

## Mini-Lecture 1.4

### Introduction to Variable Expressions and Equations

#### Learning Objectives

1. Define and use exponents and the order of operations.
2. Evaluate algebraic expressions, given replacement values for variables.
3. Determine whether a number is a solution of a given equation.
4. Translate phrases into expressions and sentences into equations.

#### Examples:

1. Evaluate.

a)  $2^3$                       b)  $1^7$                       c)  $\left(\frac{6}{7}\right)^2$                       d)  $(0.3)^3$

Using order of operation, simplify each expression.

e)  $7 + 3 \cdot 2$                       f)  $25 - 3^2 \cdot 2$                       g)  $6[-5 + 6(-3 + 8)]$                       h)  $\frac{20(-1) - (-4)(-3)}{2[-12 \div (-3 - 3)]}$

2. Evaluate each expression when  $x = 3$ ,  $y = 2$ , and  $z = 6$ .

a)  $x + y + z$                       b)  $3x - z$                       c)  $|5x - 2z|$                       d)  $\frac{5z}{x} - \frac{3y^2}{z}$

3. Determine whether the given number is a solution of the given equation.

a)  $x - 12 = 15$ ; 27                      b)  $12 + y = 29$ ; 7                      c)  $\frac{3}{4}x = \frac{15}{20}$ ; 5                      d)  $y = 3y + 2$ ; 0

4. Write each phrase as an algebraic expression.

a) The sum of a number and thirteen                      b) The quotient of forty-two and a number

Write each sentence as an equation.

c) The product of one-third and a number is nine                      d) A number added to twelve is fourteen.

#### Teaching Notes:

- Be sure to identify base and exponent when working with exponential notation.
- Most students find order of operations challenging.
- Many students will confuse expression and equation. Be sure students understand that you simplify an expression, but solve an equation.
- Many students have problems with translating sentences into equations.
- Each section in the text has 3 worksheets in the Extra Practice featuring differentiated learning.

Answers: 1a) 8; 1b) 1; 1c) 36/49; 1d) 0.027; 1e) 13; 1f) 7; 1g) 150; 1h) -8; 2a) 11; 2b) 3; 2c) 3; 2d) 8; 3a) true; 3b) false; 3c) false; 3d) false; 4a)  $x + 13$ ; 4b)  $42/x$ ; 4c)  $1/3 x = 9$ ; 4d)  $12 + x = 14$

## Mini-Lecture 1.5

### Adding Real Numbers

#### Learning Objectives:

1. Add real numbers with the same sign.
2. Add real numbers with unlike signs.
3. Solve problems that involve addition of real numbers.
4. Find the opposite of a number.

#### Examples:

1. Add the following real numbers with the same sign.

a)  $8 + 11$                       b)  $(-3) + (-15)$                       c)  $(-14) + (-35)$                       d)  $\left(-\frac{3}{5}\right) + \left(-\frac{1}{2}\right)$

2. Add the following real numbers with different signs.

a)  $(-9) + 5$                       b)  $16 + (-25)$                       c)  $(-15.3) + 27.03$                       d)  $\left(\frac{1}{2}\right) + \left(-\frac{5}{8}\right)$

Mixed exercise of addition of signed numbers.

e)  $-7 + (-23)$                       f)  $-42 + 38$                       g)  $53 + (-22)$                       h)  $\left(-\frac{5}{12}\right) + \left(\frac{3}{8}\right)$

3. Solve each of the following.

a) At the beginning of a chemistry experiment, Amy measured the temperature of a liquid to be  $-5^{\circ}\text{C}$ . During the experiment, the temperature rose  $14^{\circ}\text{C}$ . What was the liquid's temperature at the end of the experiment?

b) A local restaurant reported net incomes of  $-\$1,397$ ,  $-\$2,042$ , and  $-\$809$  for the past three months. What was its total net income for the three months?

4. Find the additive inverse or opposite.

a) 8                      b) -9                      c) 0                      d)  $|-17|$

#### Teaching Notes:

- Some students will need to see addition performed on a number line.
- Some students will need instruction with inputting negative numbers into a calculator.
- Review the definition of absolute value.
- Each section in the text has 3 worksheets in the Extra Practice featuring differentiated learning.

*Answers:* 1a) 19; 1b) -18; 1c) -49; 1d) -11/10; 2a) -4; 2b) -9; 2c) 11.73; 2d) -1/8; 2e) -30; 2f) -4; 2g) 31; 2h) -1/24; 3a)  $9^{\circ}\text{C}$ ; 3b)  $-\$4,248$ ; 4a) -8; 4b) 9; 4c) 0; 4d) -17

# Mini-Lecture 1.6

## Subtracting Real Numbers

### Learning Objectives:

1. Subtract real numbers.
2. Add and subtract real numbers.
3. Evaluate algebraic expressions using real numbers
4. Solve problems that involve subtraction of real numbers.

### Examples:

1. Subtract.

a)  $-8 - 4$

b)  $11 - 18$

c)  $-15 - (-10)$

d)  $-12 - 12$

e)  $22 - (-13)$

f)  $-132 - (-207)$

g)  $1.3 - (3.8)$

h)  $\frac{15}{7} - \left(-\frac{9}{14}\right)$

2. Simplify each expression.

a)  $-3 - (-4) - 5 + (-2)$

b)  $7 - 10 - 8 + (-7)$

c)  $-2 + |-3 - 5| - 3^2$

3. Evaluate each expression when  $x = -3$ ,  $y = -7$ , and  $z = 9$

a)  $x - y$

b)  $\frac{10 - x}{y - 2}$

c)  $|x| + |y| - |z|$

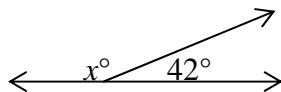
d)  $x^2 - y$

4. Solve:

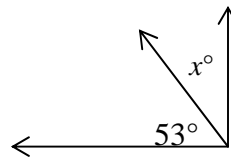
- a) In a game of cards, Alicia won 11 chips, lost 6 chips, won 3 chips, lost 14 chips, and won 1 chip. What was her final count of chips?

Find the complementary or supplementary angle.

b)



c)



### Teaching Notes:

- Remind students to always change subtraction to addition and “add the opposite”.
- Some students forget to change the sign of the second value after changing to addition.
- Encourage students to take the time to write the steps:  $3 - (-2) = 3 + (+2) = 5$
- Each section in the text has 3 worksheets in the Extra Practice featuring differentiated learning.

*Answers:* 1a) -12; 1b) -7; 1c) -5; 1d) -24; 1e) 35; 1f) 75; 1g) -2.5; 1h) 39/14; 2a) -6, 2b) -18, 2c) -3; 3a) 4; 3b) -13/9; 3c) 1; 3d) 16; 4a) -5; 4b) 138°; 4c) 37°

# Mini-Lecture 1.7

## Multiplying and Dividing Real Numbers

### Learning Objectives

1. Multiply and divide real numbers.
2. Evaluate algebraic expressions using real numbers.

### Examples

1. Multiply the real numbers.

a)  $-6(5)$                       b)  $(-11)(-3)$                       c)  $-\frac{3}{5}\left(\frac{10}{21}\right)$                       d)  $2(-5)(-1)(-3)$

Find the reciprocal of the real number.

e)  $\frac{3}{7}$                       f)  $5$                       g)  $-\frac{5}{21}$                       h)  $0.3$

Divide the real numbers.

i)  $\frac{27}{-3}$                       j)  $-90 \div (-5)$                       k)  $-\frac{1}{2} \div \left(-\frac{8}{15}\right)$                       l)  $\frac{-22}{0}$

2. Evaluate each expression.

a)  $2x - y^2$ , when  $x = 4, y = -3$                       b)  $\frac{-2-x}{y-5}$ , when  $x = -4, y = 6$

c)  $\frac{-6x-4y}{-2z+3-(-10)}$  when  $x = 5, y = -1, z = 0$                       d)  $-8^2$

e)  $(-7)^2$                       f)  $-1^8$                       g)  $(-1)^{87}$

### Teaching Notes:

- Most students find multiplying and dividing real numbers relatively easy.
- Many students confuse  $\frac{0}{5} = 0$  and  $\frac{5}{0} = \text{undefined}$ .
- Many students have difficulty with the fact that  $-5^2 \neq (-5)^2$
- Each section in the text has 3 worksheets in the Extra Practice featuring differentiated learning.

Answers: 1a) -30; 1b) 33; 1c) -2/7; 1d) -30; 1e) 7/3; 1f) 1/5; 1g) -21/5; 1h) 10/3; 1i) -9; 1j) 18;  
1k) 15/16; 1l) undefined; 2a) -1, 2b) 2, 2c) -2, 2d) -64, 2e) 49, 2f) -1, 2g) -1

# Mini-Lecture 1.8

## Properties of Real Numbers

### Learning Objectives:

1. Use the commutative and associative properties.
2. Use the distributive property.
3. Use the identity and inverse properties.

### Examples:

1. Use the commutative property of addition or multiplication to complete each statement.

a)  $3 + y = \underline{\hspace{2cm}}$     b)  $a + (-9) = \underline{\hspace{2cm}}$     c)  $-10 \cdot x = \underline{\hspace{2cm}}$     d)  $s \cdot t = \underline{\hspace{2cm}}$

Use the associative property of addition or multiplication to complete each statement.

e)  $(3 + x) + y = \underline{\hspace{2cm}}$     f)  $-2 \cdot (5x) = \underline{\hspace{2cm}}$

Use the commutative and associative properties to simplify each expression.

g)  $12 + (4 + x)$     h)  $-7(5x)$     i)  $\left(-\frac{1}{3} + x\right) + \frac{5}{12}$     j)  $0.13(-1.2y)$

2. Use the distributive property to write each expression without parentheses. Then simplify the result, if possible.

a)  $8(x + y)$     b)  $-3(7x - 9)$     c)  $-2(-6y - 10)$     d)  $6(4x - 3y - 9)$

Use the distributive property to write each sum as a product.

e)  $6 \cdot x + 6 \cdot y$     f)  $13 \cdot x + 13 \cdot 4$     g)  $(-2)x + (-2)y$     h)  $\frac{1}{3}a + \frac{1}{3} \cdot 6$

3. Name the property that is illustrated by each true statement.

a)  $0 + 11 = 11$     b)  $3 \cdot \frac{1}{3} = 1$     c)  $5 + (-5) = 0$     d)  $12 \cdot 1 = 12$

### Teaching Notes:

- Many students use the Properties of Real Numbers without realizing that they are using these properties.
- Some students, when using the distributive property, forget to multiply the second term.
- Each section in the text has 3 worksheets in the Extra Practice featuring differentiated learning.

*Answers:* 1a)  $y+3$ ; 1b)  $-9+a$ ; 1c)  $x-10$ ; 1d)  $t \cdot s$ ; 1e)  $3 + (x + y)$ ; 1f)  $(-2 \cdot 5)x$ ; 1g)  $16 + x$ ; 1h)  $-35x$ ;  
1i)  $1/12 + x$ ; 1j)  $-0.156y$ ; 2a)  $8x + 8y$ ; 2b)  $-21x + 27$ ; 2c)  $12y + 20$ ; 2d)  $24x - 18y - 54$ ; 2e)  $6(x + y)$ ;  
2f)  $13(x + 4)$ ; 2g)  $-2(x + y)$ ; 2h)  $1/3(a + 6)$ ; 3a) addition property of zero; 3b) inverse property of multiplication; 3c) inverse property of addition; 3d) multiplication property of one