True and False Multiplication Equations

Students are asked to determine if each of two equations is true without performing any operations.

General Information

Subject(s): Mathematics
Grade Level(s): 4
Intended Audience: Educators

Keywords: MFAS, equality, comparative relational thinking, equal, multiplication

Instructional Component Type(s): Formative Assessment

Resource Collection: MFAS Formative Assessments

Attachment

MFAS_TrueAndFalseMultiplication EquationsWorksheet.docx

Formative Assessment Task

Instructions for Implementing the Task
This task should be completed individually.

1. The teacher provides the student with the *True and False Multiplication Equations* worksheet and says, "Without multiplying 27 and 5, determine whether the equation 27 x 5 = 9 x 23 is true or false."
2. The student is given ample time to respond and the teacher prompts the student to explain his or her thinking.
3. The teacher then says, "Without multiplying 36 x 4, determine whether the equation 36 x 4 = 18 x 8 is true or false."
4. The student is given ample time to respond and the teacher prompts the student to explain his or her thinking.

TASK RUBRIC

Getting Started

Misconception/Error

The student has an operational view of the equal sign.

Examples of Student Work at this Level

The student says both equations are false because 27 x 5 does not equal 9 (the number just to the right of the equal sign in the first equation) and 36 x 4 does not equal 18 (the number just to the right of the equal sign in the second equation).

Questions Eliciting Thinking

What does the equal sign mean?

Show the student the equations 5 = 5 and 16 = 2 x 8. Ask the student if the equations are true or false.

I see that you did not consider the number 23 to the right of the equal sign. Should we just ignore this number?

Instructional Implications

Consider using the MFAS task *True or Not True* (1.OA.4.7) which provides insight into the student's understanding of the equal sign.

Provide explicit instruction on the meaning of the equal sign. Use an interpretation of multiplication with which the student is comfortable to show that the product of the expressions on the left and right sides of the equal sign must have the same value. Then provide the student with multiplication equations that contain a missing number, *n*, such as 5 x 9 = *n* x 3. Model for the student how to determine the value of one side of the equation and then use that value to solve for the unknown on the other side of the equation. Eventually, model comparative relational thinking to solve equations.

Moving Forward

Misconception/Error

The student has a relational understanding of the equal sign but is unable to use comparative relational thinking to determine if the equations are true.

Examples of Student Work at this Level

The student understands that the two quantities on each side of the equal sign must have the same value. However, the student needs to calculate 27 x 5 and then 9 x 23 in order to determine if the equation is true or false.

Questions Eliciting Thinking

You have a good understanding of the meaning of the equal sign. Could you determine if the equations are true by comparing the numbers on each side of the equation?

How does 27 compare to nine? How does five compare to 23?

Instructional Implications

Model for the student how to use comparative relational thinking to determine if the equations are true. Introduce the student to the concept of compensation. For example, show the student the expression 27 x 5. Then divide 27 by three and ask the student how five can be adjusted to compensate for the change (i.e., 27 x 5 = 9 x ?). Make explicit that when 27 is divided by three, five must be *multiplied* by three to compensate. Show the student that 27 x 5 = (9 x 3) x 5 = 9 x (3 x 5) = 9 x 15 demonstrating the first equation to be false. Provide the student with additional practice in using comparative relational thinking. Encourage the student to explain his or her thinking to other students.

Provide opportunities for the student to hear the explanations of Got It level students using comparative relational thinking to determine if equations relating two products are true.

Almost There

Misconception/Error

The student attempts to use comparative relational thinking but makes errors.

Examples of Student Work at this Level

The student attempts to use comparative relational thinking but makes an error or becomes confused. For example, the student attempts to compare the expressions additively instead of multiplicatively.

Questions Eliciting Thinking

If 27 is three times nine, what needs to be true of the other two factors in order for the equation to be true?

If 36 is twice the value of 18, what needs to be true of the other two factors in order for the equation to be true?

Instructional Implications

Assist the student in identifying the error in his or her reasoning. Introduce the student to the concept of compensation. For example, show the student the expression 27 x 5. Then divide 27 by three and ask the student how 5 can be adjusted to compensate for the change (i.e., 27 x 5 = 9 x ?). Make explicit that when 27 is divided by three, 5 must be *multiplied* by three to compensate. Show the student that 27 x 5 = (9 x 3) x 5 = 9 x (3 x 5) = 9 x 15. Provide the student with additional practice in using comparative relational thinking. Encourage the student to explain his or her thinking to other students.

Got It

Misconception/Error

The student provides complete and correct responses to all components of the task.

Examples of Student Work at this Level

The student determines that the first equation is false and explains that since 27 is three times nine but 23 is not three times five, then the equation is false. The student also says that the second equation is true because 36 is twice the value of 18 and eight is twice the value of four.

Questions Eliciting Thinking

What symbol can replace the equal sign to make the first equation true?

What number could be changed in order to make the first equation true? Is there another way to change a single number to make the first equation true?

Instructional Implications

Consider using the MFAS task *Comparative Relational Thinking in a Multiplication Equation* (4.OA.1.b).

Provide a false equation such as 40 x 12 = 20 x 6. Have the student determine the error and then use comparative relational thinking to rewrite the equation so that it is true.

Accommodations & Recommendations

Special Materials Needed:

- *True and False Multiplication Equations* worksheet

Source and Access Information

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Aligned Standards

Name	Description
MAFS.4.OA.1.a:	Determine whether an equation is true or false by using comparative relational thinking. *For example, without adding 60 and 24, determine whether the equation 60 + 24 = 57 + 27 is true or false.*