

## CHAPTER 1 Linear Equations and Inequalities

### SECTION 1.1 Linear Equations

- $5 + x = x + 5$  illustrates the Commutative Property of Addition.
- $10 \cdot \frac{1}{10} = 1$  illustrates the Multiplicative Inverse Property.
- $6(x - 2) = 6x - 6 \cdot 2$  illustrates the Distributive Property.
- $3 + (4 + x) = (3 + 4) + x$  illustrates the Associative Property of Addition.
- $4 - |-3| = 4 - 3 = 1$
- $-10 - (4 - 18) = -10 - (-14)$   
 $= -10 + 14$   
 $= 4$
- $\frac{3 - (5 - 20)}{4} = \frac{3 - (-15)}{4} = \frac{3 + 15}{4} = \frac{18}{4} = \frac{9}{2}$
- $\frac{|3 - 18|}{3} = \frac{|-15|}{3} = \frac{15}{3} = 5$
- $6\left(\frac{2}{15}\right) = \frac{3 \cdot 2 \cdot 2}{5 \cdot 3} = \frac{4}{5}$
- $\frac{7}{12} \div \frac{5}{16} = \frac{7}{12} \cdot \frac{16}{5}$   
 $= \frac{7 \cdot 4 \cdot 4}{4 \cdot 3 \cdot 5}$   
 $= \frac{28}{15}$
- Money saved =  $\$75(20)(12) = \$18,000$
- Length of each piece =  $\frac{135 \text{ feet}}{15} = 9 \text{ feet}$

### SECTION 1.2 Linear Equations and Problem Solving

- An algebraic expression is a collection of letters (called variables) and real numbers (called constants) combined, using the operations of addition, subtraction, multiplication, and division.
- The terms of an algebraic expression are those parts separated by addition or subtraction.
- $a^m \cdot a^n = a^{m+n}$
- $(ab)^m = a^m b^m$
- $-360 + 120 = -240$
- $5(57 - 33) = 5(24) = 120$
- $-\frac{4}{15} \cdot \frac{15}{16} = -\frac{4 \cdot 5 \cdot 3}{5 \cdot 3 \cdot 4 \cdot 4}$   
 $= -\frac{1}{4}$
- $\frac{3}{8} \div \frac{5}{16} = \frac{3}{8} \cdot \frac{16}{5}$   
 $= \frac{3 \cdot 8 \cdot 2}{8 \cdot 5}$   
 $= \frac{6}{5}$
- $(12 - 15)^3 = (-3)^3 = -27$
- $\left(\frac{5}{8}\right)^2 = \left(\frac{5}{8}\right)\left(\frac{5}{8}\right) = \frac{25}{64}$

$$\begin{aligned}
 11. \text{ Perimeter} &= x + x + (x + 3) + (3x - 2) \\
 &= (x + x + x + 3x) + (3 - 2) \\
 &= 6x + 1
 \end{aligned}$$

$$\begin{aligned}
 12. \text{ Perimeter} &= (4x + 1) + (2x) + (3x - 1) + x + (x + 2) + (3x) \\
 &= (4x + 2x + 3x + x + x + 3x) + (1 - 1 + 2) \\
 &= 14x + 2
 \end{aligned}$$

### SECTION 1.3 Business and Scientific Problems

1. The sign of  $(-7) + (-3)$  is negative. The rule used is to add two real numbers with like signs, add their absolute values and attach the common sign to the result.

2. The sign of the sum of  $-7 + 3$  is negative. The rule used is to add two real numbers with unlike signs, subtract the smaller absolute value from the greater absolute value and attach the sign of the number with the greater absolute value.

3. The sign of  $(-6)(-2)$  is positive. The rule used is to multiply two real numbers with like signs, find the product of their absolute values.

4. The sign of the product  $6(-2)$  is negative. The rule used is to multiply two real numbers with unlike signs, find the product of their absolute values. The product is negative.

$$5. \quad 2x - 5 = x + 9$$

$$2x - x - 5 = x - x + 9$$

$$x - 5 = 9$$

$$x - 5 + 5 = 9 + 5$$

$$x = 14$$

$$6. \quad 6x + 8 = 8 - 2x$$

$$6x + 2x + 8 = 8 - 2x + 2x$$

$$8x + 8 = 8$$

$$8x + 8 - 8 = 8 - 8$$

$$8x = 0$$

$$\frac{8x}{8} = \frac{0}{8}$$

$$x = 0$$

$$7. \quad 2x + \frac{3}{2} = \frac{3}{2}$$

$$2x + \frac{3}{2} - \frac{3}{2} = \frac{3}{2} - \frac{3}{2}$$

$$2x = 0$$

$$x = 0$$

$$8. \quad -\frac{x}{10} = 1000$$

$$(-10) \cdot -\frac{x}{10} = 1000(-10)$$

$$x = -10,000$$

$$9. \quad -0.35x = 70$$

$$\frac{-0.35x}{-0.35} = \frac{70}{-0.35}$$

$$x = -200$$

$$10. \quad 0.60x = 24$$

$$\frac{0.60x}{0.60} = \frac{24}{0.60}$$

$$x = 40$$

11. Verbal Model:  $\boxed{\text{Length of race}} = \boxed{\text{Length of first part}} + \boxed{\text{Length of last part}}$

Labels: Length of race = 2.5

Length of first part = 1.8

Length of last part =  $x$

Equation:  $2.5 = 1.8 + x$

$$2.5 - 1.8 = x$$

$$0.7 \text{ mile} = x$$

12. *Verbal Model:*

Total soybeans
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 = 

Soybeans in January
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 + 

Soybeans in February
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 + 

Soybeans in March
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*Equation:*  $x = 34\frac{1}{3} + 18\frac{1}{5} + 25\frac{5}{6}$   
 $x = 34\frac{10}{30} + 18\frac{6}{30} + 25\frac{25}{30}$   
 $x = (34 + 18 + 25) + (\frac{10}{30} + \frac{6}{30} + \frac{25}{30})$   
 $x = 77\frac{41}{30} = 78\frac{11}{30}$  tons

## SECTION 1.4 Linear Inequalities

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|--|--|--|
| <p>1. <math>3yx = 3xy</math> illustrates the Commutative Property of Multiplication.</p>                         | <p>2. <math>3xy - 3xy = 0</math> illustrates the Additive Inverse Property.</p>  | <p>3. <math>6(x - 2) = 6x - 6 \cdot 2</math> illustrates the Distributive Property.</p>  |
| <p>4. <math>3x + 0 = 3x</math> illustrates the Additive Identity Property.</p>                                   | <p>5. <math>x^2 - y^2, x = 4, y = 3</math><br/> <math>4^2 - 3^2 = 16 - 9 = 7</math></p>  | <p>6. <math>4s + st, s = 3, t = -4</math><br/> <math>4(3) + 3(-4) = 12 + -12 = 0</math></p>  |
| <p>7. <math>\frac{x}{x^2 + y^2}, x = 0, y = 3</math><br/> <math>\frac{0}{0^2 + 3^2} = \frac{0}{9} = 0</math></p> | <p>8. <math>\frac{z^2 + 2}{x^2 - 1}, x = 2, z = -1</math><br/> <math>\frac{(-1)^2 + 2}{2^2 - 1} = \frac{1 + 2}{4 - 1} = \frac{3}{3} = 1</math></p> | <p>9. <math>\frac{a}{1 - r}, a = 2, r = \frac{1}{2}</math><br/> <math>\frac{2}{1 - \frac{1}{2}} = \frac{2}{\frac{1}{2}} = 4</math></p> |
| <p>10. <math>2l + 2w, l = 3, w = 1.5</math><br/> <math>2(3) + 2(1.5) = 6 + 3 = 9</math></p>                      | <p>11. <math>A = \frac{1}{2}(b_1 + b_2)h</math><br/> <math>A = \frac{1}{2}(7 + 4)3.6</math><br/> <math>A = 19.8</math> square meters</p>           | <p>12. <math>A = \frac{1}{2}(b_1 + b_2)h</math><br/> <math>A = \frac{1}{2}(16 + 10)8</math><br/> <math>A = 104</math> square feet</p>  |

## SECTION 1.5 Absolute Value Equations and Inequalities

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|---|--|
| <p>1. If <math>n</math> is an integer, <math>2n</math> is an even integer and <math>2n + 1</math> is an odd integer.</p>  | <p>2. <math>-2x^4</math> and <math>(-2x)^4</math> are not equal. By order of operations <math>-2x^4 = -2x^4</math> and <math>(-2x)^4 = 16x^4</math>.</p>                                 |
| <p>3. <math>\frac{35}{14} = \frac{7 \cdot 5}{7 \cdot 2} = \frac{5}{2}</math><br/>                 Divide the numerator and denominator by 7 to put the fraction in simplified form.</p> | <p>4. <math>\frac{4}{5} \div \frac{z}{3} = \frac{4}{5} \cdot \frac{3}{z} = \frac{12}{5z}</math><br/>                 To divide fractions, multiply by the reciprocal of the divisor.</p> |
| <p>5. <math>-3.2 &lt; 2</math> because <math>-3.2</math> is to the left of 2 on the number line.</p>  | <p>6. <math>-3.2 &gt; -4.1</math> because <math>-3.2</math> is to the right of <math>-4.1</math> on the number line.</p>   |
| <p>7. <math>-\frac{3}{4} &gt; -5</math> because <math>-\frac{3}{4}</math> is to the right of <math>-5</math> on the number line.</p>  | <p>8. <math>-\frac{1}{5} &gt; -\frac{1}{3}</math> because <math>-\frac{1}{5}(-\frac{3}{15})</math> is to the right of <math>-\frac{1}{3}(-\frac{5}{15})</math> on the number line.</p>   |
| <p>9. <math>\pi &gt; -3</math> because <math>\pi</math> is to the right of <math>-3</math> on the number line.</p>  | <p>10. <math>6 &lt; \frac{13}{2}</math> because 6 is to the left of <math>\frac{13}{2}(\frac{6}{2})</math> on the number line.</p>   |

11. Verbal Model:  $\boxed{\text{Difference}} = \boxed{\text{Actual expense}} - \boxed{\text{Budgeted amount}}$

Equation:  $x = 163,356 - 162,700$   
 $x = \$656$  which is more than \$500.

12. Verbal Model:  $\boxed{\text{Difference}} = \boxed{\text{Actual expense}} - \boxed{\text{Budgeted amount}}$

Equation:  $x = |42,335 - 42,640|$   
 $x = |-305| = \$305$  which is less than \$500.

## CHAPTER 2 Graphs and Functions

### SECTION 2.1 The Rectangular Coordinate System

- $3x = 7$  is a linear equation because it can be written in the form  $ax + b = 0$ . Since  $x^2 + 3x = 2$  cannot be written in the form  $ax + b = 0$ , it is not a linear equation.
- To check  $x = 3$  is a solution of the equation  $5x - 4 = 11$  substitute 3 for  $x$  in the equation. If the result is true,  $x = 3$  is a solution.
- $6x(2x^2) = (6 \cdot 2) \cdot (x \cdot x^2) = 12x^3$
- $3t^2 \cdot t^4 = 3t^{2+4} = 3t^6$
- $-(-3x^2)^3(2x^4) = (-1)(-3)^3(2)(x^2)^3(x^4)$   
 $= (-1)(-27)(2)(x^6)(x^4)$   
 $= 54x^{10}$
- $(4x^3y^2)(-2xy^3) = (4)(-2)(x^3)(x)(y^2)(y^3)$   
 $= -8x^4y^5$
- $4 - 3(2x + 1) = 4 - 6x - 3 = 1 - 6x$
- $5(x + 2) - 4(2x - 3) = 5x + 10 - 8x + 12$   
 $= -3x + 22$
- $24\left(\frac{y}{3} + \frac{y}{6}\right) = 8y + 4y = 12y$
- $0.12x + 0.05(2000 - 2x) = 0.12x + 100 - 0.1x$   
 $= 0.02x + 100$

11. Your rate =  $\frac{1}{4}$  job per hour  
 Friend's rate =  $\frac{1}{5}$  job per hour

Verbal model:  $\boxed{\text{Work done}} = \boxed{\text{Work done by you}} + \boxed{\text{Work done by friend}}$

Labels: Work done = 1  
 Your rate =  $\frac{1}{4}$   
 Friend's rate =  $\frac{1}{5}$   
 Time =  $t$

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