Lesson Six

Using Formulas

Textbook Pages 143 - 146

GOAL:

During this lesson, students will learn about and use a number of important mathematical formulas.

OBJECTIVES:

The student will be able to:

- List the mathematical formulas for area, perimeter and rate.
  - State Standard – 2.3.8.A.
  - National Standards – Measurement 2.2, 2.6
  - Bloom's Taxonomy Level - Knowledge
- Use formulas to calculate area, perimeter, rate and scale conversions.
  - State Standards – 2.1.8.G., 2.2.8.B., 2.3.8.A.
  - National Standards – Numbers and Operations 1.1, 2.1, 2.2, 2.3, 3.2
  - Bloom's Taxonomy Level – Comprehension
- Solve problems using formulas.
  - State Standards – 2.1.8.G., 2.2.8.B., 2.3.8.A., 2.3.8.D.
  - National Standards – Numbers and Operations 1.1, 2.1, 2.2, 2.3, 3.2
  - Bloom's Taxonomy Level – Application

MATERIALS:

- Rope with length in feet marked on it
- Small, soft ball
- Stopwatch
- Calculators
- A yard stick or similar measuring tool
- A large piece of cardboard (preferably one square yard)

ANTICIPATORY SET:

5 Minutes

Have students stand in a line. If necessary, have the line bend around the room. Use the rope to measure the distance from one end of the line to the other. Write this total on the board.

Hand the ball to the first student in line. Start the stopwatch. Have students hand the ball down the line. When the ball reaches the end of the line, stop the stopwatch. Write the time on the board.

Ask students if they can do it faster. Time a few more attempts. Try passing the ball down the line in the other direction.

LESSON PROCEDURES:

Teacher: *8 Minutes*

Ask students how fast they think the ball went. Tell them we can use a formula to calculate exactly how fast the ball went. Write on the board d=rt. Tell students that d stands for "distance", r stands for "rate" and t stands for "time."

Ask students how far the ball traveled. Write the amount under the d in the formula on the board. Be sure to include the word "feet".

Ask students how long it took the ball to travel the first time we tried it. Write the amount under the t in the formula on the board. Be sure to include the word "seconds" (or minutes).

Copy into the formula the r, multiplication symbol and equals sign:

21 feet = r x 24 seconds

Ask students if this looks familiar. If students seem confused, rewrite the equation without the units (feet and seconds). Try to elicit that we have an algebraic expression. Solve the expression as a class.

Ask students if our answer is in miles per hour. Elicit that our answer is in feet per second because we used feet and seconds in our equation.

If, through questioning, it seems that students are comfortable with this process, have students calculate another rate from the data on the board. If students are still uncomfortable, calculate the rate as a class.

Ask students if their rate was particularly fast. How does it compare to a car, for example? Elicit that the rate of cars are measured in miles per hour and we used feet per second. So we need to convert to miles per hour. How do we do that? Another formula! Write this formula on the board: *5 Minutes*

Feet / 5280 = Miles

Have students use the same substitution process to calculate miles. Do the same with the formula for seconds to hours.

Seconds / 360 = Hours

Now that we have miles and hours, we can go back to the original equation and calculate miles per hour. Do this either as a class or individually. Emphasize that the answer in miles per hour is different from feet per second. Stress that this is why we must be very careful with our units.

Present this problem to students (and show on OH1): *5 Minutes*

"It is exactly 23.1 miles from Edinboro University (where I go to school) to Wilson Middle School (where you go to school). I have one hour to get to my class this afternoon. I will drive my car an average of 45 miles per hour. How long will it take for me to get to my class? Will I be on time?"

Have students copy the steps from OH1 into their notebooks:

1. What do you know?
2. What do you want to know?
3. What formula do you think you can use?
4. What units of measure are you using?
5. Substitute.
6. Solve the equation.
7. What unit of measure do you end up with?
8. Does your answer make sense?

Talk students through the process with the problem:

1. We know the distance: 23.1 miles. We know the rate: 45 miles per hour.
2. We want to know the time.
3. We can use the formula d=rt.
4. We are using miles and miles per hour.
5. We will substitute 23.1 miles for distance and 45 miles per hour for rate.
6. Solve the equation. The answer is .51333….
7. We end up with hours.
8. Yes our answer makes sense. If we ended up with a negative number, it wouldn't make sense.

Ask students, is .51333… greater than or less than one hour? So I would make it to class on time? Yes.

Show students OH2: *5 Minutes*

"Oh no! Today, Mr. Halmi's car broke down. How will he get back to Edinboro? Don't worry! Mr. Halmi brought his pet camel, Michael, with him. He will ride Michael back to Edinboro. Camels run at 12 miles per hour. How long will it take Mr. Halmi to get home? (Remember, it is 23.1 from Wilson to Edinboro.")

As a class, talk through the eight steps. The answer is 1.925 hours.

Explain that, in addition to d=rt, there are two other formulas they should know. Students are probably already familiar with them. Write them on the board: *5 Minutes*

Area = Length x Width (A=lw)

Perimeter = 2 x Length + 2 x Width P=(2l + 2w)

Explain that we are going to find the area and perimeter around the blackboard. Talk through the eight steps with students. Have a volunteer measure the blackboard with the tape measure.

Emphasize what units we will end up with. Perimeter is measured in feet (or meters, yards, miles…). Area is measured in square feet (or meters, yards, miles…). Use the yard stick and the square piece of cardboard to demonstrate the difference between length and area.

In the remaining time, have students work on problems in their book. Students should do page 145, problems 1, 4, 17, 18, 19, 20, 21 and 22. Complete unfinished problems for homework. *10 Minutes*

CLOSURE:

As a class, calculate the perimeter and area of the room.

EXTRA TIME ACTIVITIES:

If there is extra time, introduce the formula for converting from Celsius to Fahrenheit: F = 1.8C + 32

EVALUATION:

- List the mathematical formulas for area, perimeter and rate
  Evaluated through questioning and homework.
- Use formulas to calculate area, perimeter, rate and scale conversions.
  Evaluated through questioning and homework.
- Solve problems using formulas.
  Evaluated through questioning.

SUPPLEMENTARY MATERIALS:

OH1, OH2, OH3, Textbook