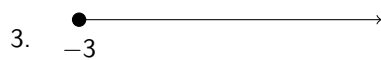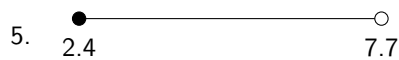# Chapter 1

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. $(9, \infty)$

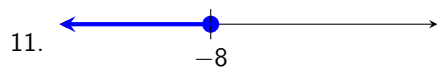Write each using interval notation and graph on a number line.

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

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

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

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

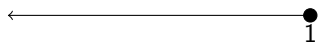You are given the graph of an interval. Write the interval and set-builder notation for it.

11.
    -8

12.
    $7 \qquad\qquad 12$

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

$\underset{-5}{\circ}\rule{2cm}{0.4pt}\underset{8}{\bullet}$

2. $(-\infty, 1]$

$\longleftarrow\rule{2cm}{0.4pt}\underset{1}{\bullet}$

3. $[-3, \infty)$ $\{x|x \ge -3\}$

4. $(-\infty, 4) \cup (4, 11) \cup (11, \infty)$

$\longleftarrow\underset{4}{\circ}\rule{1cm}{0.4pt}\underset{11}{\circ}\longrightarrow$

5. $[2.4, 7.7)$ $\{x|2.4 \le x < 7.7\}$

6. $\{x|x > 9\}$

$\underset{9}{\circ}\longrightarrow$

7. $[2, \infty)$

$\underset{2}{\bullet}\longrightarrow$

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

$\longleftarrow\underset{-8}{\circ}$

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

$\longleftarrow\underset{3}{\circ}\longrightarrow$
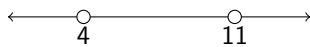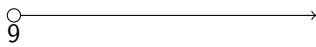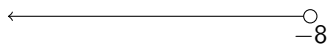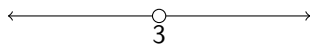
10. $(\infty, -2) \cup (-2, 5) \cup (5, \infty)$

$\longleftarrow\underset{-2}{\circ}\rule{1cm}{0.4pt}\underset{5}{\circ}\longrightarrow$
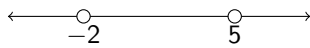
11. $(-\infty, -8]$ $\{x|x \le -8\}$

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

2.3   Piecewise Functions

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

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

1. $f(3)$

2. $f(0)$

3. $f(-2)$

4. $f(-3)$

5. $f(0.5)$

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. $(-\infty, \infty)$

Piecewise Functions

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

2. 7

3. 6.6

4. 6.4

5. 7.1

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. 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?

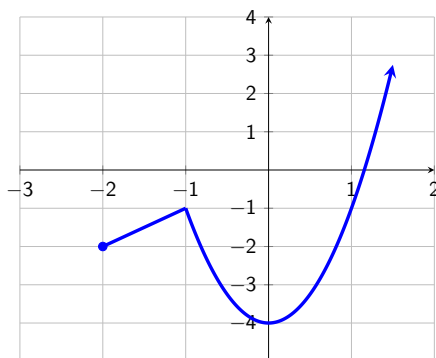## 3.2 Increasing, Decreasing, and Constant Intervals

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

3.3 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

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. About 2.16 hours

Increasing, Decreasing, and Constant Intervals

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

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

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

Chapter 4

Linear Functions and Slope

4.1   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.

5. $[-2, -1]$

6. $[5, 6]$

7. $[0, 1]$

Average Rate of Change

1. 2.1
2. 2.01
3. 2.001
4. 2.0001
5. 2
6. 25
7. -59
8. 1

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

FUNCTION TRANSFORMATIONS KEY

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

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

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