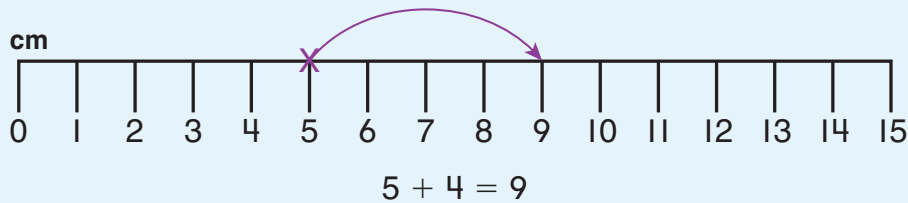


Lesson
1

From a Ruler to a Number Line

In this lesson, students connect the ruler, which they used extensively in the previous topic, to the number line, which they used extensively in Grade 1. This connection helps students develop meaning for addition and subtraction as they relate it to measurement. Working with number lines complements students' ideas about computation in the context of counting objects.



Grade 2 Standards

Measurement and Data

Measure and estimate lengths in standard units.

1. Measure the length of an object by selecting and using appropriate tools such as rulers, yardsticks, meter sticks, and measuring tapes.

Relate addition and subtraction to length.

6. Represent whole numbers as lengths from 0 on a number line diagram with equally spaced points corresponding to the numbers 0, 1, 2, ..., and represent whole-number sums and differences within 100 on a number line diagram.



Learning Goals

- I can use rulers to measure an object.
- I can use a number line to add and subtract with numbers up to 20.

About the Math

- The number line is a geometric model of all real numbers. Students can use a number line to model addition and subtraction, jumping right from a starting number for addition and left for demonstrating subtraction.
- There are two different subtraction strategies: *take away* and *determining the difference*. Although both are very effective and use a number line to solve, this lesson focuses on using the *take away* strategy only.


Where are we?

1 From a Ruler to a Number Line

- 2 Extending the Number Line
- 3 Re-Engaging with Using Number Lines
- 4 Adding on a Number Line
- 5 Adding on an Open Number Line
- 6 Re-Engaging with Identifying a Start, Change, and Result Using a Number Line
- 7 Subtracting on a Number Line
- 8 Subtracting on an Open Number Line
- 9 Using Strategies to Subtract on an Open Number Line
- 10 Creating a Picture Book
- 11 Re-Engaging with Computations on a Number Line

- Concept Lesson
- Re-Engagement Lesson

Daily Math Routines

 **Log in to Clear Learning Center Elementary** to download these digital resources and facilitation notes.

 **Headline Story**


An open-ended problem to develop language and reasoning skills

 **Mental Math**

Choral Counting by 2, 5, 10, and 100

Lesson Structure and Pacing Guide

Activate

 20 minutes

Guided Inquiry

Adding and Subtracting with Paper Strips

Students model addition and subtraction with a ruler and strips of paper.



Scissors



Strips of blank paper



Tape



Adding and Subtracting with Paper Strips

Explore 1

 15 minutes

Number Line

Adding and Subtracting with Serena

Students model jumps along a ruler and a number line that represent addition and subtraction equations.




Cutouts of Serena



Adding and Subtracting with Serena

Explore 2

 15 minutes

Collaborative Problem Solving


Adding and Subtracting on the Number Line

Students write equations based on models that show a starting number and a jump.



Adding and Subtracting on the Number Line

Reflect

 10 minutes

Writing to Learn Math

Reflect and Summarize

Students reflect on using a number line to model addition or subtraction equations.



Reflect and Summarize

Assignment



From a Ruler to a Number Line

Students write equations to represent a number line model that shows a starting point and a jump. They then label number lines having different intervals.



Adding and Subtracting with Paper Strips

Purpose: To model addition and subtraction with a ruler and strips of paper

- Scissors
- Strips of blank paper
- Tape

Adding and Subtracting with Paper Strips

Setting the Stage

- Prepare strips of blank paper that are at least 15 centimeters long.
- Distribute scissors, tape, and strips of paper to each pair of students. Use strips of paper that are wide enough that students can label them.
- Direct students to the *Adding and Subtracting with Paper Strips* activity.

Activate
Adding and Subtracting with Paper Strips
 > Use the rulers to complete the activity.

$8\text{ cm} + 5\text{ cm} = 13\text{ cm}$

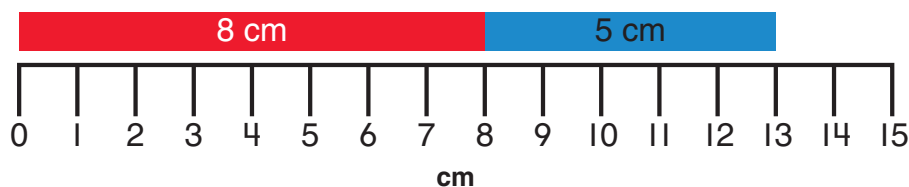
$14\text{ cm} - 6\text{ cm} = 8\text{ cm}$

13 LXV sixty-five 65

Task

- Have students work in pairs to complete the activity.
- Have one student in each pair cut and label two strips of paper that are each 8 centimeters long. Have them each tape a paper strip onto the first ruler from 0 to 8 centimeters.
- Have the other student in each pair cut and label two strips of paper that are each 5 centimeters long. Have them each tape a paper strip onto the same ruler, starting at 8 centimeters.

- How long is the first strip of paper? **8 centimeters**
- How long is the second strip of paper? **5 centimeters**
- How long are both strips combined? **13 centimeters**
- What operation did you model? **Addition**
- How can you represent this model as an addition equation?
 $8\text{ cm} + 5\text{ cm} = 13\text{ cm}$



Habits of Mind

- Model with mathematics.
- Use appropriate tools strategically.



Differentiation Strategy

Assistance for All

Suggest that students mark off the lengths that they are measuring first and check with a partner before cutting their strips of paper. Have plenty of paper strips available for students who may make an incorrect cut first.

Activate continued

Language Link

Developing

Mathematical Language

Students may have learned the term *take away* to refer to subtraction. Demonstrate how folding lengths under in the activity relates to taking away lengths of the strip.

- Have students record the addition equation below the first ruler in the activity.
- Have one student in each pair cut and label two strips of paper that are each 14 centimeters long.
- Have the other student in each pair measure 6 centimeters from the end of each paper strip and fold that section under. Have them each label a strip with its folded length and then tape it on the second ruler.
 - 🗨 How long was the original strip of paper? **14 centimeters**
 - 🗨 How many centimeters of paper did you fold under? **6 centimeters**
 - 🗨 How long is the new strip of paper? **8 centimeters**
 - 🗨 What operation did you model? **Subtraction**
 - 🗨 How can you represent this model as a subtraction equation?
 $14\text{ cm} - 6\text{ cm} = 8\text{ cm}$
- Have students record the subtraction equation below the second ruler in the activity.

Closing

- Have students analyze the strips of paper on both rulers.
 - 🗨 You taped the first two strips you cut side by side. Explain how this represents addition. **Sample answer: My partner and I put the two strips of paper beside each other to make a longer strip. By combining the lengths, we added them together.**
 - 🗨 How do you know that the third strip of paper you folded represents subtraction? **Sample answer: The strip was originally 14 centimeters long. We folded under a section of the paper strip, taking away a part of the original strip.**
- Have students stay on this page as they transition to the Explore. They will continue to work with the strips of paper on these rulers.

NOTES



Adding and Subtracting with Serena

Purpose: To model jumps along a ruler and a number line that represent addition and subtraction equations

Cutouts of Serena

Adding and Subtracting with Serena

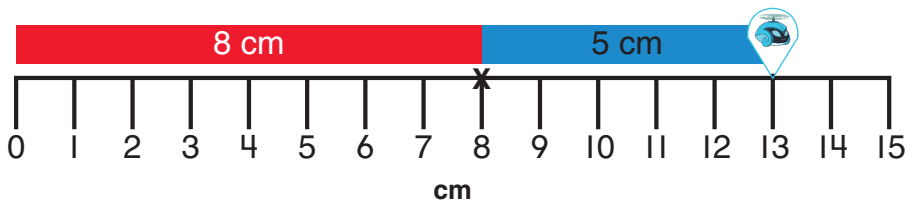
Setting the Stage

- Prepare and provide a cutout from the *Cutouts of Serena* resource for each student.
- Tell students that they are going to model the equations they just wrote with jumps.
- Have students place Serena at the end of the first paper strip labeled 8 centimeters.

What number is Serena on? **8**

- Have students show Serena jump forward, or to the right, 5 centimeters. Draw an X on 8 and model Serena jumping 5 centimeters for students.

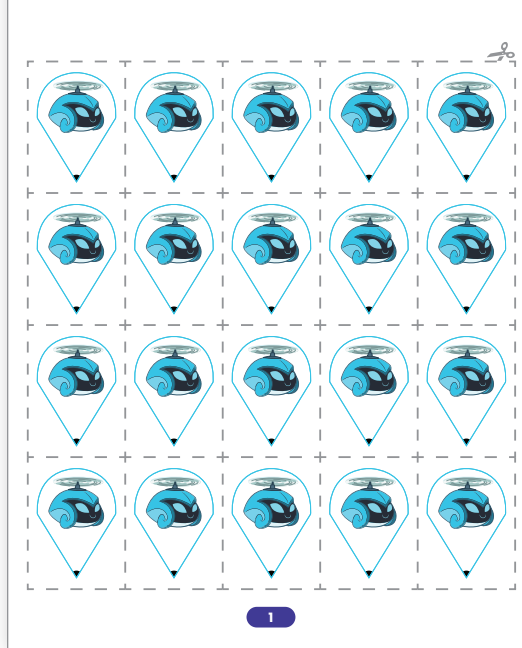
On which number did Serena land? **13**



- Have students use Serena to model the subtraction equation they wrote for the second ruler.
- Have students draw an X on 14. Then, model Serena jumping backward 6 centimeters.

Why is the X on 14? **Sample answer: The X is on 14 because that is the length of the strip I folded.**

Cutouts of Serena



Habits of Mind

- Model with mathematics.
- Use appropriate tools strategically.



Differentiation Strategy

Just in Time Support

It may be beneficial for some students to show Serena starting at 0 and jumping to the first addend or the minuend and then jumping to the second addend or the subtrahend.



Differentiation Strategies

Just in Time Support

Jumps on the number line may present a considerable cognitive challenge to students. What stands out visually is the dots, not the spaces in between them. You may want to show students how to jump on the number line one number at a time to help build their understanding of jumps on a number line.

Challenge Opportunity

Have students create their own addition and subtraction equations. They should draw them on a number line and have a partner write the equation that models their jumps.

Explore 1 continued

Task

- Direct students to the *Adding and Subtracting with Serena* activity.
- Have students draw an X on the number 5 on the ruler. Then, have them place Serena on top of the X. Tell students to jump Serena forward 4 centimeters.

Does Serena's jump model addition or subtraction? How do you know?

Sample answer: Serena's jump models addition because she jumps forward to a greater number.

Lesson 1 From a Ruler to a Number Line

Explore
Adding and Subtracting with Serena
 > Use the ruler and number line to complete the activity.

A number line is a line that shows numbers marked at equal distances from each other.

66 sixty-six LXVI ▲ $11 + 11 + 11 + 11 + 11$

What equation does Serena's jump model? $5 + 4 = 9$

- Tell students that the addition and subtraction equations do not have to represent measurements, so they can also use a number line to model any addition and subtraction equation.
- Have a student read the definition for *number line*.
 - How are a ruler and a number line alike? **Sample answer:** They both show numbers in order, and the numbers are all the same distance apart.
 - How are a ruler and a number line different? **Sample answer:** The distance between the numbers matters on a ruler, but it doesn't on a number line.
- Have students continue to model addition and subtraction on the number line using these expressions. After each one, have students describe where they start and how Serena jumped.
 - $6 + 5$
 - $4 + 8$
 - $12 - 7$
 - $11 - 2$

Closing

- Facilitate a discussion about how they used a ruler and a number line to model addition and subtraction.
 - How do you move Serena when you are modeling addition? **Sample answer:** I move Serena forward toward greater numbers.
 - How do you move Serena when you are modeling subtraction? **Sample answer:** I move Serena backward toward lesser numbers.
 - How does a ruler and a number line support your thinking when adding and subtracting? **Sample answer:** They both have numbers in order, so I can show jumps that represent numbers I am adding or subtracting.



Adding and Subtracting on the Number Line

Purpose: To write equations based on models that show a starting number and a jump

Adding and Subtracting on the Number Line

Setting the Stage

- Direct students to the *Adding and Subtracting on the Number Line* activity. Have a student read the directions aloud.

Task

- Have students work in pairs to complete the activity.
- Monitor students to determine whether they can identify the starting point, the jump (change), or the ending point (result) based on the model and work through the questions together.

Closing

- Facilitate a discussion about Question 2. Have students describe their model and share their equation.

How can you describe this model? **Sample answers:** This is an addition model because the jump is forward. Serena started at 2 and jumped 7 spaces to the 9.

What equation does this model represent? $2 + 7 = 9$

Explore
Adding and Subtracting on the Number Line
 > Write the equation modeled by each jump.

1 $5 + 5 = 10$

2 $2 + 7 = 9$

3 $10 - 6 = 4$

4 $8 + 3 = 11$

70 - 3 LXVII sixty-seven 67

Lesson 1 From a Ruler to a Number Line

Explore continued
 > Complete each equation to represent the jump modeled on each number line.

5 $4 + 2 = 6$

6 $7 + 3 = 10$

7 $8 - 5 = 3$

8 $7 - 5 = 2$

Habits of Mind

- Model with mathematics.
- Use appropriate tools strategically.

Common Misconception

Students sometimes count the dots they pass over as the jump distance when determining the jump difference. When necessary, remind students that the distance of the jump is the number of spaces between the starting and ending points. Have students place cubes within each space to indicate the number of jumps it takes to move from 1 number to another.



Ongoing Assessment

Observe students as they write equations to model each jump.

- For each ruler and number line, can students explain the meaning of the arrow, the X, and the jump distance?
- Can students distinguish addition from subtraction?



Habits of Mind

- Model with mathematics.
- Use appropriate tools strategically.

Language Link

Multilingual Learner Support

Display the words *line*, *dot*, *label*, *jump*, *starting point*, *ending point*, and *equation*. Display a number line model and have students label it with the terms to reinforce the mathematical language in the lesson.



Differentiation Strategy

Just in Time Support

Consider providing students with specific equations to use as they explain how to model addition and subtraction using a number line. You may wish to draw the model as students explain, making sure that students relate each number in the equation to the starting point, the jump, and the ending point on the model.

Reflect and Summarize

Purpose: To reflect on using a number line to model addition or subtraction equations

Reflect and Summarize

Setting the Stage

- Direct students to the *Reflect and Summarize* activity. Have a student read the question aloud.

Task

- Have students work individually to answer the question.

Reflect

Reflect and Summarize

► Think about what you learned in this lesson.

- 1 How can you model addition or subtraction equations on a number line? Explain your thinking using words, numbers, or pictures.

Sample answer: For addition, I can start on the number line at one of the numbers I am adding and then show a jump forward to the ending number, or sum. For subtraction, I can start on the number line and jump backward the number of spaces I am subtracting. Where I land is the difference.

68

sixty-eight LXVIII 34 + 34

Closing

- Facilitate a discussion about using a number line to add or subtract.

- ◻ How can you model addition on a number line? **Sample answer:** I can model a jump forward so that the ending number is greater than the starting number.
- ◻ How can you model subtraction on a number line? **Sample answer:** I can model a jump backward so that the ending number is less than the starting number.

NOTES

Planning to Re-Engage

Use the Reflect activity to assess each student's current level of understanding with using number lines to model addition and subtraction. In preparation for the Re-Engagement Lesson, indicate here which students are demonstrating green, yellow, and red levels of understanding.

Green

Student demonstrates a complete and correct understanding.

Yellow

Student demonstrates a partial understanding.

Red

Student cannot yet demonstrate an understanding or demonstrates significant misunderstandings.

Assignment



From a Ruler to a Number Line

Purpose: To write equations to represent a number line model that shows a starting point and a jump and to label number lines having different intervals

Name: _____

Assignment

Lesson 1
From a Ruler to a Number Line

Write the equation modeled by each jump.

1 $3 + 4 = 7$

2 $12 - 8 = 4$

3 $5 + 5 = 10$

4 $8 + 6 = 14$

70 - 1 **LXIX** sixty-nine **69**

Lesson 1 From a Ruler to a Number Line

Assignment

Complete the labels for each number line.

5 $49 \quad 50 \quad 51 \quad 52 \quad 53 \quad 54 \quad 55 \quad 56 \quad 57 \quad 58$

6 $25 \quad 27 \quad 29 \quad 31 \quad 33 \quad 35 \quad 37 \quad 39 \quad 41 \quad 43 \quad 45 \quad 47 \quad 49$

7 $3 \quad 6 \quad 9 \quad 12 \quad 15 \quad 18 \quad 21 \quad 24 \quad 27$

8 $8 \quad 10 \quad 12 \quad 14 \quad 16 \quad 18 \quad 20 \quad 22 \quad 24 \quad 26$

9 $54 \quad 56 \quad 58 \quad 60 \quad 62 \quad 64 \quad 66 \quad 68 \quad 70 \quad 72$

70 seventy **LXX** 14

NOTES