Grade 4 Mathematics
Algebra: Lesson 2

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 (⌡) by them.

Purpose of Lesson 2:

- In this lesson, the tutor and the students will
  - ✓ identify and create open and closed number sentences, and
  - ✓ identify and create true or false number sentences.

Equipment/Materials Needed:

- Copies of Student Sheet 73
- Paper and pencils
- Chalkboard

Preparations before beginning Lesson 2:

- Run one copy of the Student Sheet 73 for each student.
- Have paper and pencils available.

Lesson 2: Algebra

⌡ Write these sentences on the board. $2 + 5 = 7$ and $4 + 4 = 2 \times 4$.

Say:

In mathematics, we can write sentences. "2 + 5 = 7" is a *mathematical sentence*. It means that 2 + 5 equals 7 or that 2 + 5 is the same as 7. How could you read the sentence, 4 + 4 = 2 ´ 4? (Four plus four equals two times four, or four plus four is the same as two times four.**)** Students often think that an equal sign means that an answer is coming or that 2 + 5 makes 7. This thinking leads to trouble when we ask them to work with number sentences that have two or more numbers on both sides of the equation, such as $4 + 4 = 2 \times 4$. Have the students make different number sentences that have 4 + 4 on one side of the equal sign.
(Examples: $4 + 4 = 10 - 2$, $4 + 4 = 7 + 1$, $4 + 4 = 16 \div 2$)

⌡ Write this sentence on the board. $4 + 4 < 7 + 2$.

Say:

A number sentence can have an inequality sign instead of the equal sign. "4 + 4 < 7 + 2" is an example. Ask students to make number sentences that use 2 + 5 and a less than (<) sign and sentences that use 2 + 5 and a greater than (>) sign. (Examples: $2 + 5 < 4 \times 2$; $2 + 5 > 2 + 1$)

Say:

The English sentence "Thursday is the day right after Wednesday." is a true sentence. The English sentence, "March is the month right after April." is a false statement. Mathematical statements can be true or can be false.

⌡ Give students Part A of Student Sheet 73. Students must work both sides of the number sentence in order to decide whether the sentence is true.

Part A Answers:

1. No; $10 \neq 24$.
2. Yes; $11 = 11$.
3. No; 14 is not > 14.
4. No; 4 is not < 0.
5. Yes; $2 = 2$.
6. No; 13 is not > 13.
7. No; 6 is not > 24
8. No; 17 is not < 17.

Say:

If I said to you, "He is my father.", could you tell me whether the sentence is true or false? (No.) **Why not?** (I don't have enough information to make a decision.) **Sometimes in mathematics, we don't have enough information to say whether a sentence is true or false. Let's look at the following problem. I had 10 stamps, but I needed to mail 12 letters. How many more stamps do I need? Some mathematical sentences that could be written for this problem are the following:**

10 + __ = 12 **10 + • = 12** **10 + s = 12**

There are many others; but in each of these, I cannot tell whether the sentence that I have written is true of false. When you cannot tell whether a sentence is true or false, the sentence is called an *open sentence*. Open sentences contain blanks, boxes, or variables. Variables were introduced in Algebra: Lesson 1. **When the sentence has enough information to tell whether it is true or false, it is called a *closed sentence*. "4 + 6 = 5 ´ 2" is a closed sentence. The sentence "4 + 6 = 5 + 1." is also a closed sentence, but it is false. Sometimes, we can make an open sentence into a true, closed sentence. In the problem 10 + • = 12, if we replace the • with 2, the number sentence is 10 + 2 = 12. This sentence is closed and is a true sentence.**

⎫ Give students Part B of Student Sheet 73. In these problems, the students will change open sentences into closed, true sentences.

Part B Answers:

9. 4; 12 = 12 10. 12; 4 = 4 11. 0; 9 = 9
12. 3; 63 = 63 13. +; 16 = 16 14. ÷; 9 = 9
15. ×; 36 = 36 16. +; 15 = 15
17. <; Students may see that you are adding the same number, 41, to both numbers, so 30 + 41 < 40 + 41.
18. <; Students may see that you are subtracting both numbers from 63. You are subtracting more with 19 than 2, so 63 – 19 < 63 – 2.
19. =; Students may see that 18 is the same as 9 × 2, so 18 × 2 = 9 × 2 × 2.
20. >; Students may see that you are dividing both numbers by 5. Since 30 is larger than 25, 30 ÷ 5 > 25 ÷ 5.

⎫ Have one student summarize today's lesson. Students need to understand the difference in open and closed sentences and ways to change an open sentence into a true, closed sentence.

Student Sheet 73 (Algebra: Lesson 2)

Part A

Which of the following mathematical sentences are true?

1. $6 + 4 = 12 \times 2$
2. $21 - 10 = 10 + 1$
3. $8 + 6 > 6 + 8$
4. $24 \div 6 < 24 \times 0$
5. $9 - 7 = 10 \div 5$
6. $13 \div 1 > 13 \times 1$
7. $18 \div 3 > 6 \times 4$
8. $16 + 1 < 17 - 0$

Part B

What number belongs in the box to make each of the following number sentences true?

9. $8 + \square = 20 - 8$
10. $\square - 8 = 2 \times 2$
11. $27 \div 3 = \square + 9$
12. $21 \times 3 = 60 + \square$

What sign (+, –, ´, ¸) belongs in the box to make the number sentence true?

13. $10 \square 6 = 20 - 4$
14. $27 \square 3 = 6 + 3$
15. $12 \times 3 = 9 \square 4$
16. $8 + 7 = 14 \square 1$

What symbol (<, >, or =) belongs in the box to make the number sentence true? Explain your reasoning.

17. $30 + 41 \square 40 + 41$
18. $63 - 19 \square 63 - 2$
19. $18 \times 2 \square 9 \times 2 \times 2$
20. $30 \div 5 \square 25 \div 5$