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$a^2 + b^2 = c^2$

Ten Frames:

Using Ten Frames for Algebraic Equations Up to 20

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Grades 1-2



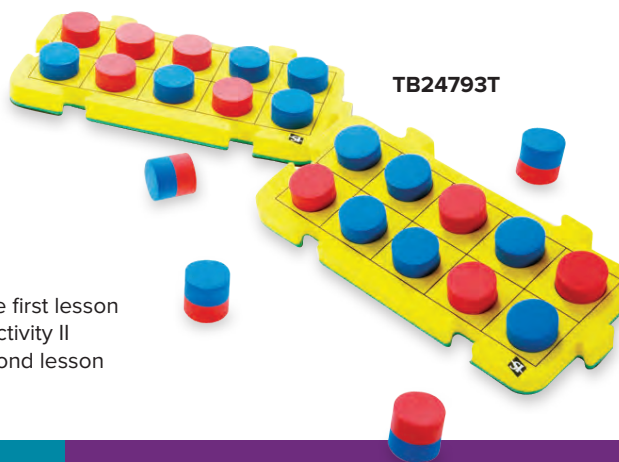
Content

Find the missing addend using algebraic principles.



Time

This lesson can be completed in 1-2 days. If broken into two days, the first lesson would be Activity I and Practice I, and the second lesson would be Activity II and Practice II. The first lesson deals only with numbers, and the second lesson introduces word problems.



Objectives

Students will...

- Be able to apply basic algebraic principles to addition problems.
- Be able to create fact families with the given digits.
- Be able to manipulate ten frames to solve addition problems with missing addends.



Materials

- Ten Frames (Cat. No. TB24793T) or Ten Frames Classroom Set (Cat. No. TB25754T)
- Worksheets (attached with lesson plan download)



Common Core State Standards

CCSS.Math.Content.1.OA.D.8 — Determine the unknown whole number in an addition or subtraction equation relating three whole numbers (For example, determine the unknown number that makes the equation true in each of the equations $[8 + ? = 11, 5 = \underline{\quad} - 3, 6 + 6 = \underline{\quad}]$).

CCSS.Math.Content.2.OA.B.2 — Fluently add and subtract within 20 using mental strategies. By end of Grade 2, know from memory all sums of two one-digit numbers.



Introduction

As students become familiar with the ten frames while using them during the Introduction, it is important to make sure that they hold the ten frames vertically and fill in the holes all the way in the first column on the left before beginning to fill in the next column. Keep this in mind as you model for students throughout the Introduction. This helps students visualize the problems more clearly. Students will require 2 ten frames for everything in the lesson aside from the first problem of the Introduction.

1. Put 6 pieces in the 10 frame with the red side up, then flip 3 pieces to the blue side.
 - How many total pieces did we put in the ten frame? (6)
 - How many are still red? (3)
2. Write $3 + \underline{\quad} = 6$ on the board, making sure students understand that 6 represents the total number of pieces in the ten frame and 3 represents how many are still red. Looking at their ten frames, students should be able to fill in the blank by determining that 3 pieces are still blue.
3. Remove all pieces from the ten frame, then hook 2 ten frames together just like puzzle pieces.
4. Put 11 pieces into the ten frames with the red side up, then flip 4 pieces to the blue side. Ask students how many are still red (7). Write $7 + 4 = 11$.
5. Flip two more pieces to the blue side and ask students how many pieces are now blue and how many are now red. Write $5 + 6 = 11$.



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Activity #1

DAY ONE

1. The problems in this activity will be recorded on problems 1 and 2 on Worksheet #1. This way, students will have a reference when they work independently. Have each student follow these directions as you model them on your own set of ten frames.
2. Put 15 pieces with the red side up into the ten frames, making sure that the three columns on the left are filled and the final column is empty, then have students look at the first problem on the worksheet and determine which number was just added to the ten frames (the answer). Flip 9 pieces to the blue side, making sure students understand this is done because the problem says so. Students should now be able to see how many red pieces are left and be able to fill in the missing number in the problem. Point out to students that, yes, they did work a bit backwards here by starting with the answer and using one of the addends to figure out the missing number.
3. Remind students that fact families always use the same three numbers before working on the fact family containing 6, 9, and 15. Point out that they already know the first fact in this fact family ($6 + 9 = 15$), and that the second fact is also an addition problem that is obtained by flipping the first 2 numbers and leaving the 15 alone ($9 + 6 = 15$).
4. Now it's time to come up with the 2 subtraction problems in the fact family. Tell students that with subtraction, they always have to put the greatest number at the beginning, and ask them what that number is in this family (15). By choosing one of the other two numbers to put in the second spot, they can come up with one of the two remaining fact families, then by switching those numbers around, they can determine the final fact family ($15 - 9 = 6$ and $15 - 6 = 9$).
5. For problem 2 on Worksheet #1, remind students that they are working backwards with the problem. Put 16 pieces on the ten frames with the red side up, then flip 7 pieces to the blue side. They should be able to see that 9 red pieces remain and fill in the missing number in the problem.
6. Guide students in coming up with the other three problems for the fact family of 7, 9, and 16 ($7 + 9 = 16$, $16 - 7 = 9$, and $16 - 9 = 7$).

Practice #1

Students should work on problem 3 independently. Before allowing them to move on, ask them the questions listed in the Check for Understanding I section below. If they can answer those questions, have them work on problems 4-5 independently. If not, model again for problem 4 using the same line of questioning as you work through it, then have them work on problem 5 independently.

Check for Understanding I

1. How many pieces did you start with on the red side? (12)
2. How did you know to put 12 pieces? (We work backwards and 12 is the last number in the problem.)
3. How many of the red pieces did you flip to blue? (8)
4. How did you know to flip 8 pieces? (That was the other number given in the problem.)
5. What number did you fill in as your missing addend? (4)
6. How did you know to use 4? (After I flipped 8 of my pieces to blue, I had 4 left that were red.)
7. What was the first problem in your fact family? ($4 + 8 = 12$)
8. What was the other addition problem in your fact family? ($8 + 4 = 12$)
9. What number did you put first in your two subtraction problems? (12)
10. How did you know? (12 was the largest of all my numbers.)
11. What was one of the subtraction problems you created? ($12 - 8 = 4$ or $12 - 4 = 8$)

Day 1

Ten Frames Worksheet #1

Ten Frames Extension Worksheet #1

$- + 9 = 15$

Day 2

Ten Frames Worksheet #2

Ten Frames Extension Worksheet #2

$- + = 14 \text{ cups}$



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Activity #2 Word Problems

As with Activity I, you will model and work through problems 1 and 2 from Worksheet #2 with students.

1. Examine the first word problem: *Henry needs 14 cups for his birthday party next week. Henry already has 6 cups. How many more cups does Henry need for the party?*
2. What does the problem tell us? (*That Henry needs a total of 14 cups, and that he already has 6 of those 14 cups.*) That means we know our answer number, which is 14. Have students fill that number in. We also know our second addend, which is 6. Remind students that we work from the end of the problem to the beginning. We know that $___ + 6 = 14$. It's important that students understand that these problems are done in exactly the same fashion as the problems from Activity I. We're working from the end of the problem to the front every single time.
3. The number we start with is 14, which means we need 14 red pieces put in our ten frames. Remind students to start on the left of their ten frames while filling them in, and check to make sure the first two columns are completely filled in and the third column has 4 red pieces.
4. We know that Henry already has 6 cups, so 6 pieces need to be flipped to the blue side. Students should then be able to determine that 8 pieces are still red and use that number to fill in the missing addend. They will also be able to answer the question, "How many cups does Henry still need?" (*8 cups*)
5. Make sure that students understand that they did this problem exactly the same way they did the problems in Activity I. They worked from the end of the problem to the start. The first number in the problem is the answer. The second number in the problem is the addend. They're trying to find the first addend at the beginning of the problem.
6. Examine the second word problem: *Brianna needs to earn 11 stickers to get a pick from her teacher's treasure box. She's already earned 4 stickers. How many more stickers does Brianna need to earn?*
7. What does the problem tell us? (*That Brianna needs 11 stickers, and that she's already earned 4 of those stickers.*) We need to figure out how many more she needs.
8. Remember the first number, 11, is our final answer. The other number, 4, is our second addend. That means we know $___ + 4 = 11$.
9. Start with the 11 and put that many red pieces on the ten frame boards, remembering to fill from the left to right. Based on the problem, students should know that they need to flip 4 red pieces to blue. After doing this, they can see that 7 pieces are still red, meaning the missing addend in the equation is 7. They should fill the missing number into the equation. They will also be able to answer the question, "How many more stickers does Brianna need to earn?" (*7 stickers*)

DAY TWO

Practice #2

Have students work on problem 3 independently. Before allowing them to move on, ask them the questions listed in the Check for Understanding II section below. If they can answer those questions, have them work on problems 4-5 independently. If not, model again for problem 4 using the same line of questioning as you work through it, then have them work on problem 5 independently.

Check for Understanding II

1. How many pieces did you start with on the red side? (*18*)
2. How did you know to put 18 pieces? (*The first number in a word problem is always the last number in our equation. We always work backwards.*)
3. How many of the red pieces did you flip to blue? (*12*)
4. How did you know to flip 12 pieces? (*The word problem told us that he already has 12 cards.*)
5. What number did you fill in as your missing addend? (*6*)
6. How did you know to use 6? (*After I flipped 12 pieces to blue, I had 6 that were still red.*)

Intervention

- Students can work on problems with missing addends up to 10.
- All problems could be done in a whole group setting.
- The Intervention Worksheets could be done before the traditional worksheets. If doing this, keep in mind that Intervention Worksheet #1 is designed to accompany Activity I and that Intervention Worksheet #2 is designed to accompany Activity II.



Extension

- Students can work on problems with missing addends up to a higher number, like 30, 40, or 50.
- Students can create their own real world problems that replicate those that have been practiced during the lesson.
- Students can use ten frames to solve a variety of subtraction problems.
- Extension Worksheets have also been provided for further practice. Extension Worksheet #1 has been designed to accompany Activity I, and Extension Worksheet #2 has been designed to accompany Activity II.



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Ten Frames Worksheet #1

1. _____ + 9 = 15

2. _____ + 7 = 16

3. _____ + 8 = 12

Fact Family:

_____ + _____ = _____

_____ + _____ = _____

_____ - _____ = _____

_____ - _____ = _____

Fact Family:

_____ + _____ = _____

_____ + _____ = _____

_____ - _____ = _____

_____ - _____ = _____

Fact Family:

_____ + _____ = _____

_____ + _____ = _____

_____ - _____ = _____

_____ - _____ = _____

4. _____ + 5 = 13

5. _____ + 8 = 17

Fact Family:

_____ + _____ = _____

_____ + _____ = _____

_____ - _____ = _____

_____ - _____ = _____

Fact Family:

_____ + _____ = _____

_____ + _____ = _____

_____ - _____ = _____

_____ - _____ = _____

Name: _____

Ten Frames Intervention Worksheet #1

1. _____ + 3 = 9

Fact Family:

_____ + _____ = _____

_____ + _____ = _____

_____ - _____ = _____

_____ - _____ = _____

2. _____ + 5 = 8

Fact Family:

_____ + _____ = _____

_____ + _____ = _____

_____ - _____ = _____

_____ - _____ = _____

3. _____ + 2 = 10

Fact Family:

_____ + _____ = _____

_____ + _____ = _____

_____ - _____ = _____

_____ - _____ = _____

4. _____ + 3 = 7

Fact Family:

_____ + _____ = _____

_____ + _____ = _____

_____ - _____ = _____

_____ - _____ = _____

Name: _____

Ten Frames Extension Worksheet #1

1. _____ + 16 = 25

Fact Family:

_____ + _____ = _____

_____ + _____ = _____

_____ - _____ = _____

_____ - _____ = _____

2. _____ + 12 = 23

Fact Family:

_____ + _____ = _____

_____ + _____ = _____

_____ - _____ = _____

_____ - _____ = _____

3. _____ + 8 = 21

Fact Family:

_____ + _____ = _____

_____ + _____ = _____

_____ - _____ = _____

_____ - _____ = _____

4. _____ + 6 = 32

Fact Family:

_____ + _____ = _____

_____ + _____ = _____

_____ - _____ = _____

_____ - _____ = _____

5. _____ + 19 = 35

Fact Family:

_____ + _____ = _____

_____ + _____ = _____

_____ - _____ = _____

_____ - _____ = _____

6. _____ + 23 = 37

Fact Family:

_____ + _____ = _____

_____ + _____ = _____

_____ - _____ = _____

_____ - _____ = _____

Name: _____

Ten Frames Worksheet #2

1. Henry needs 14 cups for his birthday party next week. Henry already has 6 cups. How many more cups does Henry need for the party?

$$\underline{\hspace{2cm}} + \underline{\hspace{2cm}} = \underline{\hspace{2cm}}$$

Answer: _____

2. Brianna needs to earn 11 stickers to get a pick from her teacher's treasure box. She's already earned 4 stickers. How many more stickers does Brianna need to earn?

$$\underline{\hspace{2cm}} + \underline{\hspace{2cm}} = \underline{\hspace{2cm}}$$

Answer: _____

3. Simon wants to collect 18 baseball cards. He already has 12 cards. How many more cards does Simon need?

$$\underline{\hspace{2cm}} + \underline{\hspace{2cm}} = \underline{\hspace{2cm}}$$

Answer: _____

4. Stanley needs 19 books to fill his shelf. He already has 11 books on the shelf. How many more books does Stanley need on the shelf?

$$\underline{\hspace{2cm}} + \underline{\hspace{2cm}} = \underline{\hspace{2cm}}$$

Answer: _____

5. Kylie needs 17 strawberries for a recipe. She already has 5 strawberries. How many more strawberries does Kylie need?

$$\underline{\hspace{2cm}} + \underline{\hspace{2cm}} = \underline{\hspace{2cm}}$$

Answer: _____

Name: _____

Ten Frames Intervention Worksheet #2

1. Sydney needs 6 markers for art class. She has 2 markers. How many more markers does she need?

 $\underline{\hspace{2cm}} + \underline{\hspace{2cm}} = \underline{\hspace{2cm}}$ Answer: $\underline{\hspace{4cm}}$

2. Ariel needs 9 shirts for her trip. She has 4 shirts already. How many more shirts does she need?

 $\underline{\hspace{2cm}} + \underline{\hspace{2cm}} = \underline{\hspace{2cm}}$ Answer: $\underline{\hspace{4cm}}$

3. Paulo wants to eat 10 apple slices. He's already had 3 slices. How many more slices will he eat?

 $\underline{\hspace{2cm}} + \underline{\hspace{2cm}} = \underline{\hspace{2cm}}$ Answer: $\underline{\hspace{4cm}}$

4. Zach scored 10 points in the basketball game. He scored 6 points in the first half. How many points did he score in the second half?

 $\underline{\hspace{2cm}} + \underline{\hspace{2cm}} = \underline{\hspace{2cm}}$ Answer: $\underline{\hspace{4cm}}$

Name: _____

Ten Frames Extension Worksheet #2

1. Mrs. Hayes needs 26 pencils for her class. She already has 17 pencils. How many more pencils does Mrs. Hayes need?

$$\underline{\hspace{2cm}} + \underline{\hspace{2cm}} = \underline{\hspace{2cm}}$$

Answer: _____

2. Fred has 34 people coming to his party. 13 of his friends have already arrived. How many more friends are on their way?

$$\underline{\hspace{2cm}} + \underline{\hspace{2cm}} = \underline{\hspace{2cm}}$$

Answer: _____

3. Gloria needs 22 envelopes. She already has 14 envelopes. How many more does she need?

$$\underline{\hspace{2cm}} + \underline{\hspace{2cm}} = \underline{\hspace{2cm}}$$

Answer: _____

Student Self-Created Word Problems

1. _____

$$\underline{\hspace{2cm}} + \underline{\hspace{2cm}} = \underline{\hspace{2cm}}$$

Answer: _____

2. _____

$$\underline{\hspace{2cm}} + \underline{\hspace{2cm}} = \underline{\hspace{2cm}}$$

Answer: _____