

Section 1.1

Algebraic Expressions, Real Numbers, and Interval Notation

Is Your College Going GREEN?

In 2010, U.S. colleges created 100 new majors, minors, and certificates in energy and sustainability-focused programs.



That compares to only 3 such programs that were created in 2005.



As you work the applications in this section of your textbook, you will explore this trend by using a formula that models this growth.

First Steps:

- Take comprehensive notes** from your instructor's lecture and insert your notes into this section of the *Learning Guide*. Be sure to write down all examples, definitions, and other key concepts. Additional learning resources include the *Lecture Series on DVD*, the *PowerPoints*, and Section 1.1 of your textbook which begins on page 2.
- Complete the *Concept and Vocabulary Check* on page 12 of the textbook.

Guided Practice:

- Review each of the following *Solved Problems* and complete each *Pencil Problem*.

Objective #1: Translate English phrases into algebraic expressions.

✓ *Solved Problem #1*

- 1a.** Write the English phrase as an algebraic expression.
Let x represent the number.
Five more than 8 times a number

$$\overbrace{8x}^{\text{eight times a number}} + \overbrace{5}^{\text{five more}} = 8x + 5$$

- 1b.** Write the English phrase as an algebraic expression.
Let x represent the number.
The quotient of a number and 7, decreased by twice the number

$$\overbrace{\frac{x}{7}}^{\text{the quotient of a number and seven}} - \overbrace{2x}^{\text{decreased by twice the number}} = \frac{x}{7} - 2x$$

✎ *Pencil Problem #1* ✎

- 1a.** Write the English phrase as an algebraic expression.
Let x represent the number.
The difference of six and half of a number

- 1b.** Write the English phrase as an algebraic expression.
Let x represent the number.
The quotient of three and the difference of five and a number

Objective #2: Evaluate algebraic expressions. **Solved Problem #2****2a.** Evaluate $23 - 0.12x$ for $x = 10$.

$$\begin{aligned} & \text{replace } x \text{ with } 10 \\ & \overbrace{23 - 0.12x} \\ & = 23 - 0.12(10) \\ & = 23 - 1.2 \\ & = 21.8 \end{aligned}$$

2b. Evaluate $8 + 6(x - 3)^2$ for $x = 13$.

$$\begin{aligned} & \text{replace } x \text{ with } 13 \\ & \overbrace{8 + 6(x - 3)^2} \\ & = 8 + 6(13 - 3)^2 \\ & = 8 + 6(10)^2 \\ & = 8 + 6(100) \\ & = 8 + 600 \\ & = 608 \end{aligned}$$

 **Pencil Problem #2** **2a.** Evaluate $7 + 5x$ for $x = 10$.**2b.** Evaluate $4 + 5(x - 7)^3$ for $x = 9$.**Objective #3:** Use mathematical models. **Solved Problem #3**

3. The formula $S = 2.7x^2 + 5.6x + 8$ models the number of smartphone users in the United States, S , in millions, x years after 2007. Use the formula to find the number of U.S. smartphone users in 2010.

Since 2010 is 3 years after 2007, replace x with 3.

$$\begin{aligned} S &= 2.7x^2 + 5.6x + 8 \\ S &= 2.7(3)^2 + 5.6(3) + 8 \\ &= 2.7(9) + 5.6(3) + 8 \\ &= 24.3 + 16.8 + 8 \\ &= 49.1 \end{aligned}$$

There were 49.1 million U.S. smartphone users in 2010.

 **Pencil Problem #3** 

3. The formula $C = \frac{5}{9}(F - 32)$ expresses the relationship between Fahrenheit temperature, F , and Celsius temperature, C . Use the formula to convert 50°F to its equivalent temperature on the Celsius scale.

Objective #4: Recognize the sets that make up the real numbers.

 **Solved Problem #4**

4. True or false: The set of whole numbers includes 0 and the natural numbers.

True, the set of whole numbers is $\{0, 1, 2, 3, 4, 5, \dots\}$.

 **Pencil Problem #4** 

4. True or false:
The set of natural numbers includes -2 .

Objective #5: Use set-builder notation.

 **Solved Problem #5**

5. Use the roster method to list the elements in the set.
 $\{x \mid x \text{ is a natural number less than } 6\}$

$\{1, 2, 3, 4, 5\}$

 **Pencil Problem #5** 

5. Use the roster method to list the elements in the set.
 $\{x \mid x \text{ is an integer between } -8 \text{ and } -3\}$

Objective #6: Use the symbols \in and \notin .

 **Solved Problem #6**

- 6a. True or false: $13 \in \{x \mid x \text{ is an integer}\}$

The number 13 is an element of the set of integers.
Thus, the statement is true.

 **Pencil Problem #6** 

- 6a. True or false: $7 \in \{x \mid x \text{ is a irrational number}\}$

- 6b. True or false: $6 \notin \{7, 8, 9, 10\}$

The number 6 is not an element of $\{7, 8, 9, 10\}$.
Thus, the statement is true.

- 6b. True or false: $\sqrt{2} \notin \{x \mid x \text{ is a rational number}\}$

Objective #7: Use inequality symbols.

 **Solved Problem #7**

- 7a. True or false: $-8 < -2$

-8 is less than -2 .
Thus, the statement is true.

 **Pencil Problem #7** 

- 7a. True or false: $5 > -7$

7b. True or false: $5 \geq 5$

5 is greater than or equal to 5.
Thus, the statement is true.

7b. True or false: $-2 \leq -6$

Objective #8: Use interval notation.

 **Solved Problem #8**

8a. Express $[-2, 5)$ in set-builder notation and graph.

$$\{x | -2 \leq x < 5\}$$

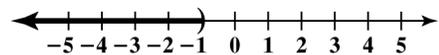


 **Pencil Problem #8** 

8a. Express $(1, 6]$ in set-builder notation and graph.

8b. Express $(-\infty, -1)$ in set-builder notation and graph.

$$\{x | x < -1\}$$



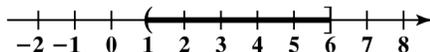
8b. Express $[-3, \infty)$ in set-builder notation and graph.

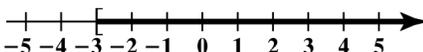
Answers for Pencil Problems (Textbook Exercise references in parentheses):

1a. $6 - \frac{1}{2}x$ (1.1 #9) 1b. $\frac{3}{5-x}$ (1.1 #13) 2a. 57 (1.1 #15) 2b. 44 (1.1 #23)

3. 10°C (1.1 #95) 4. false (1.1 #27-33) 5. $\{-7, -6, -5, -4\}$ (1.1 #29)

6a. false (1.1 #39) 6b. true (1.1 #45) 7a. true (1.1 #51) 7b. false (1.1 #57)

8a. $\{x | 1 < x \leq 6\}$;  (1.1 #65)

8b. $\{x | x \geq -3\}$;  (1.1 #73)

Homework:

- Review the Section 1.1 summary on page 93 of the textbook.
- Insert your homework into this section of the *Learning Guide*. Show all work neatly and check your answers. Strive to work through difficulties when possible, making note of any exercises where you need additional help. Remember, even if your instructor assigns homework through *MyMathLab*, you should still write out your work.