Introductory Mathematical Analysis for Business Economics International 13th Edition Haeussler Test Bank

Exam

Name_____

SHORT ANSWER. Write the word or phrase that best completes each statement or answers the question.

Provide an appropriate response.

1) Find the domain of the function: $f(t) = \dfrac{t^2 - t}{4}$

    Answer: all real numbers

1) _____

2) Find the domain of the function: $f(t) = \dfrac{t - 3}{t^2 + t - 2}$

    Answer: all real numbers except –2 and 1

2) _____

3) Find the domain of the function: $f(x) = \dfrac{\sqrt{x - 1}}{x^2 - 9}$

    Answer: all real numbers ≥ 1 except 3

3) _____

4) Find the domain of the function: $f(x) = \sqrt{x - 11}$

    Answer: all $x \geq 11$

4) _____

5) Find the domain of the function: $f(q) = \sqrt{4 - 3q}$

    Answer: all $q \leq \dfrac{4}{3}$

5) _____

6) If $f(x) = 5 - 8x$, find:
   (a) the domain
   (b) $f(1)$
   (c) $f(-2)$
   (d) $f\left(\dfrac{5}{8}\right)$
   (e) $f(t)$
   (f) $f(x + 2)$

6) _____

    Answer: (a) all real numbers
            (b) –3
            (c) 21
            (d) 0
            (e) $5 - 8t$
            (f) $-11 - 8x$

7) Given the function $f(x) = x^2 + 4x + 2$, find:

   (a) the domain

   (b) $f(0)$

   (c) $f(3)$

   (d) $f(-2)$

   (e) $f(-t^2)$

   Answer: (a) all real numbers

             (b) 2

             (c) 23

             (d) –2

             (e) $t^4 - 4t^2 + 2$

7) _____

8) If $f(x) = x^2 - 2x + 3$, find:

   (a) the domain

   (b) $f(2)$

   (c) $f(-2)$

   (d) $f\left(-\dfrac{1}{2}\right)$

   (e) $f(t^3)$

   (f) $f(s + 1)$

   (g) $f(x + h)$

   Answer: (a) all real numbers

             (b) 3

             (c) 11

             (d) $\dfrac{17}{4}$

             (e) $t^6 - 2t^3 + 3$

             (f) $s^2 + 2$

             (g) $x^2 + 2hx + h^2 - 2x - 2h + 3$

8) _____

9) If $g(x) = \dfrac{x}{x - 4}$, find:

   (a) the domain

   (b) $g(0)$

   (c) $g(-4)$

   (d) $g\left(\dfrac{1}{2}\right)$

   (e) $g(x^2)$

   Answer: (a) all real numbers except 4

             (b) 0

             (c) $\dfrac{1}{2}$

             (d) $-\dfrac{1}{7}$

             (e) $\dfrac{x^2}{x^2 - 4}$

9) _____

10) If $g(s) = \dfrac{3}{s-2} - s$, find:

   (a) the domain
   (b) $g(0)$
   (c) $g(3)$
   (d) $g(-4)$
   (e) $g\left(\dfrac{1}{s}\right)$

   Answer: (a) all real numbers except 2

           (b) $-\dfrac{3}{2}$

           (c) 0

           (d) $\dfrac{7}{2}$

           (e) $\dfrac{3s}{1-2s} - \dfrac{1}{s}$

10) _____

11) Given the function $F(t) = \sqrt{t+3}$, find:
   (a) the domain
   (b) $F(-3)$
   (c) $F(13)$
   (d) $f(t^2 + 1)$

   Answer: (a) all $t \geq -3$
           (b) 0
           (c) 4
           (d) $\sqrt{t^2 + 4}$

11) _____

12) If $f(x) = 3x - 1$, find $\dfrac{f(x+h) - f(x)}{h}$.

   Answer: 3

12) _____

13) If $f(x) = x^2 + 2x - 6$, find $\dfrac{f(x+h) - f(x)}{h}$.

   Answer: $2x + h + 2$

13) _____

14) If $f(x) = 4 - x^2$, find $\dfrac{f(x+h) - f(x)}{h}$

   Answer: $-2x - h$

14) _____

15) If $f(x) = 4x^2 + 6x$, find $f(3s)$.

   Answer: $f(3s) = 36s^2 + 18s$

15) _____

16) If $g(x) = \dfrac{x+2}{x-5}$, find $g(x-1)$

   Answer: $g(x-1) = \dfrac{x+1}{x-6}$

16) _____

17) True or False: If $x + y^2 - 5 = 0$, then x is a function of y.   17) _____

   Answer: True

18) For the equation $4y = x^2$, (a) is y a function of x? (b) Is x a function of y?   18) _____

   Answer: (a) yes (b) no

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

19) The domain of $f(x) = \dfrac{x^2 - 3x}{6}$ is   19) _____

   A) all real numbers except 0, 3, and 6
   B) all real numbers except 6
   C) all real numbers except 0 and 3
   D) all real numbers except 0
   E) all real numbers

   Answer: E

20) The domain of $f(t) = \dfrac{2}{t - 4}$ is   20) _____

   A) all real numbers except 0
   B) all real numbers except 4
   C) all real numbers except 2
   D) all real numbers
   E) all real numbers except 2 and 4

   Answer: B

21) The domain of the function $f(x) = \dfrac{\sqrt{x + 2}}{x^2 - 16}$ is   21) _____

   A) all real numbers ≥ 2 except 4
   B) all real numbers ≥ -2 except 4
   C) all real numbers except 4 and -4
   D) all real numbers ≥ 2
   E) all real numbers ≥ -2

   Answer: B

22) The domain of $f(q) = \dfrac{q^2 - 1}{q^2 + 4}$ is   22) _____

   A) all real numbers except 1 and -1
   B) all real numbers except -2 and 2
   C) all real numbers except -4
   D) all real numbers
   E) all real numbers except -1, 1, and -2

   Answer: D

23) The domain of $f(s) = \sqrt{9 - 5s}$ is all real numbers s such that   23) _____

   A) $s \geq \dfrac{9}{5}$.   B) $s \leq \dfrac{9}{5}$.   C) $s \geq \dfrac{5}{9}$.   D) $s \geq -\dfrac{5}{9}$.   E) $s \leq \dfrac{5}{9}$.

   Answer: B

4

24) The domain of $f(x) = \dfrac{1}{\sqrt{2x + 3}}$ consists of all real numbers x such that   24) _____

    A) $x \geq \dfrac{3}{2}.$ B) $x > \dfrac{2}{3}.$ C) $x > -\dfrac{3}{2}.$ D) $x \geq \dfrac{2}{3}.$ E) $x \geq -\dfrac{3}{2}.$

    Answer: C

25) If $f(x) = \sqrt{21 - 2x} + x$, then $f(-2) =$ 25) _____
    A) 0.   B) 7.   C) $\sqrt{17} - 2.$ D) –7.   E) 3.

    Answer: E

26) If $f(x) = (4x^2 + 1)^2$, then $f\left(-\dfrac{1}{2}\right) =$ 26) _____

    A) 0.   B) 4.   C) 3.   D) –1.   E) 2.

    Answer: B

27) If $g(x) = 2x^2 - 3x + 4$, then $g(0) - g(2) =$ 27) _____
    A) –14.   B) 2.   C) –2.   D) 0.   E) 14.

    Answer: C

28) If $f(x) = -x^2 - 2x - 6$, then $f(2) - f(t) =$ 28) _____
    A) $-4t^2 - 4t + 6.$
    B) $-t^2 - 2t + 4.$
    C) $t^2 + 2t - 8.$
    D) $t^2 - 2t + 4.$
    E) $-t^2 + 6t - 2.$
    Answer: C

29) If $f(x) = 2x^2 - 3x + 4$, then $f(x + 1) =$ 29) _____
    A) $2x^2 - 3x.$
    B) $2x^2 + x + 6.$
    C) $2x^2 + x + 3.$
    D) $2x^2 + 4x + 7.$
    E) $2x^2 - 3x + 5.$
    Answer: C

30) If $f(t) = (t + 4)^2$, then $f(t - 3) =$ 30) _____
    A) $t^2 + 4t + 13.$
    B) $t^2 + 8t + 19$
    C) $t^2 + 2t + 1.$
    D) $t^2 + 8t + 13.$
    E) $t^2 + 1 + 1.$
    Answer: C

31) If $f(x) = x^2 - 3x + 4$, then $f(2 + h) - f(2) =$ 31) _____
   A) $h^2 + h$.
   B) $h^2 - 3h - 4$.
   C) h.
   D) $h^2 + h - 4$.
   E) $h^2 - 3h + 4$.
   Answer: A

32) If $F(t) = (t^2 + 4)^3$, then $F(t^2 + 1) =$ 32) _____
   A) $(t^2 + 1)^3$.
   B) $(t^4 + 2t^2 + 5)^3$.
   C) $(t^2 + 5)^3 + 1$.
   D) $(t^2 + 1)^3 + 4$.
   E) $(t^2 + 5)^3$.
   Answer: B

33) If $f(x) = 4x + 5$, then $\dfrac{f(x + h) - f(x)}{h} =$ 33) _____

   A) 0.   B) 4.   C) $\dfrac{4x + h + 5}{h}$.   D) 1.   E) $4h$.

   Answer: B

34) If $f(x) = x^2 + 3x - 8$, then $\dfrac{f(x + h) - f(x)}{h} =$ 34) _____

   A) $2x + h + 3$.
   B) 1.
   C) $\dfrac{h^2 + 3h - 8}{h}$.
   D) 0.
   E) $4x + 3h - 2$.
   Answer: A

35) Exactly how many of the following equations define y as a function of x? 35) _____
   (a) $y = 7 - x$
   (b) $y^2 = 4x$
   (c) $y = \sqrt{x}$
   (d) $x^2 = y + 4$
      A) none   B) one   C) two   D) three   E) all
   Answer: D

6

36) Which equation below defines y as a function of x? 36) _____

    A) $\dfrac{x}{y} = y$

    B) $3y - x^2 = 0$
    C) $3x - y^2 = 0$
    D) $x^2 + y^2 = 9$
    E) $y = \pm\sqrt{4 - x^2}$

    Answer: B

SHORT ANSWER. Write the word or phrase that best completes each statement or answers the question.

37) Find the domain of the function: $F(x) = \sqrt{2x + 3}$ 37) _____

    Answer: $x \geq -\dfrac{3}{2}$

38) Find the domain of the function: $f(x) = \sqrt{x^2 + x + 1}$ 38) _____

    Answer: all real numbers

39) Find the domain: $\dfrac{3x + 5}{\sqrt{x^2 + 5}}$ 39) _____

    Answer: all real numbers

40) Let $g(x) = \sqrt{2x + 3}$, find $\dfrac{g(x + h) - g(x)}{h}$ 40) _____

    Answer: $\dfrac{\sqrt{2x + 2h + 3} - \sqrt{2x + 3}}{h}$

41) If $f(x) = 1.05x^3 + 7.5x^2 - 1.9$, then find $f(-0.5)$ 41) _____

    Answer: -0.15625

42) Let $f(t) = t^2 - 1$, find (a) $f(3t)$; (b) $3 \times f(t)$ 42) _____

    Answer: (a) $9t^2 - 1$ (b) $3t^2 - 3$

43) Suppose $f(x) = xy^2 + 3xy - y^2$. Find $f(y)$. 43) _____

    Answer: $y^3 + 2y^2$

44) In the equation $x^2 + y^2 = 17$; (a) Is x a function of y? (b) Is y a function of x? 44) _____

    Answer: (a) No   (b) No

45) In the equation $xy^2 + 2x + 3xy + 7y^2 = 11$, is x a function of y? 45) _____

    Answer: Yes

46) If $f(t) = 1.9x^2 - 3.1x + 2.01$, then find $f(x + 1.1)$. 46) _____

    Answer: $1.9x^2 + 1.08x + .899$

47) If $f(x) = \dfrac{1}{2x + 3}$, then find $\dfrac{f(x + h) - f(x)}{h}$ and simplify.

47) _____

Answer: $-\dfrac{2}{(2x + 2h + 3)(2x + 3)}$

48) The perimeter of a square depends on the length of its side.

48) _____

   (a) Write a function $p(l)$ for the perimeter of a square when the length of its side is l.
   (b) What is the domain of this function out of context?
   (c) What is the domain of this function in the given context?
   (d) Find $p(x)$, $p(2x)$ and $p(3x)$.
   (e) What happens to the perimeter of a square when the side is scaled by a factor s?
Describe using an equation.

   Answer: (a) $p(l) = 4l$
          (b) all are real numbers
          (c) $l \geq 0$
          (d) $4x$; $8x$; $12x$
          (e) The perimeter gets scaled by a factor s; $p(sx) = 4sx$

49) The elapsed time in seconds since January 1, 2000 at 12:00 A.M. depends on the elapsed hours since January 1, 2000 at 12:00 A.M.

49) _____

   (a) Write a function $e(h)$ for the elapsed seconds since January 1, 2000 at 12:00 A.M. when the elapsed hours are h.
   (b) What is the domain of the function out of context?
   (c) What is the domain of this function in the given context?
   (d) Find $e(t)$, $e(-t)$, $e(100t)$, and $e(-100t)$.
   (e) What does multiplying the elapsed hour by -1 mean?

   Answer: (a) $e(h) = 3600h$
          (b) all real numbers
          (c) all real numbers
          (d) $3600t$; $-3600t$; $360,000t$; $-360,000t$;
          (e) The sign changes. Since the function gives the seconds since January 1, 2000 at 12:00 A.M., a positive number represents seconds after that moment, and a negative number represents seconds before that moment.

50) The proceeds from an event depend on the number of people who attend.

50) _____

   (a) Write a function $p(n)$ for the proceeds if each ticket costs \$8.00 and the number of tickets sold is n.
   (b) What is the domain of this function out of context?
   (c) What is the domain of this function in the given context?
   (d) Find $p(c)$, $p(c + 5)$, and $p(c + 25)$.
   (e) What happens to the proceeds when the number who attend increases by a constant m? Describe using an equation.

   Answer: (a) $p(n) = 8n$
          (b) all real numbers
          (c) whole numbers
          (d) $8c$; $8c + 40$; $8c + 200$
          (e) The proceeds increase by \$8m; $p(x + m) = 8x + 8m$

51) The weekly salary of an hourly employee depends on the number of hours worked.   51) _____
Employers are required to pay time and a half if an employee works over 40 hours per
week. Suppose an employer refuses to pay time and a half and time cards are recorded in
half–hour increments.
(a) Write a function $s(h)$ for the weekly salary if a person's hourly pay is $12.25 and the
number of hours worked is h.
(b) What is the domain of this function out of context?
(c) What is the domain of this function in the given context?
(d) Find $s(t)$, $s(t - 5)$, and $s(t - 7)$.
(e) What happens to the salary if the work time decreases by a constant m? Describe
using an equation.

Answer: (a) $s(h) = 12.25h$
      (b) all real numbers
      (c) {0, 0.5, 1, 1.5, ... 40}
      (d) $12.25t$; $12.25t - 61.25$; $12.25t - 85.75$
      (e) The salary decreases by $12.25m$; $s(x - m) = 12.25x - 12.25m$

52) The speed you must travel for a given amount of time depends on the distance you must   52) _____
cover.
(a) Write a function $r(d)$ for the speed if the time is 5 hours and the distance covered is d.
(b) What is the domain of this function out of context?
(c) What is the domain of this function in the given context?
(d) Find $r(x)$, $r\left(\dfrac{x}{2}\right)$ and $r\left(\dfrac{x}{4}\right)$.
(e) What happens to the speed if the distance is reduced (divided) by a constant c?
Describe using an equation.

Answer: (a) $r(d) = \dfrac{d}{5}$

      (b) all real numbers
      (c) $d \geq 0$
      (d) $\dfrac{x}{5}$; $\dfrac{x}{10}$; $\dfrac{x}{20}$

      (e) The speed is reduced by a factor of c; $r\left(\dfrac{x}{c}\right) = \dfrac{x}{5c}$

53) The height of an object thrown in the air depends on the time since it's been thrown. For a   53) _____
particular situation the height in meters of an object after t seconds can be represented by
$h(t) = 20t - 4.9t^2$.
(a) What is the domain of this function out of context?
(b) What is the domain of this function in the given context?
(c) Find $h(s)$, $h(s + 2)$, and $h(s + 6)$.
(d) Use an equation to describe what happens to the height if the time increases by a
constant d.

Answer: (a) all real numbers
      (b) $t \geq 0$
      (c) $-4.9s^2 + 20s$; $-4.9s^2 + 0.4s + 20.4$; $-4.9s^2 - 38.8s - 56.4$
      (d) $h(s + d) = -4.9s^2 + (20 - 9.8d)s + 20d - 4.9d^2$

54) The perimeter of a square depends on the length of its side.   54) _____
    (a) Write a function $p(l)$ for the perimeter of a square.
    (b) How much linear fencing material is needed to fence a square garden of length x?
    (c) If the sides of the square garden are increased by 3 feet, how much more linear fencing material is needed?
    (d) How much more linear fencing material is needed per foot increase?
    (e) If the sides of the square garden is increased by h, how much more linear fencing material is needed?
    (f) How much more linear fencing material is needed per unit increase?

    Answer: (a) $p(l) = 4l$
            (b) $4x$ feet
            (c) 12 feet
            (d) 4 feet
            (e) $4h$ units
            (f) 4 units

55) The area of a circle depends on the length of its radius.   55) _____
    (a) Write a function $a(r)$ for the area of a circle.
    (b) How many square units of sod are needed to cover a circular grass area of radius x?
    (c) If the radius of the circular grass area is increased by 2 feet, how much more sod is needed?
    (d) How much more sod is needed per foot increase?
    (e) If the radius of a circular grass area is increased by h, how much more sod is needed?
    (f) How much more sod is needed per unit increase?

    Answer: (a) $a(r) = \pi r^2$
            (b) πx^2 square feet
            (c) $4\pi x + 4\pi$ square feet
            (d) $2\pi x + \pi$ square feet
            (e) $2\pi x h + \pi h^2$ square units
            (f) $\pi x + \pi$ square units

56) The time it takes to go a given distance depends on the rate.

    (a) Write a function $t(r)$ for the time it takes if the distance is 400 miles and the rate is r miles per hour.

    (b) How much time is needed when the rate is x?

    (c) If the speed is increased by 10 miles per hour, how much less time is needed?

    (d) How much less time is needed per mile per hour increase?

    (e) If the speed is increased by h, how much less time is needed?

    (f) How much less time is needed per unit increase?

Answer: (a) $t(r) = \dfrac{400}{r}$

      (b) $\dfrac{400}{x}$ hours

      (c) $\dfrac{4000}{x(x+10)}$ hours

      (d) $\dfrac{400}{x(x+1)}$ hours

      (e) $\dfrac{400h}{x(x+h)}$ hours

      (f) $\dfrac{400}{x(x+1)}$ hours

56) _____

57) The height of an object thrown in the air depends on the time since it has been thrown. For a particular situation the height in meters of an object after t seconds can be represented by $h(t) = 20t - 4.9t^2$.

    (a) What is the height of the object if the time is x seconds?

    (b) If the time is increased by 2 seconds, how much higher is the object?

    (c) How much higher is the object per second increase?

    (d) If the time is increased by h, how much higher is the object?

    (e) How much higher is the object per unit increase?

Answer: (a) $20x - 4.9x^2$ meters

      (b) $-19.6x + 20.4$ meters

      (c) $-9.8x + 15.1$ meters

      (d) $-9.8hx + 20h - 4.9h^2$ meters

      (e) $-9.8x + 15.1$ meters

57) _____

58) Suppose the weekly demand function for a pound of the house blend coffee at a local coffee shop is $p = 15 - \dfrac{q}{60}$.

    (a) If the current price is $11.25 per pound, how much coffee is sold each week?

    (b) If they are selling 180 pounds of coffee each week, what is the current price?

    (c) If the owner wants to sell 300 pounds of coffee each week, what should the price be?

Answer: (a) 225 pounds

      (b) $12.00 per pound

      (c) $10.00 per pound

58) _____

59) Suppose the yearly demand function for an artist's paintings is $p = \dfrac{25{,}000}{q}$.

    (a) If the current prices is $200.00 per painting, how many paintings are sold each year?

    (b) If the artist wants to sell 4 paintings per year, what should the price be?

    Answer: (a) 125 paintings
           (b) $6250

59) _____

60) Suppose the weekly supply function for a large pizza at a local pizza parlor is $p = \dfrac{q}{40}$.

    (a) How many large pizzas will be supplied if the price is $12.50 per pizza?

    (b) How many large pizzas will be supplied if the price is $18.75 per pizza?

    (c) How does the amount supplied change as the price increases?

    Answer: (a) 500 pizzas
           (b) 750 pizzas
           (c) Amount supplied increases as the price increases.

60) _____

61) Suppose the yearly supply function for a particular actor to star in a film is $p = 150{,}000x$.

    (a) How many films per year is the actor willing to produce if he earns $300,000 per film?

    (b) How many films per year is the actor willing to produce if he earns $900,000 per film?

    (c) How does the amount supplied change as the price increases?

    Answer: (a) 2 films per year
           (b) 6 films per year
           (c) Amount supplied increases as the price increases.

61) _____

62) Suppose the yearly supply function for paintings from an artist is $p = 3000x$.

    (a) How many paintings per year will be supplied if the price is $21,000 per painting?

    (b) How many paintings per year will be supplied if the price is $51,000 per painting?

    (c) How does the amount supplied change as the price increases?

    Answer: (a) 7 paintings per year
           (b) 17 paintings per year
           (c) Amount supplied increases as the price increases.

62) _____

63) Find the domain of the function $f(x) = 6$.

    Answer: all real numbers

63) _____

64) If $f(x) = 7$, find $f(14)$.

    Answer: 7

64) _____

65) If $g(x) = |x + 4|$, find $g(-5)$.

    Answer: 1

65) _____

66) If $f(x) = |1 - 2x| + 2x$, find: (a) $f(1)$ and (b) $f(-1)$.

    Answer: (a) 3   (b) 1

66) _____

67) Find: (a) the degree and (b) the leading coefficient of the polynomial function $f(x) = 5x + 7$.

    Answer: (a) 1   (b) 5

67) _____

68) Find: (a) the degree and (b) the leading coefficient of the polynomial function $f(x) = 7 + 5x^2$ 68) _____

   $- x^3$.

   Answer: (a) 3   (b) -1

69) Find: (a) the degree and (b) the leading coefficient of the polynomial function   69) _____

   $P(x) = -x^5 + 6x^4 - 9x^2 + 7x + 3$

   Answer: (a) 5   (b) -1

70) Given the function $f(x) = \begin{cases} 3, \text{ if } x \geq 2 \\ -3, \text{ if } x < 2, \end{cases}$ find: 70) _____

   (a) the domain
   (b) $f(0)$
   (c) $f(2)$
   (d) $f(-2)$
   (e) $f(-3)$

   Answer: (a) all real numbers
           (b) -3
           (c) 3
           (d) -3
           (e) -3

71) Given the function $G(x) = \begin{cases} 4, \text{ if } x > 0 \\ x + 5, \text{ if } x \leq 0, \end{cases}$ find: 71) _____

   (a) the domain
   (b) $G(0)$
   (c) $G(6)$
   (d) $G(-4)$
   (e) $G(-10)$

   Answer: (a) all real numbers
           (b) 5
           (c) 4
           (d) 1
           (e) -5

72)   72) _____

   Given the function $f(x) = \begin{cases} 2x, \text{ if } 0 < x < 1 \\ 1 - x, \text{ if } 1 \leq x < 2, \\ 0, \text{ if } 2 \leq x \leq 3 \end{cases}$

   find:
   (a) the domain
   (b) $f(1)$
   (c) $f(2)$
   (d) $f(3)$
   (e) $f(0.1)$

   Answer: (a) $0 < x \leq 3$
           (b) 0
           (c) 0
           (d) 0
           (e) 0.2

73)   73) _____

Given the function $F(x) = \begin{cases} 2 + x, & \text{if } x > 3 \\ 5, & \text{if } x = 2 \\ 4 - x, & \text{if } x < 2 \end{cases}$

find:

(a) the domain

(b) $F(2)$

(c) $F(-2)$

(d) $F(5)$

Answer: (a) $x \le 2 \cup x > 3$

(b) 5

(c) 6

(d) 7

74)   74) _____

Given the function $f(x) = \begin{cases} x^2, & \text{if } -1 < x < 0 \\ 2x + 1, & \text{if } 0 \le x < 1 \\ -x, & \text{if } 1 \le x < 2 \end{cases}$

find:

(a) the domain

(b) $f(0)$

(c) $f(1)$

(d) $f\left(-\dfrac{1}{2}\right)$

(e) $f\left(\dfrac{1}{2}\right)$

(f) $f\left(\dfrac{3}{2}\right)$

Answer: (a) $-1 < x < 2$

(b) 1

(c) -1

(d) $\dfrac{1}{4}$

(e) 2

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

75) Under certain conditions, if two brown–eyed parents have exactly four children, the   75) _____
probability P that exactly r of them are blue–eyed is a function of r and is given by $P(r) =$
$$\dfrac{4!\left(\dfrac{1}{4}\right)^r\left(\dfrac{3}{4}\right)^{4-r}}{r!(4-r)!}.$$
Find the probability that exactly thee children will be blue–eyed.

Answer: $\dfrac{3}{64}$

76) Under certain conditions, if two brown–eyed parents have exactly four children, the probability P that exactly r of them are blue–eyed is a function of r and is given by $P(r) = \dfrac{4!\left(\frac{1}{4}\right)^r\left(\frac{3}{4}\right)^{4-r}}{r!(4-r)!}$.

Find the probability that exactly one child will be blue–eyed.

Answer: $\dfrac{27}{64}$

77) The response R to a shock of intensity I is a number estimated by $R = f(I) = \dfrac{I^2}{1000}$.

   (a) Express $f(2I_0)$ in terms of $f(I_0)$.

   (b) What effect does the doubling of intensity have on response?

   Answer: (a) $4f(I_0)$

         (b) It quadruples response.

78) For the polynomial function $f(x) = 4x^3 + 2x^6$,

   Find: (a) the degree, and (b) the leading coefficient

   Answer: (a) 6;   (b) 2

79) For the polynomial function $f(x) = 4 - 6x - 5x^3$,

   Find: (a) the degree, and (b) the leading coefficient

   Answer: (a) 3;   (b) –5

80)

If $f(x) = \begin{cases} x^2, & \text{if } x < 0 \\ 4x, & \text{if } 0 \le x \le 1 \\ x, & \text{if } x > 1 \end{cases}$, find

   (a) $f(-2)$

   (b) $f(0)$

   (c) $f\left(\dfrac{1}{4}\right)$

   (d) $f(1)$

   (e) $f(5)$

   Answer: (a) 4

         (b) 0

         (c) 1

         (d) 4

         (e) 5

81) If $g(x) = \begin{cases} x^2 - 2x + 1, & \text{if } x < 0 \\ 2 - 3x, & \text{if } x \ge 0 \end{cases}$,

   (a) $g(-3)$

   (b) $g(0)$

   (c) $g(4)$

   Answer: (a) 16

         (b) 2

         (c) –10

82) Is $3x^{-2} + x^{-1} + 5 + 6x + 11x^2$ a polynomial function or a rational function? Why?   82) _____

Answer: Rational function, since it has negative exponents.

83)   83) _____

If $f(x) = \begin{cases} 3 - x, & \text{if } 2 \le x \le 5 \\ 1 - 2x, & \text{if } 0 \le x < 2 \\ 7 + x^2, & \text{if } -3 \le x < 0 \end{cases}$,

(a) find the domain of $f(x)$
(b) find $f(3)$

Answer: (a) $-3 \le x \le 5$ \qquad (b) 0

84)   84) _____

If $g(x) = \begin{cases} x^2 - 1, & \text{if } -1 \le x \le 2 \\ 2x - 3, & \text{if } -3 \le x < -1 \\ x^2 + 1, & \text{if } -5 \le x < -3 \end{cases}$

(a) find the domain of $f(x)$
(b) find $f(2) + f(-2)$

Answer: (a) $-5 \le x \le 2$ \qquad (b) -4

85) Determine: (a) 5!; (b) $\dfrac{5!}{3!2!}$ 85) _____

Answer: (a) 120 \qquad (b) 10

86) Let $f(x) = |2x - 3|$. Find $f(4) - f(-4)$ 86) _____

Answer: -6

87) $f(x) = \begin{cases} .01x^2 - 3.12 & \text{if } x \ge 6.3 \\ .39x - 1.2 & \text{if } x < 6.3 \end{cases}$ 87) _____

Find: (a) $f(6.3)$; (b) $f(0)$
Answer: (a) -2.7231 \qquad (b) -1.2

88) Ellen's health plan has a \$5.00 copayment for complete pregnancy care.   88) _____
(a) Write the cost of her prenatal care as a function of the number of prenatal visits she makes.
(b) How does Ellen's cost change as her number of prenatal visits increases?
(c) What kind of function is this?

Answer: (a) $p(n) = 5$
(b) Her cost does not change.
(c) constant function

89) A train holds 200 passengers and departs daily at 8:00 A.M.   89) _____
(a) Write the daily departure time as a function of the number of people on the train.
(b) How does the departure time change as the number of people on the train increases?
(c) What kind of function is this?

Answer: (a) $t(n) = 8:00$
(b) The departure times does not change.
(c) constant function

16

90) A coffee shop earns $8.75 for every pound of coffee it sells.   90) _____
   (a) Write the profit as a function of the number of pounds of coffee sold.
   (b) What kind of function is this?
   (c) What is its degree?
   (d) What is its leading coefficient?

   Answer: (a) $p(n) = 8.75n$
           (b) linear function
           (c) 1
           (d) 8.75

91) The height of an object thrown in the air depends on the time since it has been thrown.   91) _____
   For a particular situation the height in meters of an object after t seconds can be
   represented by $h(t) = 32t - 4.9t^2$.
   (a) What kind of function is this?
   (b) What is its degree?
   (c) What is its leading coefficient?

   Answer: (a) quadratic function
           (b) 2
           (c) −4.9

92) A rectangular sheet of metal has a length that is 4 more than the width.   92) _____
   (a) Write the area of the rectangular sheet as a function of the width.
   (b) Without simplifying, write the ratio of the length of the sheet to the area of the sheet as
   a function of the width.
   (c) Simplify the function you wrote in b.
   (d) What kind of function is this?
   (e) What is its domain out of context?
   (f) What is its domain in the given context?

   Answer: (a) $a(w) = w(w + 4)$
           (b) $f(w) = \dfrac{w + 4}{w(w + 4)}$

           (c) $f(w) = \dfrac{1}{w}$

           (d) rational function
           (e) all real numbers except 0 and −4
           (f) $w > 0$

93) A rectangular sheet of metal has a length that is 2 less than 4 times the width.   93) _____
   (a) Write the area of the rectangular sheet as a function of the width.
   (b) Without simplifying, write the ratio of the length of the sheet to the area of the
        sheet as a function of the width.
   (c) Simplify the function you wrote in b.
   (d) What kind of function is this?
   (e) What is its domain out of context?
   (f) What is its domain in the given context?

   Answer: (a) $a(w) = w(4w - 2)$

   (b) $f(w) = \dfrac{4w - 2}{w(4w - 2)}$

   (c) $f(w) = \dfrac{1}{w}$

   (d) rational function

   (e) all real numbers except 0 and $\dfrac{1}{2}$

   (f) $w > \dfrac{1}{2}$

94) A cylinder has a height that is 4 more than the diameter of its base.   94) _____
   (a) Write the area of its circular base as a function of its radius.
   (b) Write the volume of the cylinder as a function of its radius.
   (c) Without simplifying, write the ratio of the area of the circular base and the
        volume of the cylinder as a function of the radius.
   (d) Simplify the function you wrote in c.
   (e) What kind of function is this?
   (f) What is its domain out of context?
   (g) What is its domain in the given context?

   Answer: (a) $a(r) = \pi r^2$

   (b) $v(r) = (2r + 4)(\pi r^2)$

   (c) $f(r) = \dfrac{\pi r^2}{(2r + 4)(\pi r^2)}$

   (d) $\dfrac{1}{2r + 4}$

   (e) rational function
   (f) all real numbers except –2 and 0
   (g) $r > 0$

18

95) A cylinder has a height that is 3 times as long as the radius. 95) _____
   (a) Write the area of its circular base as a function of its radius.
   (b) Write the volume of the cylinder as a function of its radius.
   (c) Without simplifying, write the ratio of the area of the circular base and the volume of
   the cylinder as a function of the radius.
   (d) Simplify the function you wrote in c.
   (e) What kind of function is this?
   (f) What is its domain out of context?
   (g) What is its domain in the given context?

Answer: (a) $a(r) = \pi r^2$

      (b) $v(r) = 3r\,(\pi r^2)$

      (c) $f(r) = \dfrac{\pi r^2}{3r(\pi r^2)}$

      (d) $\dfrac{1}{3r}$

      (e) rational function
      (f) all real numbers except 0
      (g) $r > 0$

96) To encourage conservation, a gas company charges two rates. You pay $0.53 per therm for 96) _____
0–70 therms and $0.74 for each therm over 70. Write a compound fraction to represent the
monthly cost of t therms of water.

Answer: $c(t) = \begin{cases} 0.53t & \text{if } t \le 70 \\ 0.74\,(t-70)+37.1 & \text{if } t > 70 \end{cases}$ which simplifies to $c(t) = \begin{cases} 0.53t & \text{if } t \le 70 \\ 0.74t - 14.7 & \text{if } t > 70 \end{cases}$

97) To encourage an even flow of customers, a restaurant varies the price of an item 97) _____
throughout the day. From 6:00 P.M. to 8:00 P.M. customers pay full price. At lunch from
10:30 A.M. until 2:30 P.M. customers pay half price. From 2:30 until 4:30 customers get a
dollar off the lunch price. From 4:30 P.M. until 6:00 P.M. customers get $5.00 off the dinner
price. From 8:00 until closing time at 10:00 customers get $5.00 off the dinner price. Write a
compound function to represent the cost of an item throughout the day for a dinner price
of d.

Answer: $c(t) = \begin{cases} d/2 & \text{10:30 A.M. } \le t < \text{2:30 P.M.} \\ d/2 - 1 & \text{2:30 P.M. } \le t < \text{4:30 P.M.} \\ d - 5 & \text{4:30 P.M. } \le t < \text{6:00 P.M.} \\ d & \text{6:00 P.M. } \le t < \text{8:00 P.M.} \\ d - 5 & \text{8:00 P.M. } \le t < \text{10:00 P.M.} \end{cases}$

98) Brett rented a bike from a rental shop and rode at a constant rate of 12 mph for 2.5 hours 98) _____
along a bike path, and then returned along the same path at the same rate. Write an
absolute–value function to represent Brett's distance from the rental shop as a function of
time.

Answer: $f(x) = -\left|12(x-2.5)\right| + 30$

99) Julie lives 32 miles from the city. She drove home from the city at a constant rate of 60 mph 99) _____
along the highway. At the exit 2 miles from her home, she realized she had left her purse
at the department store. She immediately returned to the department store at a rate of 60
mph. Write an absolute–value function to represent Julie's distance from home as she
drove home from the city.

Answer: $f(x) = \left|60(x-0.5)\right| + 2$

100) In June Gail decided to save $20.00 a week. She saved for 14 weeks and then for 14 weeks she spent $20.00 a week on gifts. Write an absolute–value function to represent the amount of money Gail had in savings.

Answer: $f(x) = -|20(x - 14)| + 280$

100) _____

101) In November, Steve uses his credit cards to buy $30.00 of holiday gifts each week. After 8 weeks he begins saving $30.00 each week to pay his credit card bill. Write an absolute–value function to represent the amount Steve has saved since he started buying holiday gifts. (Hint: Let purchases on credit cards represent negative savings.)

Answer: $f(x) = |30(x - 8)| - 240$

101) _____

102) Suppose a committee of 6 people is to be selected from a group of 25. How many groups are possible? Represent as a factorial and give the solution.

Answer: $\dfrac{25!}{6!19!} = 177,100$

102) _____

103) You want to play a lottery that uses 50 numbers. How many combinations are possible if you need to pick 5 numbers? Represent as a factorial and give the solution.

Answer: $\dfrac{50!}{5!45!} = 2,118,760$

103) _____

104) If $f(x) = x^2$ and $g(x) = 2x + 1$, find:
  (a) $(f + g)(x)$
  (b) $(f + g)(3)$
  (c) $(f - g)(x)$
  (d) $(fg)(x)$
  (e) $(fg)\left(-\dfrac{1}{2}\right)$
  (f) $\left(\dfrac{f}{g}\right)(t^2)$
  (g) $f(g(x))$
  (h) $f(g(1))$
  (i) $g(f(x))$

Answer: (a) $x^2 + 2x + 1$
      (b) 16
      (c) $x^2 - 2x - 1$
      (d) $2x^3 + x^2$
      (e) 0
      (f) $\dfrac{t^4}{2t^2 + 1}$
      (g) $4x^2 + 4x + 1$
      (h) 9
      (i) $2x^2 + 1$

104) _____

105) If $f(x) = 2x + 3$ and $g(x) = x^2 - 4x - 2$, find:

    (a) $(f + g)(x)$
    (b) $(f - g)(x)$
    (c) $(fg)(x)$
    (d) $\left(\dfrac{f}{g}\right)(x)$
    (e) $f(g(x))$
    (f) $g(f(x))$
    (g) $f(g(1))$
    (h) $g(f(1))$

Answer: (a) $x^2 - 2x + 1$

          (b) $6x + 5 - x^2$

          (c) $2x^3 - 5x^2 - 16x - 6$

          (d) $\dfrac{2x + 3}{x^2 - 4x - 2}$

          (e) $2x^2 - 8x - 1$

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

          (g) -7

          (h) 3

106) If $f(x) = 5 - x$ and $g(x) = 2x^2 - 3x + 4$, find:

    (a) $(f + g)(x)$
    (b) $(f - g)(x)$
    (c) $(f - g)(2)$
    (d) $(fg)(x)$
    (e) $(fg)(0)$
    (f) $\left(\dfrac{f}{g}\right)(x)$
    (g) $f(g(x))$
    (h) $g(f(x))$
    (i) $g(f(1))$

Answer: (a) $2x^2 - 4x + 9$

          (b) $-2x^2 + 2x + 1$

          (c) -3

          (d) $-2x^3 + 13x^2 - 19x + 20$

          (e) 20

          (f) $\dfrac{5 - x}{2x^2 - 3x + 4}$

          (g) $1 - 2x^2 + 3x$

          (h) $2x^2 - 17x + 39$

          (i) 24

107) Let $f(x) = x^2 + 3x + 1$ and $g(x) = -2$.

    (a) Find: $(f \circ g)(x)$
    (b) Find: $(g \circ f)(x)$

Answer: (a) -1 (b) -2

108) If $f(x) = 2x + 3$ and $g(x) = 3x - 2$, find: 108) _____
    (a) $(f \circ g)(x)$
    (b) $(g \circ f)(x)$
    Answer: (a) $6x - 1$ (b) $6x + 7$

109) If $f(x) = 3 - 2x$ and $g(x) = x^2 + 7$, find: 109) _____
    (a) $(f \circ g)(x)$
    (b) $(g \circ f)(x)$
    Answer: (a) $-11 - 2x^2$ (b) $16 - 12x + 4x^2$

110) If $f(x) = 2x^2 + 1$ and $g(x) = x - 1$, find $(f \circ g)(x) - (g \circ f)(x)$ 110) _____
    Answer: $-4x + 3$

111) If $f(x) = \sqrt{x + 4}$ and $g(x) = x^3 + 5$, find: (a) $f(g(x))$ and (b) $g(f(x))$.   111) _____
    Answer: (a) $\sqrt{x^3 + 9}$ (b) $\left(\sqrt{x + 4}\right)^3 + 5$

112) If $f(x) = \dfrac{1}{x + 1}$ and $g(x) = x + 1$, find: (a) $f(g(x))$ and (b) $g(f(x))$.   112) _____

    Answer: (a) $\dfrac{1}{x + 2}$ (b) $\dfrac{1}{x + 1} + 1 = \dfrac{x + 2}{x + 1}$

113) If $(f(x) = 3 - 2x$, find $f(f(x))$.   113) _____
    Answer: $4x - 3$

114) If $h(x) = (2x - 3)^5$, find functions f and g such that $h(x) = f(g(x))$.   114) _____
    Answer: $f(x) = x^5$, $g(x) = 2x - 3$ (Other answers are possible.)

115) If $h(x) = \dfrac{x^2}{x^2 + 1}$, find functions f and g such that $h(x) = f(g(x))$.   115) _____

    Answer: $f(x) = \dfrac{x}{x + 1}$, $g(x) = x^2$. (Other answers are possible.)

116) If $h(x) = \sqrt[3]{x + 4}$, find functions f and g such that $h(x) = f(g(x))$.   116) _____
    Answer: $f(x) = \sqrt[3]{x}$, $g(x) = x + 4$ (Other answers are possible.)

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

117) If $f(x) = \sqrt{x - 3}$ and $g(x) = x^2 - 7$, then $f(g(7)) =$ 117) _____
    A) 81.   B) $\sqrt{42}$.   C) $\sqrt{39}$.   D) 84.   E) –3.
    Answer: C

118) If $f(x) = x^2 + 1$ and $g(x) = x^3$, then $(f \circ g)(x) =$ 118) _____
     A) $(x^2 + 1)^3 + 1.$
     B) $x^6.$
     C) $x^6 + 1.$
     D) $(x^2 + 1)^3.$
     E) $x^5 + 1.$
     Answer: C

119) If $f(x) = 4x - 5$ and $g(x) = x^2 + 3x - 1$, then $f(g(x)) =$ 119) _____
     A) $x^2 + 4x + 5.$
     B) $16x^2 - 28x + 9.$
     C) $4x^3 + 7x^2 - 19x + 5.$
     D) $4x^2 + 12x - 9.$
     E) $x^2 + 7x - 6.$
     Answer: D

120) If $f(x) = \sqrt{x + 5}$ and $g(x) = x^2 - 3x - 5$, then the value of $(f \circ g)(4)$ is   120) _____
     A) 2.   B) –3.   C) $2\sqrt{3}.$ D) 5.   E) –4.
     Answer: A

121) If $f(x) = 4 - 3x$, then $(f \circ f)(x) =$ 121) _____
     A) $6x - 8.$
     B) $16 - 9x^2.$
     C) $9x - 8.$
     D) $16 - 24x + 9x^2.$
     E) $8 - 6x.$
     Answer: C

SHORT ANSWER. Write the word or phrase that best completes each statement or answers the question.

122) If $f(x) = \dfrac{x + 1}{x - 7}$ and $g(x) = 2x^3$, find $(f(g(x))$.   122) _____

     Answer: $(f(g(x)) = \dfrac{2x^3 + 1}{2x^3 - 7}$

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

123) If $f(x) = 2x - 1$ and $g(x) = 4x + 8$, then $g(f(x)) =$ 123) _____
     A) $8x + 4.$
     B) $16x^2 + 12x - 8.$
     C) $8x + 15.$
     D) $16x + 7.$
     E) $16x - 8.$
     Answer: A

SHORT ANSWER. Write the word or phrase that best completes each statement or answers the question.

124) If $f(x) = \sqrt{x + 1}$ and $g(x) = 3x^2 + 4$, find $f(g(x))$.   124) _____

Answer: $f(g(x)) = \sqrt{3x^2 + 5}$

125) Let $f(x) = \begin{cases} x^2 + 2x & \text{if } 0 \le x \le 5 \\ 3x - 2 & \text{if } -3 \le x < 0 \end{cases}$; $g(x) = 1 - 4x$.   125) _____

Find:
(a) $f(0)$
(b) $f(-1)$
(c) $f(4) - f(-2)$
(d) $f(g(0))$
(e) $g(f(0))$

Answer: (a) 0
       (b) –5
       (c) 32
       (d) 3
       (e) 1

126) Let $g(x) = 1 - 4x$, $h(x) = x^2 + 3x$. Find: (a) $(g \circ h)(x)$; (b) $(h \circ g)(x)$ 126) _____

Answer: (a) $1 - 4x^2 - 12x$ (b) $16x^2 - 20x + 4$

127) $h(x) = x^3 - 7x^2 + 1$; $g(x) = x^2 + 2x$. Find   127) _____
(a) $(h + g)(.1)$
(b) $(h - g)(.1)$
(c) $(hg)(.1)$
(d) $\left(\dfrac{h}{g}\right)(.1)$

Answer: (a) 1.141
       (b) 0.721
       (c) 0.19551
       (d) 4.433

128) Let $h(x) = \sqrt{7 - x}$. Find functions f and g such that $h = f \circ g$.   128) _____

Answer: $f(x) = \sqrt{x}$; $g(x) = 7 - x$

129) Let $h(x) = 3(x - 1)^3 + 7(x - 1)^2 + 8(x - 1) + 11$. Find functions f and g such that   129) _____
$h = f \circ g$.

Answer: $f(x) = 3x^3 + 7x^2 + 8x + 11$; $g(x) = x - 1$

130) $f(x) = \begin{cases} x - 2 & \text{if } x \geq 0 \\ 2x + 1 & \text{if } x < 0 \end{cases}$; $g(x) = x^2 - 4$.

130) _____

Find:
(a) $(f \circ g)(-1)$
(b) $(g \circ f)(-1)$
(c) $(f \circ g)(2)$
(d) $(g \circ f)(2)$

Answer: (a) –5
    (b) –3
    (c) –2
    (d) –4

131) Traci earns $15.00 per hour and Rich earns $18.00 per hour.

131) _____

(a) Write a function $t(x)$ for Traci's earnings as a function of hours worked.
(b) Write a function $r(x)$ for Rich's earnings as a function of hours worked.
(c) Assuming they work the same number of hours each week, write a function
  $(t + r)(x)$ for their combined earnings as a function of hours worked.

Answer: (a) $t(x) = 15x$
    (b) $r(x) = 18x$
    (c) $(t + r)(x) = 33x$

132) Suppose an artist always paints rectangular pictures using a square of unknown length as a reference. She always makes the length 4 units longer than the square, and the width is 2 units longer than the square.

132) _____

(a) Write a function $l(x)$ for the length of a painting as a function of the length of the square.
(b) Write a function $a(x)$ for the area of a painting as a function of the length of the square.
(c) Write a function $\left(\dfrac{l}{a}\right)(x)$ for the ratio of the length to the area as a function of the length of the square.

Answer: (a) $l(x) = x + 4$
    (b) $a(x) = (x + 4)(x + 2)$
    (c) $\left(\dfrac{l}{a}\right)(x) = \dfrac{1}{x + 2}$

133) A shirt costs x wholesale. The price the store pays is given by the function $s(x) = \dfrac{3}{2}x + 5$, where x is the wholesale price. The price the customer pays is $c(x) = 2(x + 1)$ where x is the price the store pays. Write a composite function to find the customer's price as a function of the wholesale price.

133) _____

Answer: $c(s(x)) = 3x + 12$

134) A coat costs x wholesale. The price the store pays is given by the function $s(x) = 1.2x$ where x is the wholesale price. The price the customer pays is $c(x) = 2x + 50$ where x is the price the store pays. Write a composite function to find the customer's price as a function of the wholesale price.

134) _____

Answer: $c(s(x)) = 2.4x + 50$

135) A car costs x wholesale. The price the dealer pays is given by the function $s(x) =$ $x + 500$, where x is the wholesale price. The price the customer pays is $c(x) =$ $x + 1500$ where x is the price the dealer pays. Write a composite function to find the customer's price as a function of the wholesale price.

135) _____

    Answer: $c(s(x)) = x + 2000$

136) Suppose the area of a square tablecloth is $t(x) = (x + 6)^2$. Express as a composition of two functions and explain what each function represents.

136) _____

    Answer: Let the length of a side be represented by the function $l(x) = x + 6$ and the area of a square with sides of length x be represented by $a(x) = x^2$. Then $t(x) = (x + 6)^2 = [l(x)]^2 = a(l(x))$.

137) Suppose the volume of a cube is $v(x) = (x - 4)^3$. Express as a composition of two functions and explain what each function represents.

137) _____

    Answer: Let the length of a side of the cube be represented by the function $l(x) = x - 4$ and the volume of a cube with sides of length x be represented by the function $f(x) = x^3$. Then $v(x) = (x - 4)^3 = [l(x)]^3 = f(l(x))$.

138) Find the inverse of the function: $f(x) = 8x + 3$

138) _____

    Answer: $f^{-1}(x) = \frac{1}{8}(x - 3)$

139) Find the inverse of the function: $f(x) = (x - 3)^2$, for $x \geq 3$

139) _____

    Answer: $f^{-1}(x) = \sqrt{x} + 3$

140) Determine whether or not the function is one-to-one: $f(x) = 7x + 6$

140) _____

    Answer: The function is one-to-one.

141) Determine whether or not the function is one-to-one: $f(x) = x^2 - 3$

141) _____

    Answer: The function is not one-to-one.

142) Determine whether or not the function is one-to-one: $f(x) = (x + 2)^3 - 8$.

142) _____

    Answer: The function is one-to-one.

143) Determine whether or not the function is one-to-one: $f(x) = |x - 8|$.

143) _____

    Answer: The function is not one-to-one.

144) Let $p = 500 - \frac{1}{2}q$ represent a demand equation for a product where p is unit price and q is quantity with the restriction $0 \leq q < 1000$. Express the quantity q as a function of p.

144) _____

    Answer: $q = -2p + 1000$

145) The graph of $y = f(x)$ is shown below. (a) What is the domain of f? (b) What is the range of f?   145) _____
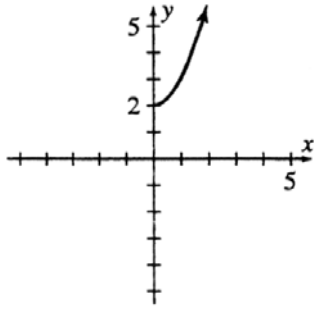
Answer: (a) all nonnegative real numbers
(b) all real numbers greater than or equal to 2

146) The graph of $y = f(x)$ is shown below. Estimate: 146) _____
(a) $f(-1)$
(b) $f(0)$
(c) $f(2)$
(d) $f(3)$
(e) What is the domain of f?
(f) What is the range of f?
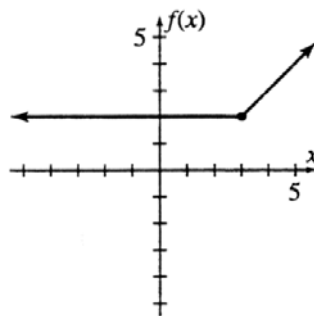
Answer: (a) 2
(b) 2
(c) 2
(d) 2
(e) all real numbers
(f) all real numbers greater than or equal to 2

147) Which graphs below represent functions of x? 147) _____

(a)
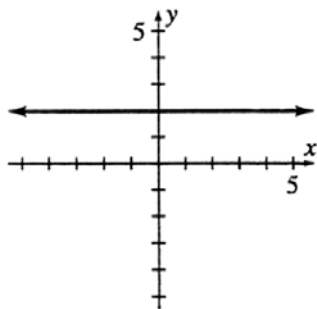
(b)
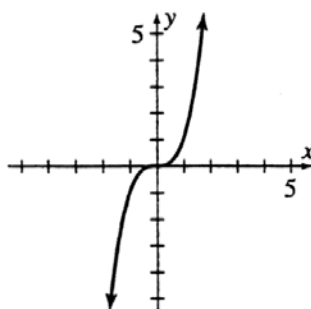
(c)
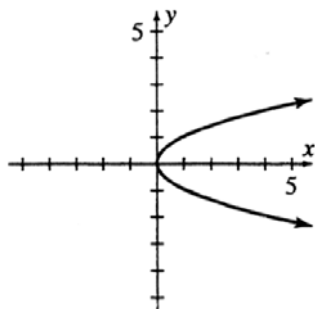
Answer: (a) and (b)

148) Determine the x- and y-intercepts of the graph of $y = x^2 + x - 12$. 148) _____
Answer: $(3, 0)$, $(-4, 0)$; $(0, -12)$

149) Determine the x- and y-intercepts of the graph of $y = x^3 - 4x$. 149) _____
Answer: $(0, 0)$, $(\pm 2, 0)$; $(0, 0)$

150) Determine the x- and y-intercepts of the graph of $y = \dfrac{7 - 14x}{(x + 2)(x - 1)}$. 150) _____

Answer: $\left(\dfrac{1}{2}, 0\right)$; $\left(0, -\dfrac{7}{2}\right)$

151) Determine the x- and y-intercepts of the graph of $y = \dfrac{4}{x^2 - 3x + 2}$. 151) _____

Answer: no x-intercept; $(0, 2)$

152) Determine the x- and y-intercepts of the graph of $\dfrac{x^2}{25} + \dfrac{y^2}{64} = 1$. 152) _____

Answer: $(\pm 5, 0)$; $(0, \pm 8)$

153) Determine the x- and y-intercepts of the graph of $y = e^x(x + 3)$. 153) _____
Answer: $(-3, 0)$; $(0, 3)$

28

154) Determine the x- and y-intercepts of the graph of $y = x^4 - 16$.   154) _____

   Answer: $(\pm 2, 0); (0, -16)$

155) Determine the x- and y-intercepts of the graph of $y = \dfrac{x^2 - 3x - 10}{x^2 + 2x + 1}$ 155) _____

   Answer: $(-2, 0), (5, 0); (0, -10)$

156) (a) Sketch the graph of $y = 2x + 1$. (b) Determine the intercepts.   156) _____
   (c) Based on your graph, is y a function of x? If so, state
   (d) the domain and (e) the range.

   Answer: (a)
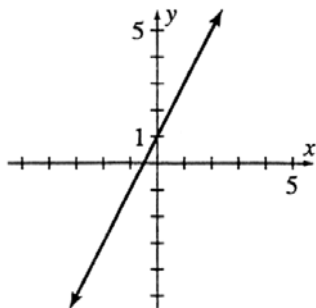
   (b) $\left(-\dfrac{1}{2}, 0\right), (0,1)$
   (c) y is a function of x
   (d) all real numbers
   (e) all real numbers

157) (a) Sketch the graph of $y = f(x) = 2x + 6$. (b) Determine the intercepts. State (c) the domain   157) _____
   and (d) the range of f.
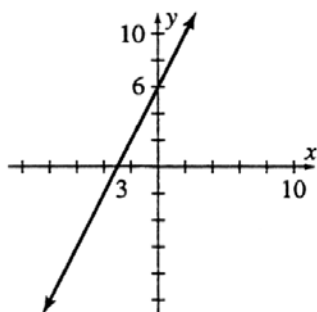
   Answer: (a)

   (b) $(-3, 0), (0, 6)$
   (c) all real numbers
   (d) all real numbers

158) Sketch the graph of $f(x) = x^2 - 2x$. Also determine the intercepts.   158) _____

Answer:
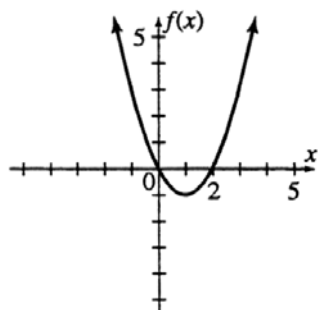
Intercepts: (2, 0), (0, 0)

159) Sketch the graph of $f(x) = x^3 + 1$. Also determine the intercepts.   159) _____

Answer:
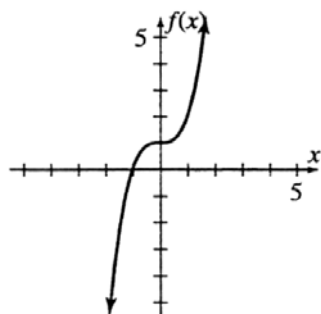
Intercepts: (−1, 0), (0, 1)

160) Sketch the graph of $s = f(t) = \sqrt{t + 2}$. Also determine the intercepts.   160) _____

Answer:
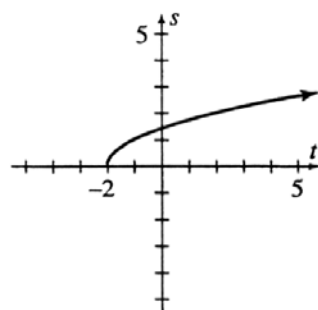
Intercepts: (−2, 0), $(0, \sqrt{2})$

161) Sketch the graph of $f(x) = \begin{cases} -1, \text{ if } x \geq 0 \\ 2, \text{ if } x < 0 \end{cases}$, and give the domain and range.

161) _____

Answer:
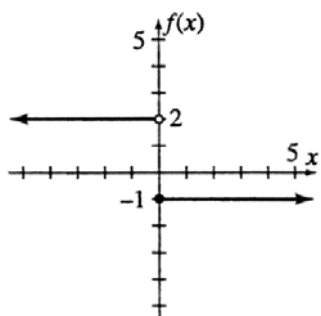
Domain: all real numbers
Range: $\{-1, 2\}$

162) Sketch the graph of $f(x) = \begin{cases} 3x + 1, \text{ if } 0 \leq x < 2 \\ 7 - x, \text{ if } x \geq 2 \end{cases}$, and give the domain and range.

162) _____

Answer:
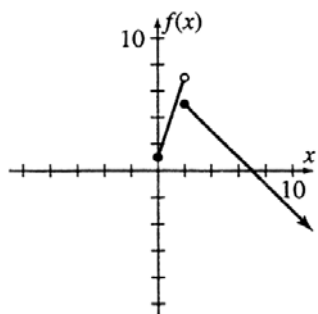
Domain: all nonnegative reals
Range: all reals < 7

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

163) The domain and range of the function f whose graph appears below is

163) _____
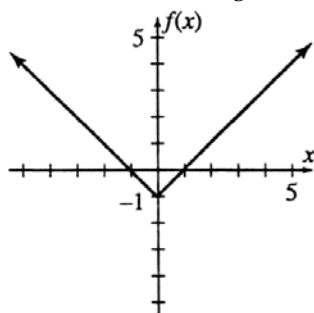
A) Domain: all real numbers
   Range: all real numbers
B) Domain: all real numbers greater than or equal to –1
   Range: all real numbers
C) Domain: all nonnegative real numbers
   Range: all real numbers less than or equal to –1
D) Domain: all real numbers
   Range: all real numbers greater than or equal to –1
E) Domain: all real numbers
   Range: all nonnegative real numbers

Answer: D

164) The domain and range of the function f whose graph appears below is

164) _____
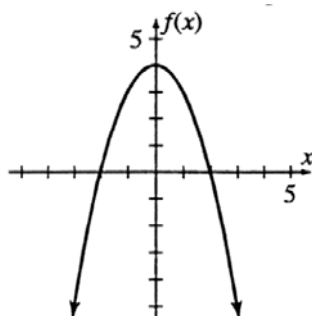
A) Domain: all nonnegative real numbers
   Range: all real numbers less than or equal to 4
B) Domain: all real numbers
   Range: all real numbers less than or equal to 4
C) Domain: all real numbers less than or equal to 4
   Range: all real numbers
D) Domain: all real numbers less than or equal to 4
   Range: all nonnegative real numbers
E) Domain: all real numbers
   Range: all real numbers

Answer: B

165) The x- and y-intercepts of the graph of $\dfrac{x^2}{4} + \dfrac{y^2}{9} = 1$ are   165) _____

      A) (0, 0), (2, 0), (0, 3).
      B) (± 2, 0) (0, ± 3).
      C) (4, 0), (0, 9).
      D) (0, ± 2) (± 3, 0).
      E) (0, 4), (9, 0).
   Answer: B

166) The x- and y-intercepts of the graph of $y = \dfrac{3}{x^2 - 1}$ are   166) _____

      A) (±1, 0), (0, 3).
      B) (1,0), (0, 3).
      C) (0, 0), (±1, 0), (0, –3).
      D) (0, –3).
      E) (3, 0).
   Answer: D

SHORT ANSWER. Write the word or phrase that best completes each statement or answers the question.

167) By looking a the graph below: 167) _____
    (a) list all values for which $f(x) = 0$
    (b) $f(2) =$
    (c) $f(-2) =$
    (d) domain of f is?
    (e) range of f is?
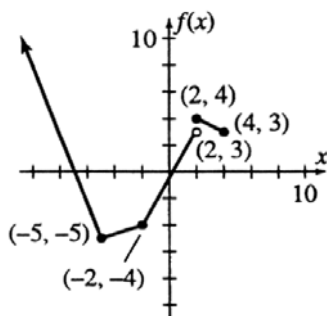
   Answer: (a) –7, 1
          (b) 4
          (c) –4
          (d) $-\infty < x \le 4$
          (e) all real numbers greater than or equal to –5

168) By looking a the graph below:

    (a) list all values for which $f(x) = -2$

    (b) $f(-1) =$

    (c) $f(0) =$

    (d) domain of $f(x)$ is?

    (e) range of $f(x)$ is?

168) _____
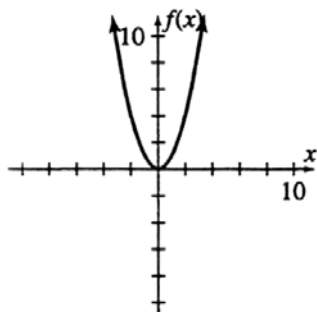
    Answer: (a) none

           (b) does not exist

           (c) 0

           (d) all reals

           (e) all reals ≥ 0

169) Find the x–intercepts and the y–intercepts of $y = \dfrac{x^2 + 4x - 5}{3}$

169) _____

    Answer: $(1, 0)$; $(-5, 0)$ and $\left(0, -\dfrac{5}{3}\right)$

170) Use a graphing calculator to find all real roots of the equation. Round answers to two decimal places, if necessary: $(x - 1)^3 = 3 - x^2$

170) _____

    Answer: 1.65

171) Use a graphing calculator to find all real roots of the given function. Round answers to two decimal places, if necessary: $f(x) = x^3 - 8x - 3$

171) _____

    Answer: –2.62, –0.38, 3

172) Use a graphing calculator to find all real roots of the given function. Round answers to two decimal places, if necessary: $f(x) = x^4 - x^3 - 7x^2 + 5x + 10 = 0$

172) _____

    Answer: –2.24, –1, 2.24

173) Use a graphing calculator to find the maximum value of f(x) and the minimum value of f(x) for the indicated values of x:

    $f(x) = 0.8x^4 - 3.1x^3 + 1.2x^2 + x + 1;\ 0 \leq x \leq 3$

173) _____

    Answer: minimum at (2.57, –6.23)

                maximum at (0.56, 1.47)

174) Tom has saved $1500 for a vacation. He plans to spend $250 a week on his vacation. Write an equation to represent the amount in savings and identify the intercepts.

174) _____

    Answer: $y = -250x + 1500$; x–intercept $(6, 0)$; y–intercept $(0, 1500)$

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175) Bill has charged $2300 on his charge card. He plans to pay $60 a month on his charge cards. Write an equation to represent the amount he owes excluding any finance charges, and identify the intercepts.

175) _____

Answer: $y = -60x + 2300$; x-intercept $\left(38\frac{1}{3}, 0\right)$; y-intercept $(0, 2300)$

176) The train holds 175 passengers. It departs daily at 9:00 A.M. Let x represent the time and y represent the number of passengers. Write an equation which represents the relationship between the number of passengers on the train and the train's departure time. Describe the graph of this equation, and identify the intercepts.

176) _____

Answer: $x = 9$; vertical line; x-intercept $(9,0)$; no y-intercept

177) A daily round trip train ticket to the city costs $4.25. Let x represent the passenger's income and y represent the cost of a daily round trip train ticket. Write an equation which represents the relationship between the cost of a daily round trip ticket and a passenger's income; describe the graph of this equation, and identify the intercepts.

177) _____

Answer: $y = 4.25$; horizontal line; no x-intercept; y-intercept $(0, 4.25)$

178) Ellen's health plan has a $10.00 copayment for complete pregnancy care. Let x represent the number of prenatal visits and y represent her cost for the pregnancy. Write an equation which represents the relationship between her cost for the pregnancy and her number of prenatal visits; describe the graph of this equation, and identify the intercepts.

178) _____

Answer: $y = 10$; horizontal line; no x-intercept; y-intercept $(0, 10)$

179) Julie lives 32 miles from the city. She drove home from the city at a constant rate of 60 mph along the highway. At the exit 2 miles from her home, she realized she had left her purse at the department store. She immediately returned to the department store at a rate of 60 mph. Graph the absolute-value function to represent Julie's distance from home as she drove home from the city over the appropriate domain.

179) _____

Answer:

35
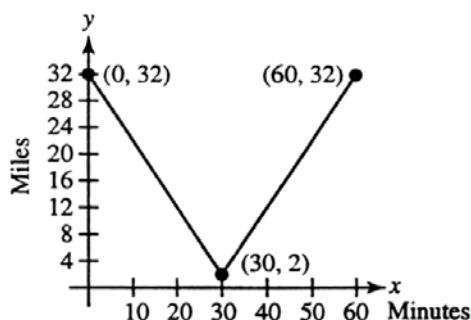
180) In June, Gail decided to save $20.00 a week. She saved for 14 weeks and then for 14 weeks she spend $20.00 a week on gifts. Graph the absolute-value function to represent the amount of money Gail had in savings over the appropriate domain.

180) _____

Answer:
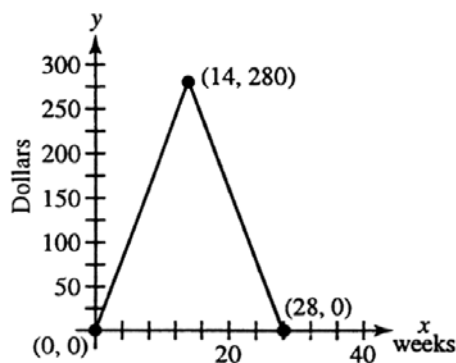
181) In November, Steve uses his credit cards to buy $30.00 of holiday gifts each week. After 8 weeks he begins saving $30.00 each week to pay his credit card bill. Graph the absolute-value function to represent the amount Steve has saved since he started buying holiday gifts over the appropriate domain. (Hint: Let purchases on credit cards represent negative savings.)

181) _____

Answer:
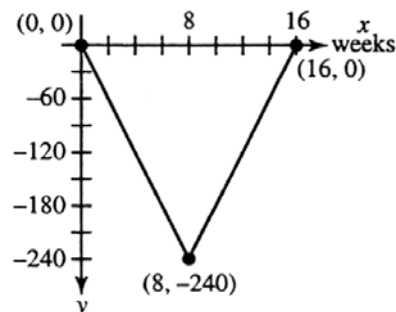
182) To reduce inventory, a department store charges three rates. If you buy 0–5 pairs of socks, the price is $3.50 per pair of socks. If you buy 6–10 pairs of socks, the price is $3.00 per pair. If you buy more than 10, the price is $2.75 per pair. Graph the compound function that represents the cost of buying N pairs of socks.

182) _____

Answer:
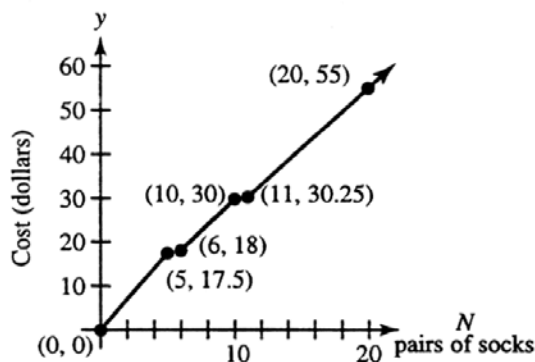
183) To encourage large group sales, a theater charges two rates. If your group is fewer than 10,   183) _____
each ticket costs $7.50. If your group is 10 or more, each ticket costs $7.00. Graph the
compound function that represents the cost of buying N tickets.
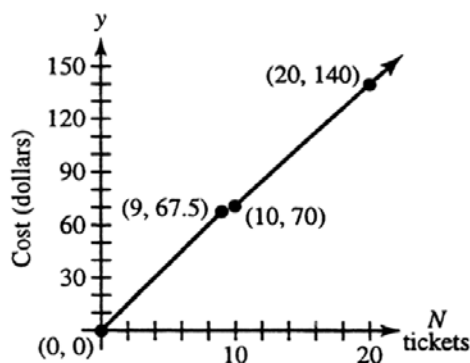
Answer:

184) Determine whether the graph of $y = x - 2x^3$ is symmetric about the x–axis, the y–axis, the   184) _____
origin, or the line $y = x$.

Answer: origin

185) Determine whether the graph of $y^2 = 4 - x^2$ is symmetric about the x–axis, the y–axis, the   185) _____
origin, or the line $y = x$.

Answer: x–axis, y–axis, origin, $y = x$

186) Determine whether or not the graph of $y = \dfrac{x^2 (x^2 - 9)}{x^4 + 4}$ is symmetric about the x–axis, the   186) _____
y–axis, the origin, or the line $y = x$.

Answer: y–axis

187) Determine whether the graph $y = \dfrac{x^2 - 1}{x}$ is symmetric about the x–axis, the y–axis, the   187) _____
origin, or the line $y = x$.

Answer: origin

188) Determine whether the graph of $x = y^2 - 4$ is symmetric about the x–axis, the y–axis, the   188) _____
origin, or the line $y = x$.

Answer: x–axis

189) Determine whether the graph of $x^2 - xy = 1$ is symmetric about the x–axis, the y–axis, the   189) _____
origin, or the line $y = x$.

Answer: origin

190) Determine whether the graph of $y = x^2 - x^4$ is symmetric about the x–axis, the y–axis, the   190) _____
origin, or the line $y = x$.

Answer: y–axis

37

191) Determine whether the graph of $\dfrac{x^2}{y^2 - 9} = 4$ is symmetric about the x-axis, the y-axis, the   191) _____

origin, or the line $y = x$.

Answer: x-axis, y-axis, origin

192) Determine the x- and y-intercepts, if they exist, of the graph of $9x^2 + y^2 + 8y = 9$. Also   192) _____
determine whether the graph is symmetric about the x-axis, the y-axis, the origin, or the
line $y = x$.

Answer: x-intercept: $(\pm 1, 0)$; y-intercept: $(0, 1)$, $(0, -9)$; symmetric about y-axis

193) Determine the x-and y-intercepts, if they exist, of the graph of $\dfrac{x^2}{4} - \dfrac{y^2}{9} = 1$. Also   193) _____

determine whether the graph is symmetric about the x-axis, the y-axis, the origin, or the
line $y = x$.

Answer: x-intercept: $(\pm 2, 0)$; no y-intercept; symmetric about x-axis, y-axis, origin

194) For the graph of $y = \dfrac{1}{x^2}$,   194) _____

   (a) Determine the intercepts.
   (b) Determine whether the graph is symmetric about the x-axis,
       the y-axis, the origin, or the line $y = x$.
   (c) Sketch the graph. (d) Based on your graph, is y a function of x? If so, state (e)
       the domain and (f) the range.

Answer: (a) none
         (b) y-axis
         (c)
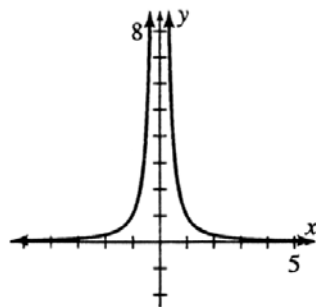
         (d) y is a function of x
         (e) all real numbers except 0
         (f) all positive real numbers

195) For the graph of $y = f(x) = x^2 - 4$,

    (a) Determine the intercepts.

    (b) Determine whether the graph is symmetric about the x–axis, y–axis, the origin, or the line $y = x$.

    (c) Sketch the graph. State (d) the domain and (e) the range of f.

    Answer: (a) (2, 0), (–2, 0), (0, –4)

               (b) y–axis

               (c)

195) _____
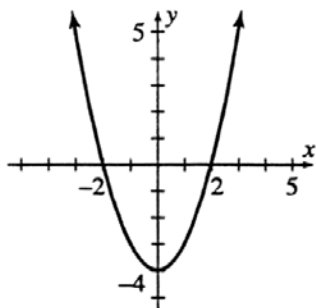
               (d) all real numbers

               (e) all real numbers greater than or equal to –4

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

196) The graph of $y = x^3$ is symmetric about the

    A) origin only.

    B) y–axis only.

    C) x–axis only.

    D) x–axis, y–axis, the origin, and the line $y = x$.

    E) none of the above

    Answer: A

196) _____

197) The graph of $y = \dfrac{x^2}{x^4 - 1}$ is symmetric about the

    A) origin only.

    B) y–axis only.

    C) x–axis only.

    D) x–axis, y–axis, the origin, and the line $y = x$.

    E) none of the above

    Answer: B

197) _____

SHORT ANSWER. Write the word or phrase that best completes each statement or answers the question.

198) Determine whether the graph of $y^2 = \dfrac{7 - 9x^2}{\frac{1}{x^2} - 1}$ is symmetric about the x–axis, the y–axis, the origin, or the line $y = x$.

    Answer: symmetric about the x–axis, y–axis and origin

198) _____

199) Determine whether the graph of $y = \dfrac{0.23 - 0.8x^2}{0.9 - 0.1x^2}$ is symmetric about the x-axis, the

199) _____

y-axis, the origin, or the line $y = x$.

Answer: symmetric about the y-axis

200) Determine the x-intercepts and y-intercepts if they exist. Also determine whether the graph is symmetric about the x-axis, y-axis, the origin, or the line $y = x$ for $3y^3 = x$.

200) _____

Answer: (0, 0); symmetric about the origin

201) Determine the x-intercepts if they exist. Also determine whether the graph is symmetric about the x-axis, y-axis, the origin, or the line $y = x$ for $y = |x|$.

201) _____

Answer: (0, 0); symmetric about the y axis

202) Sketch a graph of $y = |2x - 5|$

202) _____

Answer:
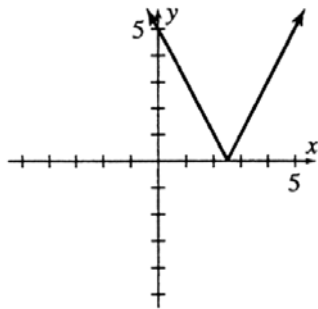
MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

203) To obtain a graph of $y = 7x^2 + 3$ from the graph of $y = 7x^2$, which of the following statements is true?

203) _____

A) shift 3 units to the left
B) shift 3 units down
C) shift 3 units up
D) shift 3 units to the right
E) none of the above

Answer: C

204) To obtain a graph of $y = 7(x - 1)^2$ from the graph of $y = 7x^2$, which of the following statements is true?

204) _____

A) shift 1 unit to the left
B) shift 1 unit down
C) shift 1 unit to the right
D) shift 1 unit up
E) none of the above

Answer: C

SHORT ANSWER. Write the word or phrase that best completes each statement or answers the question.

205) Use the graph of $y = f(x)$.
Sketch a graph of $y = f(x + 3)$.

205) _____
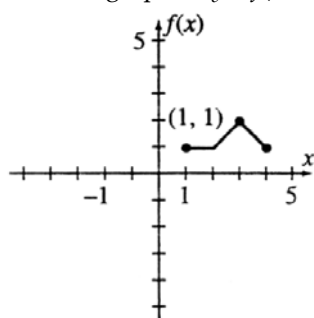
Answer: shift 3 units to the left
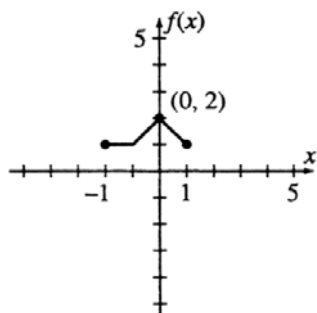
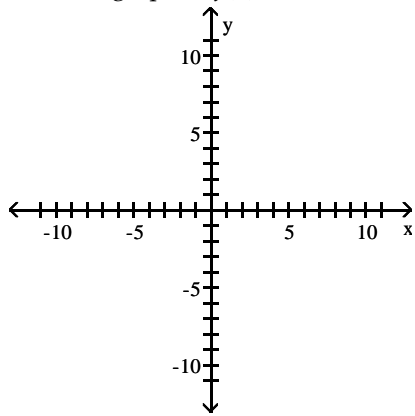
206) Sketch a graph of $f(x) = x^2 + 4$

206) _____

Answer:

207) Sketch a graph of $f(x) = (x - 4)^2$

207) _____
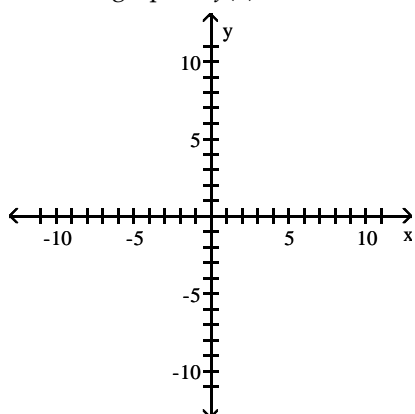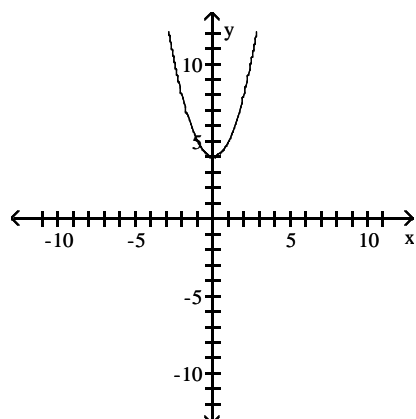
Answer:
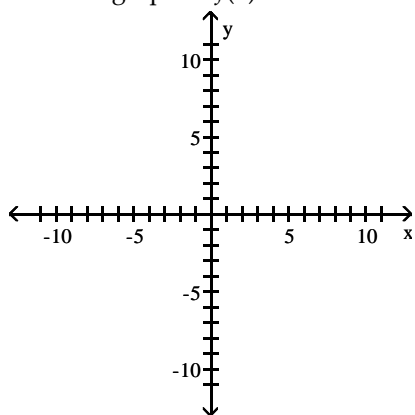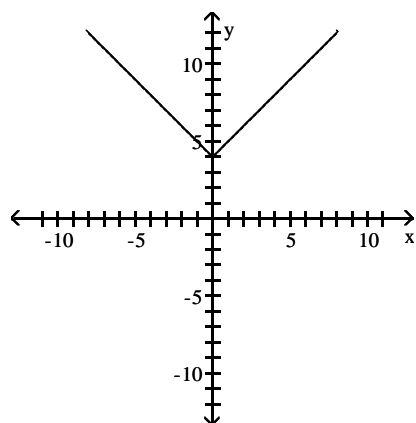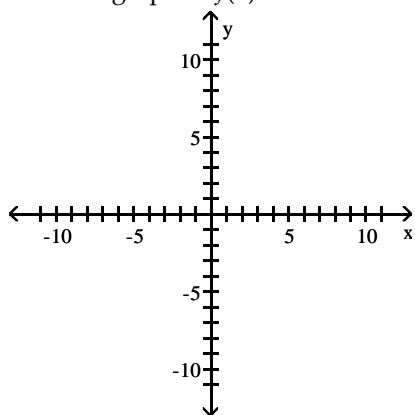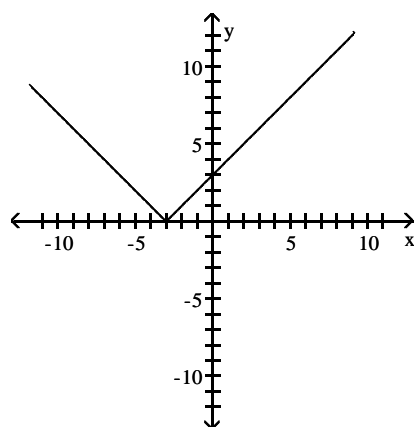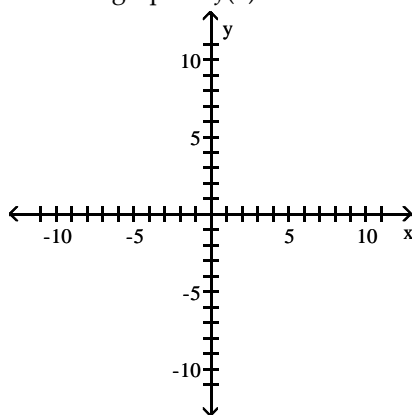
207) Sketch a graph of $f(x) = (x - 4)^2$

207) _____
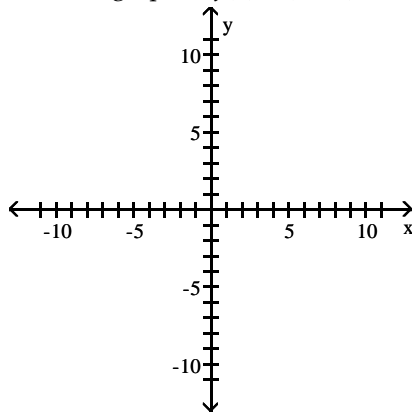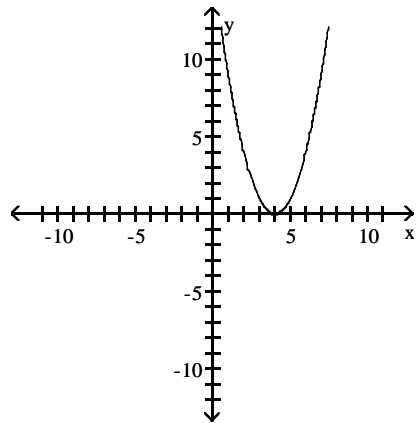
Answer:

208) Sketch a graph of $f(x) = (x + 2)^2 + 7$ 208) _____
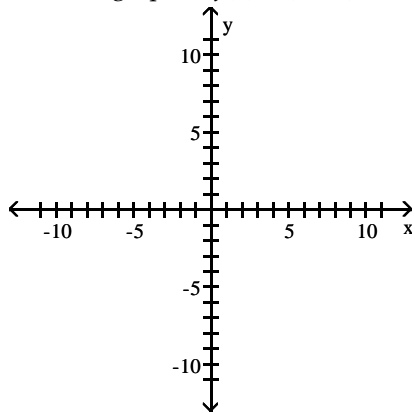
Answer:
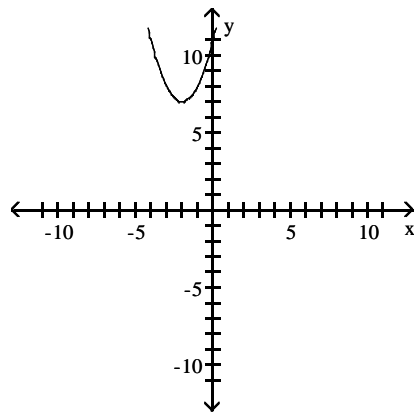
209) Sketch a graph of $f(x) = x^3 + 5$

209) _____
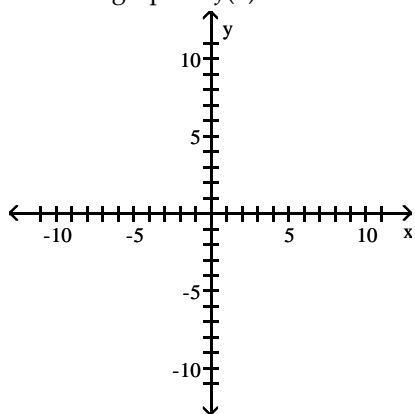
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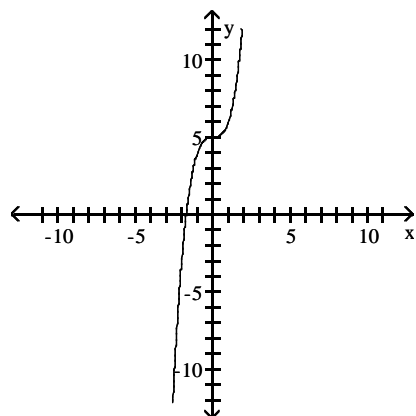
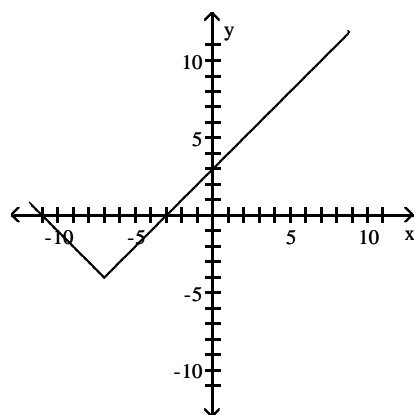210) Sketch a graph of $f(x) = (x - 5)^3$

210) _____
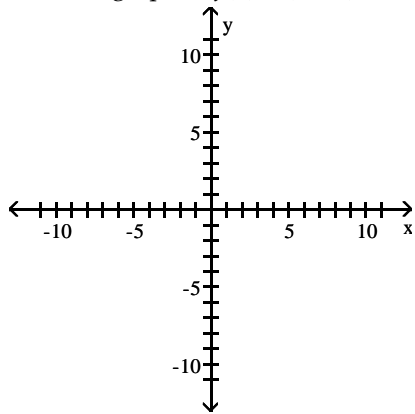
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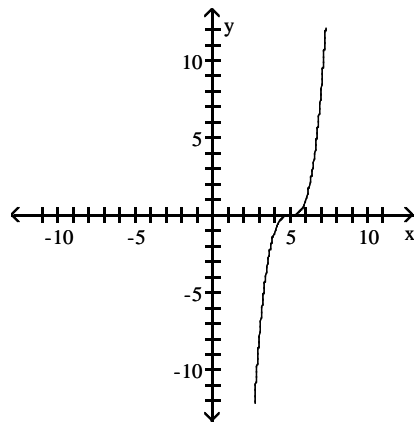
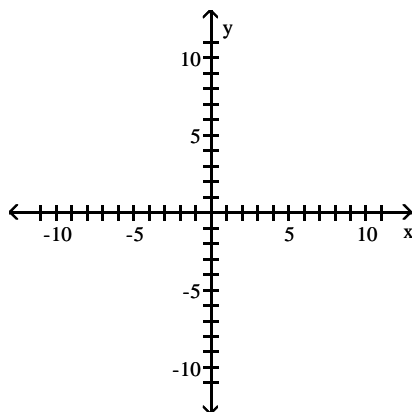211) Sketch a graph of $f(x) = (x - 3)^3 + 1$ 211) _____
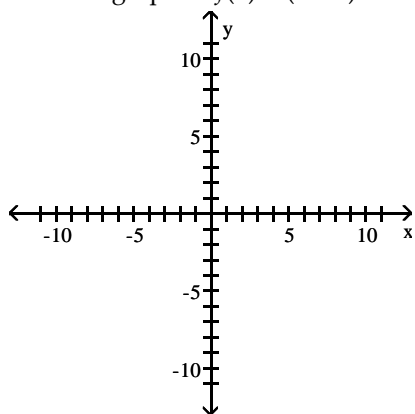
Answer:
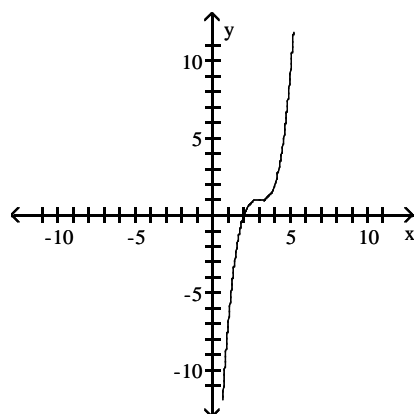
212) Sketch a graph of $f(x) = \sqrt{x} - 3$

212) _____
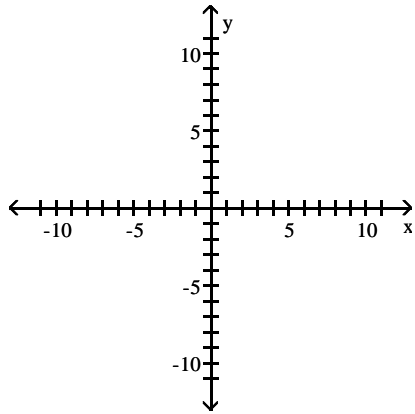
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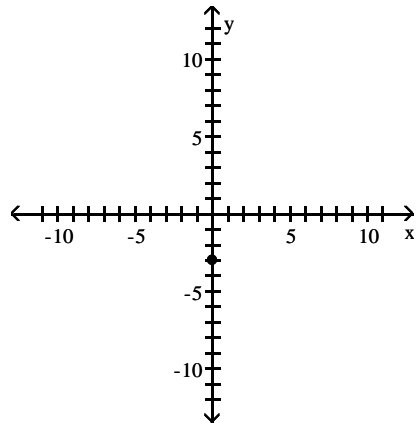
213) Sketch a graph of $f(x) = \sqrt{x + 4}$ 213) _____

Answer:
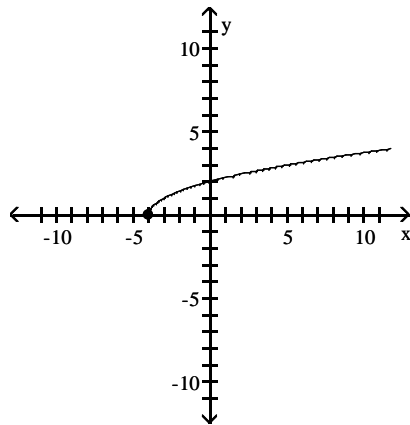
214) Sketch a graph of $f(x) = \sqrt{x + 4} + 7$

214) _____
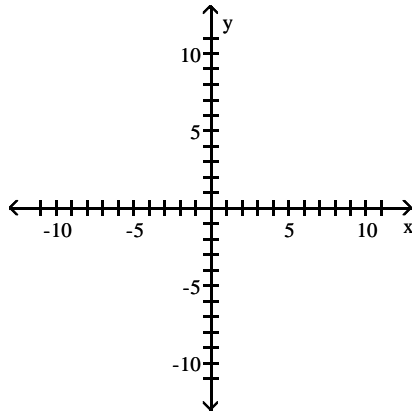
Answer:
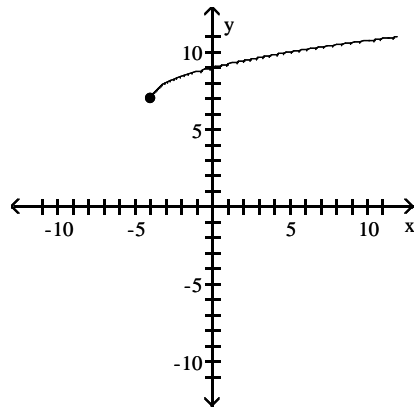
215) Sketch a graph of $f(x) = |x| + 4$

215) _____

Answer:

216) Sketch a graph of $f(x) = |x + 3|$

Answer:

216) _____

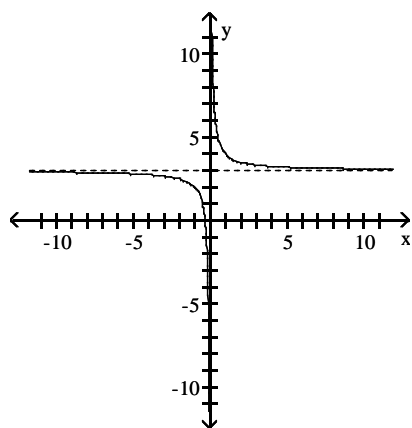217) Sketch a graph of $f(x) = |x + 7| - 4$

217) _____

Answer:

52

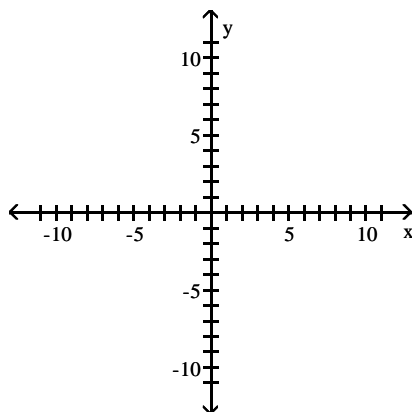218) Sketch a graph of $f(x) = \dfrac{1}{x} + 3$
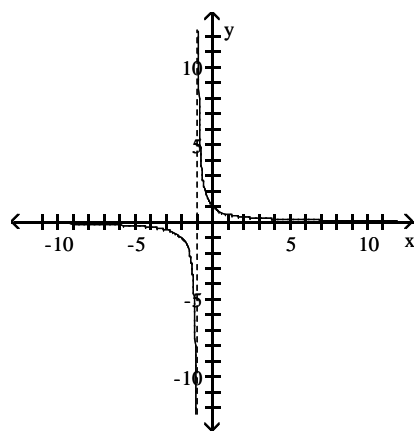
218) _____

Answer:

219) Sketch a graph of $f(x) = \dfrac{1}{x+1}$
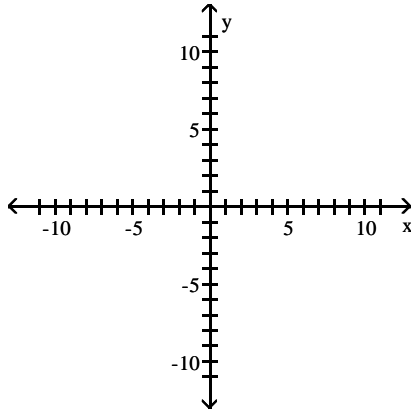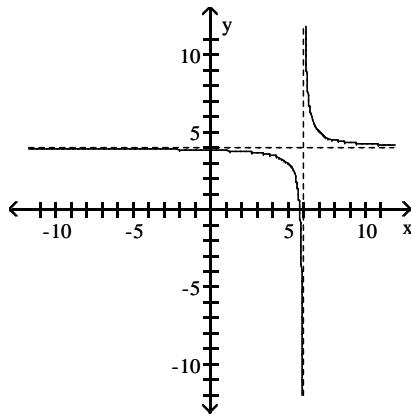
219) _____

Answer:

220) Sketch a graph of $f(x) = \dfrac{1}{x-6} + 4$ 220) _____

Answer:

221) List the graphical transformations, in the correct order, that must be done to $y = f(x)$ to   221) _____
produce the graph of $y = 2f(x + 3) - 5$.

Answer: Order: 1. Move 3 left
2. Vertical Stretch by 2
3. Move 5 down
Or any order in which 2. is before 3.

222) List the graphical transformations, in the correct order, that must be done to $y = f(x)$ to   222) _____
produce the graph of $y = -f(x - 5) + 4$.

Answer: Order: 1. Move 5 right
2. Reflect about the x–axis
3. Move 4 up
Or any order in which 2. is before 3.

223) If $f(x, y, z) = \dfrac{2x}{x + y}$, find $f(1, 2, -3)$.   223) _____

Answer: –2

224) If $f(p, q) = 3p^2 - 2q + p$, find $f(-1, 2)$.   224) _____

Answer: –2

225)   225) _____

Given the function $P(r, k) = \dfrac{k!\left(\dfrac{1}{4}\right)^r\left(\dfrac{3}{4}\right)^{k-r}}{r!(k-r)!}$, $r = 0, 1, 2, ..., k$; find $P(2, 4)$.

Answer: $\dfrac{27}{128}$

226) Find an equation of the plane that is parallel to the y, z–plane and that passes through the   226) _____
point $(1, 2, 3)$.

Answer: $x = 1$

227) Find an equation of the plane that is parallel to the x, y–plane and that passes through the   227) _____
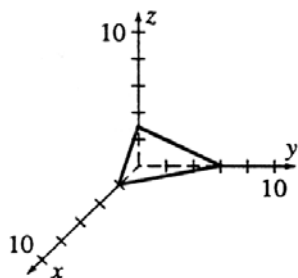point $(2, -6, 4)$.

Answer: $z = 4$

228) Find an equation of the plane that is parallel to the x, z–plane and that passes through the   228) _____
point $(-3, 2, 5)$.

Answer: $y = 2$

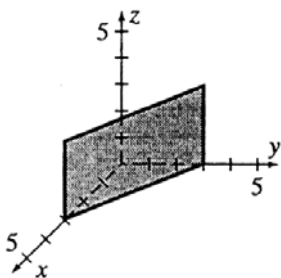229) Sketch the surface $3x + y + 2z = 6$.   229) _____

Answer:

230) Sketch the surface $x + y = 3$.   230) _____

Answer:

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

231) An equation of the plane that is parallel to the x, y–plane and that passes through $(2, 7, 3)$ is   231) _____
   A) $z = 3$.   B) $y = 7$.   C) $x = 7$.   D) $y = 3$.   E) $x = 2$.

Answer: A

232) An equation fo the plane that is parallel to the y, z–plane and that passes through (4, 6, 9) is   232) _____

    A) $x = 6$.   B) $z = 9$.   C) $z = 4$.   D) $y = 6$.   E) $x = 4$.

Answer: E

SHORT ANSWER. Write the word or phrase that best completes each statement or answers the question.

233) Given $f(x, y) = x^2 - yx$, find $f(u + v, u - v)$.   233) _____

Answer: $2uv + 2v^2$

234) Given $h(r, s, t, u) = \dfrac{rs}{3 - t^2}$, find $h(2, 3, 2, 15)$.   234) _____

Answer: -6

235) The Cobb–Douglas production function for a company is given by $P = 20l^{1/3}k^{2/3}$ where P 235) _____
is the monthly production value when k is the amount of the company's capital
investment (in dollars per month) and l is the size of the labor force (in work hours per
month). What is the production value when $l = 1728$ hours and $k = \$27{,}000$ per month?

Answer: \$216,000

236) The Cobb–Douglas production function for a company is given by $P = 70l^{1/4} k^{3/4}$ where P 236) _____
is the monthly production value when k is the amount of the company's capital
investment (in dollars per month) and l is the size of the labor force (in work hours per
month). What is the production value when $l = 2401$ hours and $k = \$10{,}000$ per month?

Answer: \$490,000

237) The Parkers are borrowing \$120,000 to buy a house. Their monthly payment amount is   237) _____
given by

$P(n, r) = \dfrac{120{,}000r}{1 - (1 + r)^{-n}}$, where r is the monthly interest rate and n is the number of months.

What is the Parker's monthly payment if they get:
(a) a 30–year loan at 9% annual interest?
(b) a 20–year loan at 10% annual interest?

Answer: (a) \$965.55   (b) \$1158.03