LESSON 7 Applications of Linear Equations and Inequalities

☐ **REFRESH YOUR SKILLS**

(Algebra 1) Multiply both sides by a power of 10 to clear the decimals, then solve.

1. $x + 0.15x = 1.38$

2. $0.10x + 0.05(x + 3) = 0.90$

☐ **SOLVING WORD PROBLEMS INVOLVING LINEAR EQUATIONS**

Word problems involving linear equations can be solved using the same strategy: 1) define a variable, 2) set up an equation to model the given situation, 3) solve the equation as usual, and then 4) answer what's being asked. Let's look at some common types of word problems.

➔ **EXAMPLE** The sum of three consecutive even integers is 12. Find the integers.

1. Let x = first even integer
   x + 2 = second even integer
   x + 4 = third even integer
2. The sum is 12, so $x + (x + 2) + (x + 4) = 12$.
3. Solve for x, and you get $x = 2$.
4. The numbers are 2, 4, and 6.

➔ **TRY IT 3.** The sum of two consecutive even integers is 26. Find the two integers.

➔ **EXAMPLE** The price of an apple rose by 15% to \$1.38/lb. What was the original price?

1. Let x = original price
   $0.15x$ = price increase
2. New price = original price + price increase, so $x + 0.15x = 1.38$.
3. Solve for x, and you get $x = 1.2$.
4. The original price was \$1.20/lb.

➔ **TRY IT 4.** Cammy bought a jacket at \$43.50. The price was 25% off the regular price. What was the regular price?

➔ **EXAMPLE** Olivia has \$0.90 in dimes and nickels. She has three more nickels than dimes. How many dimes does she have?

1. Let x = number of dimes
   x + 3 = number of nickels
   $0.10x$ = value of dimes
   $0.05(x + 3)$ = value of nickels
2. Total value = 0.90,
   so $0.10x + 0.05(x + 3) = 0.90$.
3. Solve for x, and you get $x = 5$.
4. Olivia has 5 dimes.

➔ **TRY IT 5.** Emma has \$0.95 in dimes and nickels. She has five more dimes than nickels. How many nickels does she have?

➔ **EXAMPLE** Dale is six years older than Kate. Three years ago, Dale was twice as old as Kate. How old are they now?

1. Let x = Kate's age now
   x + 6 = Dale's age now
   x − 3 = Kate's age 3 years ago
   $(x + 6) - 3$ = Dale's age 3 years ago
2. Dale's age 3 years ago = twice Kate's age 3 years ago, so $(x + 6) - 3 = 2(x - 3)$.
3. Solve for x, and you get $x = 9$.
4. Kate is 9 years old. Dale is 15 years old.

➔ **TRY IT 6.** Jamie is five years older than Nicole. Two years ago, Jamie was twice as old as Nicole. How old are they now?

☐ SOLVING WORD PROBLEMS INVOLVING LINEAR INEQUALITIES

Key phrases such as *at least* (≥) and *at most* (≤) indicate inequalities.

➔ **EXAMPLE** The length of a rectangle is twice its width. Find the possible widths if the perimeter must be at most 18 feet.

1. Let x = width of the rectangle
   $2x$ = length of the rectangle
2. Perimeter = 2(length + width) ≤ 18
   so $2(x + 2x) \le 18$.
3. Solve for x, and you get $x \le 3$.
4. The width must be at most 3 feet.

➔ **TRY IT 7.** The length of a rectangle is three times its width. Find the possible widths if the perimeter must be at most 40 feet.

➔ **EXAMPLE** Carol scored 90 and 85 on her first two tests. What must she score on her third test to average at least 88?

1. Let x = score of the third test
2. Average = (sum of three scores)/3 ≥ 88,
   so $(90 + 85 + x)/3 \ge 88$.
3. Solve for x, and you get $x \ge 89$.
4. Carol must score at least 89.

➔ **TRY IT 8.** Jacob scored 9, 8, and 10 points on his first three quizzes. What must he score on his fourth quiz to average at least 9?

☐ EXERCISE YOUR SKILLS

For each problem, 1) define a variable, 2) set up an equation, 3) solve the equation, and 4) answer what's being asked.

9. One integer is 5 less than twice another. Their sum is 25. Find the two integers.

10. The sum of three consecutive integers is 27. Find the integers.

11. The sum of three consecutive odd integers is 27. Find the integers.

12. The price of a monitor rose by 10% to $132. What was the previous price?

13. Ellen bought a shirt at $25.20. It was 40% off the regular price. What was the regular price?

14. Mia's father is 42 years old. Six years ago, he was six times as old as Mia. How old is Mia?

15. Max has one-, five-, and ten-dollar bills totaling $82. He has twice as many fives as ones and three times as many tens as ones. How many bills of each type does he have?

16. Two sides of a triangle are equal in length and twice the length of the shortest side. The perimeter is 45 inches. Find all three side lengths of the triangle.

17. The length of a rectangle is 5 cm. Find the possible widths if the area must be at least 15 cm and at most 25 cm.

18. Lucas scored 96, 85, and 88 on three algebra tests. To get an A, the average score for four tests must be at least 90. What must he score on his next test to get an A?