,4,4 , not continuous
d.   2,2,2 , not continuous
e.   1,1,1 , continuous

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

(i) $\lim\limits_{x \to -4^+} f(x)$ (ii) $\lim\limits_{x \to -4^-} f(x)$ (iii) $\lim\limits_{x \to -4} f(x)$
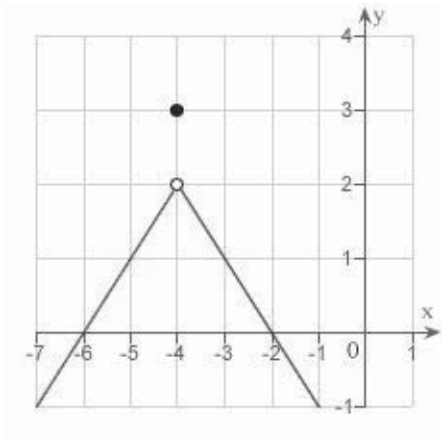
a. 3, 3, 3, continuous
b. 2, 2, 2, not continuous
c. 3, 3, 3, not continuous
d. −4, − 4, − 4, continuous
e. 2, 2, 2, continuous

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

(i) $\lim\limits_{x \to -3^+} f(x)$ (ii) $\lim\limits_{x \to -3^-} f(x)$ (iii) $\lim\limits_{x \to -3} f(x)$
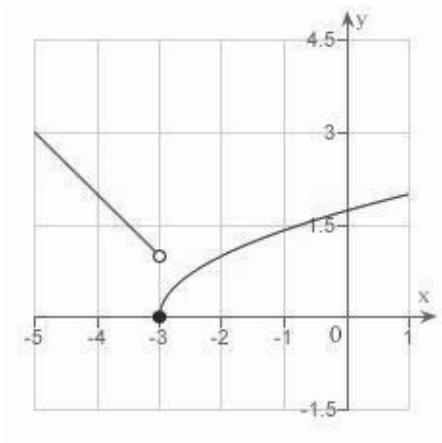
a. 1, − 1, does not exist, not continuous
b. 1, 0, does not exist, not continuous
c. 0, 1, does not exist, not continuous
d. −3, 0, does not exist, not continuous
e. 0, 1, 0, continuous

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

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

a. $\dfrac{1}{22}$

b.   0

c.   Limit does not exist.

d. $-\dfrac{1}{22}$

e. $\dfrac{1}{242}$

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

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

a.   0

b. $-\dfrac{1}{12}$

c. $\dfrac{1}{72}$

d. $\dfrac{1}{12}$

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 $f(x) = \big[\,|x|\,\big]$ represents the greatest integer function.

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

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

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

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

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

_____   9.   Discuss the continuity of the function $f(x) = \dfrac{x^2 - 4}{x - 2}$.
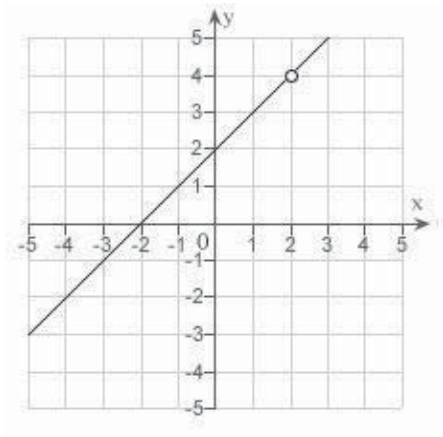
a. $f(x)$ is discontinuous at $x = -2$.
b. $f(x)$ is discontinuous at $x = -2, 2$.
c. $f(x)$ is discontinuous at $x = 2$.
d. $f(x)$ is continuous for all real x.
e. $f(x)$ is continuous at $x = 4$.

_____   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 constants a and b 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 $\left(-\infty, \infty\right)$.

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

a. $c = 3$

b. $c = 0$

c. $\dfrac{-1 + \sqrt{17}}{2}$

d. $\dfrac{1 + \sqrt{17}}{2}, \dfrac{1 - \sqrt{17}}{2}$

e. $\dfrac{-1 + \sqrt{17}}{2}, \dfrac{-1 - \sqrt{17}}{2}$

1.4 Continuity and One-Sided Limits
Answer Section

1. ANS: A   PTS: 1   DIF: Med   REF: Section 1.4
OBJ: Estimate a limit and points of discontinuity from a graph   MSC: Skill
2. ANS: B   PTS: 1   DIF: Med   REF: Section 1.4
OBJ: Estimate a limit and points of discontinuity from a graph   MSC: Skill
3. ANS: C   PTS: 1   DIF: Med   REF: Section 1.4
OBJ: Estimate a limit and points of discontinuity from a graph   MSC: Skill
4. ANS: D   PTS: 1   DIF: Easy   REF: Section 1.4
OBJ: Evaluate one-sided limits   MSC: Skill
5. ANS: D   PTS: 1   DIF: Med   REF: Section 1.4
OBJ: Evaluate one-sided limits   MSC: Skill
6. ANS: D   PTS: 1   DIF: Med   REF: Section 1.4
OBJ: Evaluate one-sided limits   MSC: Skill
7. ANS: A   PTS: 1   DIF: Med   REF: Section 1.4
OBJ: Evaluate one-sided limits   MSC: Skill
8. ANS: C   PTS: 1   DIF: Med   REF: Section 1.4
OBJ: Evaluate one-sided limits   MSC: Skill
9. ANS: C   PTS: 1   DIF: Easy   REF: Section 1.4
OBJ: Identify the discontinuities of a function if any exist   MSC: Skill
10. ANS: D   PTS: 1   DIF: Med   REF: Section 1.4
OBJ: Identify the removable discontinuities of a function   MSC: Skill
11. ANS: D   PTS: 1   DIF: Easy   REF: Section 1.4
OBJ: Identify the removable discontinuities of a function   MSC: Skill
12. ANS: D   PTS: 1   DIF: Med   REF: Section 1.4
OBJ: Identify the removable discontinuities of a function   MSC: Skill
13. ANS: C   PTS: 1   DIF: Med   REF: Section 1.4
OBJ: Identify the removable discontinuities of a function   MSC: Skill
14. ANS: A   PTS: 1   DIF: Med   REF: Section 1.4
OBJ: Identify the removable discontinuities of a function   MSC: Skill
15. ANS: E   PTS: 1   DIF: Med   REF: Section 1.4
OBJ: Identify the value of a parameter to ensure a function is continuous   MSC: Skill
16. ANS: C   PTS: 1   DIF: Med   REF: Section 1.4
OBJ: Identify the value of a parameter to ensure a function is continuous   MSC: Skill
17. ANS: B   PTS: 1   DIF: Easy   REF: Section 1.4
OBJ: Identify the value of c guaranteed by the Intermediate Value Theorem   MSC: Skill
18. ANS: D   PTS: 1   DIF: Med   REF: Section 1.4
OBJ: Identify the value of c guaranteed by the Intermediate Value Theorem   MSC: Skill
19. ANS: E   PTS: 1   DIF: Med   REF: Section 1.4
OBJ: Create functions in applications   MSC: Application
20. ANS: E   PTS: 1   DIF: Med   REF: Section 1.4
OBJ: Identify the value of a parameter to ensure a function is continuous   MSC: Skill

1.5 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
$f(x)$				

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

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

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

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

_____ 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

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

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 $f(x) = \frac{x^3+8}{x+2}$.

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

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. $x = \frac{k}{15}\pi \ \left(k = 0, \pm 1, \pm 2, \ldots\right)$

b. $x = \frac{2k+1}{30}\pi \ \left(k = 0, \pm 1, \pm 2, \ldots\right)$

c. $x = \frac{2k}{15}\pi \ \left(k = 0, \pm 1, \pm 2, \ldots\right)$

d. $x = \frac{2k+1}{15}\pi \ \left(k = 0, \pm 1, \pm 2, \ldots\right)$

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. $\dfrac{1}{20}$

b. $-\dfrac{1}{20}$

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.   −∞

e.   ∞

_____   11.   Find the limit (if it exists).

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

a.   ∞

b.   −∞

c.   0

d. $\dfrac{1}{2}$

e.   Limit does not exist

_____   12.   Use a graphing utility to graph the function $f(x) = \dfrac{x^2 - 2x + 4}{x^3 + 8}$ and determine the

one-sided limit $\lim\limits_{x \to -2^+} f(x)$.

a.   −∞

b.   ∞

c.   0

d.   12

e.   8

_____   13.   Use a graphing utility to graph the function $f(x) = \csc \dfrac{\pi x}{2}$ and determine the following one-sided limit.
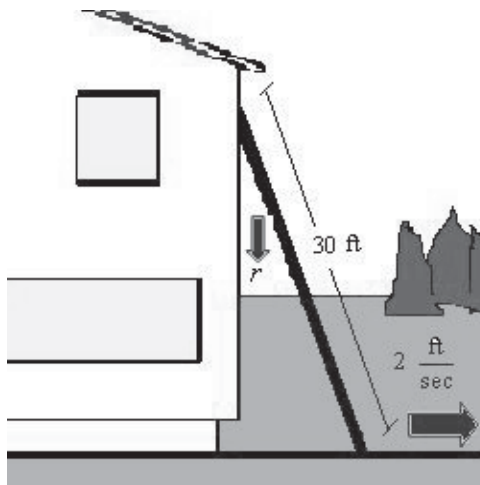
$$\lim_{x \to 2^-} f(x)$$

a. $-\infty$
b.   2
c. -2
d. ∞
e.   0

_____   14.   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 $r = \dfrac{2x}{\sqrt{900 - x^2}}$ ft / sec, where x is the distance between the base of the ladder and the house. Find the rate r when x is 18 feet.

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

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

c. $r = \dfrac{48}{5}$ ft/sec

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

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

_____   15.   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 $r = \dfrac{2x}{\sqrt{625 - x^2}}$ ft / sec where x is the distance between the base of the ladder and the house. Find the limit of r as $x \to 25^-$.

25 ft

$2 \dfrac{ft}{sec}$
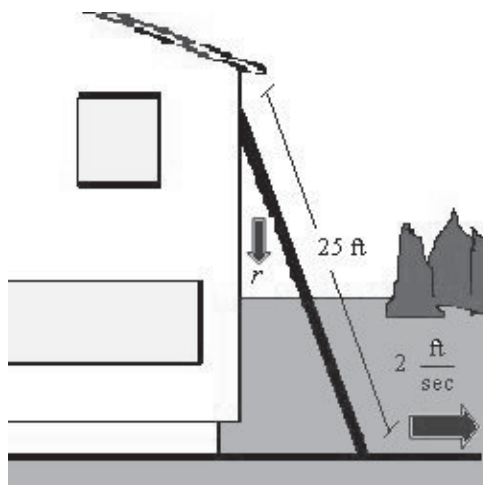
a. $-\infty$
b.   50
c.   0
d. ∞
e.   25

1.5 Infinite Limits
Answer Section

1. ANS: B   PTS: 1   DIF: Med   REF: Section 1.5
OBJ: Evaluate an infinite limit from a table of values   MSC: Skill
2. ANS: D   PTS: 1   DIF: Easy   REF: Section 1.5
OBJ: Identify the vertical asymptotes (if any) of the graph of a function   MSC: Skill
3. ANS: B   PTS: 1   DIF: Med   REF: Section 1.5
OBJ: Identify the vertical asymptotes (if any) of the graph of a function   MSC: Skill
4. ANS: D   PTS: 1   DIF: Med   REF: Section 1.5
OBJ: Identify the vertical asymptotes (if any) of the graph of a function   MSC: Skill
5. ANS: E   PTS: 1   DIF: Med   REF: Section 1.5
OBJ: Identify the vertical asymptotes (if any) of the graph of a function   MSC: Skill
6. ANS: A   PTS: 1   DIF: Med   REF: Section 1.5
OBJ: Identify the vertical asymptotes (if any) of the graph of a function   MSC: Skill
7. ANS: B   PTS: 1   DIF: Med   REF: Section 1.5
OBJ: Identify the vertical asymptotes (if any) of the graph of a function   MSC: Skill
8. ANS: D   PTS: 1   DIF: Med   REF: Section 1.5
OBJ: Evaluate one-sided limits   MSC: Skill
9. ANS: B   PTS: 1   DIF: Med   REF: Section 1.5
OBJ: Evaluate the limit of a function   MSC: Skill
10. ANS: E   PTS: 1   DIF: Med   REF: Section 1.5
OBJ: Evaluate one-sided limits   MSC: Skill
11. ANS: E   PTS: 1   DIF: Med   REF: Section 1.5
OBJ: Identify a limit that does not exist   MSC: Skill
12. ANS: B   PTS: 1   DIF: Med   REF: Section 1.5
OBJ: Estimate one-sided limits from a graph   MSC: Skill
13. ANS: D   PTS: 1   DIF: Med   REF: Section 1.5
OBJ: Estimate one-sided limits from a graph   MSC: Skill
14. ANS: A   PTS: 1   DIF: Easy   REF: Section 1.5
OBJ: Evaluate functions in applications   MSC: Application
15. ANS: D   PTS: 1   DIF: Med   REF: Section 1.5
OBJ: Evaluate limits in applications   MSC: Application