Test Bank

Calculus

TENTH EDITION

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Bruce Edwards

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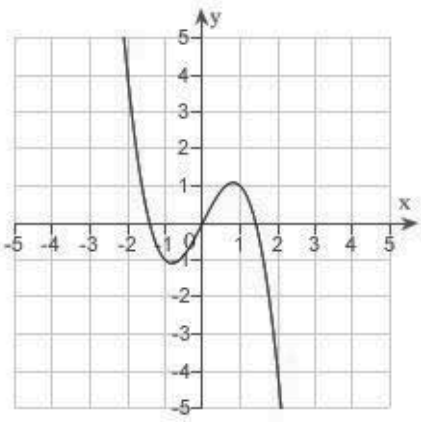
P.1 Graphs and Models

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.



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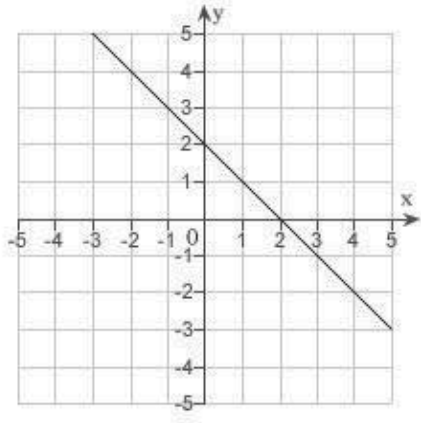

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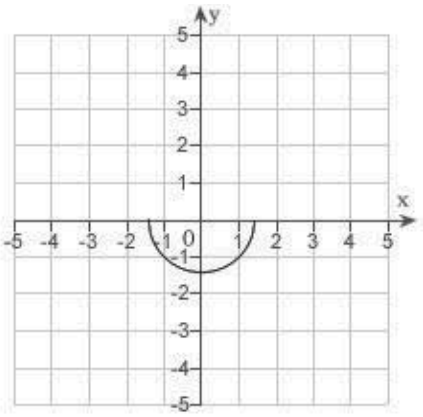

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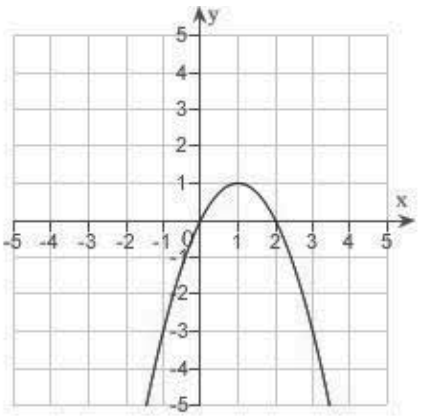

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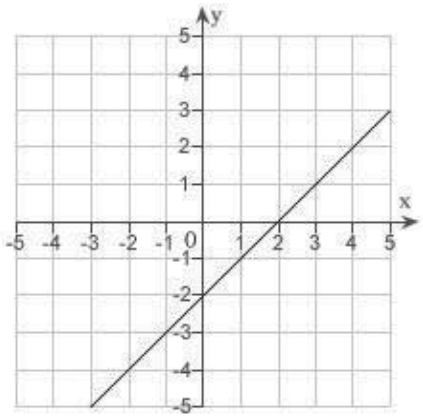
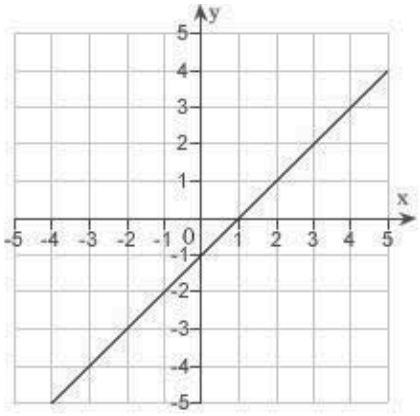


____ 2. Which of the following is the correct graph of $y = x - x^3$?

a.



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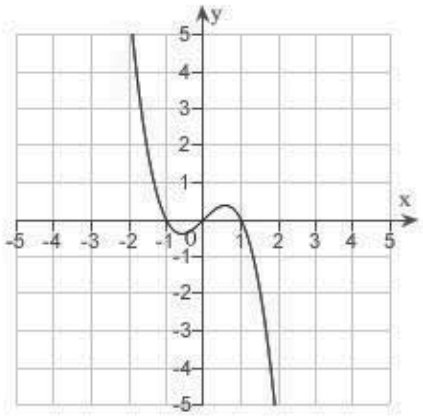

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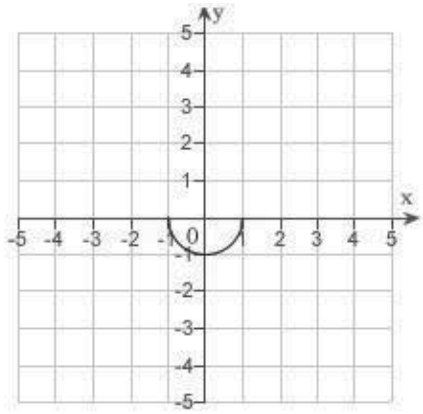

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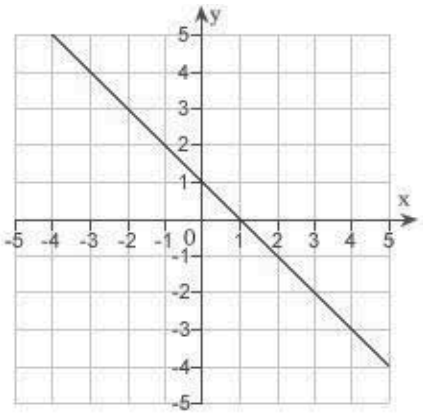
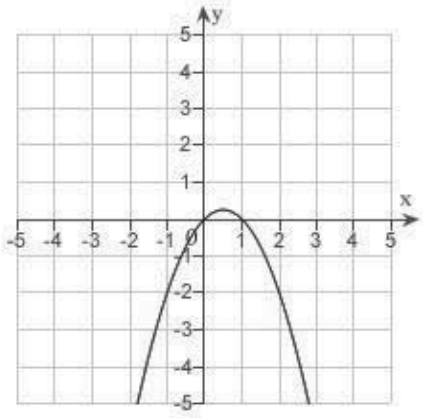


e.



____ 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.

$x^2y^2 = 8$

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

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

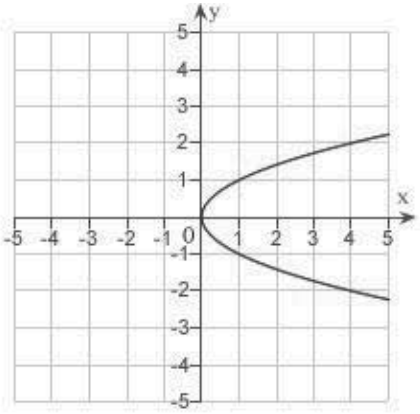
$y = \dfrac{x^2 + 2}{x}$

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

____ 7. Sketch the graph of the equation:

$x = 4 - y^2$

a.



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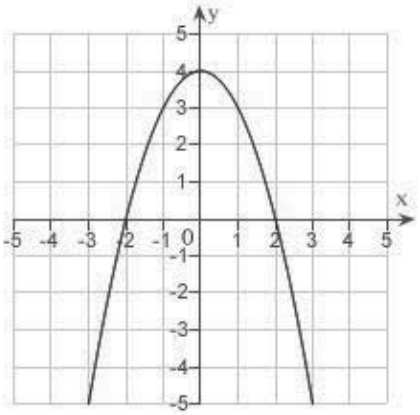

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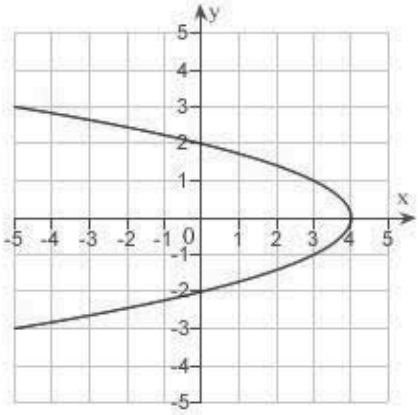
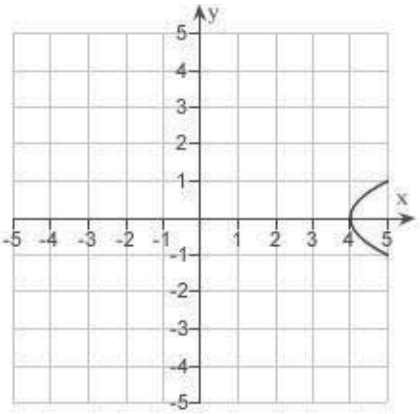


e.



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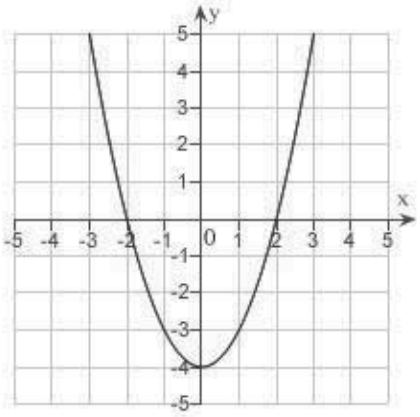
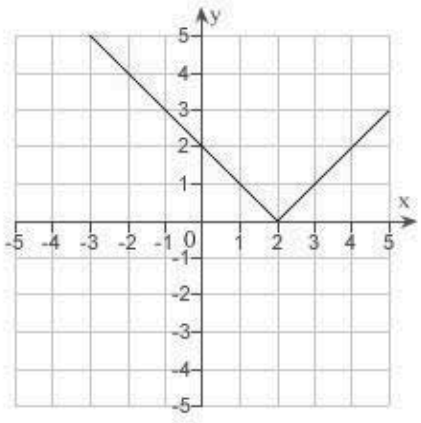


____ 8. Sketch the graph of the equation:

$y = |x + 2|$

a.



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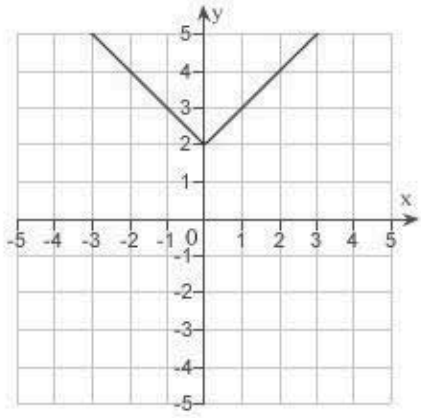
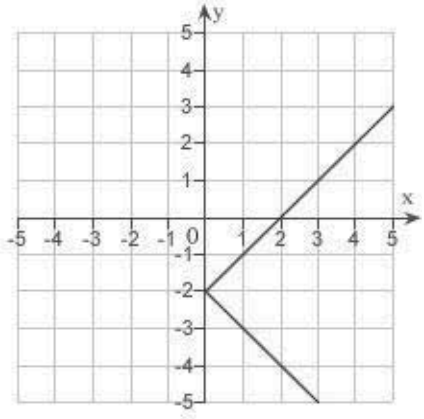


c.



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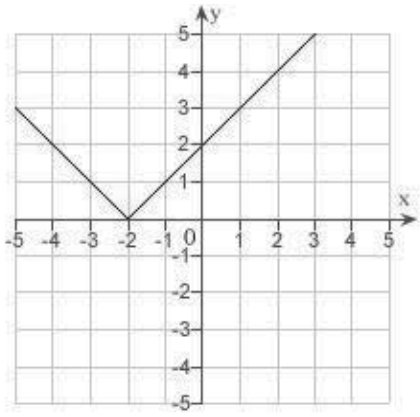


e. none of the above

____ 9. Find the points of intersection of the graphs of the equations:

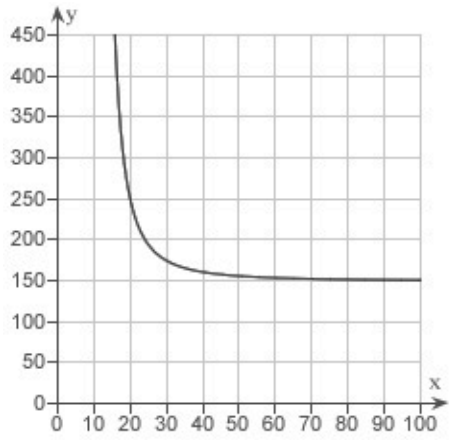
$x = y^2 - 3$

$y = x + 1$

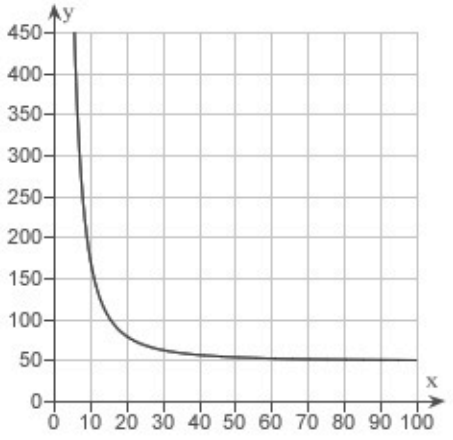
a. $(-2, 1), (-1, 2)$
b. $(-2, 0), (1, 2)$
c. $(-2, -1), (1, 2)$
d. $(2, -1), (-1, 2)$
e. $(-2, -3), (-1, 2)$

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

a.



d.



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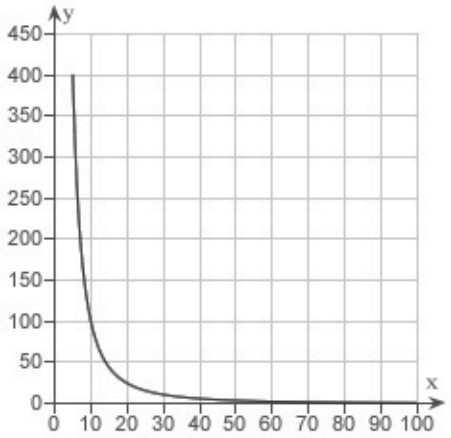
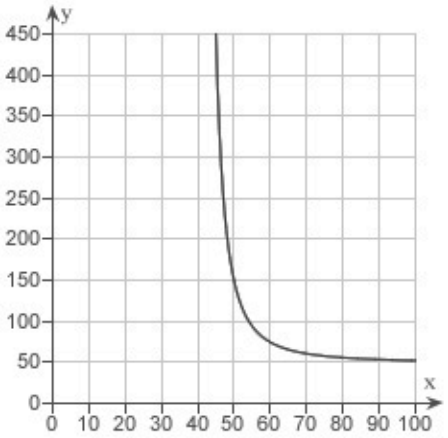
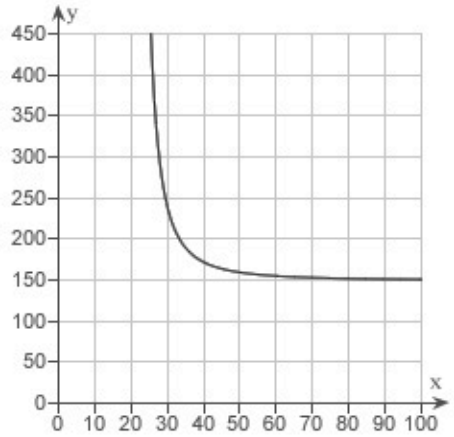


e.



c.



____ 11. The resistance y in ohms of 1000 feet of solid metal wire at $77°F$ can be approximated by the model $y = \frac{12,000}{x^2} - 0.46,\ 5 \le x \le 100,$ 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. $\frac{1}{2}$
b. $\frac{1}{5}$
c. 4
d. 5
e. $\frac{1}{4}$

____ 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:

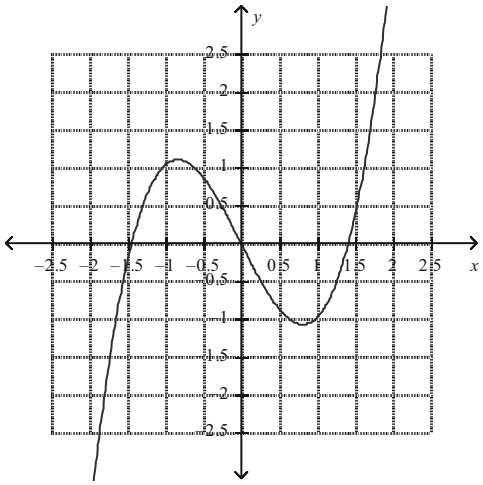
$y^2 = x^3 - 25x$

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)

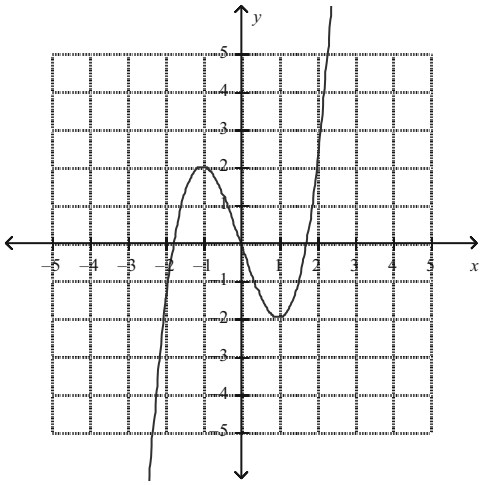
____ 15. Sketch the graph of the equation:

$y = x^3 - 3x$

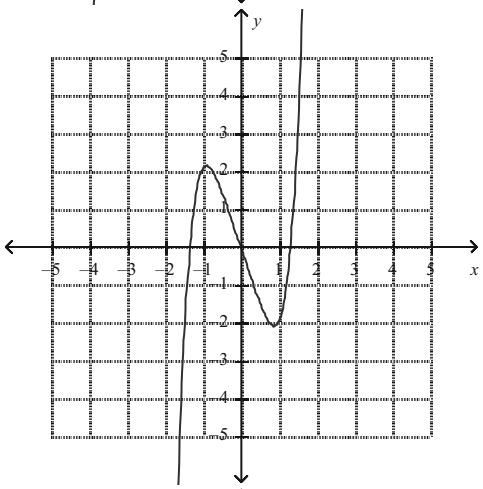
a.



d.

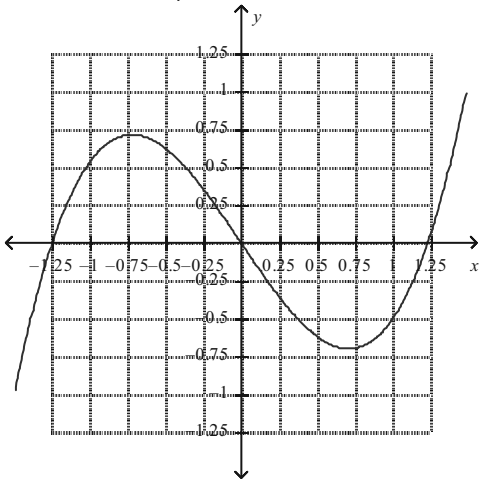


b.



e. none of the above

c.



P.1 Graphs and Models
Answer Section

MULTIPLE CHOICE

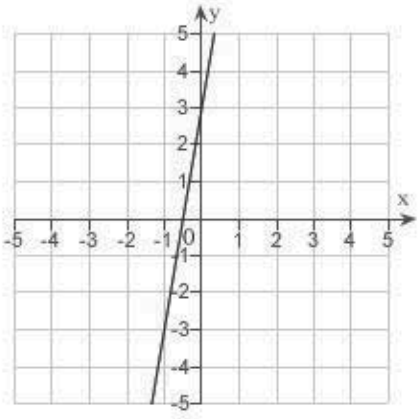
1. ANS: B PTS: 1 DIF: Easy REF: Section 0.1
OBJ: Identify the graph of a semicircle MSC: Skill
2. ANS: B PTS: 1 DIF: Easy REF: Section 0.1
OBJ: Identify the graph of a cubic equation MSC: Skill
3. ANS: C PTS: 1 DIF: Easy REF: Section 0.1
OBJ: Calculate the intercepts of an equation MSC: Skill
4. ANS: 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.

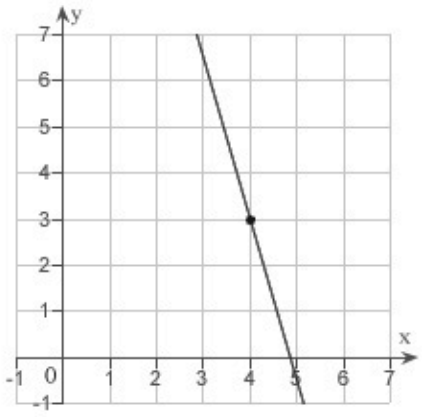
____ 1. Estimate the slope of the line from the graph.



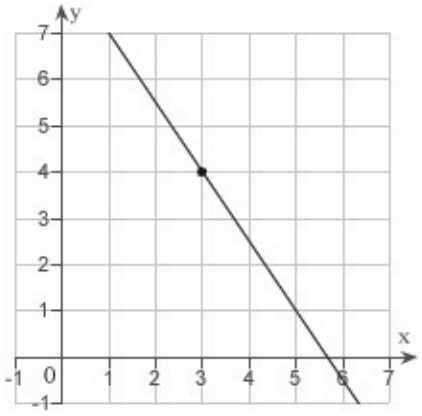
a. 3
b. $-\frac{1}{3}$
c. $-\frac{1}{6}$
d. $\frac{1}{6}$
e. 6

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

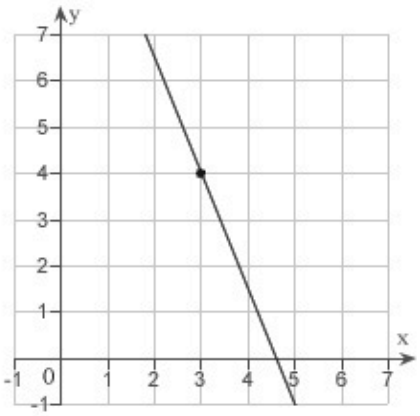
a.



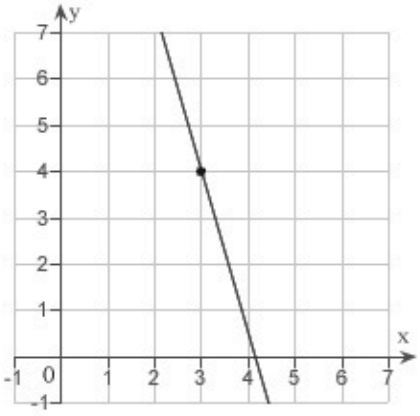
d.



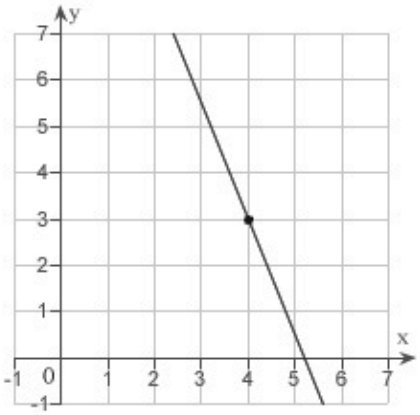
b.



e.



c.



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

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

a. $\frac{3}{5}$
b. $-\frac{5}{3}$
c. $\frac{5}{3}$
d. 0
e. $-\frac{3}{5}$

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

a. 63
b. -21
c. 42
d. 21
e. -42

____ 5. If a line has slope $m = -4$ 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. $\frac{1}{3}$
b. $-\frac{1}{5}$
c. $\frac{1}{5}$
d. $-\frac{1}{15}$
e. $-\frac{1}{3}$

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

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

____ 10. Find an equation of the line that passes through the point $(7, 2)$ 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 $m = \frac{9}{2}$.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

a. $8x - 7y - 8 = 0$

b. $7x - 8y + 7 = 0$

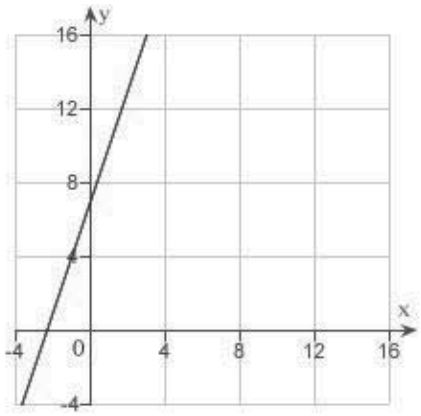
c. $8x + 7y + 8 = 0$

d. $7x + 8y + 56 = 0$

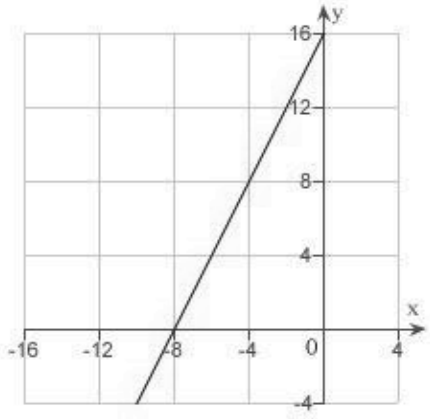
e. $7x + 8y - 56 = 0$

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

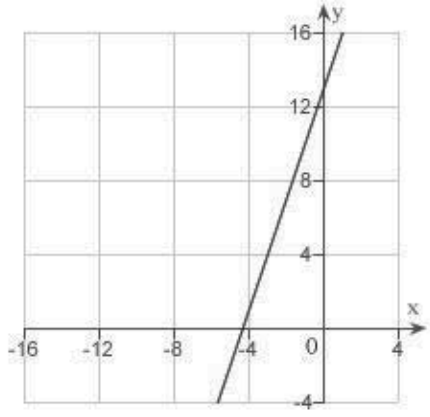
a.



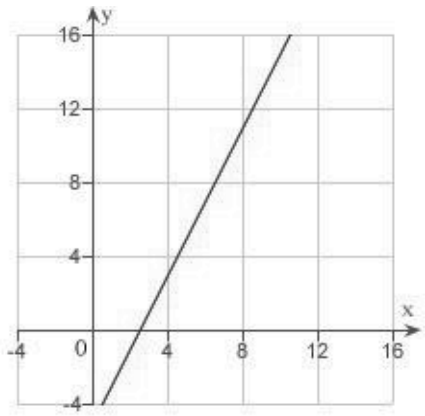
b.



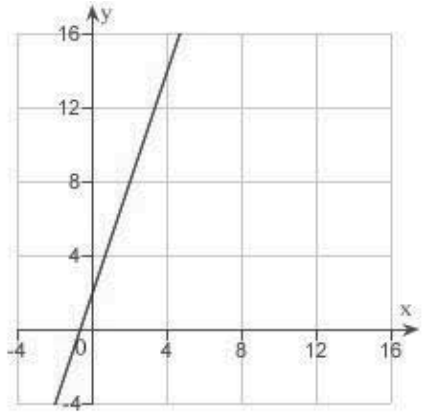
c.



d.



e.



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

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

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

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

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

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

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

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

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

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

____ 20. 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. $x = \frac{1}{15}(1595 - p)$

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

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

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

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

____ 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 $(-4, 7)$ and line $x - y - 2 = 0$ using the formula, $\text{Distance} = \frac{|Ax_1 + By_1 + C|}{\sqrt{A^2 + B^2}}$ for the distance between the point (x_1, y_1) and the line $Ax + By + C = 0$.

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

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

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

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

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

____ 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¢ 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¢ 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.

$y - 5x^2 = 6$

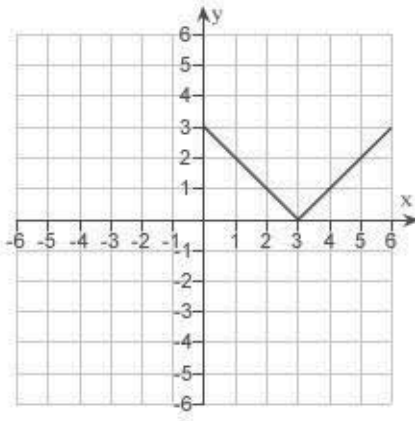
a. no
b. yes

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

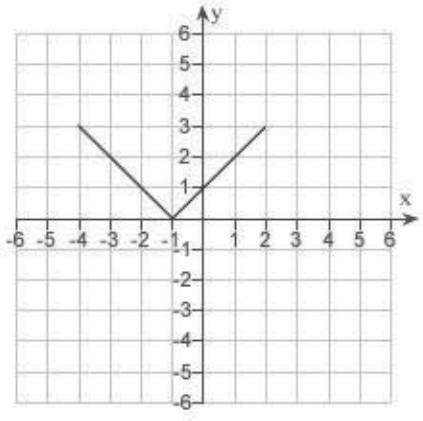
$xy - x^2 = 3y + x$

a. no
b. yes

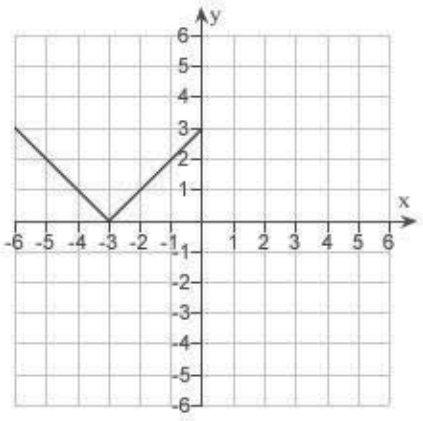
____ 13. Use the graph of $y = f(x)$ given below to find the graph of the function $y = f(x + 5)$.



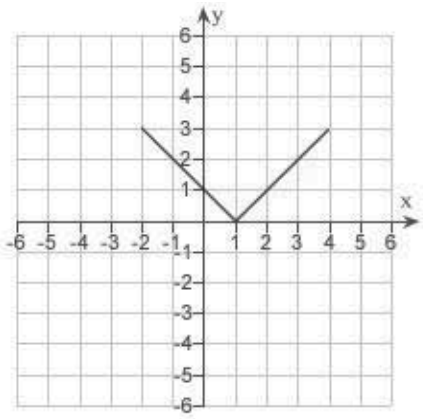
a.



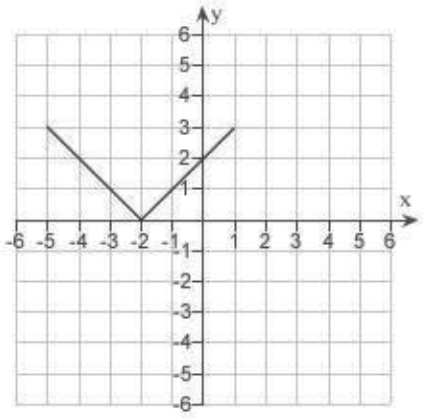
d.



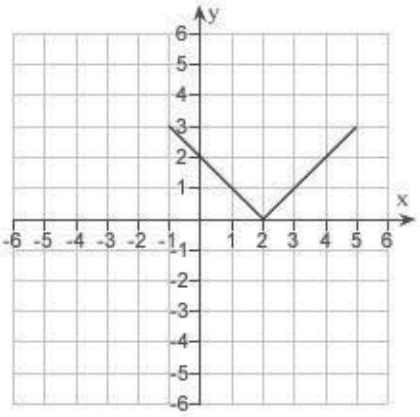
b.



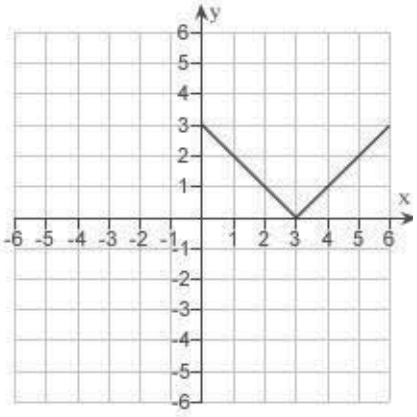
e.



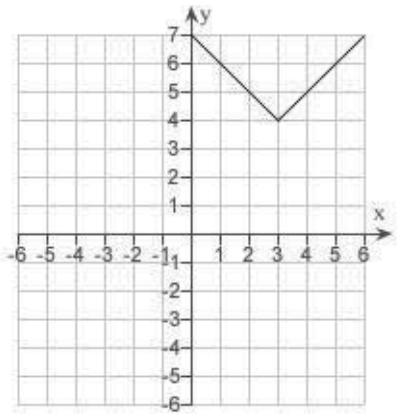
c.



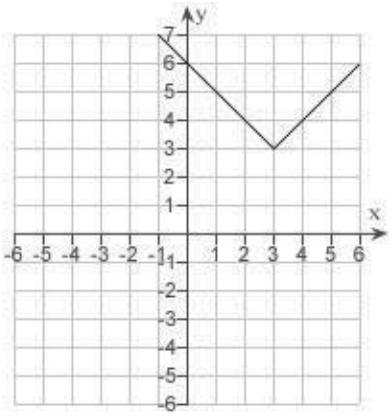
____ 14. Use the graph of $y = f(x)$ given below to find the graph of the function $y = f(x) + 4$.



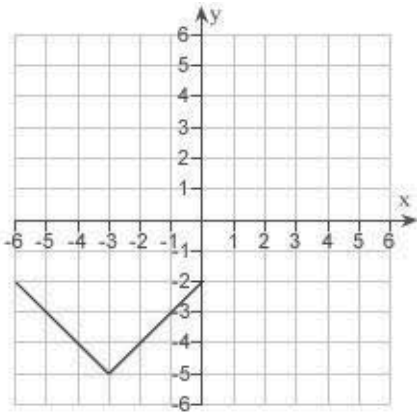
a.



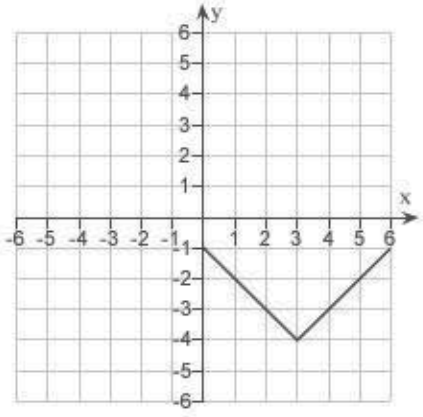
b.



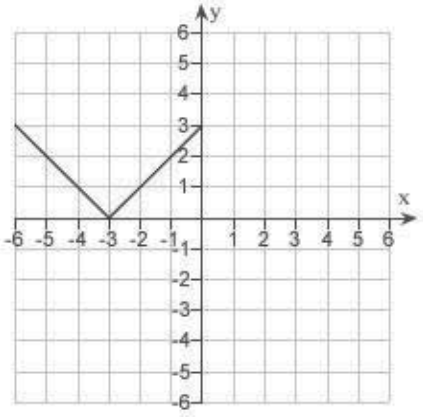
c.



d.



e.



____ 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 $H(x) = 0.002x^2 + 0.005x - 0.027, \ 10 \le x \le 100$ 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. $H\left(\frac{x}{1.1}\right) = 0.00150x^2 + 0.00455x - 0.02700$

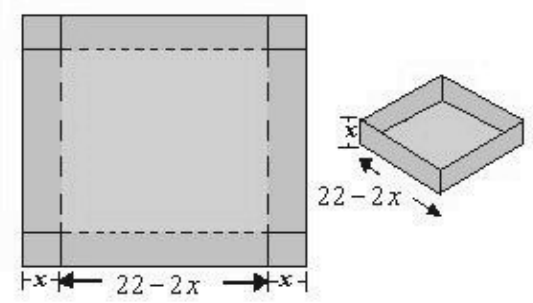
b. $H\left(\frac{x}{1.1}\right) = 0.00150x^2 + 0.00165x - 0.00455$

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

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

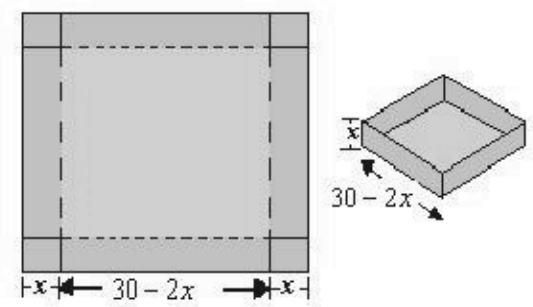
e. $H\left(\frac{x}{1.1}\right) = 0.00455x^2 + 0.00165x - 0.02700$

____ 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

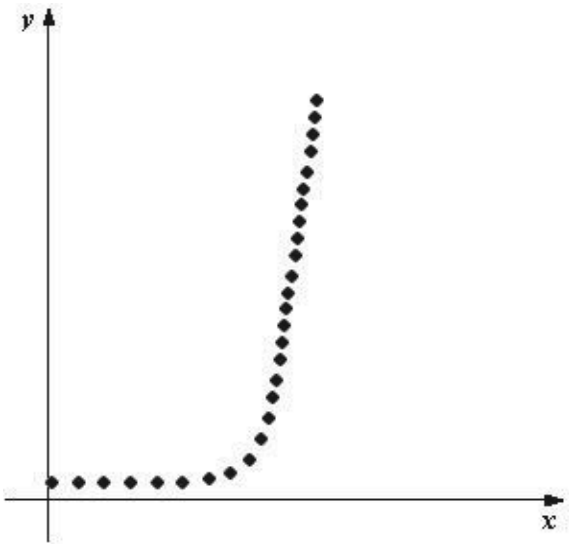
1.	ANS:	D	PTS:	1	DIF:	Easy	REF:	Section 0.3	
OBJ:	Evaluate a function and simplify						MSC:	Skill	
2.	ANS:	B	PTS:	1	DIF:	Easy	REF:	Section 0.3	
OBJ:	Evaluate a function and simplify						MSC:	Skill	
3.	ANS:	C	PTS:	1	DIF:	Easy	REF:	Section 0.3	
OBJ:	Evaluate a function and simplify						MSC:	Skill	
4.	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

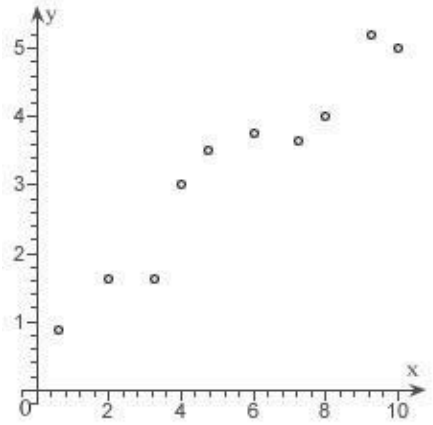
Identify the choice that best completes the statement or answers the question.

____ 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.

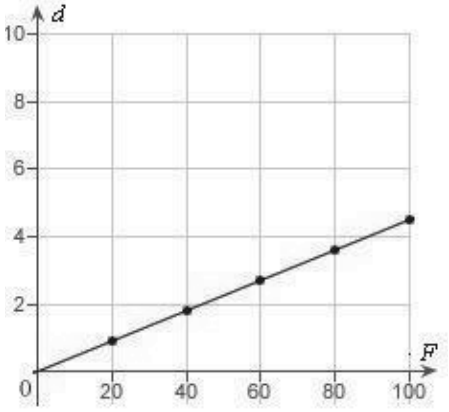
F	20	40	60	80	100
d	1.9	3.8	5.7	7.6	9.5

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

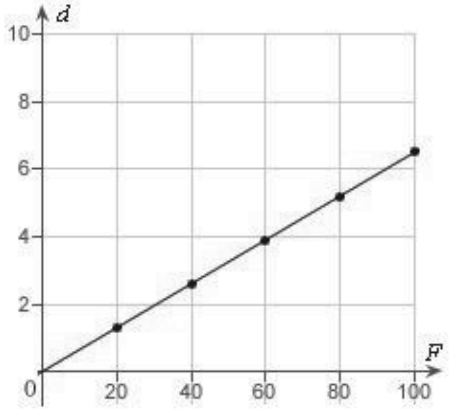
____ 4. Hooke's Law states that the force F required to compress or stretch a spring (within its elastic limits) is proportional to the distance d that the spring is compressed or stretched from its original length. That is, $F = kd$ where k is a measure of the stiffness of the spring and is called the 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

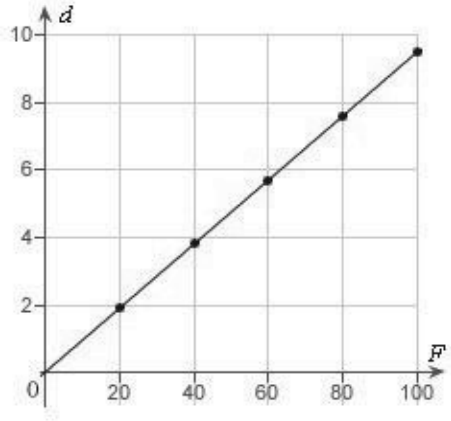
a.



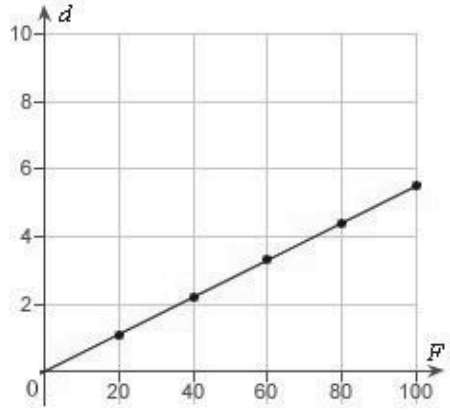
d.



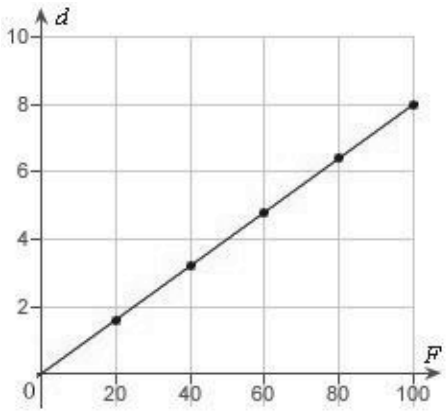
b.



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 $d = 0.085F$ to estimate the elongation of the spring when a force of 55 newtons is applied. Round your answer to two decimal places.

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

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

____ 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.

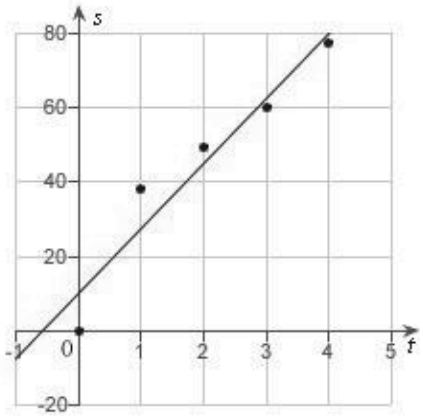
t	0	1	2	3	4
s	0	13.0	21.4	31.2	41.4

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. $s = 1.2t - 3.0$

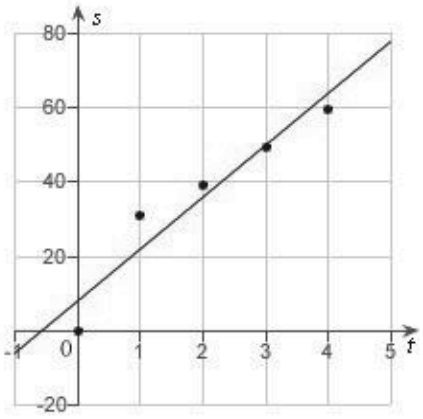
____ 7. In an experiment, students measured the speed s (in meters per second) of a falling object t seconds after it was released. The results are shown in the table below. Use the regression capabilities of a graphing utility to find a linear model for the data. Round all numerical values in your answer to one decimal place.

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

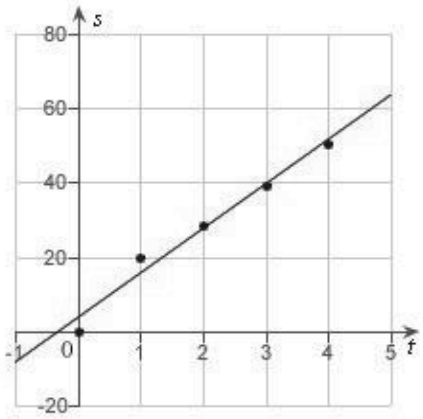
a.



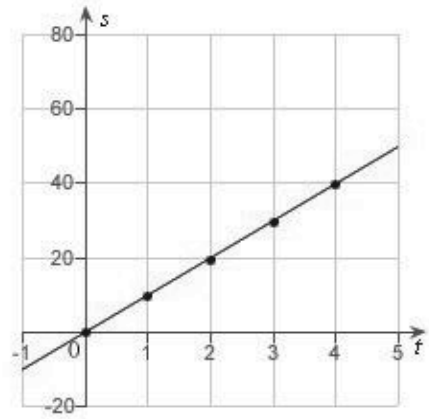
d.



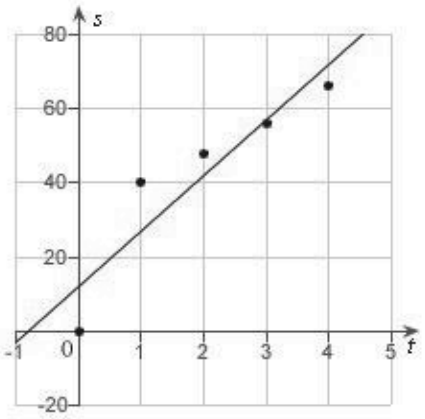
b.



e.



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.

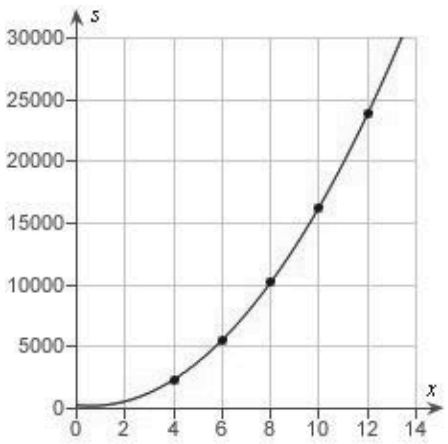
x	4	6	8	10	12
S	2422	5512	10,362	16,302	23,912

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

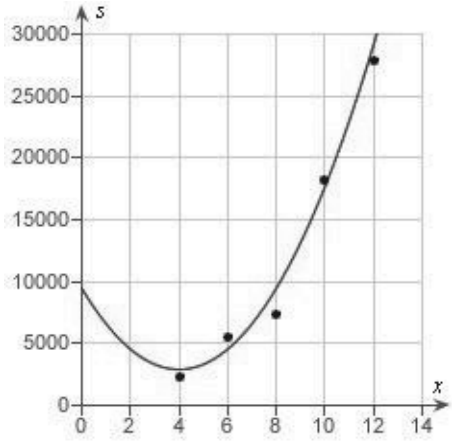
____ 10. Students in a lab measured the breaking strength S (in pounds) of wood 2 inches thick, x inches high, and 12 inches long. The results are shown in the table below. Use a graphing utility to plot the data and graph the quadratic model.

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

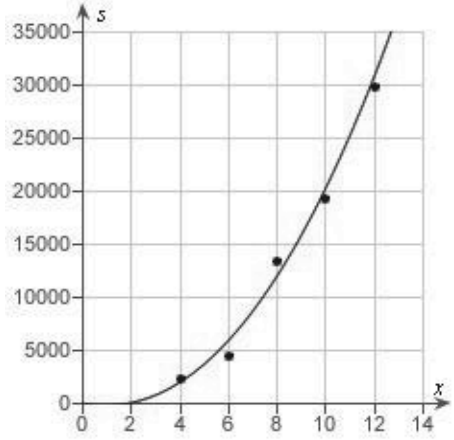
a.



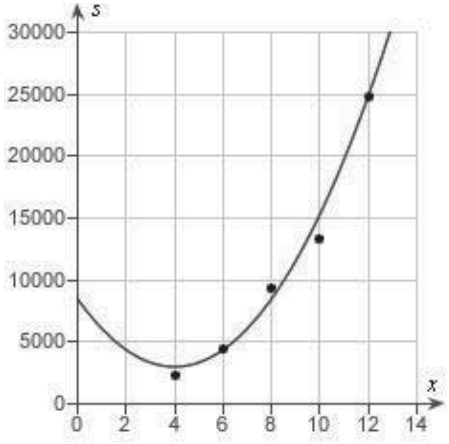
d.



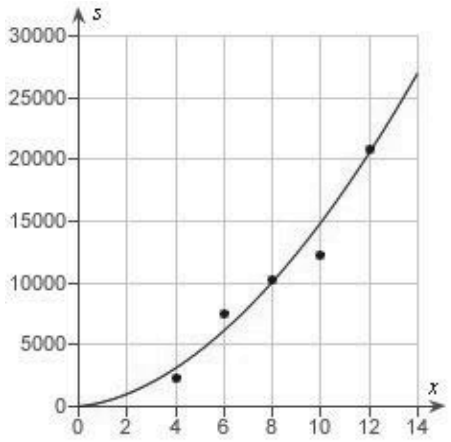
b.



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.

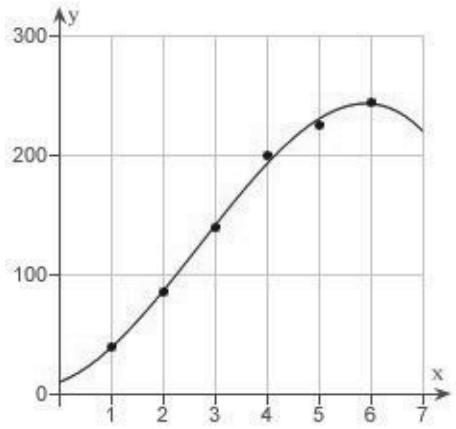
x	1	2	3	4	5	6
y	64	109	164	224	249	269

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

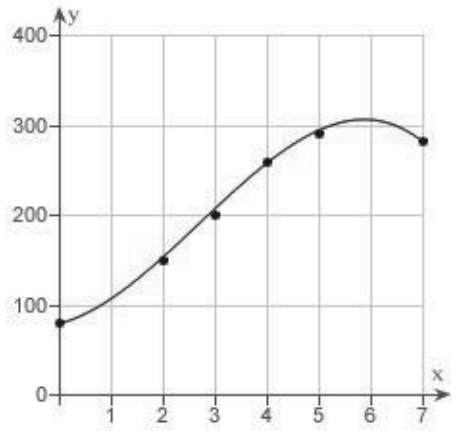
____ 13. A V8 car engine is coupled to a dynamometer and the horsepower y is measured at different engine speeds x (in thousands of revolutions per minute). The results are shown in the table below. Use a graphing utility to plot the data and graph the cubic model.

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

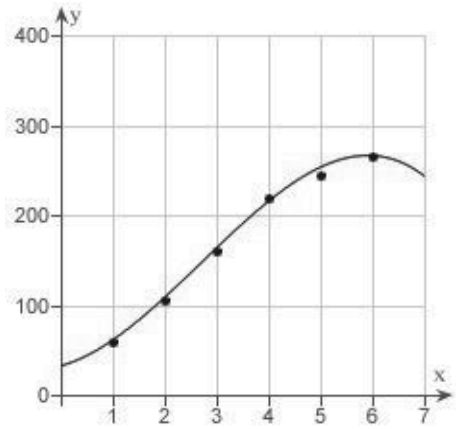
a.



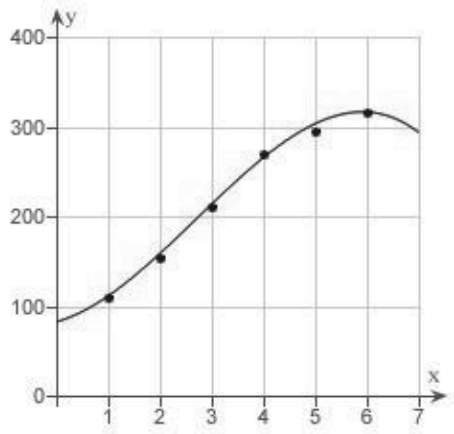
b.



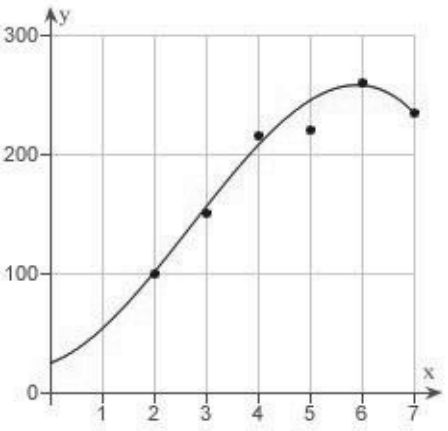
c.



d.



e.

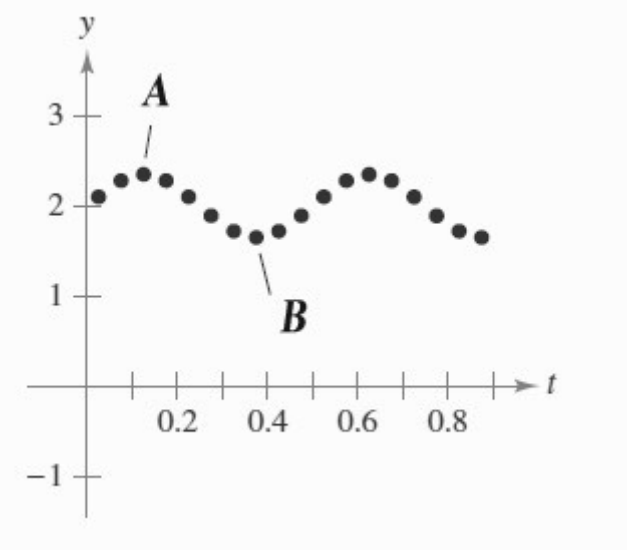


____ 14. A V8 car engine is coupled to a dynamometer and the horsepower y is measured at different engine speeds x (in thousands of revolutions per minute). The results are shown in the table below. Use the model $y = -1.806x^3 + 14.58x^2 + 16.4x + 30$ to approximate the horsepower when the engine is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

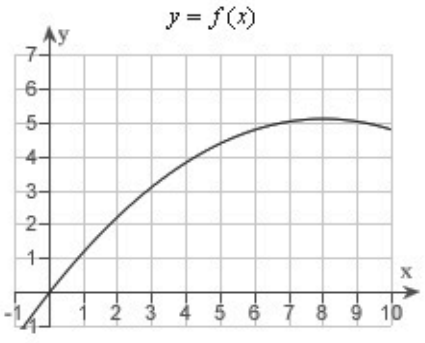
____ 2. Decide whether the following problem can be solved using precalculus, or whether calculus is required. If the problem can be solved using precalculus, solve it. If the problem seems to require calculus, use a graphical or numerical approach to estimate the solution.

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.

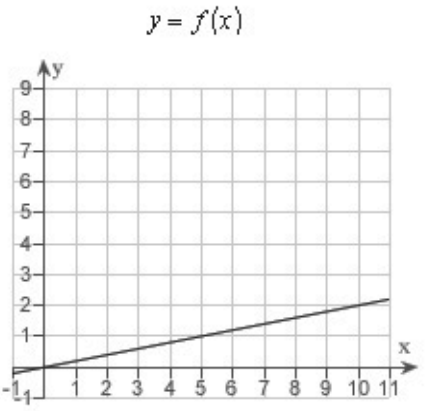
A cyclist is riding on a path whose elevation is modeled by the function $f(x) = 0.08\left(16x - x^2\right)$ where x and $f(x)$ are measured in miles. Find the rate of change of elevation when $x = 4$.



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

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

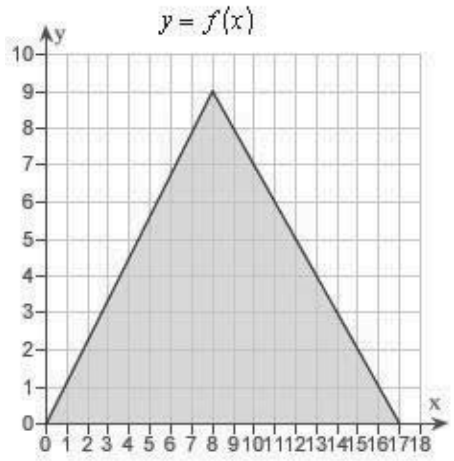
A cyclist is riding on a path whose elevation is modeled by the function $f(x) = 0.2x$ where x and $f(x)$ are measured in miles. Find the rate of change of elevation when $x = 5$.



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

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

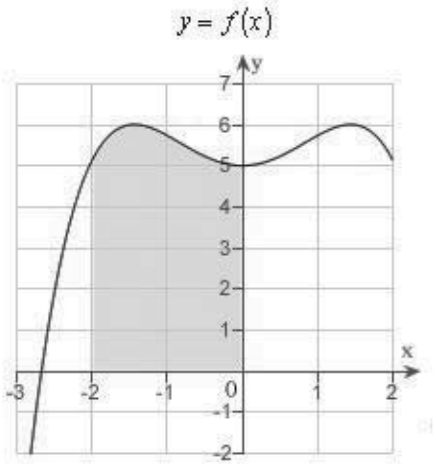
Find the area of the shaded region bounded by the triangle with vertices (0,0), (8,9), (17,0).



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

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

Find the area of the shaded region.

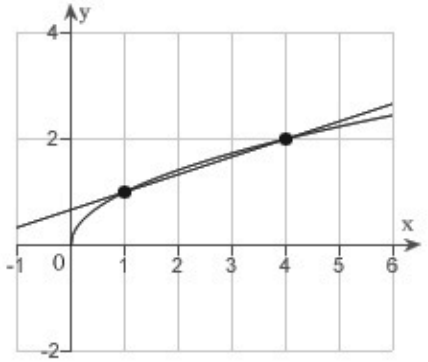


a. calculus , 11
b. precalculus , 11
c. precalculus , 13

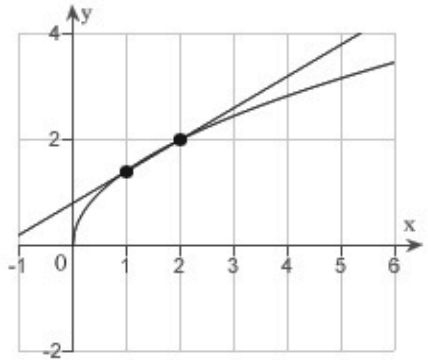
d. calculus , 16
e. precalculus , 16

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

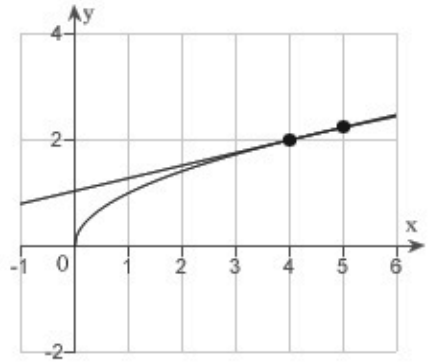
a.



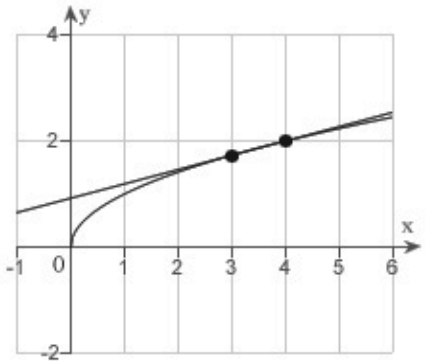
b.



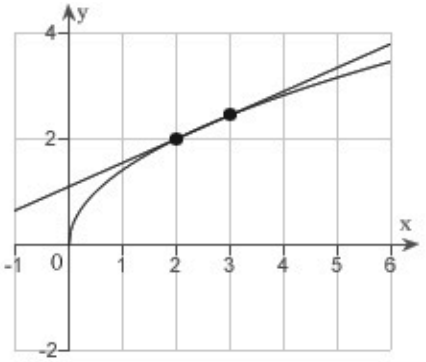
c.



d.



e.



____ 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 $Q(x, f(x))$ 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.)

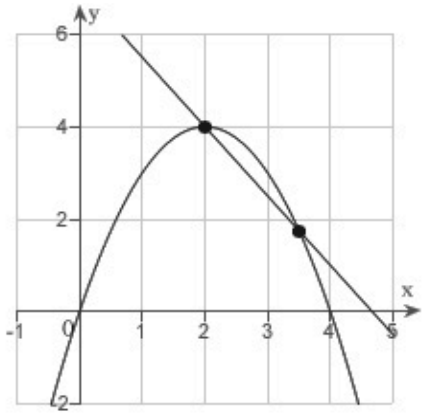
a. 0.0633 , –0.0627 , 0.0623
b. 0.0633 , 0.0627 , 0.0623
c. 0.0317 , 0.0314 , 0.0312
d. 0.0633 , –0.0627 , –0.0623
e. –0.0317 , –0.0314 , –0.0312

____ 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.

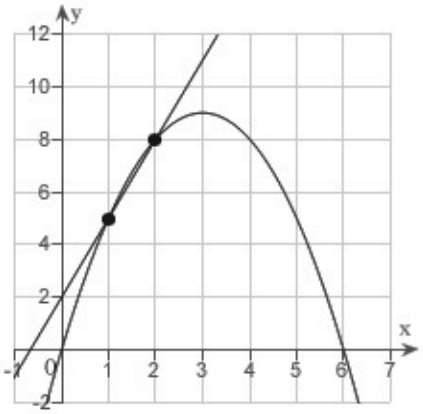
a. m=0.1667
b. m=0.0832
c. m=0.3800
d. m=0.0556
e. m=0.0833

____ 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 $x = 3$.

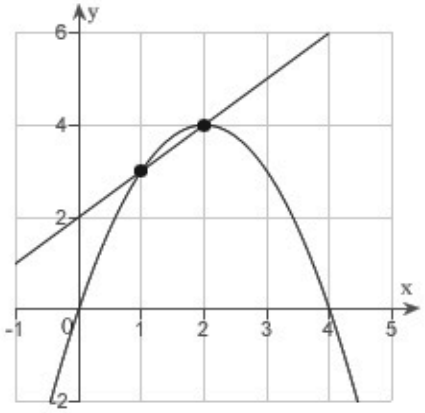
a.



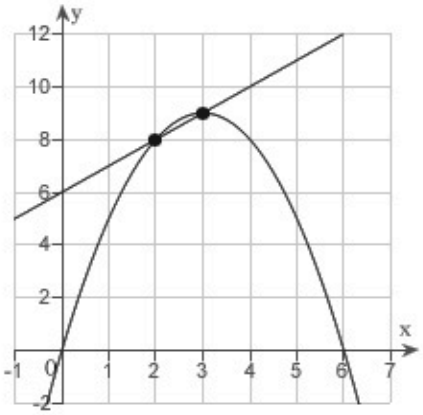
b.



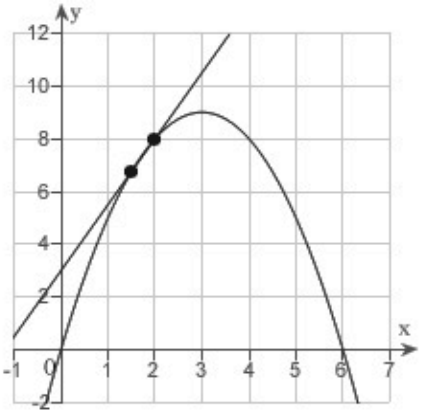
c.



d.



e.



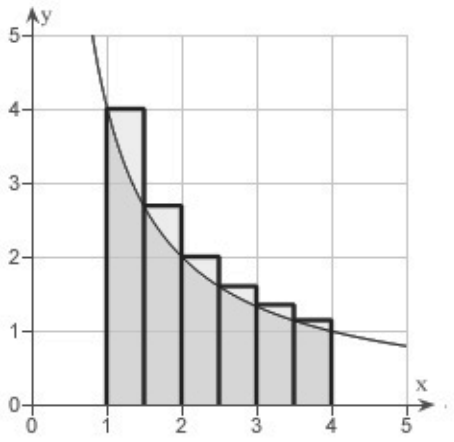
____ 12. Consider the function $f(x) = 11x - x^2$ and the point $P(4, 28)$ on the graph of *f*. Find the slope of the secant line passing through $P(4, 28)$ and $Q\left(x, f(x)\right)$ for $x = 5$. Round your answer to one decimal place.

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 $P(3, 15)$.

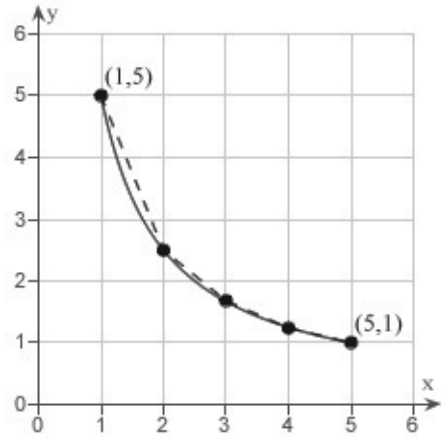
a. 10
b. 3
c. 8
d. 2
e. 9

____ 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.

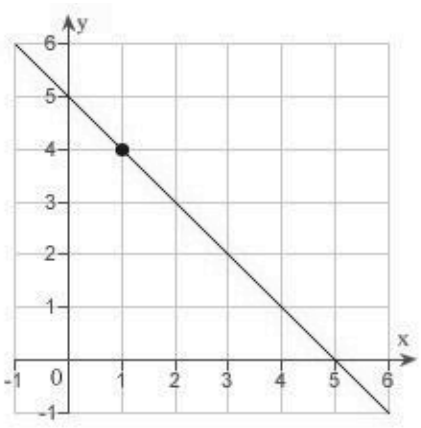
$$\lim_{x \to 0} \frac{\cos(3x) - 1}{3x}$$

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.)

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

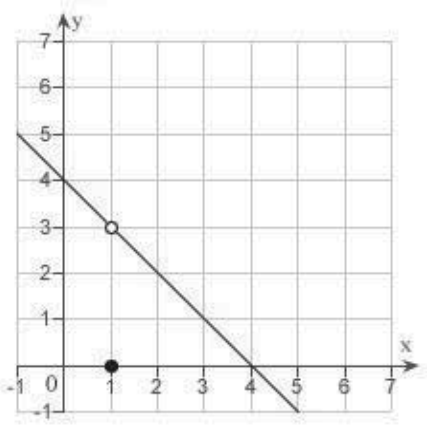


a. 6
b. 1
c. 5
d. 4
e. does not exist

____ 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.)

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

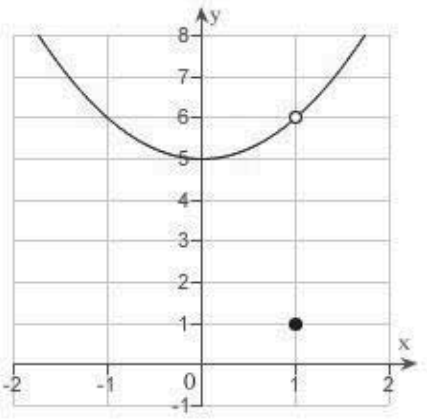


a. 5
b. 4
c. 3
d. 0
e. does not exist

____ 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.)

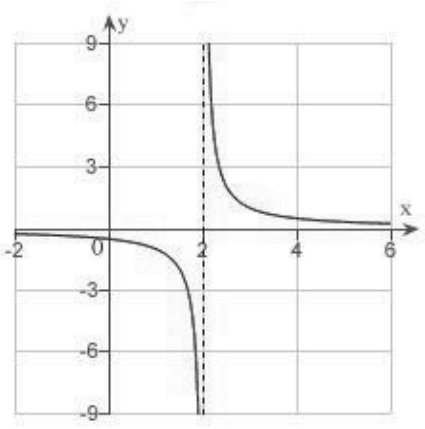
$\lim_{x \to 1} f(x)$



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.

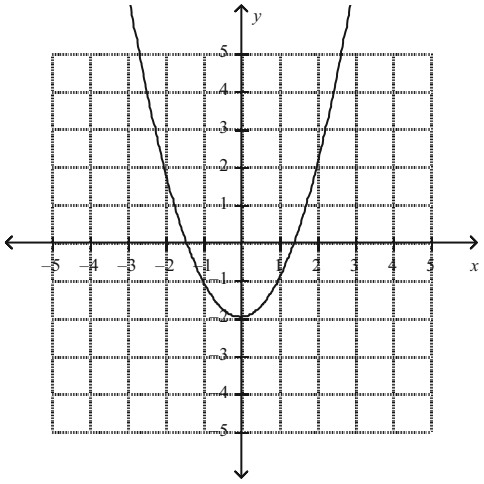
$\lim_{x \to -2} (x^2 + 4x)$

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. $\lim_{x \to \pi} (4) = \frac{\pi}{4}$
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. $\frac{1}{14}$
b. $\frac{1}{10}$
c. $\frac{3}{22}$
d. $\frac{3}{7}$
e. $\frac{3}{10}$

____ 3. Find the limit.

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

a. 3
b. −1
c. –3
d. 1
e. 9

____ 4. 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. $\frac{1}{2}$
b. $-\frac{1}{2}$
c. $-\frac{\sqrt{3}}{2}$
d. $\frac{\sqrt{3}}{2}$
e. 0

____ 9. Find the limit.

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

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

____ 10. Find the limit.

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

a. $\frac{\sqrt{3}}{2}$
b. $-\frac{\sqrt{2}}{2}$
c. $-\frac{1}{2}$
d. $\frac{\sqrt{2}}{2}$
e. does not exist

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

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

a. 0
b. –10
c. –3
d. –23
e. 130

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

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

a. –11
b. –8
c. 33
d. –14
e. 0

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

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

a. 10
b. –5
c. –25
d. –15
e. 150

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

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

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

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

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

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

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

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

a. –5
b. 15
c. –15
d. $3c$
e. 3

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

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

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

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

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

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

____ 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. $\frac{1}{6}$
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. $\frac{1}{3}x^3 - \frac{9}{2}x^2 + 2x$
b. $2x - 9$
c. $x^3 - 9x^2 + 2x$
d. $x^2 - 9x + 2$
e. does not exist

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

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

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

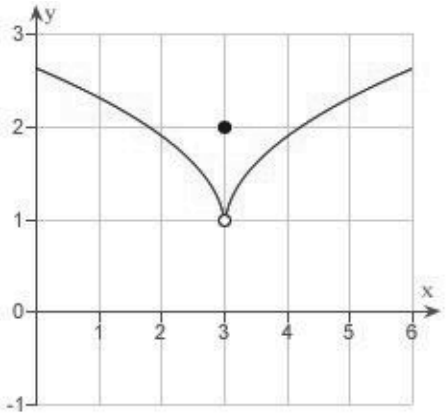
1.4 Continuity and One-Sided Limits

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 $x = 3$.

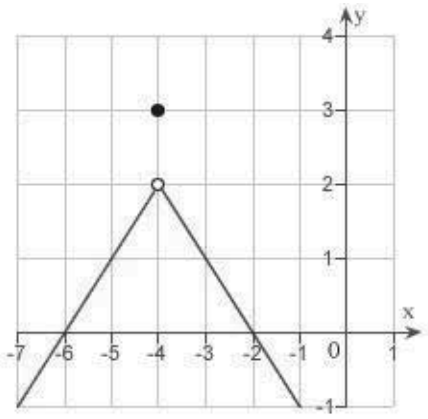
(i) $\lim_{x \to 3^+} f(x)$ (ii) $\lim_{x \to 3^-} f(x)$ (iii) $\lim_{x \to 3} f(x)$



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

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

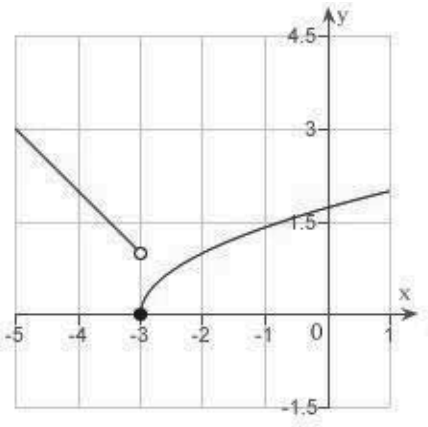
(i) $\lim_{x \to -4^+} f(x)$ (ii) $\lim_{x \to -4^-} f(x)$ (iii) $\lim_{x \to -4} f(x)$



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

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

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



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

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

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

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

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

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

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

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

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

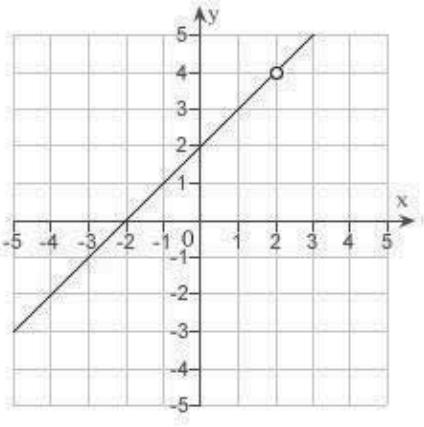
a. 13
b. -10
c. 10
d. -13
e. does not exist

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

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

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

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



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

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

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

____ 11. Find the x-values (if any) at which $f(x) = \frac{x}{x^2 - 2x}$ 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 $f(x) = \frac{x}{x^2 - 100}$ 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 $f(x) = \frac{x+2}{x^2 + 6x + 8}$ 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 $f(x) = \frac{|x-3|}{x-3}$ 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 $f(x) = \dfrac{1+x}{x^2(1-x)}$.

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

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

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

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

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

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

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

____ 8. Find the limit.

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

a. 1
b. $-\infty$
c. 0
d. ∞
e. -1

____ 9. Find the limit.

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

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

____ 10. Find the limit.

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

a. 1
b. 0
c. -1
d. $-\infty$
e. ∞

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

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

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

____ 12. Use a graphing utility to graph the function $f(x) = \frac{x^2 - 2x + 4}{x^3 + 8}$ and determine the one-sided limit $\lim_{x \to -2^+} f(x)$.

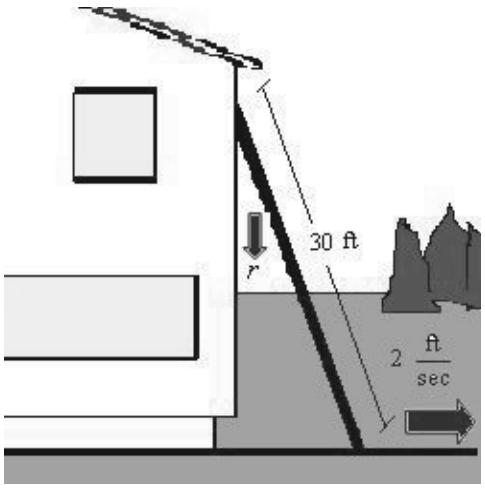
a. $-\infty$
b. ∞
c. 0
d. 12
e. 8

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

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

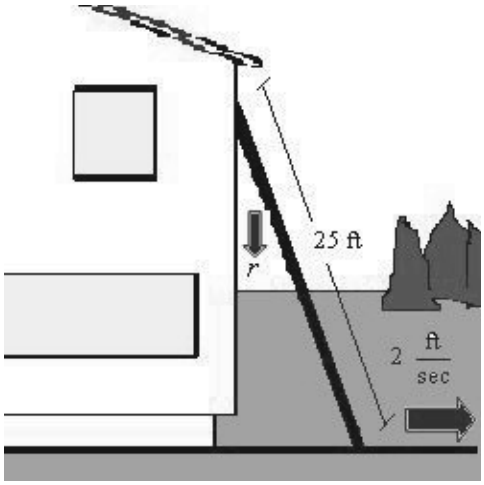
a. $-\infty$
b. 2
c. -2
d. ∞
e. 0

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



a. $r = \frac{3}{2}$ ft/sec
b. $r = \frac{4}{3}$ ft/sec
c. $r = \frac{48}{5}$ ft/sec
d. $r = \frac{2}{3}$ ft/sec
e. $r = \frac{3}{4}$ 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 $x \to 25^-$.



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

2.1 The Derivative and the Tangent Line Problem

Multiple Choice

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

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

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

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

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

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

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

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

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

____ 5. Find the derivative of the following function $f(x) = -3x^2 + 6x - 8$ using the limiting process.

a. $f'(x) = -6x + 6$
b. $f'(x) = -3x + 6$
c. $f'(x) = -6x + 6x - 8$
d. $f'(x) = -3x - 6$
e. $f'(x) = -6x - 6$

____ 6. Find the derivative of the following function using the limiting process.

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

a. –4
b. $-4x + 5$
c. $-8x - 5$
d. $-8x$
e. $-8x + 5$

____ 7. Find the derivative of the following function using the limiting process.

$f(x) = 3x^3 - 9x^2 - 8$

a. $f'(x) = 9x^2 + 18x$
b. $f'(x) = 6x^2 - 18x$
c. $f'(x) = 9x^2 - 18x - 8$
d. $f'(x) = 6x^2 + 18x$
e. $f'(x) = 9x^2 - 18x$

____ 8. Find the derivative of the following function using the limiting process.

$f(x) = \dfrac{2}{x-3}$

a. $f'(x) = \dfrac{2}{(x+3)^2}$
b. $f'(x) = -\dfrac{2x}{(x-3)^2}$
c. $f'(x) = -\dfrac{2}{(x-3)^2}$
d. $f'(x) = \dfrac{2}{(x-3)^2}$
e. $f'(x) = -\dfrac{2}{(x+3)^2}$

____ 9. Find the derivative of the following function using the limiting process.

$f(x) = \dfrac{1}{x^4}$

a. $f'(x) = \dfrac{4}{x^5}$

b. $f'(x) = -\dfrac{4}{x^3}$

c. $f'(x) = \dfrac{4}{x^3}$

d. $f'(x) = -\dfrac{5}{x^5}$

e. $f'(x) = -\dfrac{4}{x^5}$

____ 10. Find the derivative of the function $f(x) = \sqrt{7x-3}$ using the limiting process.

a. $f'(x) = \dfrac{7}{2\sqrt{7x-3}}$

b. $f'(x) = -\dfrac{7}{2\sqrt{7x-3}}$

c. $f'(x) = -\dfrac{7x}{\sqrt{7x-3}}$

d. $f'(x) = \dfrac{7}{2}\sqrt{7x-3}$

e. $f'(x) = -\dfrac{7}{\sqrt{7x-3}}$

____ 11. Find the derivative of the function $f(x) = \dfrac{20}{\sqrt{x}}$ by the limit process.

a. $f'(x) = \dfrac{20}{x}$

b. $f'(x) = -\dfrac{10\sqrt{x}}{x}$

c. $f'(x) = \dfrac{10}{x}$

d. $f'(x) = -\dfrac{10}{x\sqrt{x}}$

e. $f'(x) = -\dfrac{20}{x\sqrt{x}}$

____ 12. Find an equation of the tangent line to the graph of the function $f(x) = x^2 + 5x + 2$ at the point $(-5, 2)$.

a. $y = -23$
b. $y = -5x - 23$
c. $y = 15x$
d. $y = 5x$
e. $y = -15x - 73$

____ 13. Find an equation of the tangent line to the graph of the function $f(x) = \sqrt{x-2}$ at the point $(18, 4)$.

a. $y = \frac{x}{4} + \frac{7}{2}$
b. $y = \frac{x}{8} + \frac{7}{4}$
c. $y = \frac{x}{8} + \frac{9}{2}$
d. $y = \frac{x}{4} + \frac{9}{2}$
e. $y = \frac{x}{8} + \frac{9}{4}$

____ 14. Find an equation of the line that is tangent to the graph of the function $f(x) = 8x^2$ and parallel to the line $16x + y + 6 = 0$.

a. $16x + y + 8 = 0$
b. $12x - y + 6 = 0$
c. $16x - y + 8 = 0$
d. $16x + y + 6 = 0$
e. $12x + y + 6 = 0$

____ 15. Find an equation of the line that is tangent to the graph of f and parallel to the given line.

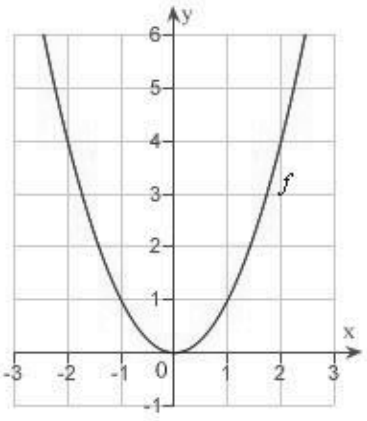
$f(x) = 3x^3$, $9x - y + 9 = 0$

a. $y = -9x + 6$
b. $y = -3x + 6$
c. $y = 9x - 3$ and $y = 9x + 3$
d. $y = -9x - 6$
e. $y = 9x - 6$ and $y = 9x + 6$

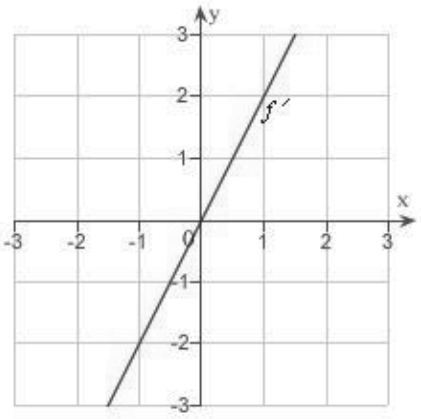
____ 16. Find an equation of the line that is tangent to the graph of the function $f(x) = \dfrac{7}{\sqrt{x}}$ and parallel to the line $7x + 2y - 18 = 0$.

a. $7x + y + 21 = 0$
b. $9x + y - 18 = 0$
c. $9x + 2y + 9 = 0$
d. $7x + 2y - 21 = 0$
e. $7x + 2y - 14 = 0$

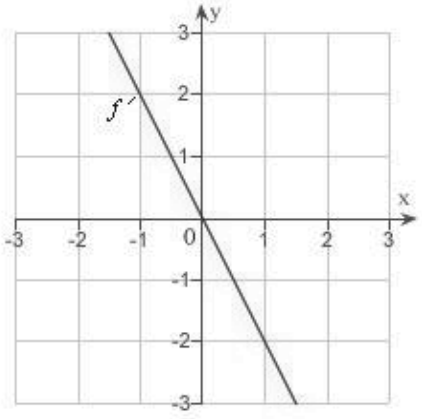
____ 17. The graph of the function f is given below. Select the graph of f'.



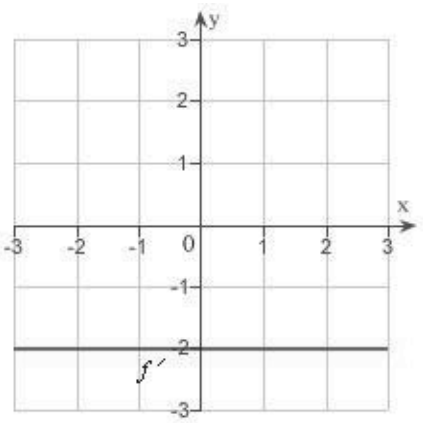
a.



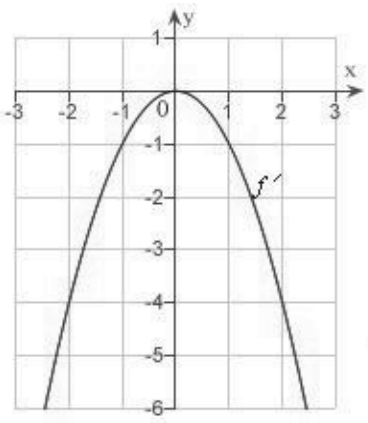
d.



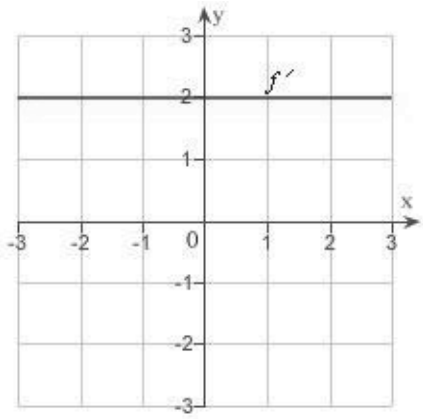
b.



e.



c.

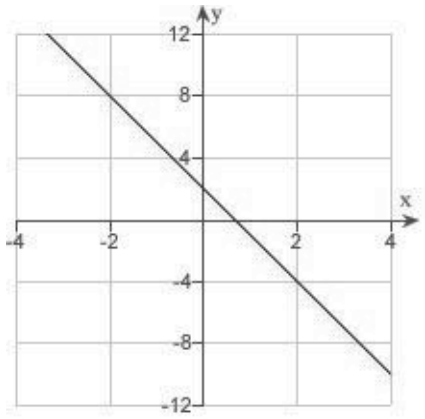


____ 18. Identify the graph which has the following characteristics.

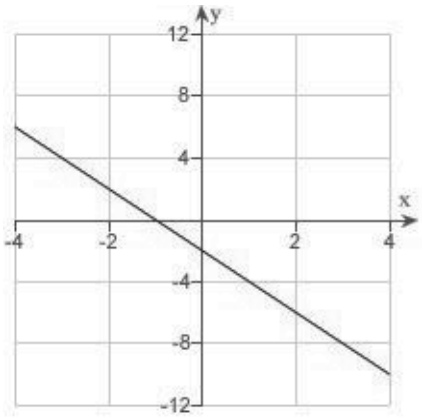
$f(0) = -2$

$f'(x) = 2, \ -\infty < x < \infty$

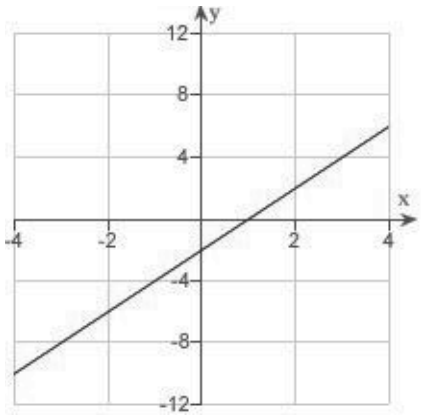
Graph 1



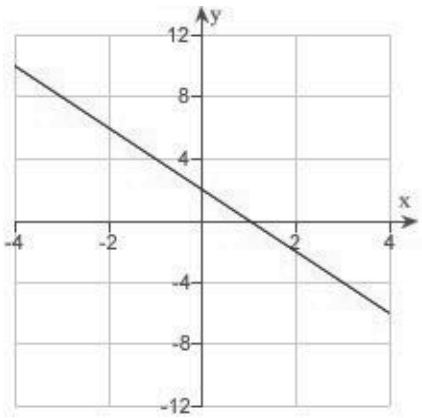
Graph 2



Graph 3



Graph 4



a. Graph 2
b. Graph 3
c. Graph 1
d. Graph 4
e. none of the above

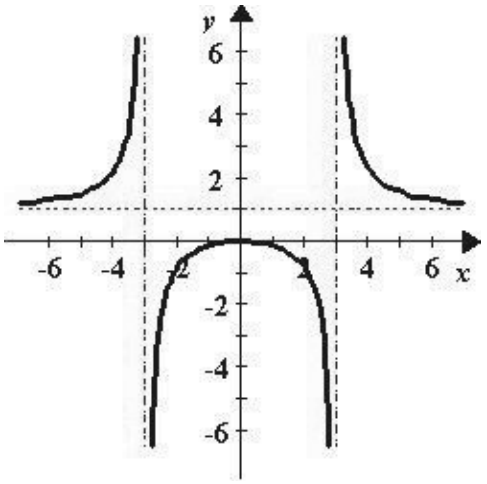
____ 19. Use the alternative form of the derivative to find the derivative of the function $f(x) = x^2 - 9$ at $x = 5$.

a. $f'(5) = 1$
b. $f'(5) = 250$
c. $f'(5) = 2$
d. $f'(5) = 125$
e. $f'(5) = 10$

____ 20. Use the alternative form of the derivative to find the derivative of the function $f(x) = \frac{3}{x^2}$ at $x = 2$.

a. $f'(2) = \frac{3}{4}$
b. $f'(2) = -\frac{3}{4}$
c. $f'(2) = \frac{3}{8}$
d. $f'(2) = -\frac{3}{2}$
e. $f'(2) = -\frac{9}{16}$

____ 21. Describe the x-values at which the graph of the function $f(x) = \dfrac{x^2}{x^2 - 9}$ given below is differentiable.



a. $f(x)$ is differentiable at $x = \pm 3$.
b. $f(x)$ is differentiable everywhere except at $x = \pm 3$.
c. $f(x)$ is differentiable everywhere except at $x = 0$.
d. $f(x)$ is differentiable on the interval $(-2, 2)$.
e. $f(x)$ is differentiable on the interval $(2, \infty)$.

2.1 The Derivative and the Tangent Line Problem
Answer Section

1. ANS: A PTS: 1 DIF: Easy REF: Section 2.1
OBJ: Calculate the slope of a line tangent to the graph of a function at a specified point
MSC: Skill
2. ANS: C PTS: 1 DIF: Med REF: Section 2.1
OBJ: Calculate the slope of a line tangent to the graph of a function at a specified point
MSC: Skill
3. ANS: D PTS: 1 DIF: Easy REF: Section 2.1
OBJ: Calculate the derivative of a function by the limit process MSC: Skill
4. ANS: C PTS: 1 DIF: Easy REF: Section 2.1
OBJ: Calculate the derivative of a function by the limit process MSC: Skill
5. ANS: A PTS: 1 DIF: Easy REF: Section 2.1
OBJ: Calculate the derivative of a function by the limit process MSC: Skill
6. ANS: E PTS: 1 DIF: Easy REF: Section 2.1
OBJ: Calculate the derivative of a function by the limit process MSC: Skill
7. ANS: E PTS: 1 DIF: Med REF: Section 2.1
OBJ: Calculate the derivative of a function by the limit process MSC: Skill
8. ANS: C PTS: 1 DIF: Med REF: Section 2.1
OBJ: Calculate the derivative of a function by the limit process MSC: Skill
9. ANS: E PTS: 1 DIF: Med REF: Section 2.1
OBJ: Calculate the derivative of a function by the limit process MSC: Skill
10. ANS: A PTS: 1 DIF: Med REF: Section 2.1
OBJ: Calculate the derivative of a function by the limit process MSC: Skill
11. ANS: D PTS: 1 DIF: Difficult REF: Section 2.1
OBJ: Calculate the derivative of a function by the limit process MSC: Skill
12. ANS: B PTS: 1 DIF: Med REF: Section 2.1
OBJ: Write an equation of a line tangent to the graph of a function at a specified point
MSC: Skill
13. ANS: B PTS: 1 DIF: Med REF: Section 2.1
OBJ: Write an equation of a line tangent to the graph of a function at a specified point
MSC: Skill
14. ANS: A PTS: 1 DIF: Med REF: Section 2.1
OBJ: Write an equation of a line tangent to the graph of a function that is parallel to a given line
MSC: Skill
15. ANS: E PTS: 1 DIF: Med REF: Section 2.1
OBJ: Write an equation of a line tangent to the graph of a function that is parallel to a given line
MSC: Skill
16. ANS: D PTS: 1 DIF: Med REF: Section 2.1
OBJ: Write an equation of a line tangent to the graph of a function that is parallel to a given line
MSC: Skill
17. ANS: A PTS: 1 DIF: Med REF: Section 2.1
OBJ: Identify the graph of f' using the given graph of f MSC: Skill
18. ANS: B PTS: 1 DIF: Easy REF: Section 2.1
OBJ: Identify the graph of a function given information about the function and its derivative
MSC: Skill

19. ANS: E PTS: 1 DIF: Easy REF: Section 2.1
OBJ: Calculate the derivative of a function at a specified point using the alternative form
MSC: Skill
20. ANS: B PTS: 1 DIF: Med REF: Section 2.1
OBJ: Calculate the derivative of a function at a specified point using the alternative form
MSC: Skill
21. ANS: B PTS: 1 DIF: Med REF: Section 2.1
OBJ: Identify the x-value (or values) at which a function is differential MSC: Skill

2.2 Basic Differentiation Rules and Rates of Change

Multiple Choice

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

____ 1. Find the derivative of the function.

$f(x) = x^4$

a. $f'(x) = 4x^4$
b. $f'(x) = 3x^3$
c. $f'(x) = 4x^5$
d. $f'(x) = 3x^5$
e. $f'(x) = 4x^3$

____ 2. Find the derivative of the function.

$f(x) = \frac{1}{x^8}$

a. $f'(x) = -\frac{9}{x^9}$
b. $f'(x) = -\frac{8}{x^7}$
c. $f'(x) = \frac{8}{x^9}$
d. $f'(x) = -\frac{8}{x^9}$
e. $f'(x) = -\frac{7}{x^9}$

____ 3. Use the rules of differentiation to find the derivative of the function $g(x) = x^6 + 5x^3$.

a. $g'(x) = 6x^5 + 3x^2$
b. $g'(x) = x^5 + 5x^2$
c. $g'(x) = 6x^5 + 15x^2$
d. $g'(x) = 6x^7 + 15x^4$
e. $g'(x) = x^7 + 5x^4$

____ 4. Find the derivative of the function $f(x) = -7x^3 + 4x^2 + 1$.

a. $f'(x) = -14x + 4x^2$
b. $f'(x) = -14x^2 + 4x$

c. $f'(x) = -7x^2 + 4x^2 + 1$
d. $f'(x) = -21x^2 + 8x + 1$
e. $f'(x) = -21x^2 + 8x$

____ 5. Find the derivative of the function $f(x) = -4x^2 - 4\cos(x)$.

a. $f'(x) = -4x + 4\sin(x)$
b. $f'(x) = -8x + 4\sin(x)$
c. $f'(x) = -8x + 4\cos(x)$
d. $f'(x) = -8x - 4\sin(x)$
e. $f'(x) = -8x - 4\cos(x)$

____ 6. Use the rules of differentiation to find the derivative of the function $y = 7 + 6\sin x$.

a. $y' = 7 + 6\cos x$
b. $y' = 7 + \cos 6x$
c. $y' = 6\cos x$
d. $y' = 7\cos 6x$
e. $y' = \cos 6x$

____ 7. Find the derivative of the function $f(x) = -5x^3 - 2\sin(x)$.

a. $f'(x) = -15x^2 + 2\cos(x)$
b. $f'(x) = -10x^2 - 2\cos(x)$
c. $f'(x) = -5x^2 - 2\cos(x)$
d. $f'(x) = -5x^2 + 2\cos(x)$
e. $f'(x) = -15x^2 - 2\cos(x)$

____ 8. Find the slope of the graph of the function at the given value.

$f(x) = \dfrac{-5}{x^3}$ when $x = 9$

a. $f'(9) = -\dfrac{5}{2187}$
b. $f'(9) = -\dfrac{5}{729}$
c. $f'(9) = \dfrac{5}{27}$
d. $f'(9) = -\dfrac{5}{27}$
e. $f'(9) = \dfrac{5}{2187}$

____ 9. Find the slope of the graph of the function at the given value.

$f(x) = -2x^2 + \frac{6}{x^2}$ when $x = 5$

a. $f'(5) = -\frac{2488}{125}$
b. $f'(5) = \frac{2488}{125}$
c. $f'(5) = \frac{2512}{125}$
d. $f'(5) = -\frac{2512}{125}$
e. $f'(5) = -\frac{1256}{125}$

____ 10. Find the slope of the graph of the function at the given value.

$f(x) = 2x^2 + 5x - \frac{7}{x^2}$ when $x = -4$

a. $f'(-4) = \frac{359}{8}$
b. $f'(-4) = \frac{359}{2}$
c. $f'(-4) = -\frac{359}{8}$
d. $f'(-4) = -\frac{359}{32}$
e. $f'(-4) = \frac{359}{32}$

____ 11. Find the slope of the graph of the function $f(x) = x\left(2x^3 + 7\right)$ at $x = 4$.

a. $f'(4) = 519$
b. $f'(4) = 512$
c. $f'(4) = 103$
d. $f'(4) = 540$
e. $f'(4) = 391$

____ 12. Find the slope of the graph of the function at the given value.

$f(x) = 5x^3 - 7x^2$ at $x = 3$

a. $f'(3) = 93$
b. $f'(3) = 177$
c. $f'(3) = 21$
d. $f'(3) = 363$
e. $f'(3) = 261$

____ 13. Find the slope of the graph of the function $f(x) = (4x - 7)^2$ at $x = 4$.

a. $f'(4) = 18$
b. $f'(4) = 36$
c. $f'(4) = 1,458$
d. $f'(4) = 184$
e. $f'(4) = 72$

____ 14. Find the slope of the graph of the function at the given value.

$f(x) = 4(5x + 6)^2$ at $x = 3$

a. $f'(3) = 840$
b. $f'(3) = 360$
c. $f'(3) = 42$
d. $f'(3) = 168$
e. $f'(3) = 210$

____ 15. Find the derivative of the function $f(x) = \dfrac{x^5 - 9}{x^4}$.

a. $f'(x) = 1 + \dfrac{36}{x^5}$
b. $f'(x) = 1 - \dfrac{36}{x^5}$
c. $f'(x) = 1 + \dfrac{4}{x^5}$
d. $f'(x) = 1 - \dfrac{9}{x^5}$
e. $f'(x) = 1 + \dfrac{9}{x^5}$

____ 16. Find the derivative of the function $f(x) = \frac{2}{\sqrt[3]{x}} + 3\cos x$.

a. $f'(x) = \frac{2}{3x^{4/3}} - 3\sin x$

b. $f'(x) = -\frac{2}{3x^{4/3}} - 3\sin x$

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

d. $f'(x) = -\frac{2}{3x^{3/4}} - 3\sin x$

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

____ 17. Determine all values of x, (if any), at which the graph of the function has a horizontal tangent.

$y(x) = x^3 + 12x^2 + 8$

a. $x = 0$
b. $x = -8$
c. $x = 0$ and $x = -8$
d. $x = 0$ and $x = 8$
e. The graph has no horizontal tangents.

____ 18. Determine all values of x, (if any), at which the graph of the function has a horizontal tangent.

$y(x) = x^4 - 4x + 4$

a. $x = 1$
b. $x = 0$ and $x = -1$
c. $x = 0$ and $x = 1$
d. $x = 0$
e. The graph has no horizontal tangents.

____ 19. Determine all values of x, (if any), at which the graph of the function has a horizontal tangent.

$y(x) = \frac{9}{x - 6}$

a. $x = 9$ and $x = -6$
b. $x = 9$
c. $x = 9$ and $x = 6$
d. $x = 6$
e. The graph has no horizontal tangents.

____ 20. Suppose the position function for a free-falling object on a certain planet is given by $s(t) = -13t^3 + v_0 t + s_0$. A silver coin is dropped from the top of a building that is 1370 feet tall. Determine the velocity function for the coin.

a. $v(t) = -13t^3 + 1370$
b. $v(t) = -39t^2$
c. $v(t) = -39t^3 + 1370$
d. $v(t) = -13t^2$
e. $v(t) = -3t^4$

____ 21. Suppose the position function for a free-falling object on a certain planet is given by $s(t) = -16t^2 + v_0 t + s_0$. A silver coin is dropped from the top of a building that is 1372 feet tall. Determine the average velocity of the coin over the time interval $[3, 4]$.

a. –113 ft/sec
b. 80 ft/sec
c. 112 ft/sec
d. –112 ft/sec
e. –80 ft/sec

____ 22. Suppose the position function for a free-falling object on a certain planet is given by $s(t) = -12t^2 + v_0 t + s_0$. A silver coin is dropped from the top of a building that is 1372 feet tall. Find the instantaneous velocity of the coin when $t = 4$.

a. –96 ft/sec
b. –32 ft/sec
c. –20 ft/sec
d. –144 ft/sec
e. –48 ft/sec

____ 23. Suppose the position function for a free-falling object on a certain planet is given by $s(t) = -12t^2 + v_0 t + s_0$. A silver coin is dropped from the top of a building that is 1372 feet tall. Find the time required for the coin to reach ground level. Round your answer to the three decimal places.

a. 2.849 sec
b. 10.273 sec
c. 10.693 sec
d. 3.087 sec
e. 10.091 sec

____ 24. Suppose the position function for a free-falling object on a certain planet is given by $s(t) = -14t^2 + v_0t + s_0$. A silver coin is dropped from the top of a building that is 1370 feet tall. Find velocity of the coin at impact. Round your answer to the three decimal places.

a. –286.705 ft/sec
b. –138.492 ft/sec
c. –111.041 ft/sec
d. –276.984 ft/sec
e. –261.984 ft/sec

____ 25. A ball is thrown straight down from the top of a 300-ft building with an initial velocity of –12 ft per second. The position function is $s(t) = -16t^2 + v_0t + s_0$. What is the velocity of the ball after 4 seconds?

a. The velocity after 4 seconds is –76 ft per second.
b. The velocity after 4 seconds is –116 ft per second.
c. The velocity after 4 seconds is –140 ft per second.
d. The velocity after 4 seconds is –52 ft per second.
e. The velocity after 4 seconds is –280 ft per second.

____ 26. A projectile is shot upwards from the surface of the earth with an initial velocity of 108 meters per second. The position function is $s(t) = -4.9t^2 + v_0t + s_0$.

What is its velocity after 7 seconds?

a. The velocity after 7 seconds is 181.7 meters per second.
b. The velocity after 7 seconds is –142.3 meters per second.
c. The velocity after 7 seconds is 39.4 meters per second.
d. The velocity after 7 seconds is 73.7 meters per second.
e. The velocity after 7 seconds is –176.6 meters per second.

____ 27. The volume of a cube with sides of length s is given by $V = s^3$. Find the rate of change of volume with respect to s when $s = 6$ centimeters.

a. 648 cm^2
b. 216 cm^2
c. 36 cm^2
d. 108 cm^2
e. 72 cm^2

2.2 Basic Differentiation Rules and Rates of Change
Answer Section

1.	ANS:	E	PTS:	1	DIF:	Easy	REF:	Section 2.2
OBJ:	Differentiate a function using basic differentiation rules						MSC:	Skill
2.	ANS:	D	PTS:	1	DIF:	Med	REF:	Section 2.2
OBJ:	Differentiate a function using basic differentiation rules						MSC:	Skill
3.	ANS:	C	PTS:	1	DIF:	Easy	REF:	Section 2.2
OBJ:	Differentiate a function using basic differentiation rules						MSC:	Skill
4.	ANS:	E	PTS:	1	DIF:	Med	REF:	Section 2.2
OBJ:	Differentiate a function using basic differentiation rules						MSC:	Skill
5.	ANS:	B	PTS:	1	DIF:	Med	REF:	Section 2.2
OBJ:	Differentiate trigonometric functions						MSC:	Skill
6.	ANS:	C	PTS:	1	DIF:	Easy	REF:	Section 2.2
OBJ:	Differentiate trigonometric functions						MSC:	Skill
7.	ANS:	E	PTS:	1	DIF:	Med	REF:	Section 2.2
OBJ:	Differentiate trigonometric functions						MSC:	Skill
8.	ANS:	E	PTS:	1	DIF:	Easy	REF:	Section 2.2
OBJ:	Calculate the slope of the graph of a function at a given point						MSC:	Skill
9.	ANS:	D	PTS:	1	DIF:	Med	REF:	Section 2.2
OBJ:	Calculate the slope of the graph of a function at a given point						MSC:	Skill
10.	ANS:	D	PTS:	1	DIF:	Med	REF:	Section 2.2
OBJ:	Calculate the slope of the graph of a function at a given point						MSC:	Skill
11.	ANS:	A	PTS:	1	DIF:	Med	REF:	Section 2.2
OBJ:	Calculate the slope of the graph of a function at a given point						MSC:	Skill
12.	ANS:	A	PTS:	1	DIF:	Easy	REF:	Section 2.2
OBJ:	Calculate the slope of the graph of a function at a given point						MSC:	Skill
13.	ANS:	E	PTS:	1	DIF:	Med	REF:	Section 2.2
OBJ:	Calculate the slope of the graph of a function at a given point						MSC:	Skill
14.	ANS:	A	PTS:	1	DIF:	Med	REF:	Section 2.2
OBJ:	Calculate the slope of the graph of a function at a given point						MSC:	Skill
15.	ANS:	A	PTS:	1	DIF:	Med	REF:	Section 2.2
OBJ:	Differentiate a function using basic differentiation rules						MSC:	Skill
16.	ANS:	B	PTS:	1	DIF:	Med	REF:	Section 2.2
OBJ:	Differentiate trigonometric functions						MSC:	Skill
17.	ANS:	C	PTS:	1	DIF:	Med	REF:	Section 2.2
OBJ:	Calculate the values for which the slope of a function is zero						MSC:	Skill
18.	ANS:	A	PTS:	1	DIF:	Difficult	REF:	Section 2.2
OBJ:	Calculate the values for which the slope of a function is zero						MSC:	Skill
19.	ANS:	E	PTS:	1	DIF:	Difficult	REF:	Section 2.2
OBJ:	Calculate the values for which the slope of a function is zero						MSC:	Skill
20.	ANS:	B	PTS:	1	DIF:	Med	REF:	Section 2.2
OBJ:	Write the velocity function for a specified position function						MSC:	Application
21.	ANS:	D	PTS:	1	DIF:	Med	REF:	Section 2.2
OBJ:	Calculate the average velocity from a given position function						MSC:	Application
22.	ANS:	A	PTS:	1	DIF:	Med	REF:	Section 2.2
OBJ:	Interpret a derivative as a rate of change						MSC:	Application

23. ANS: C PTS: 1 DIF: Med REF: Section 2.2
OBJ: Calculate the height of an object from a given position function MSC: Application
24. ANS: D PTS: 1 DIF: Med REF: Section 2.2
OBJ: Calculate the velocity for an object falling according to a given position function
MSC: Application
25. ANS: C PTS: 1 DIF: Difficult REF: Section 2.2
OBJ: Derive the free-fall position function and evaluate velocity at different points
MSC: Application
26. ANS: C PTS: 1 DIF: Difficult REF: Section 2.2
OBJ: Derive the free-fall position function and evaluate velocity at different points
MSC: Application
27. ANS: D PTS: 1 DIF: Med REF: Section 2.2
OBJ: Interpret a derivative as a rate of change MSC: Application

2.3 Product and Quotient Rules and Higher-Order Derivatives

Multiple Choice

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

____ 1. Find the derivative of the algebraic function $H(v) = \left(v^5 - 3\right)\left(v^3 + 3\right)$.

a. $H'(s) = 8v^7 + 15v^4 + 9v^2$
b. $H'(s) = 8v^7 + 9v^4 + 15v^2$
c. $H'(s) = 8v^7 - 15v^4 - 9v^2$
d. $H'(s) = 8v^7 + 15v^4 - 9v^2$
e. $H'(s) = 8v^7 + 9v^4 - 3v^2$

____ 2. Use the Product Rule to differentiate $f(u) = \sqrt{u}\left(5 - u^6\right)$.

a. $f'(u) = 6u^{\frac{11}{2}} + \dfrac{5 - u^7}{2\sqrt{u}}$
b. $f'(u) = -6u^{\frac{13}{2}} - \dfrac{5 - u^6}{2\sqrt{u}}$
c. $f'(u) = 6u^{\frac{13}{2}} - \dfrac{5 - u^6}{2\sqrt{u}}$
d. $f'(u) = -6u^{\frac{11}{2}} + \dfrac{5 - u^6}{2\sqrt{u}}$
e. $f'(u) = -6u^{\frac{13}{2}} + \dfrac{5 - u^6}{2\sqrt{u}}$

____ 3. Use the Product Rule to differentiate $f(s) = s^5 \cos s$.

a. $f'(s) = -5s^4 \sin s$
b. $f'(s) = -s^5 \cos s + 5s^4 \sin s$
c. $f'(s) = -s^5 \sin s - 5s^4 \cos s$
d. $f'(s) = -s^5 \sin s + 5s^4 \cos s$
e. $f'(s) = s^5 \sin s + 5s^4 \cos s$

____ 4. Use the Product Rule to differentiate.

$f(t) = t^{-3}\cos t$

a. $f(t) = -t^{-3}\sin t + 3t^{-4}\cos t$

b. $f'(t) = 3t^{-2}\cos t - t^{-3}\sin t$

c. $f'(t) = t^{-3}\sin t - 3t^{-4}\cos t$

d. $f'(t) = -t^{-3}\sin t - 3t^{-4}\cos t$

e. $f'(t) = -t^{-3}\sin t + 3t^{-4}\sin t$

____ 5. Use the Product Rule to differentiate $f(t) = t^{-4}\sin t$.

a. $f(t) = t^{-4}\cos t - 4t^{3}\sin t$

b. $f'(t) = -t^{-4}\cos t + 4t^{-5}\sin t$

c. $f'(t) = -t^{-4}\cos t - 4t^{-3}\sin t$

d. $f'(t) = t^{-4}\cos t + 4t^{-5}\sin t$

e. $f'(t) = t^{-4}\cos t - 4t^{-5}\sin t$

____ 6. Use the Quotient Rule to differentiate the function $f(x) = \dfrac{8x}{x^5 + 3}$.

a. $f'(x) = -\dfrac{8\left(-3 + 4x^5\right)}{\left(x^5 + 3\right)^2}$

b. $f'(x) = \dfrac{8\left(-3 - 4x^5\right)}{\left(x^5 + 3\right)^2}$

c. $f'(x) = -\dfrac{8\left(3 + 5x^5\right)}{\left(x^5 + 3\right)^2}$

d. $f'(x) = \dfrac{8\left(3 + 4x^5\right)}{\left(x^5 + 3\right)^2}$

e. $f'(x) = -\dfrac{8\left(3 + 6x^5\right)}{\left(x^5 + 3\right)^2}$

____ 7. Use the Quotient Rule to differentiate the function $f'(x) = \dfrac{4 + x}{x^2 + 9}$.

a. $f'(x) = \dfrac{\left(9 + 8x - x^2\right)}{\left(x^2 + 9\right)^2}$

b. $f'(x) = \dfrac{\left(9 - 8x - x^2\right)}{\left(x^2 + 9\right)^2}$

c. $f'(x) = \dfrac{\left(9 - 4x - x^2\right)}{\left(x^2 + 9\right)^2}$

d. $f'(x) = -\dfrac{\left(9 - 8x - x^2\right)}{\left(x^2 + 9\right)^2}$

e. $f'(x) = \dfrac{\left(9 - 8x + x^2\right)}{\left(x^2 + 9\right)^2}$

____ 8. Use the Quotient Rule to differentiate the function $f(x) = \dfrac{\sin x}{x^2 + 3}$.

a. $f'(x) = \dfrac{\left(3 + x^2\right)\cos x + 2x\sin x}{\left(x^2 + 3\right)^2}$

b. $f'(x) = \dfrac{\left(3 + x^2\right)\cos x - 2x\sin x}{\left(x^2 + 3\right)^2}$

c. $f'(x) = \dfrac{(3 + x)\cos x - 2x\sin x}{\left(x^2 + 3\right)^2}$

d. $f'(x) = \dfrac{\left(3 - x^2\right)\cos x - 2x\sin x}{\left(x^2 + 3\right)^2}$

e. $f'(x) = \dfrac{\left(3 + x^2\right)\cos x - 2x\sin x}{\left(x^2 + 3\right)}$

____ 9. Use the Quotient Rule to differentiate the following function $f(s) = \dfrac{2s}{s^5 + 7}$ and evaluate $f'(-2)$.

a. $f'(-2) = \dfrac{54}{5}$

b. $f'(-2) = -\dfrac{54}{3125}$

c. $f'(-2) = \dfrac{54}{125}$

d. $f'(-2) = -\dfrac{54}{5}$

e. $f'(-2) = -\dfrac{54}{125}$

____ 10. Find the derivative of the algebraic function $f(x) = x\left(3 - \dfrac{4}{x+6}\right)$.

a. $f'(x) = \dfrac{84 - 36x + 3x^2}{(x+6)^2}$

b. $f'(x) = \dfrac{84 + 36x + 3x^2}{(x+6)^2}$

c. $f'(x) = \dfrac{84 + 9x + 3x^2}{(x+6)^2}$

d. $f'(x) = \dfrac{84 - 36x - 3x^2}{(x+6)^2}$

e. $f'(x) = \dfrac{84 + 36x - 3x^2}{(x+6)}$

____ 11. Find the derivative of the function $f(t) = 15t^3 + 6\sec(t)$.

a. $f'(t) = 45t^2 + 6\sec(t)\tan(t)$
b. $f'(t) = 3t^2 + 6\sec^2(t)$
c. $f'(t) = 45t^2 + 6\tan(t)$
d. $f'(t) = 3t^2 + 6\sec(t)\tan(t)$
e. $f'(t) = 45t^2 - 6\sec(t)\tan(t)$

____ 12. Find the derivative of the function.

$f(s) = 9s\sin s + 5\cos s$.

a. $f'(s) = 9s\sin s - 4\cos s$
b. $f'(s) = 9s\cos s + 4\sin s$
c. $f'(s) = 9s\sin s - 9\cos s$
d. $f'(s) = -9s\sin s + 4\cos s$
e. $f'(s) = 9s\cos s + 5\sin s$

____ 13. Find the derivative of the trigonometric function $f(s) = s^3\tan s$.

a. $f'(s) = s^3\sec^2 s + 3s^2\tan s$
b. $f'(s) = s^3\sec^2 s + 2s^2\tan s$
c. $f'(s) = 3s^2\tan s - s^2\sec^2 s$
d. $f'(s) = s^2\sec^2 s - 3s^2\tan s$
e. $f'(s) = s^3\sec s + 3s^2\tan s$

____ 14. Find the derivative of the function.

$f(t) = 2t^3\sin t + 5t^6\cos t$

a. $f'(t) = \left(6t^6 - 5t^2\right)\sin t + \left(2t^3 + 30t^5\right)\cos t$
b. $f'(t) = \left(6t^2 - 5t^6\right)\sin t + \left(2t^3 + 30t^5\right)\cos t$
c. $f'(t) = -\left(6t^2 - 5t^6\right)\sin t + \left(2t^3 + 30t^5\right)\cos t$
d. $f'(t) = \left(2t^3 - 30t^5\right)\sin t + \left(6t^2 - 5t^6\right)\cos t$
e. $f'(t) = \left(6t^2 - 5t^6\right)\sin t - \left(2t^3 + 30t^5\right)\cos t$

____ 15. Find an equation of the tangent line to the graph of *f* at the given point.

$f(t) = (t-5)\left(t^2-3\right)$, at $(2,-3)$

a. $y = 11t + 19$
b. $y = -11 + 19t$
c. $y = -11t + 19$
d. $y = 25t - 11$
e. $y = -11t - 25$

____ 16. Determine all values of *x*, (if any), at which the graph of the function has a horizontal tangent.

$$y(x) = \frac{6x}{(x-9)^2}$$

a. $x = 9$ and $x = -6$
b. $x = -9$
c. $x = -9$ and $x = 6$
d. $x = 6$
e. The graph has no horizontal tangents.

____ 17. The length of a rectangle is $4t + 6$ and its height is t^4, where *t* is time in seconds and the dimensions are in inches. Find the rate of change of the area, *A,* with respect to time.

a. $\frac{dA}{dt} = t^4(24 + 20t)$ square inches/second
b. $\frac{dA}{dt} = t^3(24 + 16t)$ square inches/second
c. $\frac{dA}{dt} = t^3(24 + 20t)$ square inches/second
d. $\frac{dA}{dt} = t^4(18 + 20t)$ square inches/second
e. $\frac{dA}{dt} = t^3(20t + 6)$ square inches/second

____ 18. The radius of a right circular cylinder is $\sqrt{3t + 6}$ and its height is t^5, where *t* is time in seconds and the dimensions are in inches. Find the rate of change of the volume of the cylinder, *V,* with respect to time.

a. $\frac{dV}{dt} = \pi t^4(30 + 15t)$ cubic inches per second
b. $\frac{dV}{dt} = \pi t^4(30 + 18t)$ cubic inches per second

c. $\frac{dV}{dt} = \pi t^3(30 + 18t)$ cubic inches per second

d. $\frac{dV}{dt} = \pi t^4(6 + 18t)$ cubic inches per second

e. $\frac{dV}{dt} = \pi t^5(30 + 18t)$ cubic inches per second

____ 19. The ordering and transportation cost C for the components used in manufacturing a product is $C = 160\left(\frac{280}{x^2} + \frac{x}{x + 40}\right), x \geq 1$ where C is measured in thousands of dollars and x is the order size in hundreds. Find the rate of change of C with respect to x for $x = 24$. Round your answer to two decimal places.

a. –6.44 thousand dollars per hundred

b. 8.04 thousand dollars per hundred

c. 3.28 thousand dollars per hundred

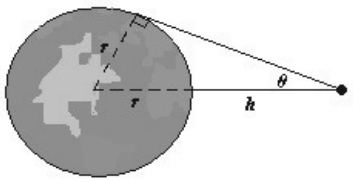
d. –4.92 thousand dollars per hundred

e. –7.96 thousand dollars per hundred

____ 20. A population of 620 bacteria is introduced into a culture and grows in number according to the equation $P(t) = 620\left(1 + \frac{4t}{34 + t^2}\right)$ where t is measured in hours. Find the rate at which the population is growing when $t = 2$. Round your answer to two decimal places.

a. 226.7 bacteria per hour
b. 68.89 bacteria per hour
c. 65.26 bacteria per hour
d. 51.52 bacteria per hour
e. 61.23 bacteria per hour

____ 21. When satellites observe Earth, they can scan only part of Earth's surface. Some satellites have sensors that can measure the angle θ shown in the figure. Let h represent the satellite's distance from Earth's surface and let r represent Earth's radius. Find the rate at which h is changing with respect to θ when $\theta = 60°$ (Assume $r = 4460$ miles.) Round your answer to the nearest unit.



a. –2973 mi/radian
b. –5150 mi/radian
c. 5150 mi/radian
d. –8920 mi/radian
e. 2973 mi/radian

____ 22. Find the second derivative of the function $f(x) = 8x^{\frac{5}{9}}$.

a. $f''(x) = \frac{-160}{81}x^{\frac{4}{9}}$
b. $f''(x) = \frac{5}{81}x^{\frac{-13}{9}}$
c. $f''(x) = \frac{-160}{81}x^{\frac{-13}{9}}$
d. $f''(x) = \frac{160}{81}x^{\frac{-13}{9}}$
e. $f''(x) = 8x^{\frac{-13}{9}}$

____ 23. Find the second derivative of the function $f(x) = \frac{3x^2 + 5x - 4}{x}$.

a. $f''(s) = -\frac{8}{x^3}$
b. $f''(s) = \frac{8}{x^3}$

c. $f''(s) = -\dfrac{x+8}{x^3}$

d. $f''(s) = \dfrac{4}{x^3}$

e. $f''(s) = -\dfrac{8}{x^2}$

____ 24. Find the second derivative of the function $f(x) = x^4 \sec x$.

a. $f''(x) = x^2 \sec x\left(12 + x\sec^2 x + 8x\tan x + x^2\tan^2 x\right)$

b. $f''(x) = x^2 \sec x\left(12 + x^2\sec^2 x + 8x\tan x + x^2\tan^2 x\right)$

c. $f''(x) = x^2 \sec x\left(12 + x^2\sec^2 x + 4x\tan x + x^2\tan^2 x\right)$

d. $f''(x) = x^2 \sec x\left(12 + x^2\sec^2 x + 8x\tan x + x^2\tan x\right)$

e. $f''(x) = x^2 \sec x\left(12 + x^2\sec^2 x + 8x\tan x + x\tan^2 x\right)$

____ 25. Given the derivative below find the requested higher-order derivative.

$f''(x) = 8x^{\frac{7}{5}}, f^{(iv)}(x).$

a. $f^{(iv)}(x) = -(56/5)x^{2/5}$

b. $f^{(iv)}(x) = (112/25)x^{2/5}$

c. $f^{(iv)}(x) = (112/25)x^{\frac{-3}{5}}$

d. $f^{(iv)}(x) = (56/5)x^{2/5}$

e. $f^{(iv)}(x) = -(112/25)x^{\frac{-3}{5}}$

____ 26. Suppose that an automobile's velocity starting from rest is $v(t) = \dfrac{240t}{5t+13}$ where v is measured in feet per second. Find the acceleration at 9 seconds. Round your answer to one decimal place.

a. 1.9 ft/sec^2
b. 0.9 ft/sec^2
c. 0.6 ft/sec^2
d. 0.2 ft/sec^2
e. 8.3 ft/sec^2

2.3 Product and Quotient Rules and Higher-Order Derivatives
Answer Section

1. ANS: D PTS: 1 DIF: Med REF: Section 2.3
OBJ: Differentiate a function using the product rule MSC: Skill
2. ANS: D PTS: 1 DIF: Med REF: Section 2.3
OBJ: Differentiate a function using the product rule MSC: Skill
3. ANS: D PTS: 1 DIF: Med REF: Section 2.3
OBJ: Differentiate a function using the product rule MSC: Skill
4. ANS: D PTS: 1 DIF: Med REF: Section 2.3
OBJ: Differentiate a function using the product rule MSC: Skill
5. ANS: E PTS: 1 DIF: Med REF: Section 2.3
OBJ: Differentiate a function using the product rule MSC: Skill
6. ANS: A PTS: 1 DIF: Difficult REF: Section 2.3
OBJ: Differentiate a function using the quotient rule MSC: Skill
7. ANS: B PTS: 1 DIF: Difficult REF: Section 2.3
OBJ: Differentiate a function using the quotient rule MSC: Skill
8. ANS: B PTS: 1 DIF: Difficult REF: Section 2.3
OBJ: Differentiate a function using the quotient rule MSC: Skill
9. ANS: C PTS: 1 DIF: Difficult REF: Section 2.3
OBJ: Differentiate a function using the quotient rule and evaluate the derivative
MSC: Skill
10. ANS: B PTS: 1 DIF: Difficult REF: Section 2.3
OBJ: Differentiate a function using the quotient rule MSC: Skill
11. ANS: A PTS: 1 DIF: Med REF: Section 2.3
OBJ: Differentiate a function using the product rule MSC: Skill
12. ANS: B PTS: 1 DIF: Med REF: Section 2.3
OBJ: Differentiate a function using the product rule MSC: Skill
13. ANS: A PTS: 1 DIF: Med REF: Section 2.3
OBJ: Differentiate a function using the product rule MSC: Skill
14. ANS: B PTS: 1 DIF: Med REF: Section 2.3
OBJ: Differentiate a function using the product rule MSC: Skill
15. ANS: C PTS: 1 DIF: Med REF: Section 2.3
OBJ: Write an equation of a line tangent to the graph of a function at a specified point
MSC: Skill
16. ANS: B PTS: 1 DIF: Difficult REF: Section 2.3
OBJ: Calculate the values for which the slope of a function is zero MSC: Skill
17. ANS: C PTS: 1 DIF: Difficult REF: Section 2.3
OBJ: Interpret a derivative as a rate of change MSC: Application
18. ANS: B PTS: 1 DIF: Difficult REF: Section 2.3
OBJ: Interpret a derivative as a rate of change MSC: Application
19. ANS: D PTS: 1 DIF: Med REF: Section 2.3
OBJ: Interpret a derivative as a rate of change MSC: Application
20. ANS: D PTS: 1 DIF: Med REF: Section 2.3
OBJ: Interpret a derivative as a rate of change MSC: Application
21. ANS: A PTS: 1 DIF: Difficult REF: Section 2.3
OBJ: Create a function in application and interpret its derivative as a rate of change
MSC: Application

22. ANS: C PTS: 1 DIF: Difficult REF: Section 2.3
OBJ: Calculate the second derivative of a function MSC: Skill
23. ANS: A PTS: 1 DIF: Med REF: Section 2.3
OBJ: Calculate the second derivative of a function MSC: Skill
24. ANS: B PTS: 1 DIF: Difficult REF: Section 2.3
OBJ: Calculate the second derivative of a function MSC: Skill
25. ANS: C PTS: 1 DIF: Med REF: Section 2.3
OBJ: Calculate a higher derivative of a function MSC: Skill
26. ANS: B PTS: 1 DIF: Med REF: Section 2.3
OBJ: Calculate the acceleration from a velocity function MSC: Application

2.4 The Chain Rule

Multiple Choice

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

____ 1. Find the derivative of the algebraic function $f(x) = \left(x^6 + 4\right)^5$.

a. $f'(x) = 5x^5\left(x^6 + 4\right)^4$

b. $f'(x) = 6x^5\left(x^6 + 4\right)^4$

c. $f'(x) = 30x^5\left(x^6 + 4\right)^4$

d. $f'(x) = 30x^7\left(x^6 + 4\right)^4$

e. $f'(x) = 30x^6\left(x^6 + 4\right)^4$

____ 2. Find the derivative of the function.

$f(t) = \left(4 + 7t^5\right)^8$

a. $f'(t) = 280t^4\left(4 + 7t^4\right)^7$

b. $f'(t) = 280t^4\left(4 + 7t^5\right)^7$

c. $f'(t) = 7t^4\left(4 + 7t^5\right)^7$

d. $f'(t) = 280t^7\left(4 + 7t^5\right)^7$

e. $f'(t) = 280t^8\left(4 + 7t^5\right)^7$

____ 3. Find the derivative of the function.

$f(t) = (1 + 8t)^{\frac{5}{9}}$

a. $f'(t) = \frac{40}{9}(1 + 8t)^{\frac{-4}{9}}$

b. $f'(t) = \frac{8}{9}(1 + 8t)^{\frac{-4}{9}}$

c. $f'(t) = \frac{1}{9}(1 + 8t)^{\frac{-4}{9}}$

d. $f'(t) = \frac{40}{9}(1 + 8t)^{\frac{-4}{5}}$

e. $f'(t) = 8(1 + 8t)^{\frac{-4}{9}}$

____ 4. Find the derivative of the function.

$f(x) = x^7(5 + 8x)^3$

a. $f'(x) = x^2(5 + 8x)^6(35 + 80x)$

b. $f'(x) = x^6(5 + 8x)^2(35 + 80x)$

c. $f'(x) = 8x^7(5 + 8x)^2(35 + 80x)$

d. $f'(x) = x^6(5 + 8x)^3(35 + 80x)$

e. $f'(x) = x^6(5 + 8x)^2(35 + 8x)$

____ 5. Find the derivative of the function.

$f(x) = x^8\sqrt{5 - 3x}$

a. $f'(x) = \frac{x^7(5 - 51x)}{2\sqrt{5 - 3x}}$

b. $f'(x) = \frac{x^7(80 - 3x)}{2\sqrt{5 - 3x}}$

c. $f'(x) = \frac{x^7(80 + 51x)}{2\sqrt{5 - 3x}}$

d. $f'(x) = \frac{x^7(5 + 3x)}{2\sqrt{5 - 3x}}$

e. $f'(x) = \frac{x^7(80 - 51x)}{2\sqrt{5 - 3x}}$

____ 6. Find the derivative of the function.

$$g(x) = \left(\frac{x+6}{x^2+7}\right)^4$$

a. $$g'(x) = \frac{4\left(7-12x+x^2\right)}{(6+x)\left(7+x^2\right)}\left(\frac{6+x}{7+x^2}\right)^4$$

b. $$g'(x) = \frac{4\left(7-12x-x^2\right)(6+x)^3}{\left(7+x^2\right)^5}$$

c. $$g'(x) = \frac{4\left(7+12x-x^2\right)(6+x)^3}{\left(7+x^2\right)^5}$$

d. $$g'(x) = \frac{4\left(7-12x-x^2\right)(6+x)^5}{\left(7+x^2\right)^3}$$

e. $$g'(x) = \frac{4\left(7-12x-x^2\right)(6+x)^3}{\left(7+x^2\right)^5}$$

____ 7. Find the derivative of the function $y = 8\cos 4x$.

a. $y' = -4\sin 4x$
b. $y' = -8\sin 4x$
c. $y' = -32\sin 4x$
d. $y' = 32\cos 4x$
e. $y' = -32\cos 4x$

____ 8. Find the derivative of the function $y = 8\sin 5x$.

a. $y' = 40\sin 5x$
b. $y' = 40\cos 5x$
c. $y' = -8\sin 5x$
d. $y' = -40\cos 5x$
e. $y' = 8\cos 5x$

____ 9. Find the derivative of the function.

$y = \cos\left(2x^4 - 6\right)$

a. $y' = 8x^4 \cos\left(2x^4 - 6\right)$

b. $y' = 8\sin\left(2x^4 - 6\right)$

c. $y' = -8x^3 \sin\left(2x^4 - 6\right)$

d. $y' = -8\sin\left(2x^4 - 6\right)$

e. $y' = -2\sin\left(2x^4 - 6\right)$

____ 10. Find the derivative of the function.

$f(\theta) = \frac{7}{5}\sin^2 2\theta$

a. $f'(\theta) = -\frac{28\sin 2\theta\cos 2\theta}{5}$

b. $f'(\theta) = \frac{28\cos 2\theta}{5}$

c. $f'(\theta) = \frac{28\sin 2\theta\cos 2\theta}{5}$

d. $f'(\theta) = \frac{7\sin 2\theta\cos 2\theta}{5}$

e. $f'(\theta) = \frac{28\sin 2\theta}{5}$

____ 11. Find the derivative of the function.

$y = \frac{3}{5}\sec^2 x$

a. $y' = -\frac{6}{5}\sec^2 x \tan x$

b. $y' = \frac{6}{5}\sec^2 x \tan^2 x$

c. $y' = \frac{6}{5}\sec x \tan x$

d. $y' = \frac{6}{5}\sec^2 x \tan x$

e. $y' = \frac{3}{5}\sec^2 x \tan x$