# Test Bank for Calculus of a Single Variable Early Transcendental Functions 6th Edition by Larson and HEdwards ISBN 1285774795 9781285774794

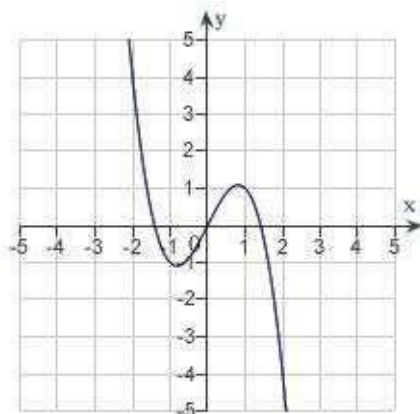Full Link Dowload

Solution Manual

Test Bank

## 1.1 Graphs and Models

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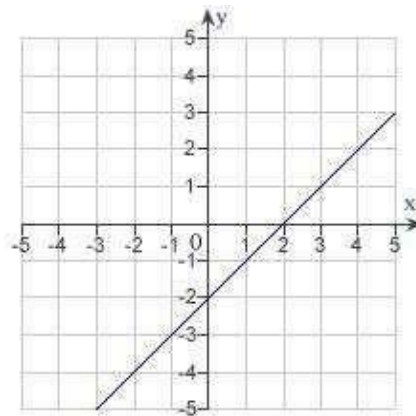*Identify the choice that best completes the statement or answers the question.*

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

a.



d.



b.
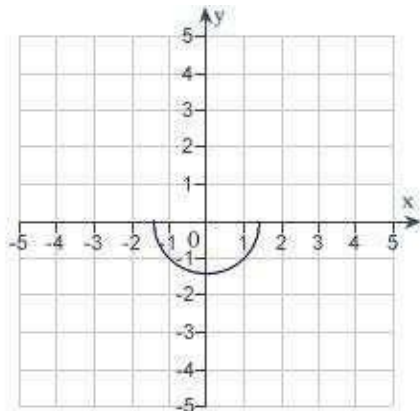


e.



c.

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

a.



d.



b.
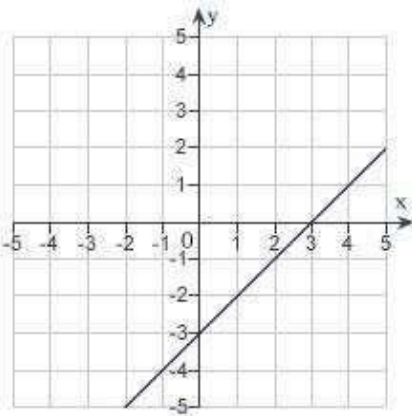


e.
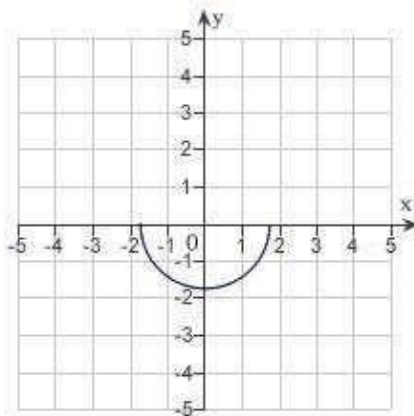


c.
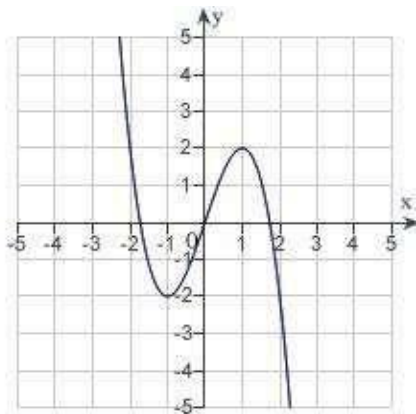
_____   3.       Which of the following is the correct graph of $y = 3x - x^2$ ?

a.
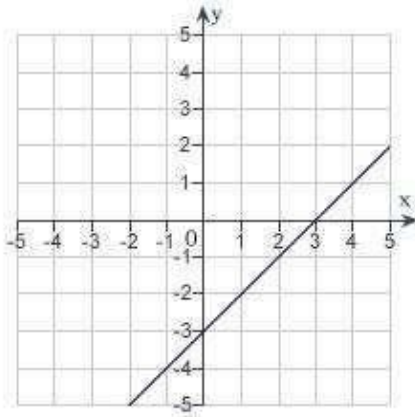
d.
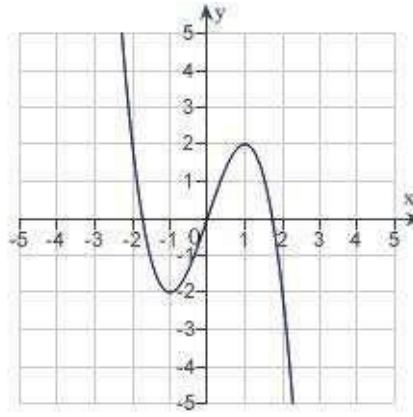
b.
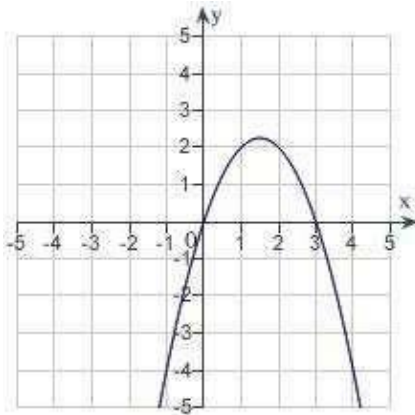
e.
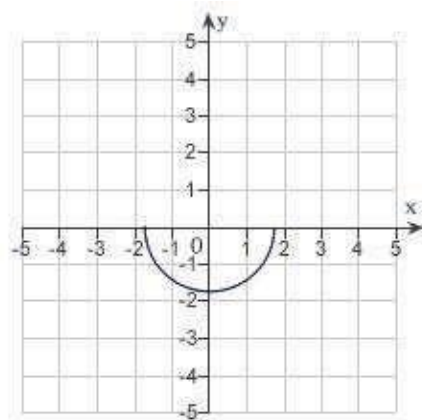
c.
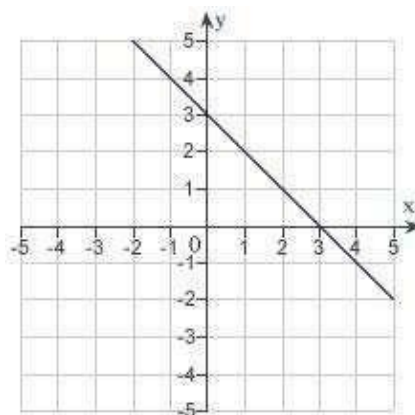
_____    4.    Which of the following is the correct graph of $y = x - x^3$ ?

a.
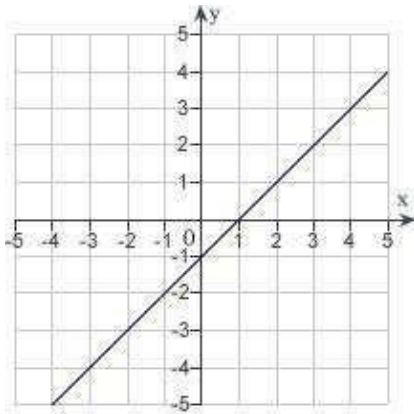


d.
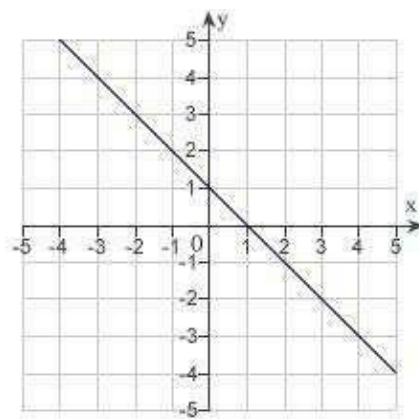


b.
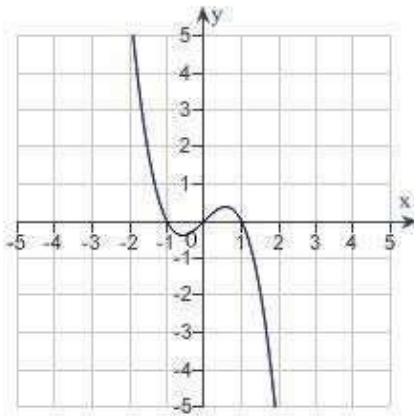


e.
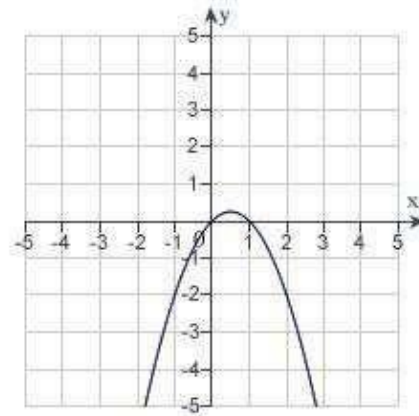


c.
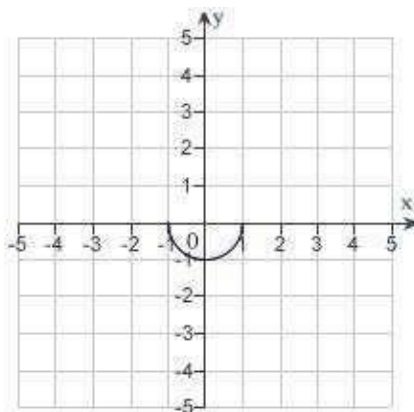
_____    5.        Find all intercepts:

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

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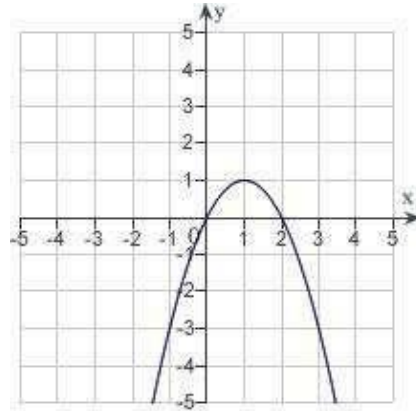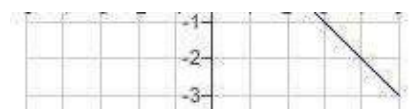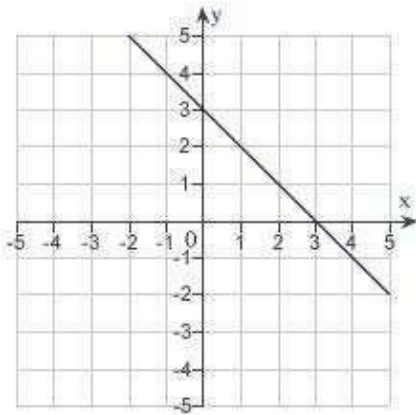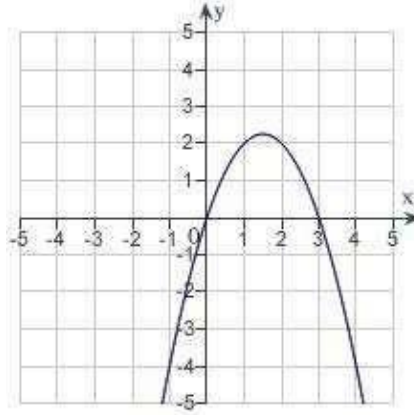d.    $x$-intercepts: (4, 0), (−3,0); $y$-intercepts: (0, –12), (0, 12)
e.    $x$-intercept: (−3, 0); $y$-intercept: (0, –12)

_____    6.        Find all intercepts:

$$y = 64x - x^3$$

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

_____    7.        Find all intercepts:

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

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

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

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

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

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

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

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

_____        10.        Sketch the graph of the equation:

$x = y^3 - 9y$

a.



d.



b.
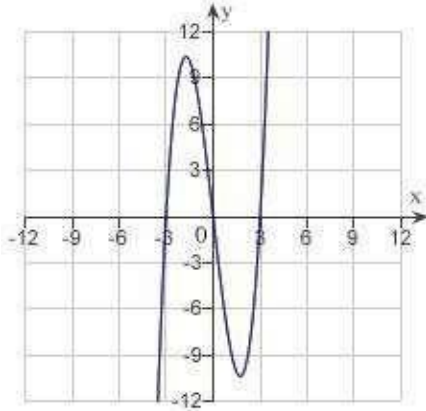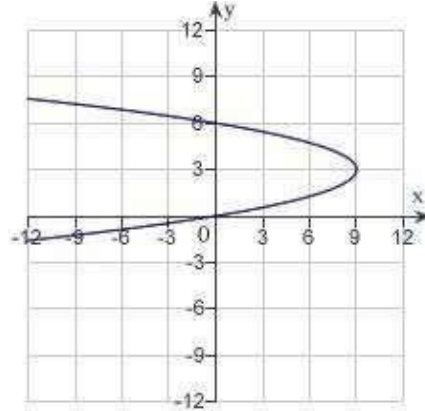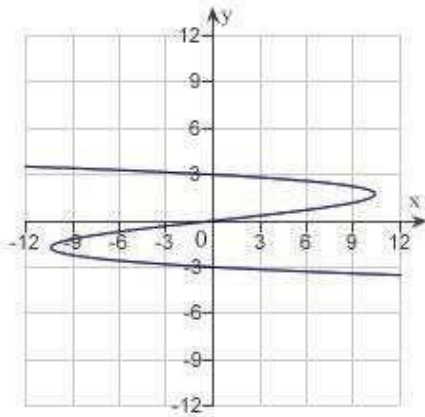


e.    none of the above

c.
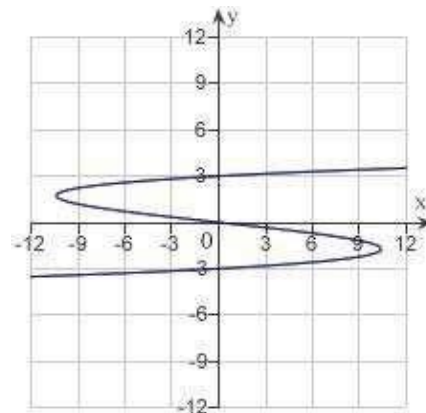
_____    11.      Sketch the graph of the equation:

$x = 4 - y^2$

a.
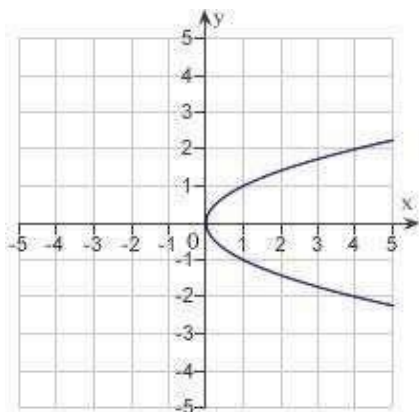


d.
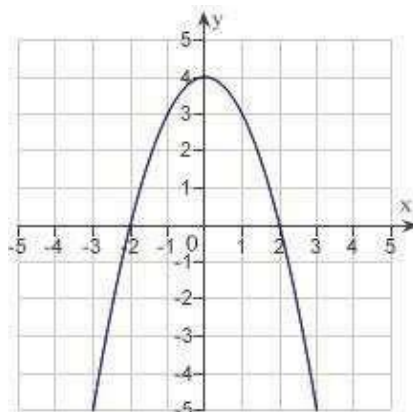


b.
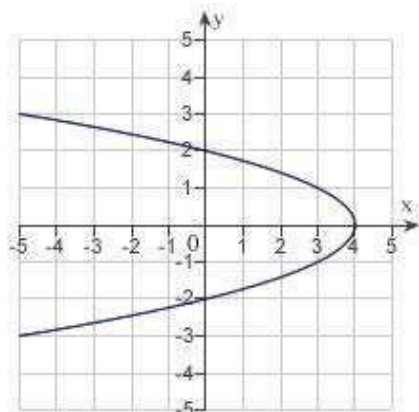


e.
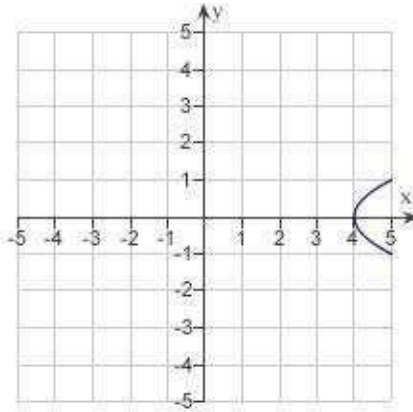


c.
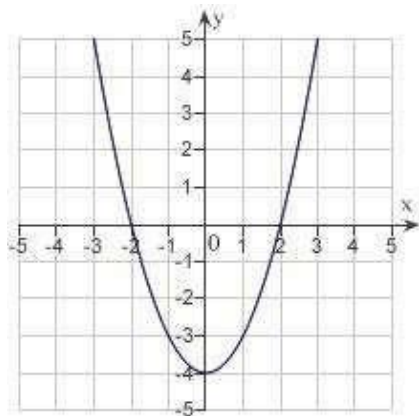
_____        12.        Sketch the graph of the equation:

$y = |x + 2|$

a.



d.



b.
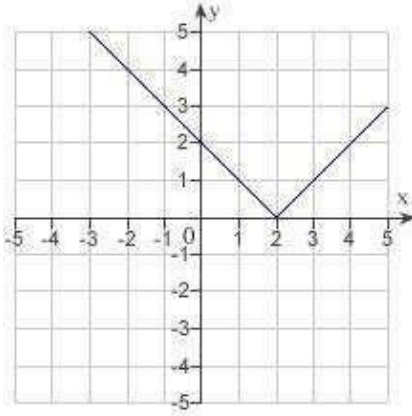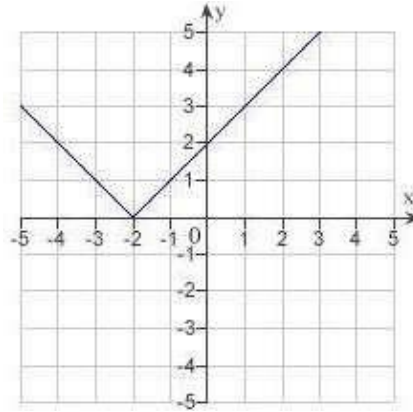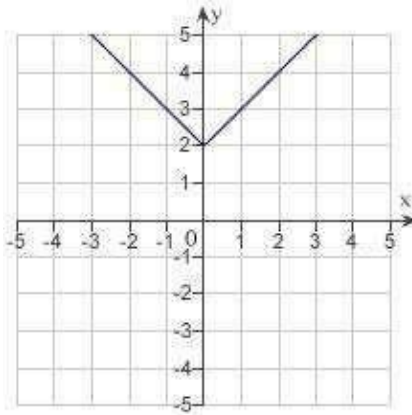


e.    none of the above

c.
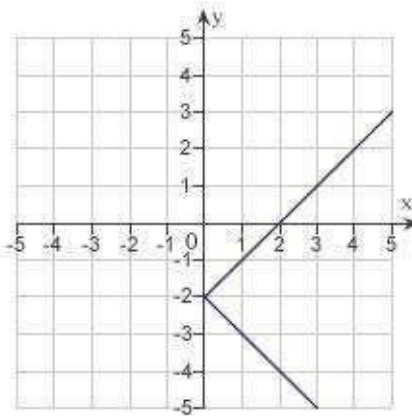
_____   13.      Find the points of intersection of the graphs of the equations:

$x = y^2 - 3$

$y = x + 1$

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

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

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

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

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

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

a.


d.


b.


e.
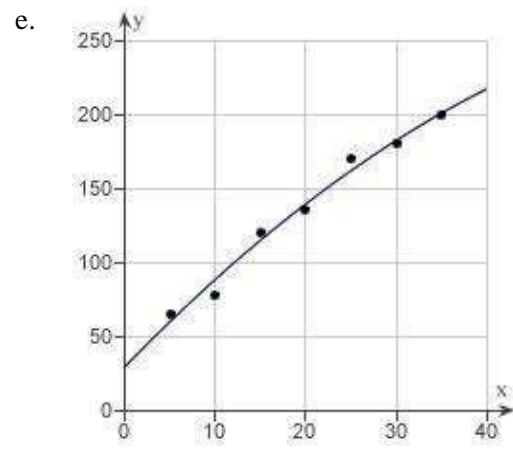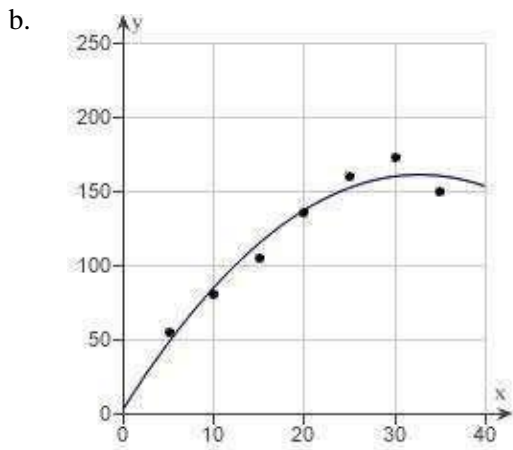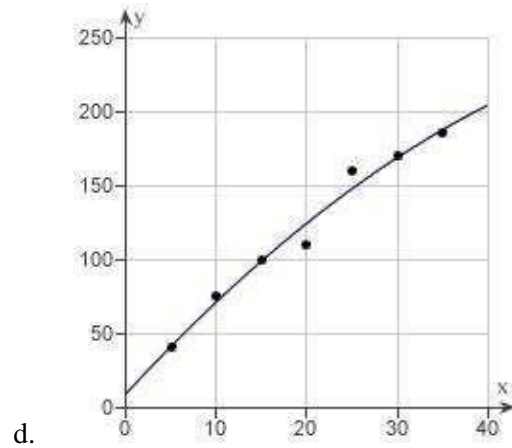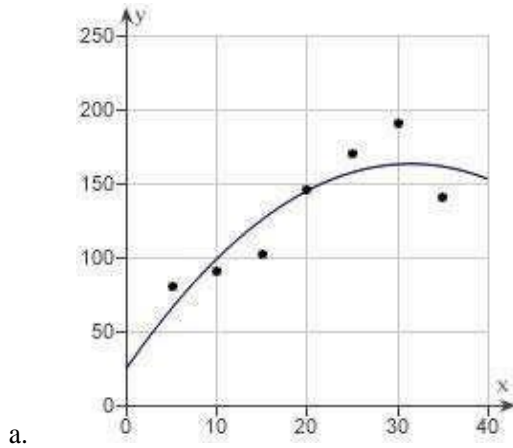
c.
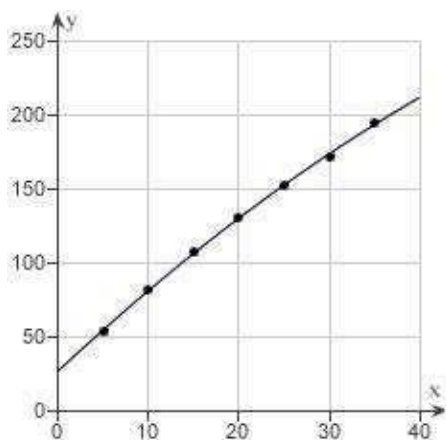


_____    16.        The table given below shows the Consumer Price Index (CPI) for selected years. The mathematical model for the data given below is $y = -0.031t^2 + 5.887t + 24.429$, where $y$ represents the CPI and $t$ represents the year, with $t = 5$ corresponding to 1975. Use the model to predict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

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

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


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

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

_____    18.    The resistance $y$ in ohms of 1000 feet of solid metal wire at $77°F$ can be approximated by the

model $y = \dfrac{10,000}{x^2} - 0.57,\ 5 \le x \le 100,$    where $x$ is the diameter of the wire in mils (0.001 in). Use a graphing

utility to graph the model $y = \dfrac{10,000}{x^2} - 0.57,\ 5 \le x \le 100.$

a.



d.



b.



e.



c.
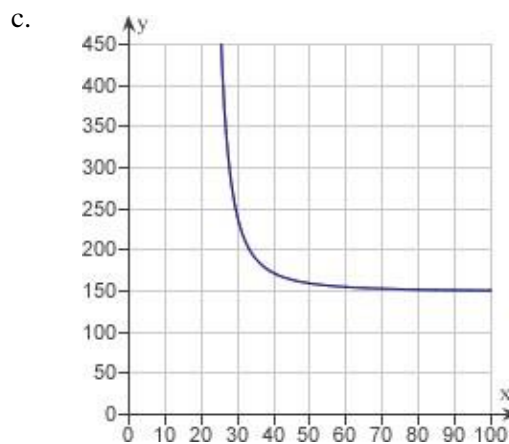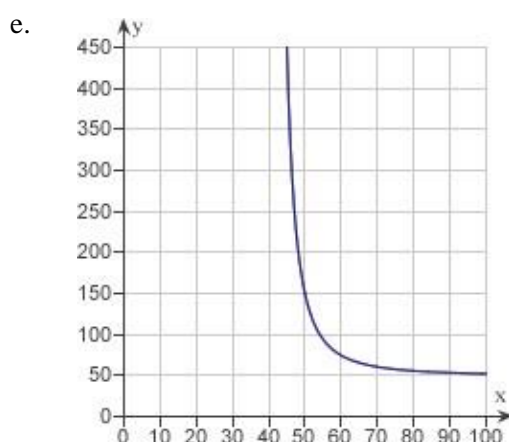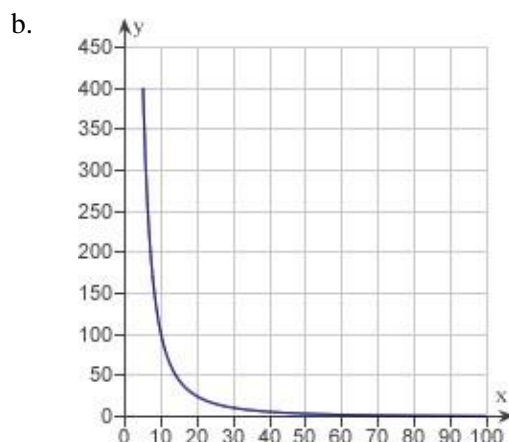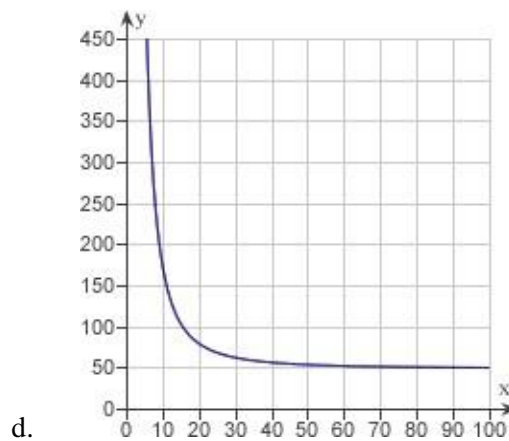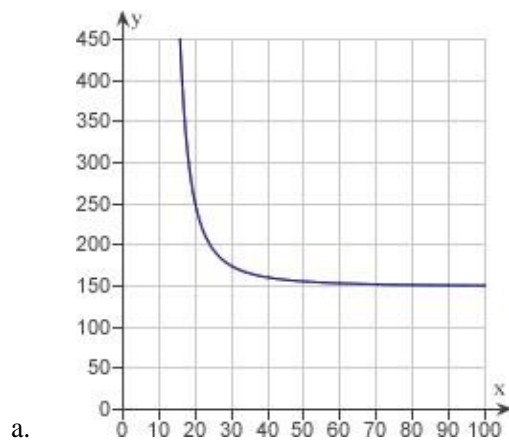
_____    19.    The resistance $y$ in ohms of 1000 feet of solid metal wire at $77°F$ can be approximated by the

model $y = \dfrac{12,750}{x^2} - 0.37, \ 5 \le x \le 100,$ where $x$ is the diameter of the wire in mils (0.001 in). If the diameter of the wire is doubled, the resistance is changed by approximately what factor? In determining your answer, you can ignore the constant –0.37.

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

b.   $2$

c.   $3$

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

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

## 1.1 Graphs and Models
## Answer Section

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

## 1.2 Linear Models and Rates of Change

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

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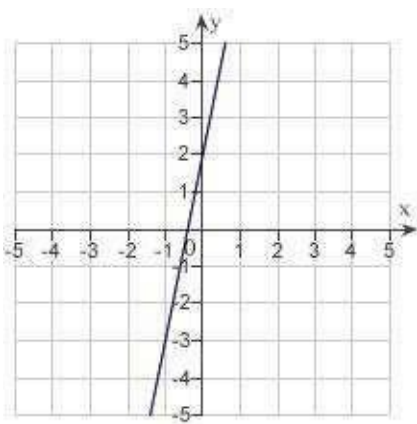


a.    $-\dfrac{1}{5}$

b.    5

c.    2

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

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

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

a.
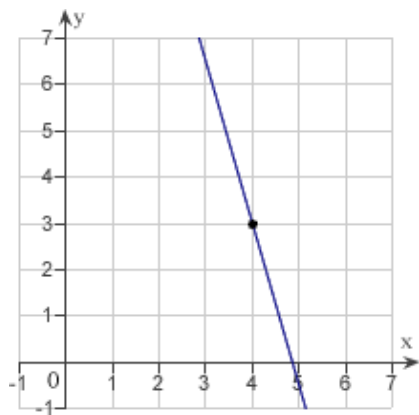


d.
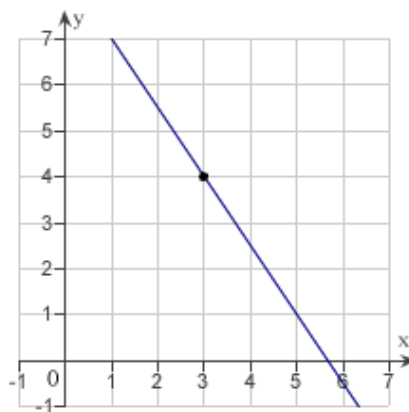
b.
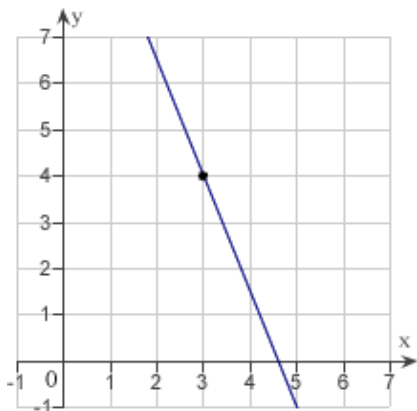


e.
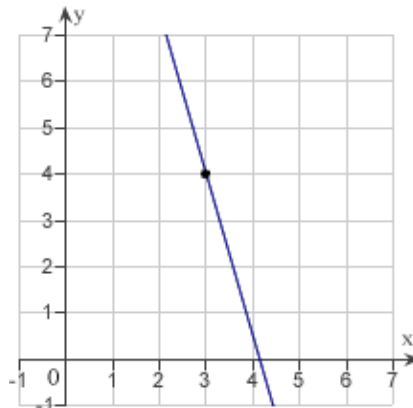


c.
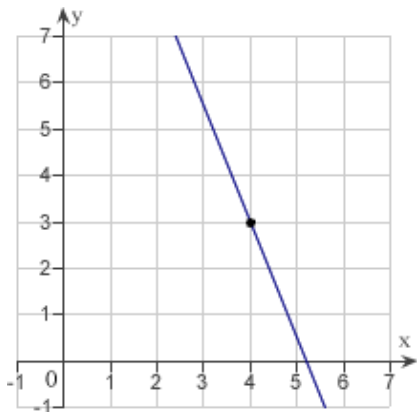


_____   3.      Find the slope of the line passing through the pair of points.

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

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

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

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

d. 0

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

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

a.  63
b.  −21
c.  42
d.  21
e.  −42

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

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

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

a.  0
b.  $\frac{5}{7}$

c.  $\frac{7}{5}$

d.  $-\frac{7}{5}$

e.  $-\frac{5}{7}$

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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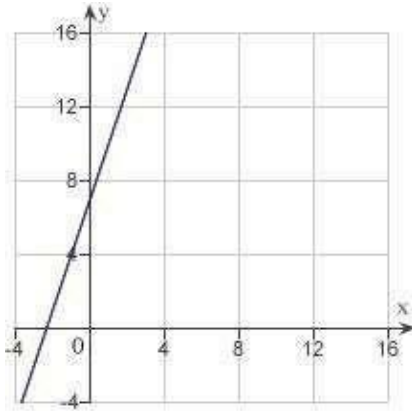
d.
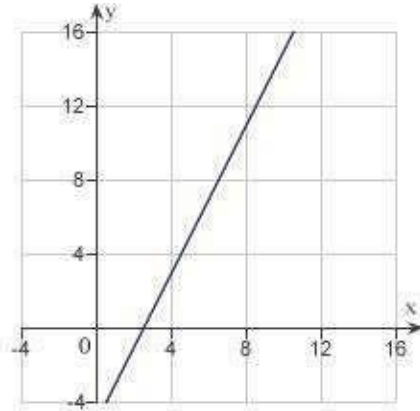
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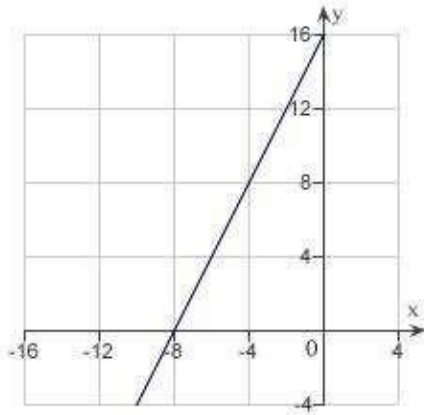
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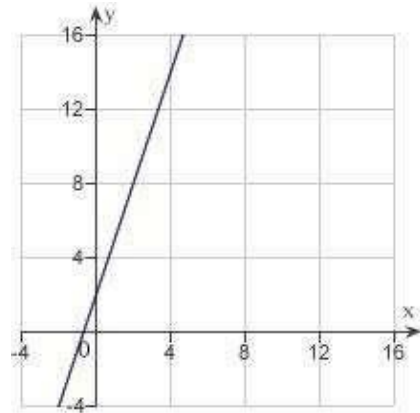
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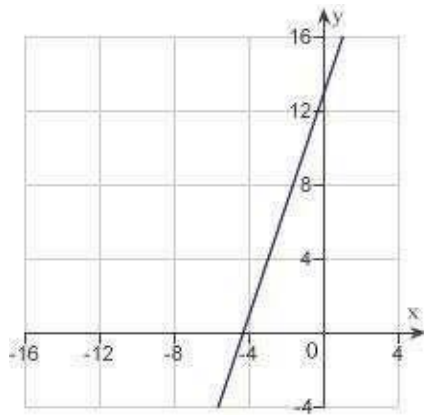
_____    16.    Write an equation of the line that passes through the given point and is perpendicular to the given line.

Point    Line

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

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

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

Point    Line

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

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

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

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

_____    19.    Write an equation of the line that passes through the point $\left( \frac{5}{4}, \frac{5}{8} \right)$ and is parallel to

the line $7x - 3y = 0.$
a.  $56x - 24y - 55 = 0$
b.  $56x + 12y - 55 = 0$
c.  $56x - 8y + 55 = 0$
d.  $56x + 6y + 55 = 0$
e.  $56x + 4y - 55 = 0$

_____ 20. Suppose that the dollar value of a product in 2008 is $174 and the rate at which the value of the product is expected to increase per year during the next 3 years is $7.50. Write a linear equation that gives the dollar value $V$ of the product in terms of the year $t$. (Let $t = 0$ represent 2000.) Round the numerical values in your answer to one decimal place, where applicable.

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

_____ 21. Find an equation of the line through the points of intersection of $y = x^2$ and $y = 6x - x^2$.

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

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

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

_____ 23. A company reimburses its sales representatives $160 per day for lodging and meals plus 45¢ per mile driven. How much does it cost the company if a sales representative drives 135 miles on a given day? Round your answer to the nearest cent.

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

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

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

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

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

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

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

_____    25.    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

_____    26.    Find the distance between the point $\left(-4, 7\right)$ and line $x - y - 2 = 0$ using the formula,

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

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

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

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

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

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

## 1.2 Linear Models and Rates of Change
## Answer Section

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

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

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

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

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

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

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

## 1.3 Functions and Their Graphs

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

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

a.   −7
b.   17
c.   3
d.   7
e.   undefined

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

a.   3
b.   3
c.   −3
d.   3
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.   15
d.   15
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.

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

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.   $f(5) = 13$
e.   $f(5) = 13$

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

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

_____    11.    Determine whether $y$ is a function of $x$.

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

_____    12.    Determine whether $y$ is a function of $x$.

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

a.  no
b.  Yes

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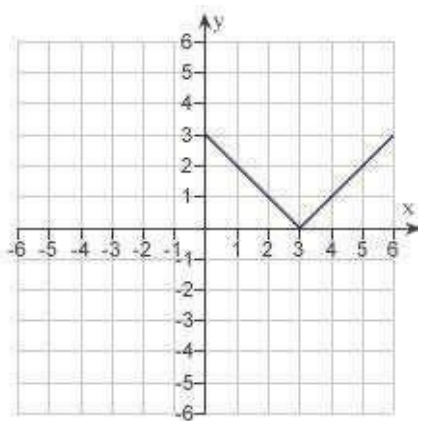


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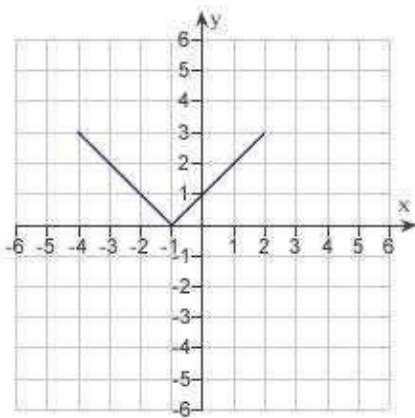


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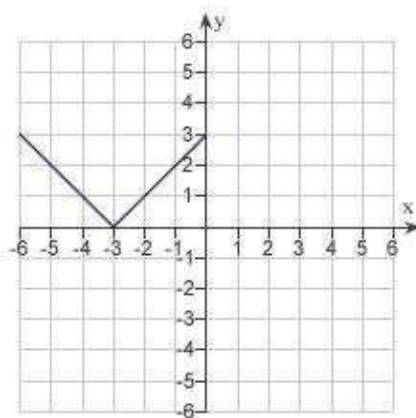
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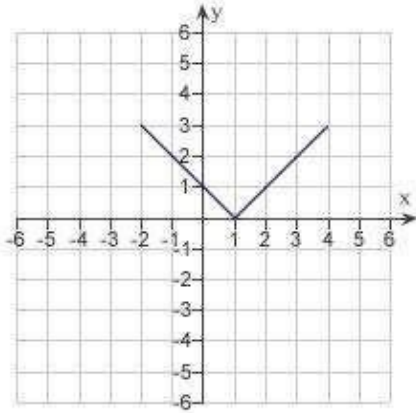


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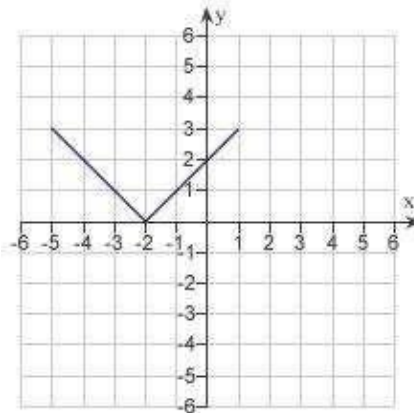


c.
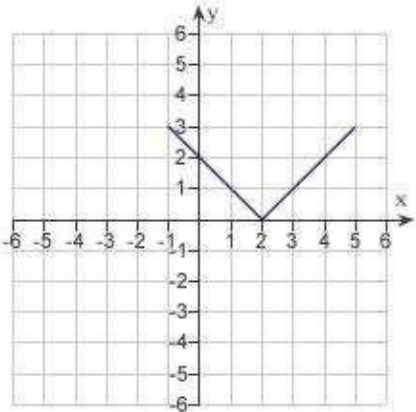


_____  14.    Use the graph of $y = f(x)$ given below to find the graph of the function $y = f(x) + 4$.
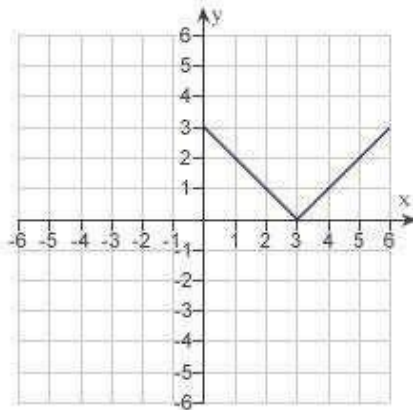
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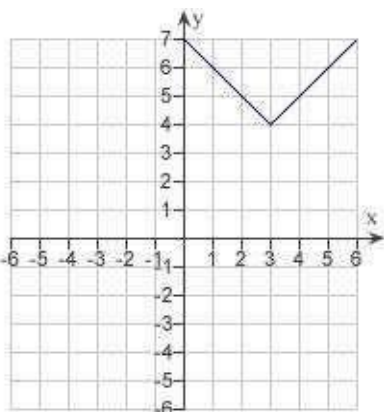
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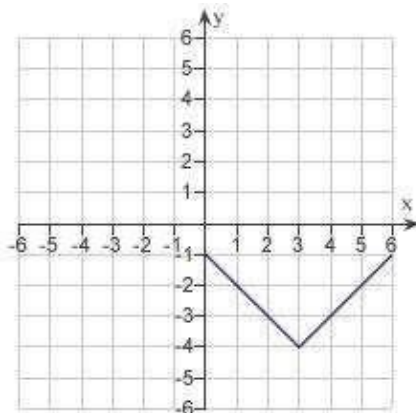
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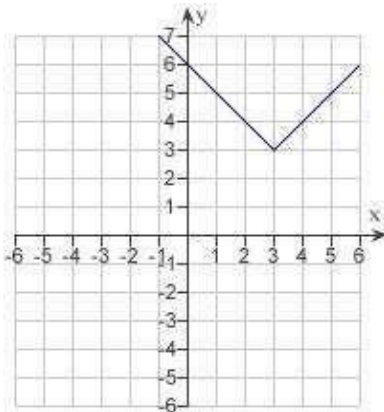
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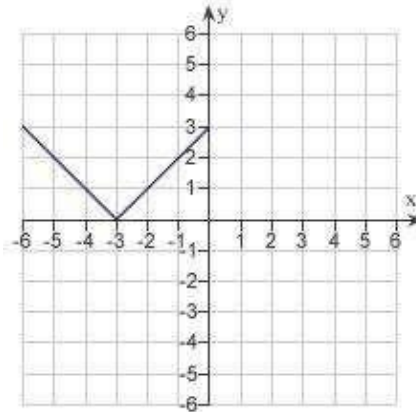
c.
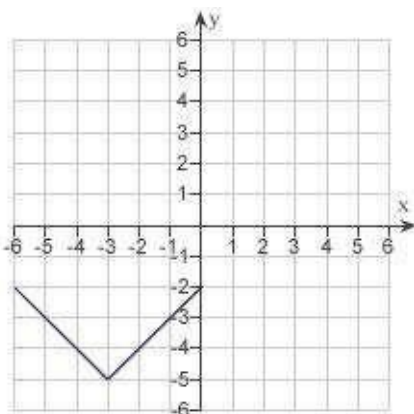
_____    15.    Specify a sequence of transformations for the function $h(x) = \sin\left(x + \dfrac{\pi}{3}\right) + 7$ that will yield the graph of $h$ from the graph of the function $f(x) = \sin x$.

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

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

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

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

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

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

a.   7

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

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

d.   $-1$

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

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

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

a.   odd
b.   even
c.   neither

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

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

a.  even
b.  odd
c.  neither

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

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

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

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

$\left(\frac{6}{5}, -8\right)$

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

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

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

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

$\left(-5, \frac{9}{8}\right)$

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

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

_____    21.    The horsepower $H$ required to overcome wind drag on a certain automobile is approximated by $H(x) = 0.002x^2 + 0.005x - 0.027,\ 10 \leq x \leq 100$ where $x$ is the speed of the car in miles per hour. Find $H\left(\dfrac{x}{1.1}\right)$. Round the numerical values in your answer to five decimal places.

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

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

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

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

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

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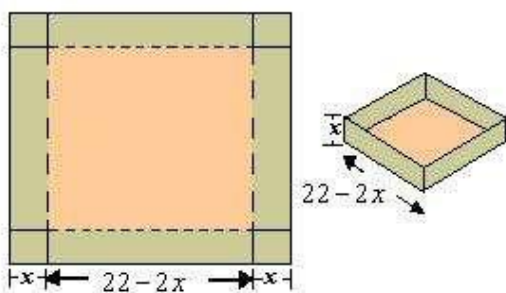


a.    $V = x(22 - 2x)^2$
b.    $V = x + (22 - x)^2$
c.    $V = x^2 + (22 - 2x)$
d.    $V = x^2(22 - 2x)$
e.    $V = x(22 - 2x)$

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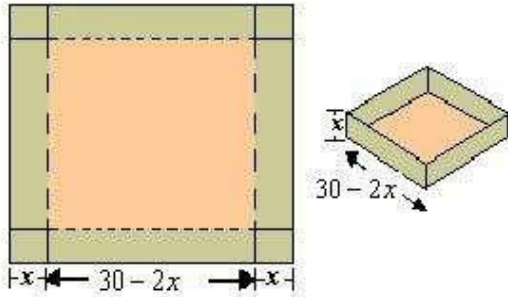


a.   domain: $0 < x < \infty$
b.   domain: $30$
c.   domain: $0 < x < 15$
d.   domain: $0 < x < 30$
e.   domain: $15$

## 1.3 Functions and Their Graphs
## Answer Section

1.     ANS:          D      PTS:          1      DIF:          Easy          REF:    Section 1.3
OBJ: Evaluate a function and simplify                                       MSC:   Skill
2.     ANS:          B      PTS:          1      DIF:          Easy          REF:    Section 1.3
OBJ: Evaluate a function and simplify                                       MSC:   Skill
3.     ANS:          C      PTS:          1      DIF:          Easy          REF:    Section 1.3
OBJ: Evaluate a function and simplify                                       MSC:   Skill
4.     ANS:          B      PTS:          1      DIF:          Med           REF:    Section 1.3
OBJ: Simplify a difference quotient                                         MSC:   Skill
5.     ANS:          A      PTS:          1      DIF:          Med           REF:    Section 1.3
OBJ: Simplify a difference quotient                                         MSC:   Skill

6.     ANS:          E      PTS:          1      DIF:          Easy          REF:    Section 1.3

OBJ: Identify the domain and range of a function                            MSC:   Skill

7.     ANS:          E      PTS:          1      DIF:          Easy          REF:    Section 1.3
OBJ: Identify the domain and range of a function                            MSC:   Skill
8.     ANS:          B      PTS:          1      DIF:          Easy          REF:    Section 1.3
OBJ: Identify the domain and range of a function                            MSC:   Skill

9.     ANS:          E      PTS:          1      DIF:          Easy          REF:    Section 1.3
OBJ:   Evaluate a piecewise function                                        MSC: Skill
10.    ANS:          B      PTS:          1      DIF:          Easy          REF:    Section 1.3
OBJ:   Identify the domain and range of a function                          MSC: Skill
11.    ANS:          B      PTS:          1      DIF:          Easy          REF:    Section 1.3
OBJ: Identify equations that are functions                                  MSC:   Skill
12.    ANS:          B      PTS:          1      DIF:          Easy          REF:    Section 1.3
OBJ: Identify equations that are functions                                  MSC:   Skill
13.    ANS:          E      PTS:          1      DIF:          Easy          REF:    Section 1.3
OBJ: Graph transformations of functions                                     MSC:   Skill
14.    ANS:          A      PTS:          1      DIF:          Med           REF:    Section 1.3
OBJ: Graph transformations of functions                                     MSC:   Skill

15.    ANS:          B      PTS:          1      DIF:          Med           REF:    Section 1.3

OBJ:   Describe a transformation of an equation                             MSC:   Skill
16.    ANS:          D      PTS:          1      DIF:          Easy          REF:    Section 1.3
OBJ:   Evaluate composite functions                                         MSC: Skill
17.    ANS:          C      PTS:          1      DIF:          Easy          REF:    Section 1.3
OBJ:   Identify the type of symmetry of the graph of a function             MSC: Skill
18.    ANS:          A      PTS:          1      DIF:          Easy          REF:    Section 1.3
OBJ:   Identify the type of symmetry of the graph of a function             MSC: Skill
19.    ANS:          E      PTS:          1      DIF:          Easy          REF:    Section 1.3
OBJ: Identify points on a graph using symmetry                              MSC:   Skill
20.    ANS:          B      PTS:          1      DIF:          Easy          REF:    Section 1.3
OBJ: Identify points on a graph using symmetry                              MSC:   Skill
21.    ANS:          D      PTS:          1      DIF:          Med           REF:    Section 1.3
OBJ: Apply composite functions                                              MSC:   Application
22.    ANS:          A      PTS:          1      DIF:          Med           REF:    Section 1.3
OBJ: Create functions in applications                                       MSC:   Application

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

## 1.4 Fitting Models to Data

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

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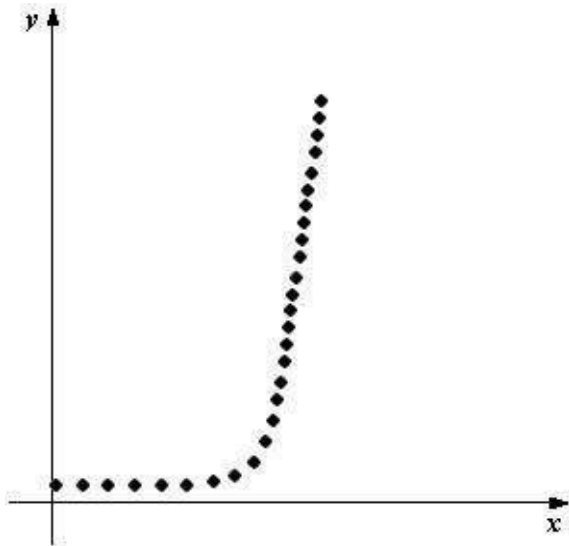


a.   exponential
b.   linear
c.   quadratic
d.   no relationship
e.   trigonometric

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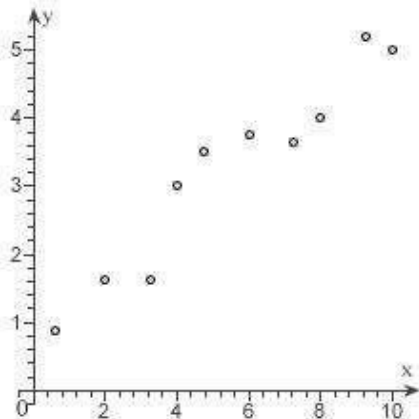
a.  no apparent relationship between x and y
b.  trigonometric
c.  quadratic
d.  linear

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

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

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

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

$(3.50, 150.1)$, $(3.58, 133.1)$, $(4.42, 132.9)$, $(2.26, 116.7)$, $(2.36, 140.7)$, $(4.85, 165.5)$,

$(12.65, 210.7)$, $(7.42, 181.0)$, $(9.35, 213.4)$

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

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

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

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

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

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

a.
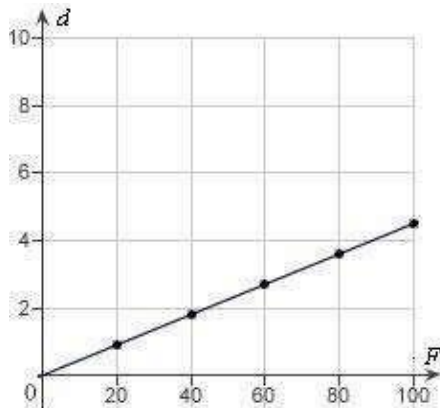


d.
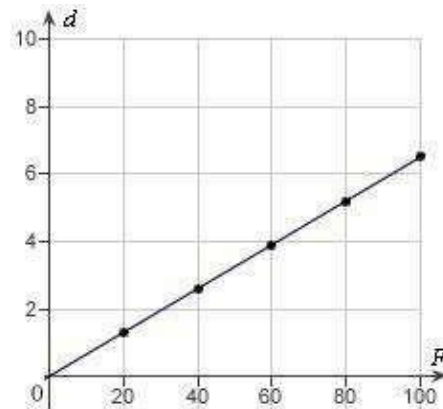


b.
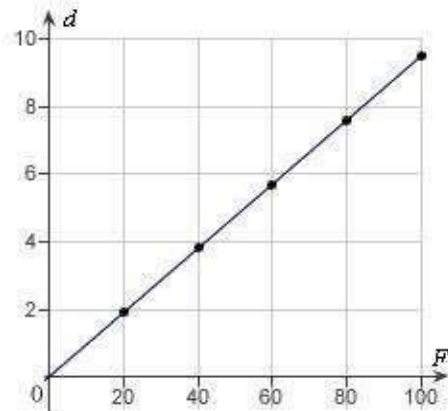


e.
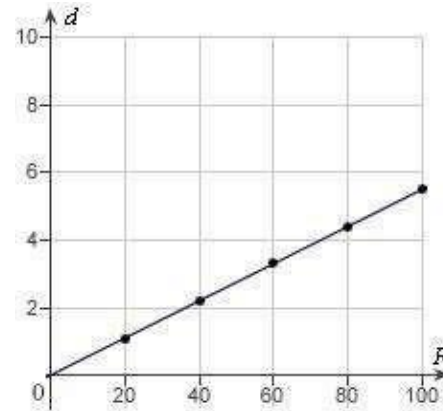
c.
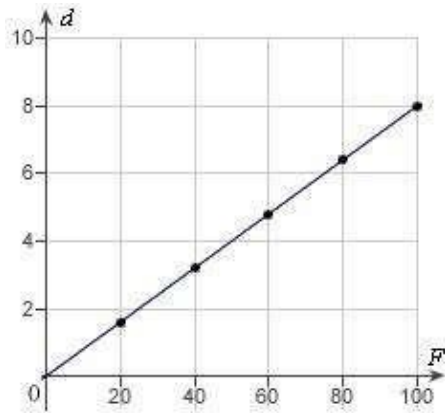


_____     7.     Hooke's Law states that the force $F$ required to compress or stretch a spring (within its elastic limits) is proportional to the distance $d$ that the spring is compressed or stretched from its original length. That is, $F = kd$ where $k$ is a measure of the stiffness of the spring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

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

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

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

| $t$ | 0 | 1 | 2 | 3 | 4 |
|---|---|---|---|---|---|
| $s$ | 0 | 13.0 | 21.4 | 31.2 | 41.4 |

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

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

| $t$ | 0 | 1 | 2 | 3 | 4 |
|---|---|---|---|---|---|
| $s$ | 0 | 40 | 48.4 | 58.2 | 68.4 |

a.
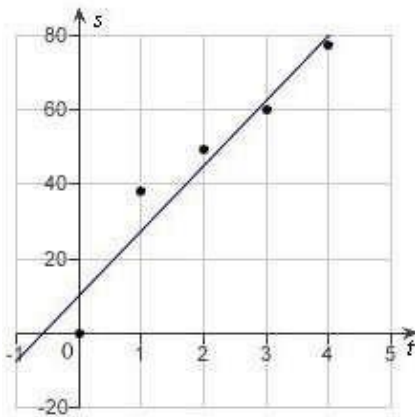


d.
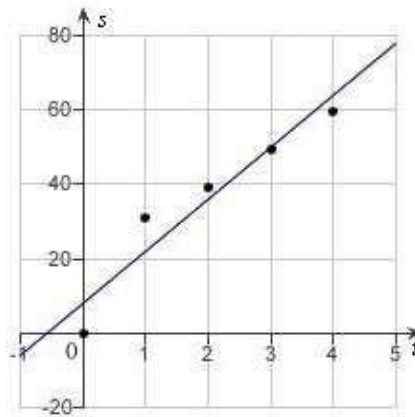


b.
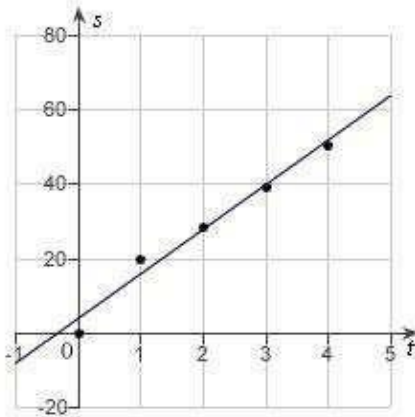


e.
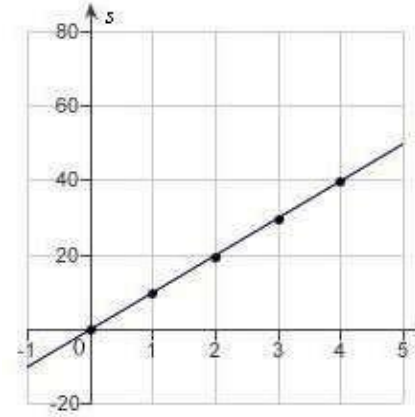
c.
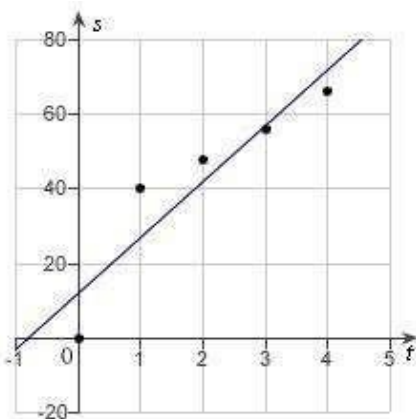


_____     10.      In an experiment, students measured the speed $s$ (in meters per second) of a falling object $t$ seconds after it was released. The results are shown in the table below. Use the model $s = 11.9t + 4.8$ to estimate the speed of the object after $1.5$ seconds. Round your answer to two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

| $t$ | 0 | 1 | 2 | 3 | 4 |
|---|---|---|---|---|---|
| $s$ | 0 | 22.0 | 30.4 | 40.2 | 50.4 |

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

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

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

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

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

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

a.



b.



d.



e.
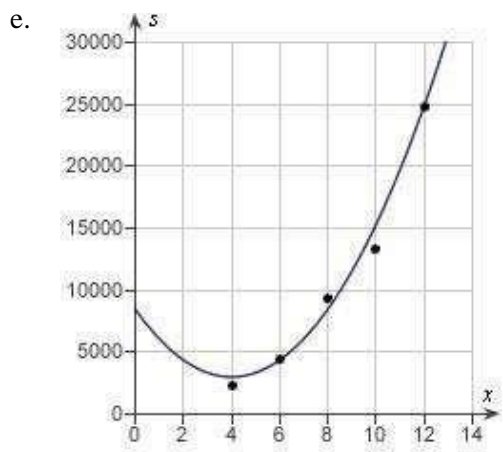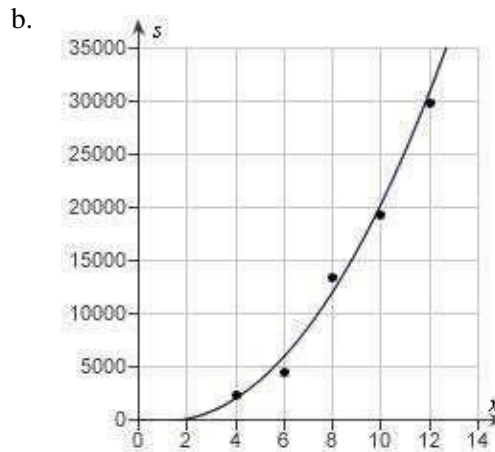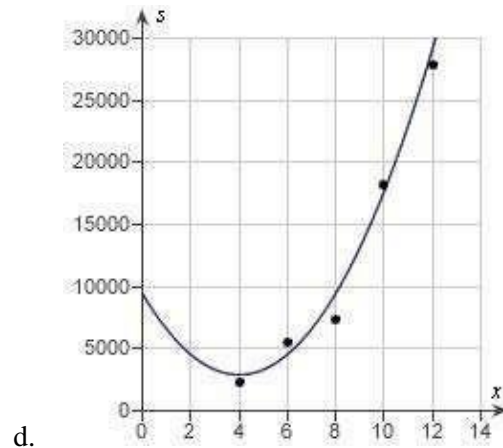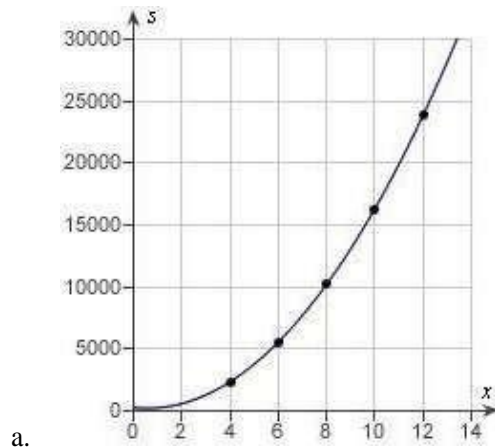
c.
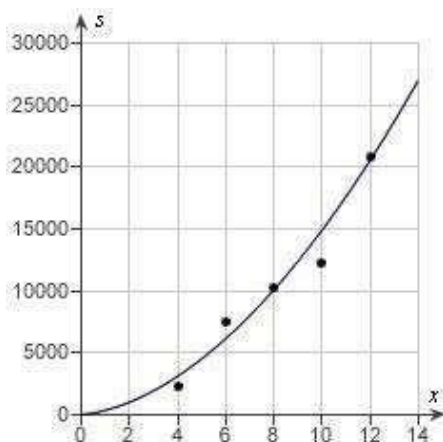


_____     13.     Students in a lab measured the breaking strength $S$ (in pounds) of wood 2 inches thick, $x$ inches high, and 12 inches long. The results are shown in the table below. Use the model $S = 180.89x^2 - 205.79x + 284$ to approximate the breaking strength when $x = 2$. Round your answer 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

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

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

a.   $y = -1.608x^3 - 14.583x^2 + 13.389x - 37$

b.   $y = -1.706x^3 - 14.583x^2 - 16.389x + 34$

c.   $y = 1.806x^3 + 11.583x^2 + 16.389x - 41$

d. $y = -1.806x^3 + 14.583x^2 + 16.389x + 34$

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

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

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

a.



d.



b.



e.
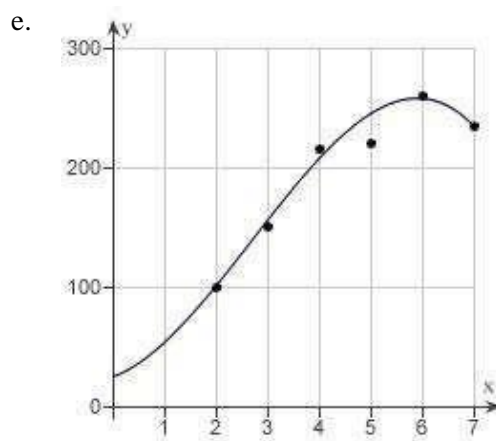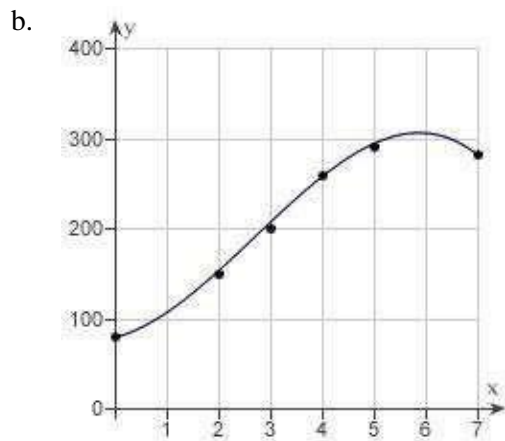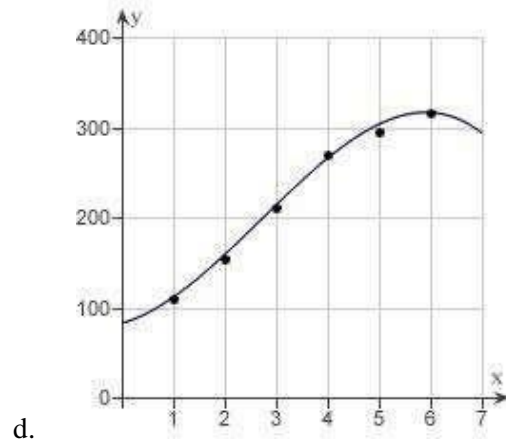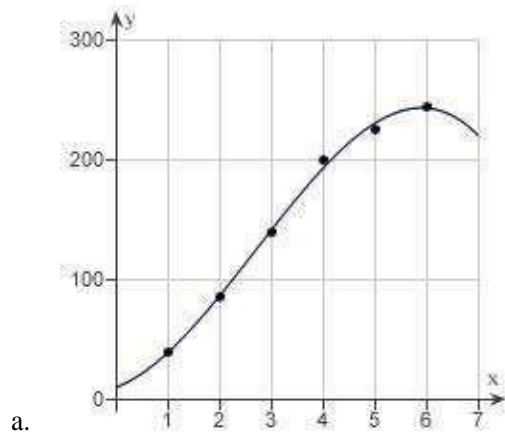
c.
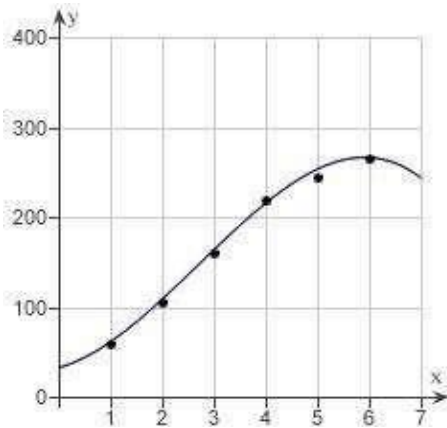


_____    16.    A V8 car engine is coupled to a dynamometer and the horsepower $y$ is measured at different engine speeds $x$ (in thousands of revolutions per minute). The results are shown in the table below. Use the model $y = -1.806x^3 + 14.58x^2 + 16.4x + 30$ to approximate the horsepower when the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

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

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

## 1.4 Fitting Models to Data
## Answer Section

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

## 1.5 Inverse Functions

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

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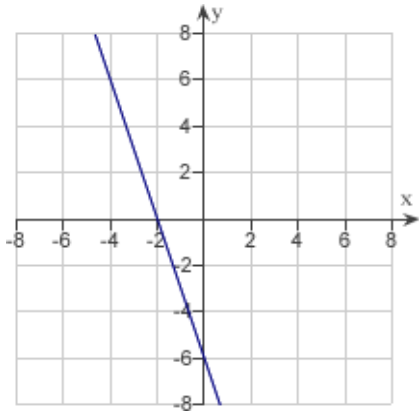


a.
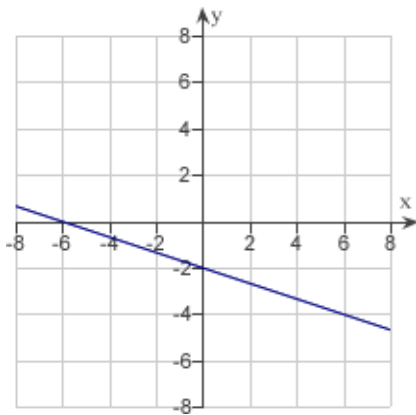


d.
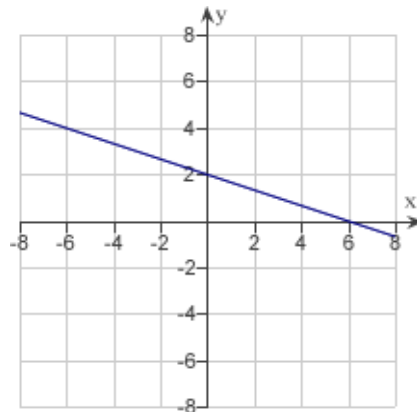


b.
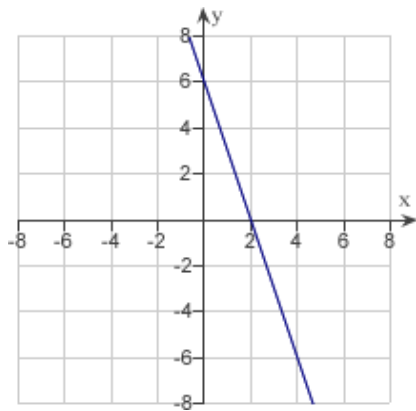


e.
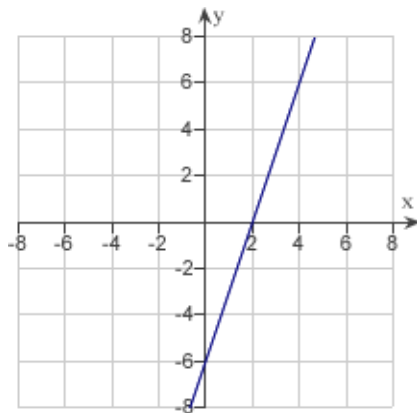
c.
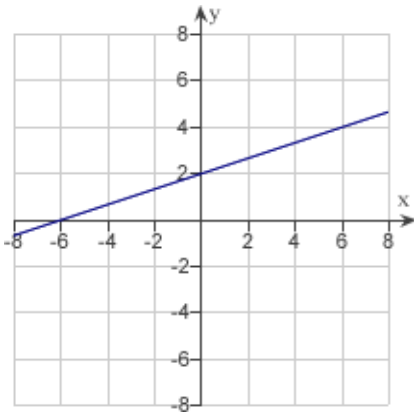


_____ 2.    Match the graph of the function given below with the graph of its inverse function.
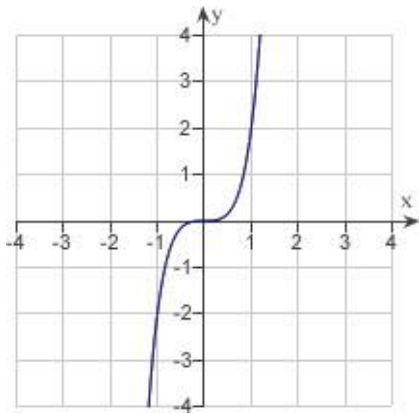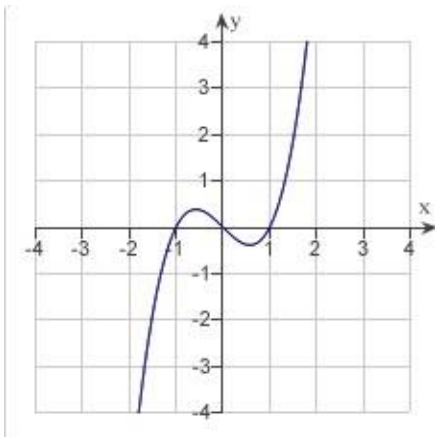


a.                                                    d.
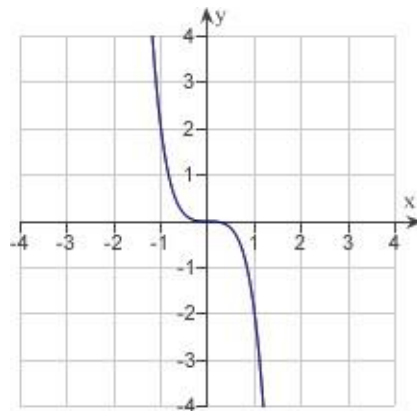
b.
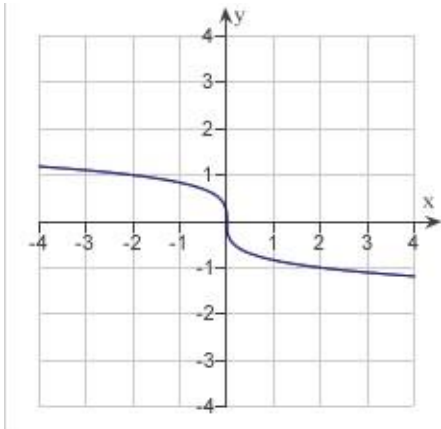


e.
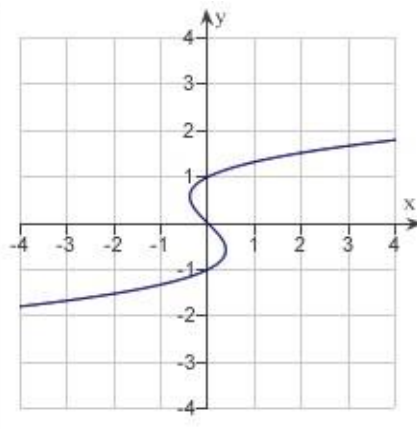


c.
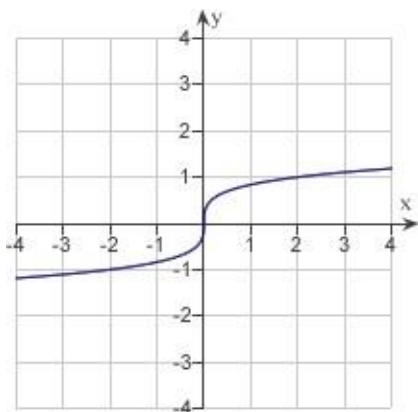


_____    3.    Use the Horizontal Line Test to determine whether the following statement is true or false.

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

a.    false
b.    true

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

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

a.    true
b.    false

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

a.   false
b.   true

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

a.   false
b.   true

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

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

_____    8.     Find $f^{-1}(x)$ if

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

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

_____   9.      Find $f^{-1}(x)$ if

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

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

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

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

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


_____   10.     Find $f^{-1}(x)$ if

$f(x) = 6x^2, x \geq 0$ a.
$\quad f^{-1}(x) = \sqrt{6x}$

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

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

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

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


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

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

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

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

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

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

_____   12.    Find $f^{-1}(x)$ if

$$f(x) = 1 \cdot 3\sqrt[5]{\frac{8x+9}{3}}$$

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

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

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

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

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


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

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

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

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

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

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


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

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

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

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

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

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

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

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

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

a.  $\dfrac{x - 5}{7}$

b.  $4x + 5$
c.  $4x - 1$
d.  $\dfrac{x + 5}{4}$

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

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

a.  $4x - 5$
b.  $\dfrac{x - 5}{4}$

c.  $\dfrac{x + 1}{4}$

d.  $\dfrac{x - 1}{3}$

e.  $4x + 1$

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

a.  0
b.  $\dfrac{3\pi}{2}$

c.  $\dfrac{7\pi}{2}$

d.  $\dfrac{\pi}{6}$

e.  $\dfrac{4\pi}{5}$

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

a.    $\dfrac{5\pi}{4}$

b.    $\dfrac{\pi}{6}$

c.    $\dfrac{3\pi}{2}$

d.    $\dfrac{\pi}{4}$

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

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

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

b.    $\dfrac{4}{5}$

c.    3

d.    5

e.    4

_____    21.    Write the following expression in algebraic form.

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

a.    $\sqrt{1-4x^2}$

b.    $1-2x^2$

c.    $1+2x^2$

d.    $1+4x^2$

e.    $\sqrt{1-2x^2}$

_____    22.    Write the following expression in algebraic form.

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

a.    $\sqrt{1-4x^4}$

b.    $1+4x^4$

c.    $\sqrt{1-2x^2}$

d.    $1+2x^2$

e.    $1+2x^4$

_____   23.     Write the following expression in algebraic form.

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

a.  $x^2 - 64$

b.  $\dfrac{\sqrt{x^2 - 64}}{8}$

c.  $1 + 64x^2$

d.  $\dfrac{\sqrt{x^2 - 8}}{1 + 8x^2}$

e.  $1 + 8x^2$

_____   24.     Solve the following equation for $x$.

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

a.  $x = \dfrac{\pi + \sin\left(\dfrac{1}{10}\right)}{7}$

b.  $x = \dfrac{\cos\left(\pi + \dfrac{1}{10}\right)}{7}$

c.  $x = \dfrac{\csc\left(\pi + \dfrac{1}{10}\right)}{7}$

d.  $x = \dfrac{\pi + \csc\left(\dfrac{1}{10}\right)}{7}$

e.  $x = \dfrac{\sin\left(\pi + \dfrac{1}{10}\right)}{7}$

_____     25.     Solve the following equation for $x$.

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

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

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

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

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

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

## 1.5 Inverse Functions
## Answer Section

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

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

## 1.6 Exponential and Logarithmic Functions

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

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

a.  $\left(0, \infty\right)$

b.  $\left[\dfrac{1}{4}, \infty\right)$

c.  $\left(0, 1\right)$

d.  $\left(1, e\right)$

e.  $\left(e, \infty\right)$

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

a.  $\left(1, \infty\right)$

b.  $\left(6, \infty\right)$

c.  $\left(0, \infty\right)$

d.  $\left(0, 6\right)$

e.  $\left(1, 6\right)$

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

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

a.  $\ln\left(\dfrac{x}{\left(x^2 + 1\right)^{-4}}\right)$

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

c.  $\ln\left(\dfrac{x}{4\left(x^2 + 1\right)}\right)$

d.  $\ln\left(\dfrac{-4x}{x^2 + 1}\right)$

e.  $\ln\left(\dfrac{x}{\left(x^2 + 1\right)^{4}}\right)$

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

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

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

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

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

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

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

_____   5.      Solve the following equation for $x$

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

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

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

c.   $x = 39$

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

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

_____    6.        Solve the following equation for $x$

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

a.    $x = 8$

b. $x = e^{\frac{\sqrt[5]{3}}{3}} + 5$

c.    $x = \dfrac{3}{\ln(5)^5}$

d.    $x = e^{\frac{3}{5}} + 5$

e.    no solution


_____    7.        Solve the following equation for $x$

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

a.    $x = \sqrt[10]{\ln(6)}$

b.    $x = \dfrac{6}{\ln(10)}$

c.    $x = \sqrt[10]{e^{-6}}$

d.    $x = \sqrt[10]{e^6}$

e.    $x = \ln(10)\ln(6)$


_____    8.        Solve the following equation for $x$

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

a.    $x = \dfrac{1}{3}\ln\dfrac{15}{7}$

b.    $x = -\dfrac{1}{3}\ln\dfrac{15}{7}$

c.    $x = \dfrac{15}{7e^3}$

d. $x = -\dfrac{1}{3}\ln\dfrac{50}{7}$

e.    $x = \dfrac{1}{3}\ln\dfrac{50}{7}$

## 1.6 Exponential and Logarithmic Functions
## Answer Section

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

## 2.1 A Preview of Calculus

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

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

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

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


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

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

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

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

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

$y = f(x)$
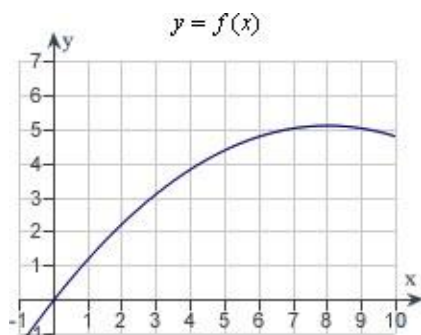


a.   precalculus, 0.08
b.   calculus, 0.2
c.   calculus, 0.64
d.   calculus, 0.08
e.   precalculus, 0.2

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

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

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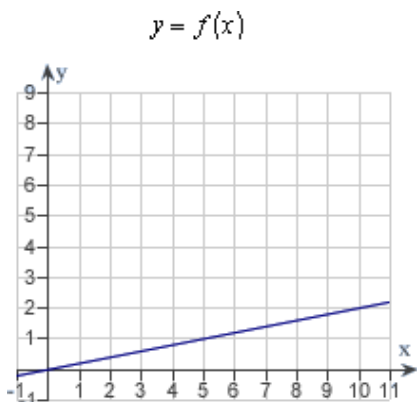
a.  calculus, 2
b.  precalculus, 0.2
c.  calculus, 0.2
d.  precalculus, 2
e.  precalculus, 0.45

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

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



$y = f(x)$
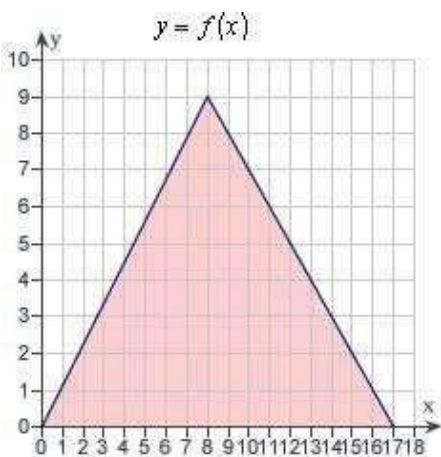
a.  precalculus , 153
b.  calculus , 229.5
c.  precalculus , 76.5
d.  precalculus , 229.5
e.  calculus , 153

_____      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.



$y = f(x)$
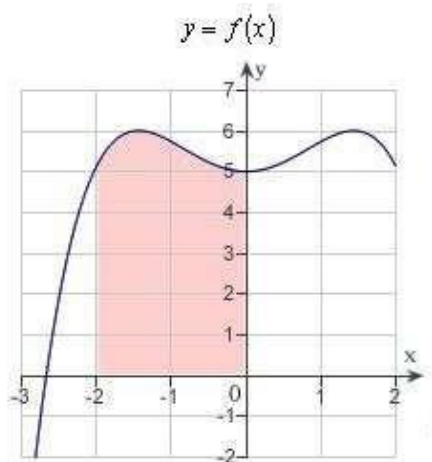
a.   calculus , 11
b.   precalculus , 11
c.   precalculus , 13
d.   calculus , 16
e.   precalculus , 16

_____      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 $Q(x, f(x))$ for $x = 3$

a.
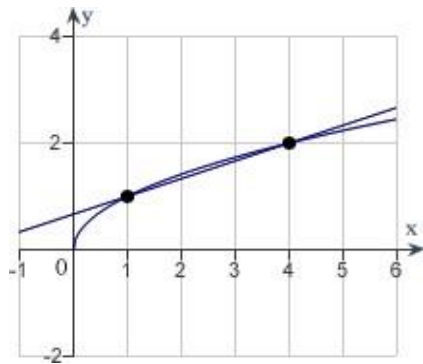


d.
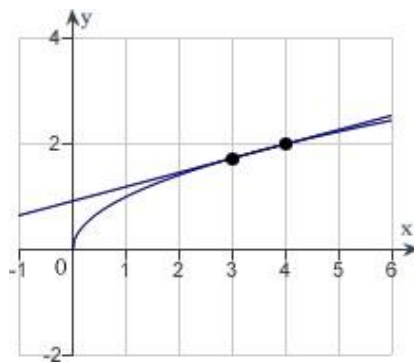
b.
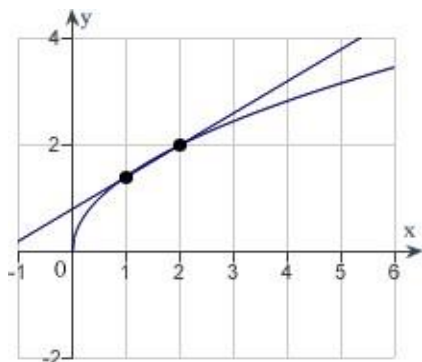


e.
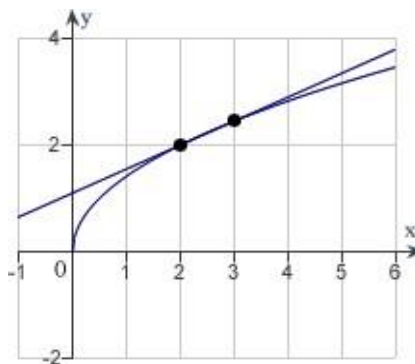


c.
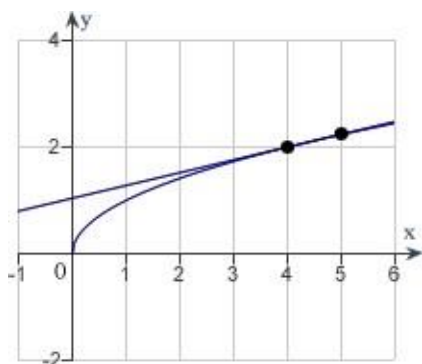


_____    8.    Consider the function $f(x) = \sqrt{x}$ and the point $P(81,9)$ on the graph of f.
Find the slope of the secant line passing through $P(81,9)$ and $Q(x, f(x))$ for $x = 1$. Round
your answer to four decimal places.

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 $P(9,3)$ on the graph of f.
Estimate the slope m of the tangent line of f at $P(9,3)$. Round your answer to four decimal
places.

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

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

a.
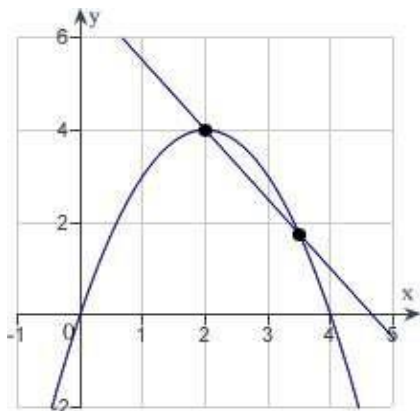


d.
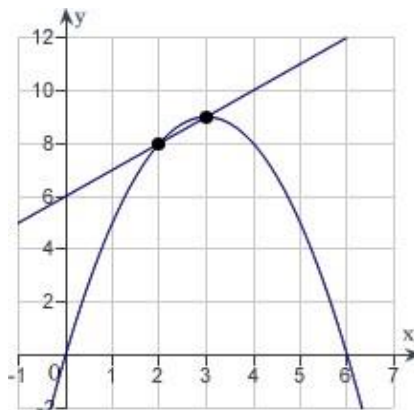


b.
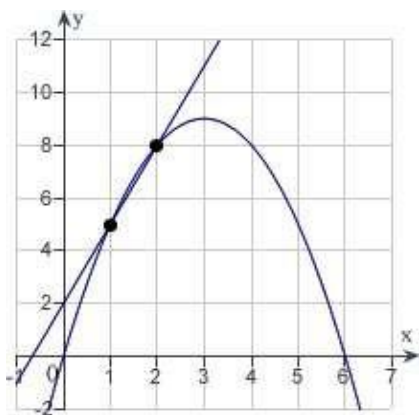


e.
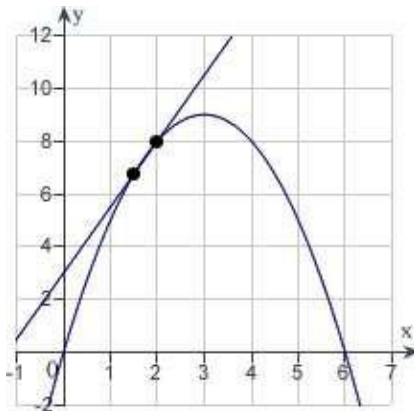


c.
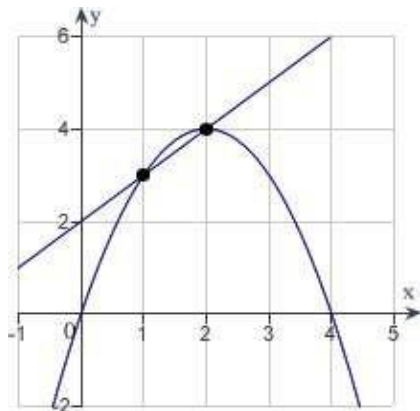
_____ 11.     Consider the function $f(x) = 11x - x^2$ and the point $P(4, 28)$ on the graph of $f$. Find the slope of the secant line passing through $P(4, 28)$ and $Q\left(x, f(x)\right)$ for $x = 3$ Round your answer to one decimal place.

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

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

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

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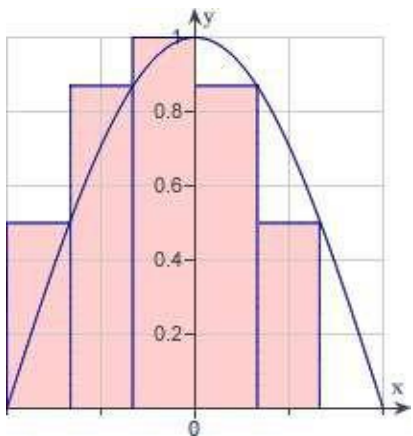


a.   3.9082
b.   2.6055
c.   1.9541
d.   1.4656
e.   0.9770

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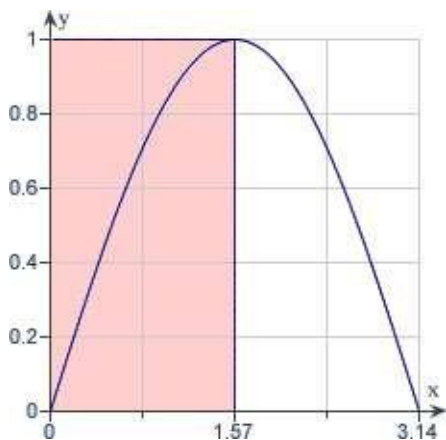


a.   0.7850
b.   1.5700
c.   3.1400
d.   1.1775
e.   1.0519

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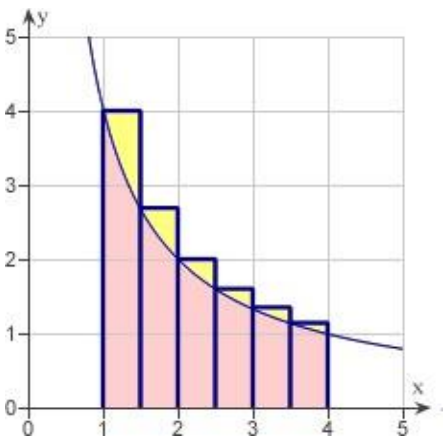


a.    2.481 units$^2$
b.    6.371 units$^2$
c.    3.585 units$^2$
d.    6.872 units$^2$
e.    6.903 units$^2$

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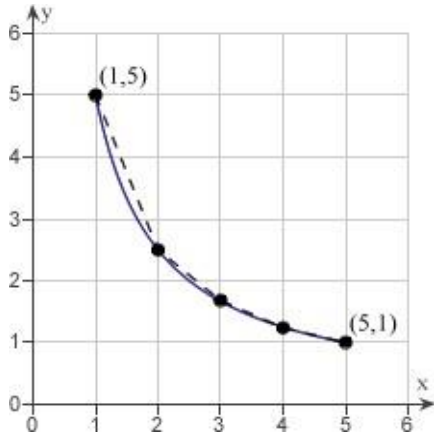


a.    6.11
b.    8.12
c.    5.66
d.    8.49
e.    7.11

## 2.1 A Preview of Calculus
## Answer Section

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

## 2.2 Finding Limits Graphically and Numerically

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

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

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

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

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

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

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

| $x$ | 6.9 | 6.99 | 6.999 | 7.001 | 7.01 | 7.1 |
|---|---|---|---|---|---|---|
| $f(x)$ | | | | | | |

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

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

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

| x | −10.1 | −10.01 | −10.001 | −9.999 | −9.99 | −9.9 |
|---|---|---|---|---|---|---|
| f(x) | | | | | | |

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

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

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

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

a.  −0.5
b.  0
c.  1
d.  0.5
e.  −1

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

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

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

a.  −1
b.  −0.5
c.  0
d.  0.5
e.  1

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

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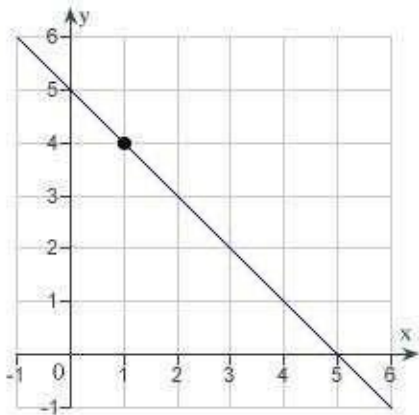


a.    6
b.    1
c.    5
d.    4
e.    does not exist

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

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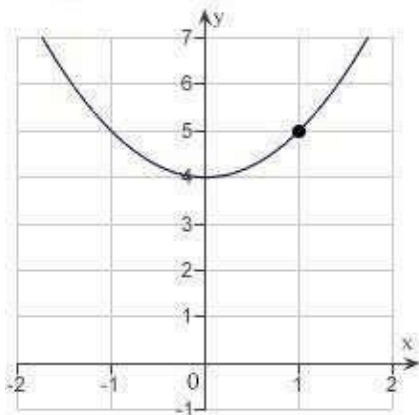


a.    5
b.    1
c.    0
d.    4
e.    does not exist

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

Determine the following limit. (Hint: Use the graph to calculate the limit.)
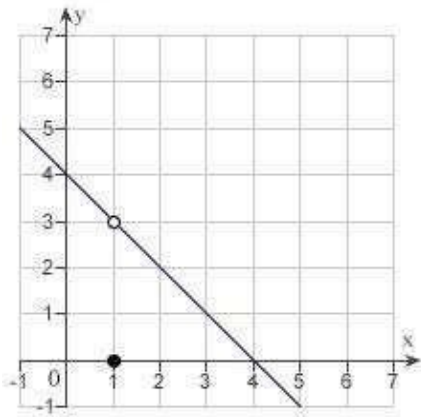
$\lim\limits_{x \to 1} f(x)$



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

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

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

$\lim\limits_{x \to 1} f(x)$
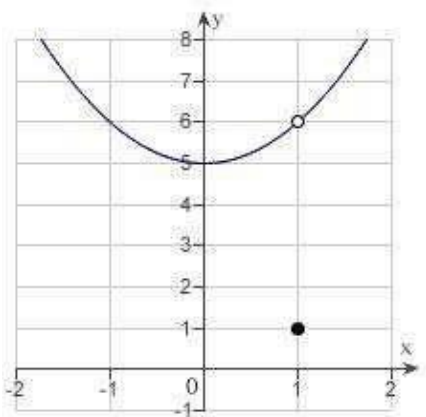


a.   6
b.   25
c.   1
d.   5
e.   does not exist.

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

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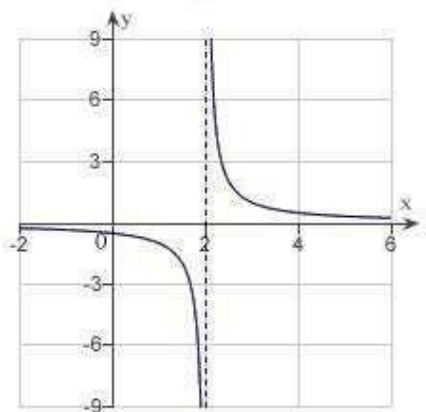
a.   –2
b.   0
c.   –4
d.   2
e.   does not exist

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

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

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

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

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

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

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

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

## 2.2 Finding Limits Graphically and Numerically
## Answer Section

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

## 2.3 Evaluating Limits Analytically

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

_____    1.    Find the limit.

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

a.  108
b.  −108
c.  288
d.  −288
e.  3

_____    2.    Find the limit.

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

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

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

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

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

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

_____    3.    Find the limit.

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

a.  3
b.  −1
c.  −3
d.  3
e.  3

_____    4.       Find the limit.

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

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

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

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

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

e.    does not exist

_____    5.       Find the limit.

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

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

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

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

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

e.    0

_____    6.       Find the limit.

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

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

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

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

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

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

_____   7.      Find the lmit.

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

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

b.   $\sqrt{3}$

c.   $-\sqrt{3}$

d.   $\dfrac{1}{\sqrt{3}}$

e.   does not exixt

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

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

a.   −18
b.   25
c.   21
d.   8
e.   9

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

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

a.   2
b.   1
c.   8
d.   −8
e.   −3

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

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

a.   $\sqrt{6}$

b.   $\sqrt{14}$

c.   $\sqrt{11}$

d.   $\sqrt{10}$

e.   $\sqrt{2}$

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

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

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

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

$\lim\limits_{x \to c} [f(x) + g(x)]$

a. 3
b. –10
c. –3
d. –23
e. 130

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

$\lim\limits_{x \to c} [f(x)g(x)]$

a. 10
b. –5
c. –25
d. –15
e. 150

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

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

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

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

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

a.  −11
b.  −8
c.  33
d.  −14
e.  3

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

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

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

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

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

a.  −5
b.  15
c.  −15
d.  3c
e.  3

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

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

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

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

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

a.  $-\dfrac{1}{16}$

b.  $-\dfrac{1}{32}$

c.  $-32$

d.  $-8$

e.  $\dfrac{1}{16}$

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

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

a.  6

b.  1

c.  1

d.  $\dfrac{1}{6}$

e.  Limit does not exist.

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

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

a.  $\dfrac{1}{3}x^3 - \dfrac{9}{2}x^2 + 2x$

b.  $2x - 9$

c.  $x^3 - 9x^2 + 2x$

d.  $x^2 - 9x + 2$

e.  does not exist

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

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

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

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

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

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

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

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

a.   1
b.   0
c.   1
d.   $\infty$
e.   does not exist

_____    25.    Find $\lim_{\Delta x \to 0} \frac{f(x + \Delta x) - f(x)}{\Delta x}$ where $f(x) = 4x - 2$.

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

## 2.3 Evaluating Limits Analytically
## Answer Section

1.    ANS:      E    PTS:      1    DIF:      Easy    REF:   Section 2.3
OBJ: Evaluate a limit using properties of limits                MSC:   Skill
2.    ANS:      C    PTS:      1    DIF:      Easy    REF:   Section 2.3
OBJ: Evaluate a limit using properties of limits                MSC:   Skill
3.    ANS:      D    PTS:      1    DIF:      Med     REF:   Section 2.3
OBJ: Evaluate a limit using properties of limits                MSC:   Skill
4.    ANS:      D    PTS:      1    DIF:      Med     REF:   Section 2.3
OBJ: Evaluate a limit using properties of limits                MSC:   Skill
5.    ANS:      B    PTS:      1    DIF:      Easy    REF:   Section 2.3
OBJ: Evaluate a limit using properties of limits                MSC:   Skill
6.    ANS:      D    PTS:      1    DIF:      Med     REF:   Section 2.3
OBJ: Evaluate a limit using properties of limits                MSC:   Skill
7.    ANS:      B    PTS:      1    DIF:      Med     REF:   Section 2.3
OBJ: Evaluate the limit of the function                         MSC:   Skill
8.    ANS:      A    PTS:      1    DIF:      Med     REF:   Section 2.3
OBJ: Evaluate the limit of composite functions                 MSC:   Skill
9.    ANS:      C    PTS:      1    DIF:      Med     REF:   Section 2.3
OBJ: Evaluate the limit of composite functions                 MSC:   Skill
10.   ANS:      B    PTS:      1    DIF:      Med     REF:   Section 2.3
OBJ: Evaluate the limit of composite functions                 MSC:   Skill
11.   ANS:      D    PTS:      1    DIF:      Med     REF:   Section 2.3
OBJ: Evaluate the limit of composite functions                 MSC:   Skill

12.   ANS:      D    PTS:      1    DIF:      Med     REF:   Section 2.3

OBJ: Evaluate the limit of a function using properties of limits        MSC:   Skill

13.   ANS:      E    PTS:      1    DIF:      Med     REF:   Section 2.3
OBJ: Evaluate the limit of a function using properties of limits        MSC:   Skill
14.   ANS:      D    PTS:      1    DIF:      Med     REF:   Section 2.3
OBJ: Evaluate the limit of a function using properties of limits        MSC:   Skill
15.   ANS:      B    PTS:      1    DIF:      Med     REF:   Section 2.3
OBJ: Evaluate the limit of a function using properties of limits        MSC:   Skill
16.   ANS:      B    PTS:      1    DIF:      Med     REF:   Section 2.3
OBJ: Evaluate the limit of a function using properties of limits        MSC:   Skill
17.   ANS:      C    PTS:      1    DIF:      Med     REF:   Section 2.3
OBJ: Evaluate the limit of a function using properties of limits        MSC:   Skill

18.   ANS:      B    PTS:      1    DIF:      Med     REF:   Section 2.3

OBJ: Evaluate the limit of the function and simplify it to an identical function except at the
discontinuity point                                            MSC:   Skill

19.   ANS:      A    PTS:      1    OBJ: Evaluate the limit of a    DIF:
OBJ: Evaluate the limit of a function analytically    function analytically
20.   ANS:      D    PTS:      1                                                   M
OBJ: Evaluate the limit of a function analytically                                e
21.   ANS:      B    PTS:      1                                                   d
OBJ: Evaluate the limit of a function analytically
22.   ANS:      A    PTS:      1                                                   R

|       |      |          | EF: MSC:  | Section 2.3 |
|-------|------|----------|-----------|-------------|
| DIF:  | Med  | REF: MSC:| Skill     |             |
| DIF:  | Med  | REF: MSC:| Section 2.3 |           |
| DIF:  | Med  | REF: MSC:| Skill     |             |
|       |      |          | Section 2.3 |           |
|       |      |          | Skill     |             |
|       |      |          | Section 2.3 |           |
|       |      |          | Skill     |             |

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

## 2.4 Continuity and One-Sided Limits

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

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

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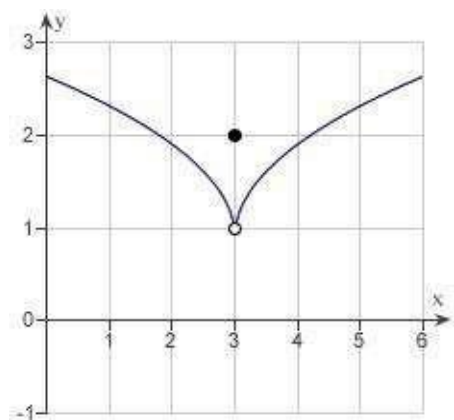


a.  $1,1,1$ , not continuous
b. $2,2,2$ ,  continuous
c.  $4,4,4$ , not continuous
d.  $2,2,2$ , not continuous
e.  $1,1,1$ , continuous

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

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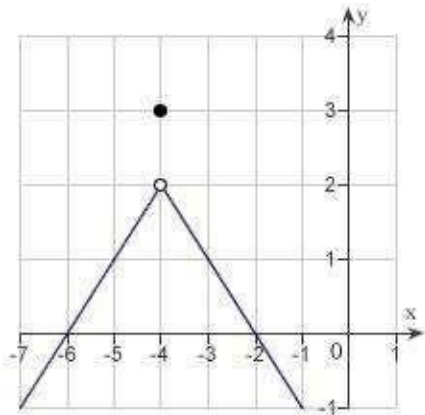


a.   $3, 3, 3$, continuous
b.   $2, 2, 2$, not continuous
c.   $3, 3, 3$, not continuous
d.   $-4, -4, -4$, continuous
e.   $2, 2, 2$, continuous

_____    3.    Use the graph to determine the following limits, and discuss the continuity of the function at $x = -2$.

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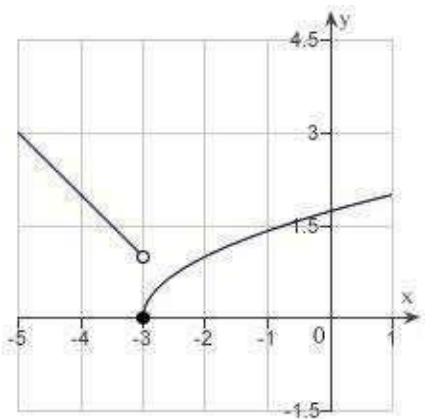


a.    $1, -1$, does not exist, not continuous
b.    $1, 0$, does not exist, not continuous
c.    $0, 1$, does not exist, not continuous
d.    $-3, 0$, does not exist, not continuous
e.    $0, 1, 0$, continuous


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

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

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

b.    $3$

c.    Limit does not exist.

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

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

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

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

a.   3
b.   $-\dfrac{1}{12}$
c.   $\dfrac{1}{72}$
d.   $\dfrac{1}{12}$
e.   Limit does not exist.


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

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

a.   Limit does not exist.
b.   3
c.   10
d.   10
e.   30


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

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

a.   10
b.   −12
c.   10
d.   −12
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.  3
b.  Limit does not exist.
c.  3
d.  3
e.  3

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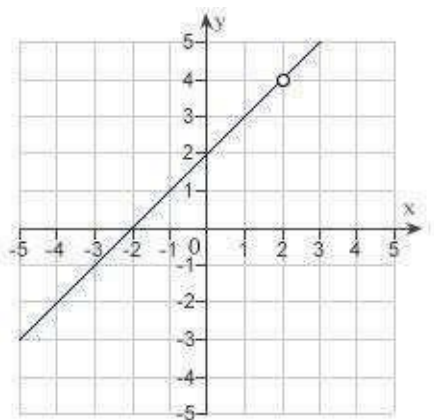


a.  $f(x)$ is discontinuous at $x = -2$.
b.  $f(x)$ is discontinuous at $x = -2, 2$.
c.  $f(x)$ is discontinuous at $x = 2$.
d.  $f(x)$ is continuous for all real $x$.
e.  $f(x)$ is continuous at $x = 4$.

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

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

_____    11.    Find the $x$-values (if any) at which

$$f(x) = \frac{x}{x^2 - 2x} \text{ is not continuous.}$$

a.

b.    $f(x)$ is not continuous at $x = 0$ and $f(x)$ has a removable discontinuity at $x = 0$.

c.    $f(x)$ is not continuous at $x = 0, 2$ and both the discontinuities are nonremovable.

d.    $f(x)$ is not continuous at $x = 2$ and $f(x)$ has a removable discontinuity at $x = 2$.

e.    $f(x)$ is not continuous at $x = 0, 2$ and $f(x)$ has a removable discontinuity at $x = 0$.

   $f(x)$ 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.  7
e.  −7

_____ 16.    Find the constant $a$ such that the function

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

is continuous on the entire real line.

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

_____ 17.    Find the value of $c$ guaranteed by the Intermediate Value Theorem.

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

a.  7
b.  7
c.  7
d.  7
e.  7

_____     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.   3
c.   3
d.   3
e.   11

_____     19.     A long distance phone service charges $0.35 for the first 11 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.
$$C = \begin{cases} 0.35 & 0 < t \le 10 \\ 0.35 + 0.1\left[|t - 10|\right] & t > 10, t \text{ is not an integer} \\ 0.35 + 0.1(t - 9) & t > 10, t \text{ is an integer} \end{cases}$$

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

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

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

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

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

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

a.  $c = 3$

b.  $c = 3$

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

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

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

## 2.4 Continuity and One-Sided Limits
## Answer Section

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

## 2.5 Infinite Limits

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

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

| $f(x)$ | -3.5 | -3.1 | -3.01 | -3.001 |
|---|---|---|---|---|
| | | | | |

| $f(x)$ | -2.999 | -2.99 | -2.9 | -2.5 |
|---|---|---|---|---|
| | | | | |

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.   $x = -2$
b.   $x = 2$
c.   $x = 3, -3$
d.   $x = 2$
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.   $x = -2$
c.   $x = 2$
d.   $x = -2$
e.   $x = -2$

_____   4.      Find all the vertical asymptotes (if any) of the graph of the function

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

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

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

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

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

e.   no vertical asymptotes

_____   8.      Find the limit.

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

a.   1
b.   $-\infty$
c.   1
d.   $\infty$
e.   $-1$

_____   9.      Find the limit.

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

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

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

c.   20
d.   $\dfrac{20}{-12}$
e.   $-20$

_____   10.     Find the limit.

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

a.   1
b.   1
c.   $-1$
d.   $-\infty$
e.   $\infty$

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

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

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

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

a.  $-\infty$

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

c.  3

d.  $\infty$

e.  Limit does not exist


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

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

a.  $-\infty$

b.  $\infty$

c.  0

d.  12

e.  8


_____    14.    Use a graphing utility to graph the function $f(x) = \csc \dfrac{\pi x}{2}$ and determine the

following one-sided limit.

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

a.  $-\infty$

b.  3

c.  $-3$

d.  $\infty$

e.  3

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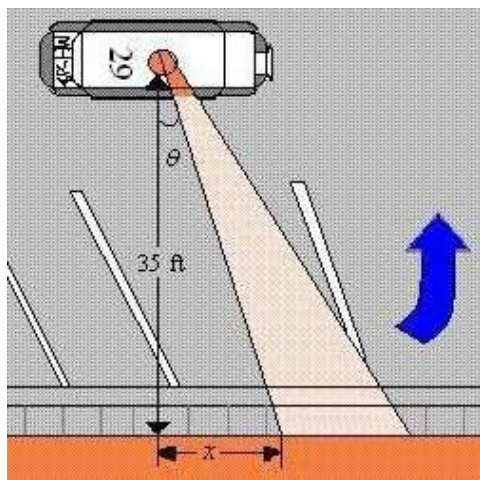


a.  $r = \dfrac{140}{3}$ ft / sec

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

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

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

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

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



a.     $\infty$
b.     $65\pi$
c.     $3$
d. 65
e.     $-\infty$
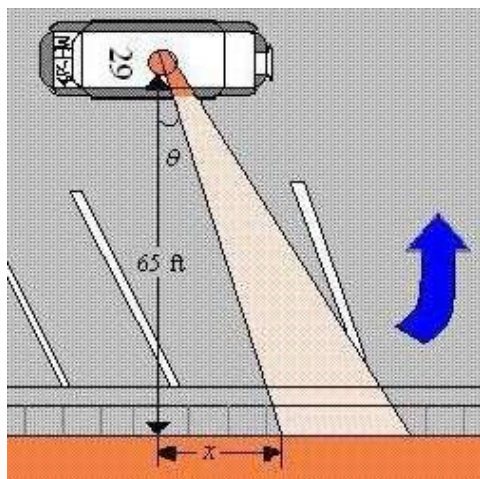
_____     17.     A $30$-foot ladder is leaning against a house (see figure). If the base of the ladder is pulled away from the house at a rate of 2 feet per second, the top will move down the wall at a rate of $r = \dfrac{2x}{\sqrt{900 - x^2}}$ ft/sec , where $x$ is the distance between the base of the ladder and the house. Find the rate $r$ when $x$ is $18$ feet.

a. $\underline{3}$
$$r = \frac{}{2} \text{ ft/sec}$$
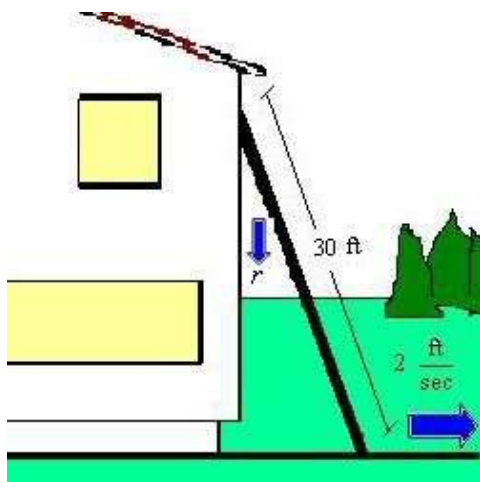
b. $\underline{4}$
$$r = \frac{}{3} \text{ ft/sec}$$

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

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

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

_____     18.     A 25-foot ladder is leaning against a house (see figure). If the base of the ladder is pulled away from the house at a rate of 2 feet per second, the top will move down the wall at a rate of

$$r = \frac{2x}{\sqrt{625 - x^2}} \text{ ft/sec}$$

where $x$ is the distance between the base of the ladder and the house. Find the limit of $r$ as $x \to 25^-$.
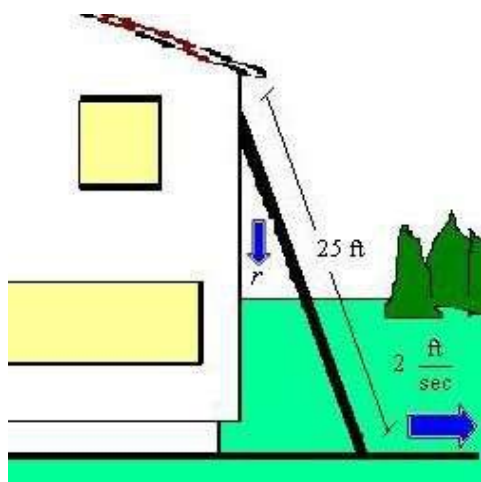


a.   $-\infty$
b.   50
c.   3
d.   $\infty$
e.   25

## 2.5 Infinite Limits
## Answer Section

1.    ANS:    B    PTS:    1    DIF:    Med    REF:    Section 2.5
OBJ:    Evaluate an infinite limit from a table of values    MSC:    Skill
2.    ANS:    D    PTS:    1    DIF:    Easy    REF:    Section 2.5
OBJ:    Identify the vertical asymptotes (if any) of the graph of a function    MSC:    Skill
3.    ANS:    B    PTS:    1    DIF:    Med    REF:    Section 2.5
OBJ:    Identify the vertical asymptotes (if any) of the graph of a function    MSC:    Skill
4.    ANS:    D    PTS:    1    DIF:    Med    REF:    Section 2.5
OBJ:    Identify the vertical asymptotes (if any) of the graph of a function    MSC:    Skill
5.    ANS:    E    PTS:    1    DIF:    Med    REF:    Section 2.5
OBJ:    Identify the vertical asymptotes (if any) of the graph of a function    MSC:    Skill
6.    ANS:    A    PTS:    1    DIF:    Med    REF:    Section 2.5
OBJ:    Identify the vertical asymptotes (if any) of the graph of a function    MSC:    Skill
7.    ANS:    B    PTS:    1    DIF:    Med    REF:    Section 2.5
OBJ:    Identify the vertical asymptotes (if any) of the graph of a function    MSC:    Skill
8.    ANS:    D    PTS:    1    DIF:    Med    REF:    Section 2.5
OBJ:    Evaluate one-sided limits    MSC:    Skill
9.    ANS:    B    PTS:    1    DIF:    Med    REF:    Section 2.5
OBJ:    Evaluate the limit of a function    MSC:    Skill
10.    ANS:    E    PTS:    1    DIF:    Med    REF:    Section 2.5
OBJ:    Evaluate one-sided limits    MSC:    Skill

11.    ANS:    D    PTS:    1    DIF:    Med    REF:    Section 2.5
OBJ:    Evaluate limits involving logarithmic functions    MSC:    Skill
12.    ANS:    E    PTS:    1    DIF:    Med    REF:    Section 2.5
OBJ:    Identify a limit that does not exist    MSC:    Skill
13.    ANS:    B    PTS:    1    DIF:    Med    REF:    Section
2.OBJ: Estimate one-sided limits from a graph    MSC:    Skill
14.    ANS:    D    PTS:    1    DIF:    Med    REF:    Section 2.5
OBJ:    Estimate one-sided limits from a graph    MSC:    Skill
15.    ANS:    D    PTS:    1    DIF:    Easy    REF:    Section 2.5
OBJ:    Evaluate functions in applications    MSC:    Application
16.    ANS:    A    PTS:    1    DIF:    Med    REF:    Section 2.5
OBJ:    Evaluate limits in applications    MSC:    Application
17.    ANS:    A    PTS:    1    DIF:    Easy    REF:    Section 2.5
OBJ:    Evaluate functions in applications    MSC:    Application
18.    ANS:    D    PTS:    1    DIF:    Med    REF:    Section 2.5
OBJ:    Evaluate limits in applications    MSC:    Application

## 3.1 The Derivative and the Tangent Line Problem

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

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

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

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

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

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

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

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

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