Lesson 1.2.1: Creating Linear Equations in One Variable
Warm-Up 1.2.1

Read the scenario and answer the questions that follow.

Andrew is practicing for a tennis tournament and needs more tennis balls. He bought 10 cans of tennis balls online and received a 25% discount. The shipping cost was $5.99. Let x represent the cost of each can.

1. Write an algebraic expression to represent the cost of the tennis balls.

2. Write an algebraic expression to represent the cost of the tennis balls with the discount.

3. Write an algebraic expression to represent the total cost of the tennis balls with the shipping cost and the discount. Simplify the expression.

- A **linear equation** is an equation that can be written in the form $ax + b = c$, where a, b, and c are rational numbers. Often, the most difficult task in turning a context into an equation is determining what the variable is and how to represent that variable.

- The variables are letters used to represent a value or unknown quantity that can change or vary. Once the equation is determined, solving for the variable is straightforward.

- The **solution** will be the value that makes the equation true.

- In some cases, the solution will need to be converted into different units. Multiplying by a unit rate or a ratio can do this.

- A **unit rate** is a rate per one given unit, and a **rate** is a ratio that compares different kinds of units.

Creating Equations from Context

1. Read the problem statement first.

2. Reread the scenario and make a list or a table of the known quantities.

3. Read the statement again, identifying the unknown quantity or variable.

4. Create expressions and inequalities from the known quantities and variable(s).

5. Solve the problem.

6. Interpret the solution of the equation in terms of the context of the problem and convert units when appropriate, multiplying by a unit rate.

Example 1

James earns $15 per hour as a teller at a bank. In one week he pays 17% of his earnings in state and federal taxes. His take-home pay for the week is $460.65. How many hours did James work?

Example 2

Brianna has saved $600 to buy a new TV. If the TV she wants costs $1,800 and she saves $20 a week, how many years will it take her to buy the TV?

Example 3

Suppose two brothers who live 55 miles apart decide to have lunch together. To prevent either brother from driving the entire distance, they agree to leave their homes at the same time, drive toward each other, and meet somewhere along the route. The older brother drives cautiously at an average speed of 60 miles per hour. The younger brother drives faster, at an average speed of 70 mph. How long will it take the brothers to meet each other?

Example 5

Ernesto built a wooden car for a soap box derby. He is painting the top of the car blue and the sides black. He already has enough black paint, but needs to buy blue paint. He needs to know the approximate area of the top of the car to determine the size of the container of blue paint he should buy. He measured the length to be 9 feet $11\frac{1}{4}$ inches, and the width to be $\frac{1}{2}$ inch less than 3 feet. What is the surface area of the top of the car? What is the most accurate area Ernesto can use to buy his paint?

Problem-Based Task 1.2.1: Rafting and Hiking Trip

To celebrate graduation, you and 4 of your closest friends have decided to take a 5-day white-water rafting and hiking trip. During your 5-day trip, 2 days are spent rafting. If the rafting trip covers a distance of 60 miles and you are expected to raft 8 hours each day, how many miles must you raft each hour?

For the hiking portion of your trip, you and your friends carry the same amount of equipment, which works out to 35 pounds of equipment each. For extra money, you can hire an assistant, who will carry 50 pounds of equipment. Each assistant charges a flat fee of $50 and an additional $22 for each mile. The total amount you would have to pay the assistant is $512. How many miles will your group be hiking? Is it worth hiring two assistants to help you and your friends carry the equipment? Justify your answers.

Practice 1.2.1: Creating Linear Equations in One Variable

For the problem below, read each scenario and give the units you would use to work with each situation.

1. What units would you use for each scenario that follows?

    a. riding a bicycle

    b. rainfall during a storm

    c. water coming from a fire hydrant

    d. watching caloric intake

For problems 2–8, read each scenario, write an equation, and then solve the problem. Remember to include the appropriate units.

2. You need to buy new tile for your kitchen. It measures 13.25 feet by 7.5 feet. What is the area of the kitchen that you calculated? What is the most accurate area you can report to your hardware store in order to purchase enough tile?

3. Zach watches TV 3 times as much as Joel. Joel watches TV 2 hours a day. How many hours a day does Zach watch TV?

4. It costs Raquel $5 in tolls to drive to work and back each day, plus she uses 3 gallons of gas. It costs her a total of $15.50 to drive to work and back each day. How much per gallon is Raquel paying for her gas? How do you know?

5. Hayden bought 4 tickets to a football game. He paid a 5% service charge for buying them from a broker. His total cost was $105.00. What was the price of each ticket, not including the service charge?

6. It cost Justin $100 to have cable TV installed in his house. Each month he pays an access fee plus tax of 7% of his monthly bill. After 6 months, Justin had paid a total of $350.38 for his access fee, taxes, and his initial installation. What is Justin's monthly access fee not including taxes?

7. You and 3 friends divide the proceeds of a garage sale equally. The garage sale earned $412. How much money did you receive?

8. The area of Sofia's herb garden is $\frac{1}{8}$ the area of her vegetable garden. The area of her herb garden is 6 square feet. What is the area of her vegetable garden?

9. Driving to your friend's house, you travel at an average rate of 35 miles per hour. On your way home, you travel at an average rate of 40 miles per hour. If the round trip took you 45 minutes, how far is it from your house to your friend's house?

10. Two trains heading toward each other are 400 miles apart. One train travels 15 miles per hour faster than the other train. If they arrive at the same station in 5 hours, how fast is each train traveling?