Honors PreCalculus

Review

Contents

Chapter 1

Basic Set Theory and Interval Notation

You are given either interval notation, set-builder notation, or a graph. Write each of the following in its other 2 forms.

1. $(-5, 8]$

2. $\{x | x \leq 1\}$

3.
   -3

4. $\{x | x \neq 4, 11\}$

5.
   $2.4 \qquad\qquad 7.7$
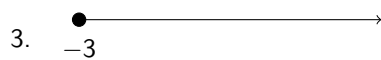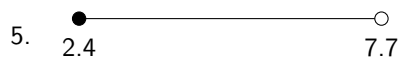
6. $(9, \infty)$

Write each using interval notation and graph on a number line.

7. $\{x | x \geq 2\}$

8. $\{x | x < -8\}$

9. $\{x | x \neq 3\}$

10. $\{x | x \neq -2, 5\}$

You are given the graph of an interval. Write the interval and set-builder notation for it.

11.
    -8

12.
    $7 \qquad\qquad 12$

1. $\{x| -5 < x \le 8\}$

2. $(-\infty, 1]$
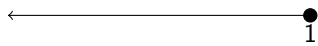
3. $[-3, \infty)$ $\{x|x \ge -3\}$

4. $(-\infty, 4) \cup (4, 11) \cup (11, \infty)$
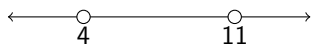
5. $[2.4, 7.7)$ $\{x|2.4 \le x < 7.7\}$

6. $\{x|x > 9\}$
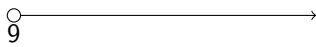
7. $[2, \infty)$

8. $(-\infty, -8)$
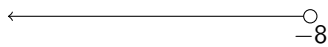
9. $(-\infty, 3) \cup (3, \infty)$
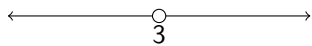
10. $(\infty, -2) \cup (-2, 5) \cup (5, \infty)$
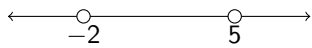
11. $(-\infty, -8]$ $\{x|x \le -8\}$

12. $(-\infty, 7) \cup (7, 12) \cup (12, \infty)$ $\{x|x \ne 7, 12\}$

Chapter 2

Functions and Their Graphs

2.1 Evaluating Functions

Given $f(x) = -3x^2 + 4x$ and $g(x) = \frac{1}{x} - 5$, evaluate each.

1. $f(5)$

2. $f(-2)$

3. $f(0)$

4. $g(1)$

5. $g(-5)$

6. $g(1/4)$

2.2 Domain of Functions

Find the domain of each write your answers in interval notation.

1. $f(x) = -8x^2 - 7x + 1$

2. $g(x) = \sqrt{5x + 12} - 2$

3. $h(x) = \frac{x+2}{9x-7}$

4. $f(x) = -5x + 4$

5. $f(x) = x^2 + 2$

6. $f(x) = \frac{2x+1}{3x-5}$

7. $f(x) = \sqrt{3x - 12}$

8. $f(x) = \frac{x}{x^2-16}$

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

10. $f(x) = \frac{x}{\sqrt{x-4}}$

11. $f(x) = \frac{x^2+1}{2x^2+8}$

12. $f(x) = -\frac{x+7}{x^2-5x-6}$

13. $g(x) = \sqrt{2x + 3}$

14. $h(x) = \sqrt[3]{2x + 3}$

15. $f(x) = -\frac{7x-10}{x^2+3x+2}$

16. $g(x) = \sqrt{-9x + 8}$

17. $h(x) = -\sqrt[3]{4x + 1}$

18. $f(x) = \sqrt[3]{8x + 1}$

19. $g(x) = \frac{x^2-1}{\sqrt{x+3}}$

20. $h(x) = \frac{3}{9+\frac{4}{x+7}}$

21. $f(x) = \frac{x+1}{\sqrt{10x+8}}$

22. $g(x) = \frac{5}{1+\frac{3}{x+2}}$

23. $i(x) = \frac{7}{3-\frac{4}{x+1}}$

24. $n(x) = \frac{7x+14}{\sqrt{2x-1}}$

2.3   Piecewise Functions

Find the value of each given the piecewise function below. Use exact answers when possible.

$$f(x) = \begin{cases} x^2 - 1 & \text{if } x < -3 \\ 0.2x + 7 & \text{if } -3 \le x < 2 \\ \sqrt{5x} & \text{if } x \ge 2 \end{cases}$$

1. $f(3)$

2. $f(0)$

3. $f(-2)$

4. $f(-3)$

5. $f(0.5)$

Find each of the following given the piecewise function

$$f(x) = \begin{cases} x^2 - 7 & x \le -4 \\ \sqrt{2x + 7} & -4 < x < 0 \\ |-x - 1| & x \ge 0 \end{cases}$$

6. $f(3)$

7. $f(-2)$

8. $f(0)$

9. $f(-5)$

Evaluating Functions

1. -55

2. -20

3. 0

4. -4

5. -5.2

6. -1

Domain of Functions

1. $(-\infty, \infty)$

2. $\left[\frac{-12}{5}, \infty\right)$

3. $\left(-\infty, \frac{7}{9}\right) \cup \left(\frac{7}{9}, \infty\right)$

4. $(-\infty, \infty)$

5. $(-\infty, \infty)$

6. $\left(-\infty, \frac{5}{3}\right) \cup \left(\frac{5}{3}, \infty\right)$

7. $[4, \infty)$

8. $(-\infty, -4) \cup (-4, 4) \cup (4, \infty)$

9. $(-\infty, -2) \cup (-2, 0) \cup (0, 2) \cup (2, \infty)$

10. $(4, \infty)$

11. $(-\infty, \infty)$

12. $(-\infty, -1) \cup (-1, 6) \cup (6, \infty)$

13. $\left[-\frac{3}{2}, \infty\right)$

14. $(-\infty, \infty)$

15. $(-\infty, -2) \cup (-2, -1) \cup (-1, \infty)$

16. $\left(-\infty, \frac{8}{9}\right]$

17. $(-\infty, \infty)$

18. $(-\infty, \infty)$

19. $(-3, \infty)$

20. $\left(-\infty, -\frac{67}{9}\right) \cup \left(-\frac{67}{9}, -7\right) \cup (-7, \infty)$

21. $\left(-\frac{4}{5}, \infty\right)$

22. $(\infty, -5) \cup (-5, -2) \cup (-2, \infty)$

23. $(-\infty, -1) \cup \left(-1, \frac{1}{3}\right) \cup \left(\frac{1}{3}, \infty\right)$

24. $\left(\frac{1}{2}, \infty\right)$

Piecewise Functions

1. $\sqrt{15} \approx 3.873$

2. 7

3. 6.6

4. 6.4

5. 7.1

6. 4

7. $\sqrt{3} \approx 1.732$

8. 1

9. 18

Chapter 3

Properties of Functions

3.1 Maxima and Minima

Find the coordinates of the any relative maxima or minima. Round to 3 decimal places when necessary.

1. $f(x) = x^2 - 3x^2 + 5$

2. $g(x) = -0.4x^3 + 0.6x^2 + 3x - 2$

3. $f(x) = -x^4 + 3x^2 - 2x + 6$

4. $g(x) = 0.25x^5 - 0.1x^4 + 2x^2 - 6x$

5. $f(x) = -4x^3 + 2x^2 + 10x + 4$

6. $g(x) = x^4 - 4x^3 + 3x^2 + 4x - 4$

7. The concentration C of a medication in the bloodstream t hours after being administered can be modeled by

$$C(t) = -0.002t^4 + 0.039t^3 - 0.285t^2 + 0.766t + 0.085, \quad t \geq 0$$

   After how many hours will the concentration be the highest?

3.2 Increasing, Decreasing, and Constant Intervals

Find the intervals in which each is increasing or decreasing. Round to 3 decimal places when necessary.

1. $f(x) = x^2 - 3x^2 + 5$

2. $g(x) = -0.4x^3 + 0.6x^2 + 3x - 2$

3. $f(x) = x^3 + 2x^2 - 4x - 8$

4. $g(x) = x^4 - 2x^2 + 1$

5. $h(x) = \sqrt{x+1} - 2$

6. $f(x) = -4x^3 + 2x^2 + 10x + 4$

7. $g(x) = x^4 - 4x^3 + 3x^2 + 4x - 4$

3.3 Miscellaneous

Use the graph of $y = f(x)$ below to answer questions 1–10. Write your answers using interval notation.
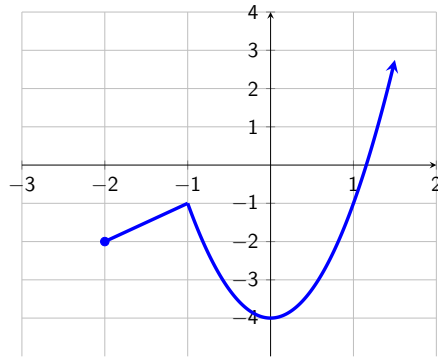
1. Domain of f

2. Range of f

3. Relative Minimum

4. Relative Maximum

5. $f(1)$

6. $f(0)$

7. Increasing Interval(s)

8. Decreasing Interval(s)

9. Absolute Maximum

10. Absolute Minimum

Find each of the following given $f(x) = -2x^3 + 6x^2 - 5x + 1$. Round to 3 decimal places and use interval notation when applicable.

11. $f(7)$

12. $f(-2)$

13. Rel. Max

14. Rel. Min

15. Global Max

16. Global Min

17. Increasing Interval(s)

18. Decreasing Interval(s)

Use the graph of $f(x)$ to answer each.
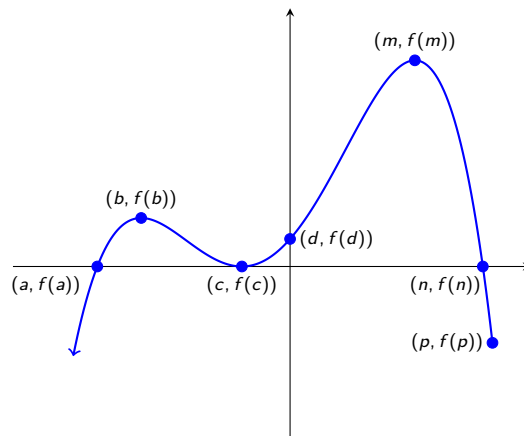
19. Relative maxima of $f(x)$

20. Relative minima of $f(x)$

21. Absolute maxima of $f(x)$

22. Absolute minima of $f(x)$

23. Intervals where f is increasing

24. Intervals where f is decreasing

25. Zeros of f

9

Maxima and Minima

1. Rel max @ $(0, 5)$; No rel min

2. Rel max @ $(2.158, 3.248)$; Rel min @ $(-1.158, -4.048)$

3. Rel Max $(-1.366, 10.848)$ and $(1, 6)$;　Rel Min $(0.366, 5.652)$

4. Rel Max $(-1.716, 11.598)$;　Rel Min $(1.132, -3.929)$

5. Rel Max: $(1.095, 12.096)$;　Rel Min $(-0.761, -0.680)$

6. Rel Max: $(1.366, 0.348)$;　Rel Min: $(-0.366, -4.848)$ and $(2, 0)$

7. About 2.16 hours

Increasing, Decreasing, and Constant Intervals

1. Increasing: $(-\infty, 0)$　Decreasing: $(0, \infty)$

2. Increasing: $(-1.158, 2.158)$　Decreasing: $(-\infty, -1.158) \cup (2.158, \infty)$

3. Inc: $(-\infty, -2) \cup \left(\frac{2}{3}, \infty\right)$　Dec: $\left(-2, \frac{2}{3}\right)$

4. Inc; $(-1, 0) \cup (1, \infty)$　Dec: $(-\infty, -1) \cup (0, 1)$

5. Inc: $(-1, \infty)$　No intervals where it is decreasing

6. Inc: $(-0.761, 1.095)$;　Dec: $(-\infty, -0.761) \cup (1.095, \infty)$

7. Inc: $(-0.366, 1.366) \cup (2, \infty)$;　Dec: $(-\infty, -0.366) \cup (1.366, 2)$;

Miscellaneous

1. $[-2, \infty)$

2. $[-4, \infty)$

3. $(0, -4)$

4. $(-1, -1)$

5. -1

6. $-4)$

7. $(-2, -1) \cup (0, \infty)$

8. $(-1, 0)$

9. $(0, -4)$

10. None

11. -426

12. 51

13. $(1.408, 0.272)$

14. $(0.592, -0.272)$

15. None

16. None

17. $(0.592, 1.408)$

18. $(-\infty, 0.592) \cup (1.408, \infty)$

19. $(b, f(b))$ and $(m, f(m))$

20. $(c, f(c))$

21. $(m, f(m))$

22. None

23. $(-\infty, b) \cup (c, m)$

24. $(b, c) \cup (m, p)$

25. $x = a$, $x = c$, $x = n$

10

Chapter 4

Linear Functions and Slope

4.1 Equations of Lines

Write the equation of each line **in point-slope form** that goes through each pair of points.

1. $(-2, 1)$, $(7, 8)$

2. $(0, 4)$, $(9, -15)$

3. $(-1, -2)$, $(-3, -13)$

4.2 Average Rate of Change

For the function $f(x) = x^2$, compute the average rate of change for each interval.

1. $[1, 1.1]$

2. $[1, 1.01]$

3. $[1, 1.001]$

4. $[1, 1.0001]$

5. For your answers in the previous four problems, what value do your average rates of change get closer and closer to?

Find the average rate of change of the function $f(x) = -6x^2 + 7x + 4$ over each specified interval.

6. $[-2, -1]$

7. $[5, 6]$

8. $[0, 1]$

9. $[5, 5.001]$

10. $[5, 5.0001]$

11. $[5, 5.00001]$

12. What value are your last 3 answers getting closer to?

For the function $f(x) = -3x^2 + 5$, determine the average rate of change of each over the given interval.

13. $[7, 7.001]$

14. $[7, 7.0001]$

15. $[7, 7.00001]$

16. For your answers in the previous three problems, what value do your average rates of change get closer and closer to?

Given $f(x) = \sqrt{x}$, find the average rate of change of each over the given interval.

17. $[1, 1.0001]$

18. $[1, 1.00001]$

19. $[1, 1.000001]$

20. For your answers in the previous three problems, what value do your average rates of change get closer and closer to?

Given $f(x) = 6\sqrt{x}$, find the average rate of change of each over the given interval.

21. $[25, 25.1]$

22. $[25, 25.01]$

23. $[25, 25.001]$

24. For your answers in the previous three problems, what value do your average rates of change get closer and closer to?

Equations of Lines

1. $y - 1 = \frac{7}{9}(x + 2)$ or $y - 8 = \frac{7}{9}(x - 7)$
2. $y - 4 = -\frac{19}{9}(x - 0)$ or $y + 15 = -\frac{19}{9}(x - 9)$
3. $y + 2 = \frac{11}{2}(x + 1)$ or $y + 13 = \frac{11}{2}(x + 3)$

Average Rate of Change

1. 2.1
2. 2.01
3. 2.001
4. 2.0001
5. 2
6. 25
7. -59
8. 1
9. -53.006
10. -53.0006
11. -53.00006
12. -53
13. -42.003
14. -42.0003
15. -42.00003
16. -42
17. -0.499988
18. -0.4999988
19. -0.49999988
20. -0.5
21. 0.5994
22. 0.59999
23. 0.6
24. 0.6

Chapter 5

Function Transformations

Write the function for $g(x)$ if it is the result of $f(x)$ after the following ordered sequence of transformations.

1. (1) Vertical stretch by 3
   (2) Shift left 1 unit
   (3) Reflect across y-axis

2. (1) Horizontal compression by 2
   (2) Shift up 1 unit

3. (1) Reflect across x-axis
   (2) Vertical compression by 4
   (3) Move right 7 units

Write the function $g(x)$ that is a result of the following ordered sequence of transformations to $f(x) = |x|$.

4. (1) Reflect across x-axis
   (2) Shift right 3 units
   (3) Horizontal stretch by factor of 5

5. (1) Shift down 2 units
   (2) Reflect across y-axis
   (3) Shift up 1 unit

6. (1) Horizontal compression by factor of 7
   (2) Vertical compression by factor of 4
   (3) Shift left 9 units

Glven $f(x) = \sqrt{x}$, determine the resulting function $g(x)$ after the following ordered sequence of transformations.

7. (1) Shift up 2 units
   (2) Horizontal stretch by 5
   (3) Shift left 3 units

8. (1) Vertical compression by factor of 3
   (2) Reflect across y-axis
   (3) Horizontal compression by 5

9. (1) Shift right 8 units
   (2) Reflect across x-axis
   (3) Horizontal compression by factor of 4

Write the final equation of $g(x)$ if it is found by taking $f(x) = \sqrt{x}$ after the following ordered sequence of transformations.

10. (1) Shift right 2 units
    (2) Horizontal stretch by factor 3
    (3) Shift down 2 units
    (4) Reflect across x-axis

11. (1) Horizontal stretch by factor 3
    (2) Shift left 1 unit
    (3) Shift up 2 units
    (4) Reflect across y-axis

12. (1) Vertical stretch by factor 5
    (2) Horizontal stretch by factor 2
    (3) Shift up 3 units
    (4) Reflect across x-axis

Find the equation for $g(x)$ if $g(x)$ is found by performing the following *ordered* sequence of transformations to $f(x) = \frac{1}{x}$.

13. (1) Shift left 3 spaces
    (2) Reflect across y-axis
    (3) Shift down 5 spaces
    (4) Vertical stretch by factor of 7

14. (1) Shift up 3 spaces
    (2) Reflect across x-axis
    (3) Shift right 5 spaces
    (4) Horizontal compression by factor of 7

1. $g(x) = 3f(-x+1)$

2. $g(x) = f(2x) + 1$

3. $g(x) = -\frac{1}{4}f(x-7)$

4. $g(x) = -\left|\frac{1}{5}x - 3\right|$

5. $g(x) = |-x| - 1$

6. $g(x) = \frac{1}{4}|7(x+9)| = \frac{1}{4}|7x+63|$

7. $g(x) = \sqrt{\frac{1}{5}(x+3)} + 2 = \sqrt{\frac{1}{5}x + \frac{3}{5}} + 2$

8. $g(x) = \frac{1}{3}\sqrt{-5x}$

9. $g(x) = -\sqrt{4x-8}$

10. $g(x) = -\left(\sqrt{\frac{1}{3}x-2} - 2\right) = -\sqrt{\frac{1}{3}x-2} + 2$

11. $g(x) = \sqrt{\frac{1}{3}(-x+1)} + 2 = \sqrt{-\frac{1}{3}x + \frac{1}{3}} + 2$

12. $g(x) = -\left(5\sqrt{\frac{1}{2}x} + 3\right) = -5\sqrt{\frac{1}{2}x} - 3$

13. $g(x) = \frac{7}{-x+3} - 35$

14. $g(x) = -\frac{1}{7x-5} - 3$

Chapter 6

Function Operations

6.1 Adding, Subtracting, Multiplying, and Dividing Functions

Given $f(x) = x + 5$, $g(x) = x^2 - 1$, and $h(x) = \sqrt{x - 10}$, simplify or evaluate each.

1. $(g - f)(x)$

2. $(fh)(14)$

3. $(f + g)(x)$

Find each of the following given the table below.

x	−4	−3	−2	−1	0	1	2	3	4
f(x)	−3	0	−1	3	1	2	4	−4	−2
g(x)	3	−1	0	1	4	−2	−4	2	−3

4. $(f + g)(-2)$ 5. $(f - g)(0)$ 6. $(fg)(1)$ 7. $\left(\frac{f}{g}\right)(3)$ 8. $(f + f)(-4)$

6.2 Operations with Functions: Domain

Given $f(x) = \sqrt{2x + 7}$ and $g(x) = 3x + 3$, find the domain of each.

1. $(f + g)(x)$

2. $\left(\frac{f}{g}\right)(x)$

3. $\left(\frac{g}{f}\right)(x)$

6.3 Difference Quotient

Write the difference quotient for each.

1. $f(x) = 2x - 7$

2. $g(x) = x^2 + 4x$

3. $h(x) = -1$

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

5. $g(x) = \sqrt{3x}$

6. $f(x) = x^2 - 2x + 5$

7. $g(x) = \frac{5}{x}$

8. $f(x) = -2x^2 + 3x - 5$

9. $g(x) = \frac{6}{2x+3}$

10. $h(x) = \sqrt{7x + 5}$

11. $f(x) = -x^2 + x$

12. $f(x) = 3x - 1$

13. $f(x) = x^3 + 5x$

Adding, Subtracting, Multiplying, and Dividing Functions

1. $x^2 - x - 6$

2. 38

3. $x^2 + x + 4$

4. -1

5. -3

6. -4

7. -2

8. -6

Operations with Functions: Domain

1. $\left[-\frac{7}{2}, \infty\right)$

2. $\left[-\frac{7}{2}, -1\right) \cup (-1, \infty)$

3. $\left(-\frac{7}{2}, \infty\right)$

Difference Quotient

1. 2

2. $2x + h + 4$

3. 0

4. $\frac{-3}{(x+2)(x+h+2)}$

5. $\frac{3}{\sqrt{3x+3h}+\sqrt{3x}}$

6. $2x + h - 2$

7. $\frac{-5}{x(x+h)}$

8. $-4x - 2h + 3$

9. $\frac{-12}{(2x+3)(2x+2h+3)}$

10. $\frac{7}{\sqrt{7x+7h+5}+\sqrt{7x+5}}$

11. $-2x - h + 1$

12. 3

13. $3x^2 + 3xh + h^2 + 5$

Chapter 7

Polynomials and Their Graphs

Determine the end behavior of each.

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

2. $g(x) = 4x^2 - 16x^6 + 3x$

3. $h(x) = 1 + x^{11} - 4x^8$

4. $f(x) = -x^4 + 3x^2 - 2x + 6$

5. $g(x) = 0.25x^5 - 0.1x^4 + 2x^2 - 6x$

1. $\displaystyle\lim_{x\to-\infty} f(x) = \infty \qquad \lim_{x\to\infty} f(x) = -\infty$

2. $\displaystyle\lim_{x\to-\infty} g(x) = -\infty, \qquad \lim_{x\to\infty} g(x) = \infty$

3. $\displaystyle\lim_{x\to-\infty} h(x) = -\infty \qquad \lim_{x\to\infty} h(x) = \infty$

4. $\displaystyle\lim_{x\to-\infty} f(x) = -\infty \qquad \lim_{x\to\infty} f(x) = -\infty$

5. $\displaystyle\lim_{x\to-\infty} g(x) = -\infty \qquad \lim_{x\to\infty} g(x) = \infty$

Chapter 8

Dividing Polynomials

8.1 Dividing Polynomials

Divide each.

1. $(28x^3 - 26x^2 + 41x - 15) \div (7x - 3)$
2. $(44y^2 + 12y^3 + 61y - 37) \div (3y + 5)$
3. $(4x^3 - 3x^2 + x + 1) \div (x + 2)$
4. $(5x^4 - x^2 + x - 2) \div (x^2 + 2)$

8.2 Remainder and Factor Theorems

Determine the remainder of each.

1. $(2x^{53} - 9x^{44} + 13x^8) \div (x - 1)$
2. $(x^{71} + 15x^{58} - 3x^{14} + 2) \div (x + 1)$

Dividing Polynomials

1. $4x^2 - 2x + 5$

2. $4y^2 + 8y + 7 - \dfrac{72}{3y + 5}$

3. $4x^2 - 11x + 23 - \dfrac{45}{x + 2}$

4. $5x^2 - 11 + \dfrac{x + 20}{x^2 + 2}$

Remainder and Factor Theorems

1. 6

2. 13

Chapter 9

Rational Functions and Their Graphs

Find the domain, coordinates of any holes, and equations of all asymptotes.

1. $f(x) = \dfrac{2x^2 + 5x - 3}{2x^2 - 15x + 7}$

2. $g(x) = \dfrac{3x^3 + 7x^2 - 20x}{x^2 - x - 12}$

3. $f(x) = \dfrac{3x}{x + 4}$

4. $g(x) = \dfrac{x^2 + 3x + 2}{x - 1}$

5. $h(x) = \dfrac{x^2 + 3x - 4}{x^3 - 2x^2 + x}$

6. $f(x) = \dfrac{2x^3 - 13x^2 + 6x + 45}{x^2 - 4x - 5}$

7. $g(x) = \dfrac{5x^2 - 19x - 4}{x^3 + 2x^2 - 24x}$

8. $h(x) = \dfrac{2x^2 - x - 3}{8x^2 + 51x + 18}$

1. Domain: $x \neq -\dfrac{1}{2}, 7$; V.A.: $x = 7$; Hole @ $\left(-\dfrac{1}{2}, -\dfrac{7}{13}\right)$; H.A.: $y = 1$

2. Domain: $x \neq -3, 4$; V.A.: $x = -3 \, x = 4$; Obl. Asymp: $y = 3x + 10$

3. Domain: $x \neq -4$; V.A.: $x = -4$; H.A.: $y = 3$

4. Domain: $x \neq 1$; V.A.: $x = 1$; Obl. Asymp: $y = x + 4$

5. Domain: $x \neq 0, 1$; V.A.: $x = 0$ and $x = 1$; H.A.: $y = 0$

6. Domain: $x \neq -1, 5$; V.A. $x = -1$; Hole @ $\left(5, \dfrac{13}{3}\right)$; Obl. Asym $y = 2x - 5$

7. Domain: $x \neq -6, 0, 4$; V.A. $x = -6$, $x = 0$; Hole @ $\left(4, \dfrac{21}{40}\right)$; H.A. $y = 0$

8. Domain: $x \neq -6, -\dfrac{3}{8}$; V.A. $x = -6$, $x = -\dfrac{3}{8}$; H.A. $y = \dfrac{1}{4}$

Chapter 10

Polynomial and Rational Inequalities

10.1 Polynomial Inequalities

Solve each. Write your answers using interval notation.

1. $6x^3 - 4x^2 - 10x \geq 0$

2. $x^4 < 9x^2$

3. $3x^3 - 7x^2 - 22x + 8 < 0$

4. $3x^2 - 4x + 1 \leq 0$

10.2 Rational Inequalities

Solve each. Write your answers using interval notation.

1. $\dfrac{3x - 4}{x + 1} < 0$

2. $\dfrac{x^2 + 3x + 2}{x - 7} \leq 0$

3. $\dfrac{x^2 - 4x + 4}{x^2 - 1} \geq 0$

4. $\dfrac{x + 2}{x - 4} \leq 1$

5. $\dfrac{x^2 - 7x - 8}{x^2 - 4x - 32} \geq 0$

Polynomial Inequalities

1. $[-1, 0] \cup \left[\dfrac{5}{3}, \infty\right)$

2. $(-3, 0) \cup (0, 3)$

3. $(-\infty, -2) \cup \left(\dfrac{1}{3}, 4\right)$

4. $\left[\dfrac{1}{3}, 1\right]$

Rational Inequalities

1. $\left(-1, \dfrac{4}{3}\right)$

2. $(-\infty, -2] \cup [-1, 7)$

3. $(-\infty, -1) \cup (1, \infty)$

4. $(-\infty, 4)$

5. $(-\infty, -4) \cup [-1, 8) \cup (8, \infty)$

Chapter 11

Function Compositions

Given $f(x) = x - 5$, $g(x) = 4 + \sqrt{2x + 1}$, and $h(x) = \dfrac{3}{x+7}$, simplify each and state the domain.

1. $(f \circ g)(x)$

2. $(g \circ f)(x)$

3. $h(h(x))$

Find each of the following given the table below.

x	−4	−3	−2	−1	0	1	2	3	4
f(x)	−3	0	−1	3	1	2	4	−4	−2
g(x)	3	−1	0	1	4	−2	−4	2	−3

4. $(f \circ g)(-1)$ 5. $(g \circ g)(0)$ 6. $(f \circ f)(2)$ 7. $(g \circ g)(-3)$ 8. $f(g(0))$

Given $f(x) = \sqrt{3x + 2}$, $g(x) = x^2 - 1$, and $h(x) = 9x - 2$, find each of the following.

9. $(g \circ f)(x)$

10. $f(g(x))$

11. $(h \circ h)(x)$

1. $-1 + \sqrt{2x+1}$ Domain: $\left[-\dfrac{1}{2}, \infty\right)$

2. $4 + \sqrt{2x-9}$ Domain: $\left[\dfrac{9}{2}, \infty\right)$

3. $\dfrac{3x+21}{7x+52}$ Domain: $\left(-\infty, -\dfrac{52}{7}\right) \cup \left(-\dfrac{52}{7}, -7\right) \cup (-7, \infty)$

4. 2

5. -3

6. -2

7. 1

8. -2

9. $3x + 1$

10. $\sqrt{3x^2 - 1}$

11. $81x - 20$

Chapter 12

Inverse Functions

Find the inverse of each. Then state the domain and range of the function and the inverse.

1. $f(x) = \sqrt{-2x + 3} + 1$

2. $g(x) = (x + 4)^2 - 1$, $x \leq -4$

3. $h(x) = \dfrac{9x}{4x - 1}$

4. $f(x) = \sqrt{x} - 3$

5. $g(x) = \dfrac{1}{1 - x}$

6. $h(x) = x^2 + 6x + 4$, $x \leq -3$

7. $f(x) = \sqrt{5x - 4}$

8. $g(x) = x^2 - 2x + 3$, $x \leq 1$

9. $h(x) = \dfrac{3}{x - 1}$

1. $f^{-1}(x) = -\dfrac{1}{2}\left((x-1)^2 - 3\right)$

	Domain	Range
$f(x)$	$(-\infty, 1.5]$	$[1, \infty)$
$f^{-1}(x)$	$[1, \infty)$	$(-\infty, 1.5]$

2. $g^{-1}(x) = -\sqrt{x+1} - 4$

	Domain	Range
$g(x)$	$(-\infty, -4]$	$[-1, \infty)$
$g^{-1}(x)$	$[-1, \infty)$	$(-\infty, -4]$

3. $h^{-1}(x) = \dfrac{-x}{9 - 4x}$

	Domain	Range
$h(x)$	$(-\infty, 1/4) \cup (1/4, \infty)$	$(\infty, 9/4) \cup (9/4, \infty)$
$h^{-1}(x)$	$(\infty, 9/4) \cup (9/4, \infty)$	$(-\infty, 1/4) \cup (1/4, \infty)$

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

	Dom	Ran
$f(x)$	$[0, \infty)$	$[-3, \infty)$
$f^{-1}(x)$	$[-3, \infty)$	$[0, \infty)$

5. $g^{-1}(x) = 1 - \dfrac{1}{x}$

	Dom	Ran
$g(x)$	$(-\infty, 1) \cup (1, \infty)$	$(-\infty, 0) \cup (0, \infty)$
$g^{-1}(x)$	$(-\infty, 0) \cup (0, \infty)$	$(-\infty, 1) \cup (1, \infty)$

6. $h^{-1}(x) = -\sqrt{x+5} - 3$

	Dom	Ran
$h(x)$	$(-\infty, -3]$	$[-5, \infty)$
$h^{-1}(x)$	$[-5, \infty)$	$(-\infty, -3]$

7. $f^{-1}(x) = \dfrac{1}{5}x^2 + \dfrac{4}{5}$

	Dom	Ran
$f(x)$	$\left[\dfrac{4}{5}, \infty\right)$	$[0, \infty)$
$f^{-1}(x)$	$[0, \infty)$	$\left[\dfrac{4}{5}, \infty\right)$

8. $g^{-1}(x) = -\sqrt{x-2} + 1$

	Dom	Ran
$g(x)$	$(-\infty, 1]$	$[2, \infty)$
$g^{-1}(x)$	$[2, \infty)$	$(-\infty, 1]$

9. $h^{-1}(x) = \dfrac{3}{x} + 1$

	Dom	Ran
$h(x)$	$(-\infty, 1) \cup (1, \infty)$	$(-\infty, 0) \cup (0, \infty)$
$h^{-1}(x)$	$(-\infty, 0) \cup (0, \infty)$	$(-\infty, 1) \cup (1, \infty)$

Chapter 13

Exponential Functions

13.1 End Behavior

Determine the end behavior of each. Write your answers using limit notation.

1. $f(x) = 3 + e^{2x}$
2. $h(x) = 5^{-x}$

Exponential Functions

1. $\displaystyle\lim_{x\to-\infty} f(x) = 3 \qquad \lim_{x\to\infty} f(x) = \infty$

2. $\displaystyle\lim_{x\to-\infty} f(x) = \infty \qquad \lim_{x\to\infty} f(x) = 0$

Chapter 14

Logarithmic Functions

Find the domain of each. Write your answers in interval notation.

1. $b(x) = \log_7 \left(x^2 - 8x + 6 \right)$

2. $a(x) = \ln \left(\dfrac{x^2 + 3x + 2}{5x + 15} \right)$

1. $(-\infty, 0.838) \cup (7.162, \infty)$

2. $(-3, -2) \cup (-1, \infty)$

Chapter 15

Properties of Logarithms

Expand or condense each completely. Simplify numerical answers.

1. $\log_b\left(\dfrac{x^2}{y^8}\right)$

2. $\ln\left(ez\right)^3$

3. $\log_5(x) + \log_5(9) - 2\log_5(w)$

Write an equivalent expression for each of the following using natural logarithms.

4. $\log_7(10)$

5. $\log_9(x)$

6. $\log_b(c)$

PROPERTIES OF LOGARITHMS KEY

1. $2\log_b(x) - 8\log_b(y)$

2. $3 + 3\ln(z)$

3. $\log_5\left(\dfrac{9x}{w^2}\right)$

4. $\dfrac{\ln(10)}{\ln(7)}$

5. $\dfrac{\ln(x)}{\ln(9)}$

6. $\dfrac{\ln(c)}{\ln(b)}$

Chapter 16

Exponential Equations

Solve each. Round to 3 decimal places when necessary.

1. $3e^{x-2} = 7$
2. $5^x + 4 > 1$
3. $2^{3x+4} = 32^{x-7}$
4. $5e^{7x} + 10 = 42$
5. $7^{4x+1} \geq 343$
6. $1000e^{0.04x} = 2000$

16.1   Applications

1. Plutonium has a half-life of 24,360 years. If 15 grams are initially present, how long until 9.5 grams remain?

1. $x \approx 2.847$

2. $(-\infty, \infty)$

3. $x = 19.5$

4. $x \approx 0.265$

5. $\left[\dfrac{1}{2}, \infty\right)$

6. $x \approx 17.329$

Applications

1. Approximately 17,952 years

Chapter 17

Logarithmic Equations

Solve each. Round to 3 decimal places when necessary.

1. $\log_5(x) + x\log_5(x) > 0$

2. $\ln\left(8 - x^2\right) = \ln(2 - x)$

3. $\log_{25}\left(\dfrac{3x + 1}{2x - 2}\right) = \dfrac{1}{2}$

LOGARITHMIC EQUATIONS KEY

1. $(1, \infty)$
2. $x = -2$
3. $x \approx 1.571$

Chapter 18

Sequences

Write the first 4 terms of each sequence.

1. $a_n = 2(-3)^n$

2. $b_n = \dfrac{n!}{2^n}$

3. $c_{n+1} = 5c_n + 1;\ c_1 = 2$

4. $d_n = \dfrac{1}{2}d_{n-1} + n;\ d_1 = 3$

1. -6, 18, -54, 162

2. $\dfrac{1}{2}$, $\dfrac{1}{2}$, $\dfrac{3}{4}$, $\dfrac{3}{2}$

3. 2, 11, 56, 281

4. 3, $\dfrac{5}{2}$, $\dfrac{17}{4}$, $\dfrac{49}{8}$

Appendix A

Factoring

Factor each of the following completely.

1. $x^2 + 2x - 15$

2. $x^2 - 8x + 12$

3. $x^2 + 15x + 56$

4. $5x^2 + 19x - 4$

5. $4x^2 - 5x - 6$

6. $9x^2 - 400$

7. $5x^2 - 7x - 6$

8. $9x^2 - 54x + 45$

9. $3x^3 + 12x^2 + 9x$

10. $9y^2 - 16$

11. $4x^2 - 28x + 49$

12. $14x^2 + 11xy - 15y^2$

13. $6x^2 - 48x - 120$

14. $9x^4 - 54x^3 + 45x^2$

15. $16y^2 - 40y + 25$

16. $30x^2 + xy - y^2$

17. $8w^2 + 33w + 4$

18. $3p^2 + 22p - 16$

19. $18x^2 - 27x + 4$

20. $14a^2 + 15a - 9$

21. $4x^2 - 4x - 24$

22. $18t^2 - 9t - 5$

23. $6a^2 + 23a + 21$

24. $25x^2 - 1$

1. $(x+5)(x-3)$

2. $(x-6)(x-2)$

3. $(x+7)(x+8)$

4. $(5x-1)(x+4)$

5. $(4x+3)(x-2)$

6. $(3x+20)(3x-20)$

7. $(5x+3)(x-2)$

8. $9(x-5)(x-1)$

9. $3x(x+3)(x+1)$

10. $(3y+4)(3y-4)$

11. $(2x-7)^2$

12. $(7x-5y)(2x+3y)$

13. $6(x-10)(x+2)$

14. $9x^2(x-1)(x-5)$

15. $(4y-5)^2$

16. $(6x-y)(5x+y)$

17. $(8w+1)(w+4)$

18. $(3p-2)(p+8)$

19. $(6x-1)(3x-4)$

20. $(7a-3)(2a+3)$

21. $4(x-3)(x+2)$

22. $(6t-5)(3t+1)$

23. $(2a+3)(3a+7)$

24. $(5x+1)(5x-1)$

Appendix B

Complex Fractions

Simplify each as much as possible.

1. $\dfrac{5 + \frac{3}{x}}{x - \frac{1}{2}}$

2. $\dfrac{\frac{1}{x} + \frac{2}{x^2}}{x + \frac{8}{x^2}}$

3. $\dfrac{3}{2 - \frac{x}{x-1}}$

4. $\dfrac{1 + \frac{3}{x}}{\frac{2}{x} + 7}$

5. $\dfrac{\frac{4}{x} - \frac{x}{x-2}}{\frac{1}{x} + \frac{3}{x-2}}$

6. $\dfrac{\frac{3}{x+1} - 4}{\frac{2}{x+1}}$

7. $\dfrac{\frac{5}{x} + \frac{3}{x-2}}{\frac{7}{x^2-2x}}$

8. $\dfrac{\frac{1}{x} - \frac{1}{7}}{x - 7}$

9. $\dfrac{\frac{1}{x} + \frac{1}{x+1}}{5}$

10. $\dfrac{\frac{5}{x} - 5x}{x - 1}$

11. $\dfrac{\frac{1}{2+x} - \frac{1}{2}}{x}$

12. $\dfrac{\frac{3}{x-4} + \frac{2x}{x+1}}{4x}$

13. $\dfrac{\frac{1}{x-a} + \frac{1}{a}}{x}$

14. $\dfrac{\frac{1}{x-1} - \frac{1}{x-3}}{\frac{2}{x-1} + \frac{3}{x+1}}$

15. $\dfrac{\frac{2}{x^2-4} + \frac{1}{x-2}}{\frac{4}{x+2}}$

COMPLEX FRACTIONS KEY

1. $\dfrac{2(5x+3)}{x(2x-1)}$

2. $\dfrac{1}{x^2-2x+4}$

3. $\dfrac{3(x-1)}{x-2}$

4. $\dfrac{x+3}{2+7x}$

5. $\dfrac{-1(x^2-4x+8)}{2(2x-1)}$

6. $\dfrac{-4x-1}{2}$

7. $\dfrac{8x-10}{7}$

8. $-\dfrac{1}{7x}$

9. $\dfrac{2x+1}{5x(x+1)}$

10. $\dfrac{-5x-5}{x}$

11. $\dfrac{-1}{2x+4}$

12. $\dfrac{(x-1)(2x-3)}{4x(x-4)(x+1)}$

13. $\dfrac{1}{a(x-a)}$

14. $\dfrac{-2x-2}{5x^2-16x+3}$

15. $\dfrac{x+4}{4x-8}$