

Grade 8 Mathematics

Algebra: Lesson 1

Read aloud to the students the material that is printed in **boldface type** inside the boxes. Information in regular type inside the boxes and all information outside the boxes should **not** be read to students. Possible student responses are included in parentheses after the questions.

NOTE: The directions read to students may depend on the available materials. Read only those parts of the lesson that apply to the materials you are using.

Any directions that ask you to do something, such as to turn to a page or to hand out materials to students will have an arrow symbol (\Rightarrow) by them.

Purpose of Lesson 1:

- In this lesson, the tutor and the students will
 - ✓ represent real-world problems as equations;
 - ✓ understand the terms *quantity*, *constant*, *variable*, *expression*, *equation*, and *number sentence*; and
 - ✓ match an oral statement to an expression or an equation.

Equipment/Materials Needed:

- Copies Student Sheets 15 and 16
- Paper and pencils

Preparations before beginning Lesson 1:

- Run off one (1) copy of Student Sheets 15 and 16 for each student.
- Have paper and pencils available.
- Write the terms *quantity*, *constant*, *variable*, *expression*, *number sentence*, and *equation* on a piece of paper or on the board.

Lesson 1: Algebra

Say:

Today we are going to talk about some ideas in algebra. Let's start with some basic terms. Anything that can be counted or measured is called a *quantity*. The *value* of the quantity is its measure or the number of objects that can be counted. Examples of quantities are your age, the time, the number of eggs in a dozen. Some of these quantities change, while some remain the same all the time. If a quantity does not change, it is called a *constant*. The number of eggs in a dozen is a constant. The number of hours in a day is a constant.

Give me another example of a constant. (Sample responses: The number of inches in a foot, the number of meters in a kilometer, etc.)

If a quantity changes or varies, it is called a *variable*. Your age and time vary. Give me another example of a variable. (Sample response: The number of students absent, the number of cars in the parking lot, etc.) **We usually use letters to represent variables. We can use any letter that we want, so usually we pick one that makes sense to us. We could let a represent the number of absent students, thinking of absent. If we thought "the number of absent students," we could use n . If we thought "students," we could use s . It doesn't matter which letter we use.**

Say:

In writing and speaking, we sometimes put letters and symbols together to form words and phrases. In algebra, we put numbers and letters and symbols together to form expressions. An *expression* is a mathematical phrase involving constants, variables, and/or symbols. If I am paid \$7.50 an hour, then for 2 hours I am paid $\$7.50 \times 2$; for 3 hours I am paid $\$7.50 \times 3$; for h hours, I am paid $\$7.50 \times h$. (As you say these,

write $\$7.50 \times 2$

$\$7.50 \times 3$

$\$7.50 \times h$ We can also write this expression as just $\$7.50h$.

When using variables, if we write them side by side, such as ab , we assume that they are multiplied. If we write a number and a variable side by side, such as $2a$, we assume that this expression means 2 times a .

⇒ Give Student Sheet 15 to the students. Have them work each problem one at a time, discussing the problems as they go along.

Say:

I want you to write expressions using variables, constants, and symbols that describe the problems. Answers:

1) $5h$ 2) $4s$ 3) $12n$ or $n \times 12$ 4) $c \div 12$

5) $50 + 25h$ or $25h + 50$ 6) $(x + y) \div 2$ or $\frac{x+y}{2}$ 7) $b - 1$

8) $s - 2$ 9) A 10) C

In number 6, the parentheses are important. The parentheses tell you to add the 2 amounts and then to divide by 2. Remind students of the order of operations (Lesson 2 in Number.) You do any operations within the parentheses, then multiplication and division from left to right, and then addition and subtraction from left to right. If we write the expression as $\frac{x+y}{2}$, the fraction bar serves as a grouping symbol, so we still add x and y first. In number 7, Sandy has one (1) less so the expression has to be $b - 1$, not $1 - b$.

Say:

In writing and speaking, we sometimes put words and phrases together to make sentences. In algebra, we can put expressions together to form number sentences. What do you think a number sentence is? (It is just a sentence with numbers in it.) $4 + 6 = 10$ is an example of a number sentence; so is $12 > 9$. Sometimes, we have numbers that are missing in a number sentence. In elementary school, we used a box or a blank to show that something was missing. For example, $4 + \underline{\quad} = 10$. Or $12 > \square$. In algebra, instead of using a box or blank, we use a variable; so in the two number sentences above, we could use $4 + s = 10$ or $12 > t$. It doesn't matter what letter we use, just as it didn't matter whether we used a box or a blank in the lower grades.

⇒ Give this problem to the students:

On Monday, the coach had selected 13 players for the team. On Tuesday, he selected more players and now the team has 24 players. How many players did the coach select on Tuesday? What do we know in this problem? (There were 13 players selected on Monday and the team has 24 players.) What information is missing? (How many players were selected on Tuesday.) There are different ways we could write this sentence.

⇒ Write the following on the board or on a sheet of paper.

$$13 + ? = 24$$

$$13 + \square = 24$$

$$13 + \underline{\quad} = 24$$

$$13 + p = 24$$

Say:

An equation is a mathematical sentence that uses an equal sign to show that two expressions have the same value. The equation, $13 + p = 24$, says that the expression $13 + p$ is equal to the expression 24. When we find a value for p that makes this true, we are solving the equation. What is the value of p ? (11) 11 is the *solution* to the equation. Note: There were other equations that could have been written to represent this problem: $p + 13 = 24$; $24 - 13 = p$; and $24 - p = 13$.

⇒ Give Student Sheet 16 to the students. Work each problem separately. Have the students discuss each problem.

Say:

We are going to write equations for the sentences in each of these problems. You do not have to solve the problems.

Answers:

1) $220 = 60h$ or $h = 220 \div 60$

2) $25 = 1.49g$ or $25 \div 1.49 = g$

3) $c = 10(2) + 20$ or $c = 20 + 20$ or $c = 40$

4) $I = 685 - 125$ or $I + 125 = 685$ This problem may give the students trouble. If I sold 685 items last month and this month I sold 125 fewer, then to find the amount I sold this month, I have to subtract the 125 from 685. Does that make sense? I sold 685 last month; this month I sold 560. Isn't that 125 fewer than last month?

5) $46 = 2(12) + 2w$ or $46 = 2(12 + w)$

6) B

7) B

8) D

⇒ Have one student summarize today's lesson. The students should feel comfortable with the idea that variables, constants and numbers make expressions and expressions make equations.

Student Sheet 15 (Algebra: Lesson 1)

Write an expression for each problem.

1. Olivia earns \$5 an hour. How much does she earn in (h) hours?
2. The perimeter of a square is four times the length of a side. Use (s) as the variable.
3. How many cookies are in (n) dozen?
4. Jody baked (c) cookies. How many dozen did she bake?
5. Tony is an electrician. He earns a flat fee of \$50 plus \$25 an hour. How much does he earn in (h) hours?
6. Ann has (x) dollars and Yvonne has (y) dollars. If they put their money together and then divided it into two equal parts, how much will each girl receive?
7. Katie had (b) balloons for the party. Sandy had one less than Katie. How many does Sandy have?
8. The side of a triangle is decreased by two units. How long is the side now? Use (s) as the variable.

Choose the correct expression for each problem.

9. Of the number (n) of booths at the fair, 22 made money. Which expression could be used to show how many booths did not make money?
A. $n - 22$ B. $22 - n$ C. $22n$ D. $22 \div n$
10. Which expression could be used to change from (n) feet to inches?
A. $12 + n$ B. $12 - n$ C. $12n$ D. $n \div 12$

Student Sheet 16 (Algebra: Lesson 1)

Write an equation to represent each problem. You do not have to solve the problem.

1. Kelly drove 220 miles at 60 miles per hour. Write an equation to find the number of hours (h) she drove. (Distance is equal to rate \times time.)
2. Donald paid \$25 for a tank of gas. If the price was \$1.49 per gallon, write an equation to show the number of gallons (g) he purchased?
3. To repair your VRC, the repair shop charges \$10 an hour, plus a fee of \$20 just to look at it. Write an equation to show the cost (c) if it took two hours to repair the VCR.
4. The Second Hand store is having a slump. They sold 125 fewer items this month than last. Last month, they sold 685 items. Write an equation to show the number of items (I) that they sold this month.
5. The perimeter of a rectangle is 46 cm. If the length of one side is 12 cm, write an equation to find the width (w) of the rectangle. ($P = 2L + 2w$.)

Choose the correct equation for each problem.

6. A ticket to the wrestling match cost three times more than a movie ticket. If the movie ticket cost \$4.50, which equation shows how to find the cost (c) of the wrestling ticket?
A. $c = 4.50 + 3$
B. $c = 4.50 \times 3$
C. $3 = 4.50 \div c$
D. $4.50 \div 3 = c$
7. Julius ran one lap around the track in 55 seconds. This time was six seconds more than the record time. Which equation shows how to find the record time (r)?
A. $r = 55 + 6$
B. $r + 6 = 55$
C. $r = 55 \div 6$
D. $r = 55 \times 6$
8. Hair grows at the rate of about 0.1 inch per week (w). Which equation shows how many weeks it would take to grow one inch?
A. $1 \times .01 = w$
B. $1 + 0.1 = w$
C. $w - 0.1 = 1$
D. $1 = 0.1w$