What Is the Missing Value?

Student Probe

What number can replace ☐ in each of the following number sentences to make a true statement?

5 + 7 = ☐

☐ + 9 = 4 + 9

12 – 5 = ☐

9 – 3 = ☐ - 3

☐ - 6 = 13 - 6

At a Glance

What: Symbols and blanks represent a missing value

Standard:
AR.Math.Content.2.OA.A.1

- Use addition and subtraction within 100 to solve one- and two-step word problems involving situations of adding to, taking from, putting together, taking apart, and comparing, with unknowns in all positions.
- Represent a strategy with a related equation including a symbol for the unknown number.

Mathematical Practices:
SMP1: Reason abstractly and quantitatively.

Who: Students who cannot determine the missing value, represented by a symbol or letter, in a number sentence.

Grade Level: 2

Prerequisite Vocabulary: None

Prerequisite Skills: Addition and subtraction strategies

Delivery Format: Individual or small group

Lesson Length: 30 minutes

Materials, Resources, Technology:
Linking cubes, tiles, blocks in two colors, balance scale

Student Worksheets: None

Lesson Description

This lesson helps develop student understanding that symbols and letters can represent a specific number or numbers in number sentences. The teacher may ask the student, "What goes in the box to make the sentence true?" As the symbol is replaced with a letter, the teacher asks, "What number could stand for the letter to make the sentence true?"

Rationale

Students are expected to write number sentences (equations) and find solutions. Initially, students have difficulty understanding that the symbols represent a missing or unknown value. Initially, work with finding the 'variable' that makes the sentence true—solving the equation—should rely on relational thinking. The use of variables, whether symbols or letters, is a powerful representational device that allows for the expression of generalizations. The ultimate goal is for students to work with expressions involving variables without thinking about the specific number or numbers that the letters may stand for.

Preparation

Provide linking cubes, tiles, or blocks in two colors for students.

Lesson

The teacher says or does…	Expect students to say or do…	If students do not, then the teacher says or does…
1. What number can we put in the square to make the number sentence 7 + 5 = ☐ true? How do you know?	12 Because 7 + 5 = 12.	Teacher uses smaller numbers; such as 4 + 1 = Rewrite the numbers sentence below the open number sentence: 7 + 5 = 7 + 5 = ☐
2. What number can we put in the square to make the number sentence 5 + 6 = ☐ + 6 true? How do you know?	5 Because 5 + 6 = 11.	Use a balance scale. Place in the left pan, counting as each cube is place, 5 + 6 cubes of the same color. Then, place in the right pan, counting as each cube is place, 6 cubes of the previous color. Say to students: Let's see how many cubes we need to add to the right pan for the balance to be level. Continue to add different color cubes one at a time, with students counting as each is put in the pan, until the balance beam is level. Then ask a student to count all of the second color cubes. Then ask: How many cubes of the second color did we add? If we replace the ☐ with 5, then is this a true statement? *yes* Rewrite the numbers sentence below the open number sentence: 5 + 6 = ☐ + 6 5 + 6 = 5 + 6

The teacher says or does…	Expect students to say or do…	If students do not, then the teacher says or does…
3. What number can we put in the square to make the number sentence ☐ + 8 = 4 + 8 true? How do you know?	4	Use a balance scale. Place in the right pan, counting as each cube is place, 4 + 8 cubes of the same color. Then, place in the right pan, counting as each cube is place, 8 cubes of the previous color. Say to students: Let's see how many cubes we need to add to the left pan for the balance to be level. Continue to add different color cubes one at a time, with students counting as each is put in the pan, until the balance beam is level. Then ask a student to count all of the second color cubes. Then ask: How many cubes of the second color did we add? If we replace ☐ with 4, then is this a true statement? *yes* Rewrite the numbers sentence below the open number sentence: ☐ + 8 = 4 + 8 4 + 8 = 4 + 8
4. 14 – 6 = ☐	8	Teacher uses smaller numbers; such as 4 - 1 = Rewrite the numbers sentence below the open number sentence: 14 - 6 = ☐ 14 - 6 = 12

The teacher says or does…	Expect students to say or do…	If students do not, then the teacher says or does…
5. 12 – 8 = 12 - ☐	8	Use a balance scale. Place cubes of the same color in each pan, counting as each cube is place. (Use different color cubes in the left and right pan.) Ask the students: Are the pans level? *yes* How many cubes do we need to remove from the left pan? *8* Are the pans level? *no* Now, remove cubes from the right pan until the pans are level. Ask students: Now are the pans level? *Yes* How many cubes are in the pan? *8* If we replace the ☐ with 8, then is this a true statement? *yes* Rewrite the numbers sentence below the open number sentence: 12 - 8 = 12 - ☐ 12 - 8 = 12 - 8

The teacher says or does…	Expect students to say or do…	If students do not, then the teacher says or does…
6. ☐ = 13 - 6	7	Give the students a problem with the symbol on the left side and determine if they can find the missing number. Then, use a pan balance and put 13 cubes all the same color in the right pan. Ask students: How many cubes do we need to rake out of the right pan? 6 Add cubes of a different color in the left pan until the pans are level. Ask students: Are the pans level? Yes How many cubes are in the left pan? *7* If we replace the ☐ with 7, then is this a true statement? *yes* Rewrite the numbers sentence below the open number sentence: ☐ = 13 - 6 7 = 13 - 7

Teacher Notes:

Relational thinking:

Students can explain an open number sentence (sentence with a symbol or letter) in at least two ways.

Consider the open number sentence: $9 - \square = 8 - 3$

Explanation 1: Since $8 - 3 = 5$, one needs to take away from 9 to make 5. Since $9 - 5 = 4$, 4 goes in the $\square$.

Explanation 2: Nine is one more than 8 on the right side. That means that one needs to take one more away on the left side to get the same number. One more than 3 is 4 so 5 goes in $\square$.

Students who successfully provide Explanation 2 are using relational thinking.

Variations

None

Formative Assessment:

What number can replace $\square$ to make the number statement true?

$3 + 8 = \square + 5$

References

Mathematics Preparation for Algebra. (n.d.). Retrieved May 25, 2011, from Doing What Works: http://dww.ed.gov/practice/?T_ID=20&P_ID=48