

Lesson  
**7-8A**  
Action Fractions  
Math+CT

# The Frog and The Fly

**Math Connections:** Children partition a line segment into equal parts.

**CS Connections:** Children explore using the repeat block and practice debugging code using test, observe, adjust to arrive at an expected output.

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► **Vocabulary**

repetition • output • debug(ging)

**Computational Thinking**

- **DEBUGGING:** Outcomes can be used to decide whether or not there are errors.
- **DEBUGGING:** Iterative refinement can help fix errors.
- **REPETITION:** Computers use repeat commands.

**1 Warm Up** 5 min

**Materials**

**Pete and Repeat**

Children consider repetition.

**"I Can ..." Statements**

Children read the explicit math and CS goals.

**2 Focus** 35–40 min

**Fraction Number Line Sketches**

Children practice partitioning and labeling number line segments.

*Fraction Number Line Poster*

**3.NF.2, 3.NF.2a**

**Using Scratch to Sketch Number Lines**

Children modify a Scratch project to successfully make equal partitions on a number line.

*The Frog and The Fly project; The Frog and The Fly TIPP&SEE journal pages; The Frog and The Fly journal pages*

**"I Can ..." statements**

- *I can carefully observe a program while it runs.*
- *I can identify the error in a program.*
- *I can fix (or correct) the error in a program.*
- *I can make a program achieve the expected outcome/goal.*

**Anticipated Barriers**

- Adjusting both arguments in the "Tickmark" sprite may be confusing for some children. Scaffold by having children adjust only one argument at a time.
- Children may struggle with reading text-heavy parts of the lesson.
- Children may have difficulty understanding the relationship between numbers in the "repeat" and "move" blocks.

**Student Options**

Consider these options for adapting the lesson to your students' preferences:

- Some children may wish to work in partnerships for the TIPP&SEE exploration of the project.

"I Can ..." statements

- I can carefully observe a program while it runs.
- I can identify the error in a program.
- I can fix (or correct) the error in a program.
- I can make a program achieve the expected outcome/goal.

# 1 Warm Up

5 min

## ► Pete and Repeat

Start by telling children the "Pete and Repeat" joke. Ask:

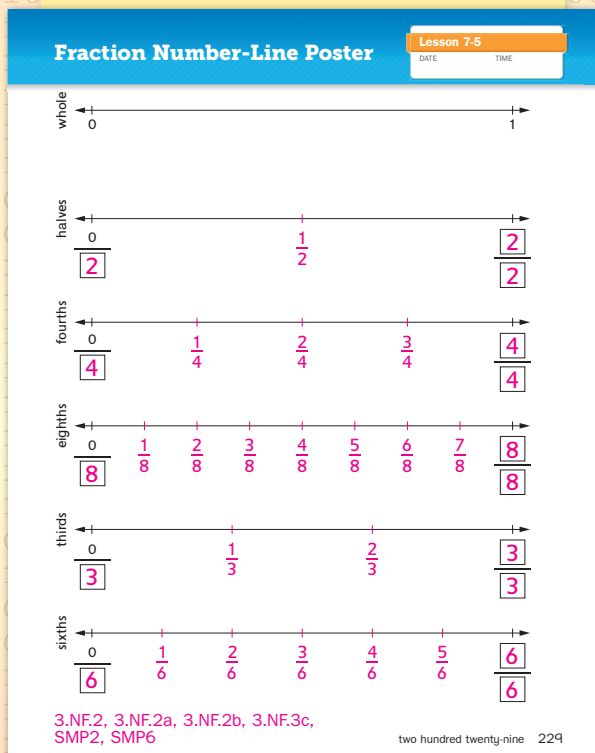
- Pete and Repeat are sitting on a fence. Pete falls off, who is left?  
Repeat
- Pete and Repeat are sitting on a fence. Pete falls off, who is left?  
Repeat
- Pete and Repeat are sitting on a fence. Pete falls off, who is left?  
Repeat ...

Ask: Why do you keep saying "Repeat?" That is the name of the person left on the fence. Ask: Why do I keep repeating the joke? Because we are saying "Repeat." Once children understand the joke (that "Repeat" is both the name of Pete's friend and also a request to tell the joke again), tell them that today's lesson will involve **repetition** or repeating. Ask children to think of everyday things that they repeat (e.g., brushing teeth up and down many times; you repeat the motion until your teeth are clean). Explain that repetition is very important when working with computer programs. We can tell a computer to do things over and over also.

## ► I Can ...

Display the "I Can ..." statements and remind children that these statements express the goals for today's lesson and can give them clues about what to expect. Carefully read each statement and ask them to use their thumbs to show how true they feel each statement is for them right now.

Fraction Number-Line Poster



# 2 Focus

35–40 min

## ► Fraction Number Line Sketches

WHOLE CLASS | SMALL GROUP | PARTNER | INDEPENDENT

Direct children's attention to your completed Fraction Number-Line Poster or the Class Fraction Number-Line Poster from Lesson 7-5 (journal page 229; see margin). Ask: What do all these number lines have in common? Sample answer: They all show numbers between 0 and 1.

As needed, point out the following to children:

- Tick marks partition each number line into equal parts.
- All the number lines show numbers between 0 and 1.
- The name of the number 0 or 1 is different for each number line, depending on the denominator of the fractions being represented. For example, on the "fourths" number line, the name for 0 is  $\frac{0}{4}$ , while the name for 1 is  $\frac{4}{4}$ . All the names for 1 are equivalent fractions.

Ask:

- What does it mean to partition a number line? **Sample answer: to break it into smaller parts**
- When you partition a number line, what part of the fraction tells how many equal parts? **the denominator**
- When you partitioned the number line, what was repeated? **Sample answers: tick marks, equal spaces, adding unit fractions**

Now tell children that you will try sketching some number lines. Sketch four identical number lines, adding tick marks at 0 and 1. Ask a volunteer to help you partition each of the number lines into thirds, fourths, or sixths. Be sure to label all the tick marks. As you partition, encourage children to think about the strategies and steps you or the volunteer is using to get equal parts.

For the last number line sketch, try partitioning the number line into fifths. Point out to children that you will have to estimate where to place the first tick mark, and ask them to observe what you do. Intentionally place the first tick mark too close to 0 or too far from 0 and ask children to predict whether you will end up with 5 equal pieces if you keep going.

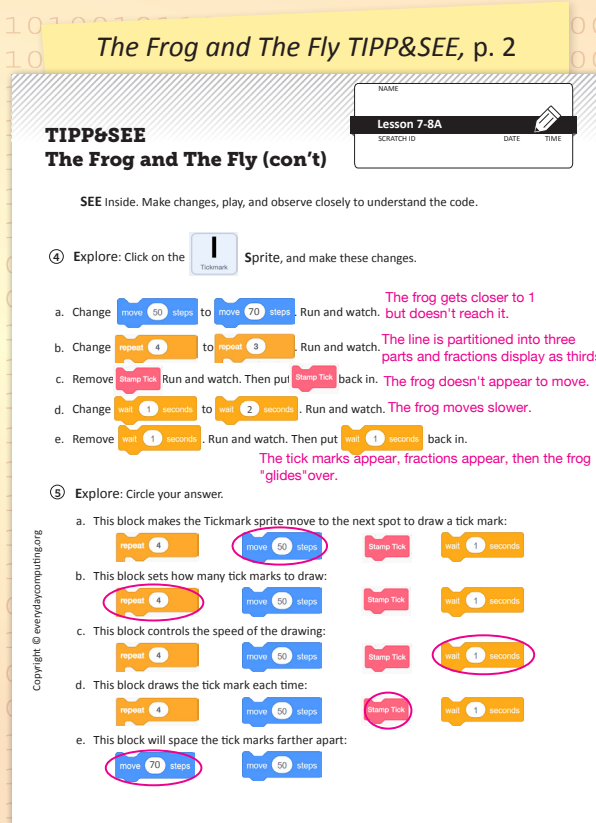
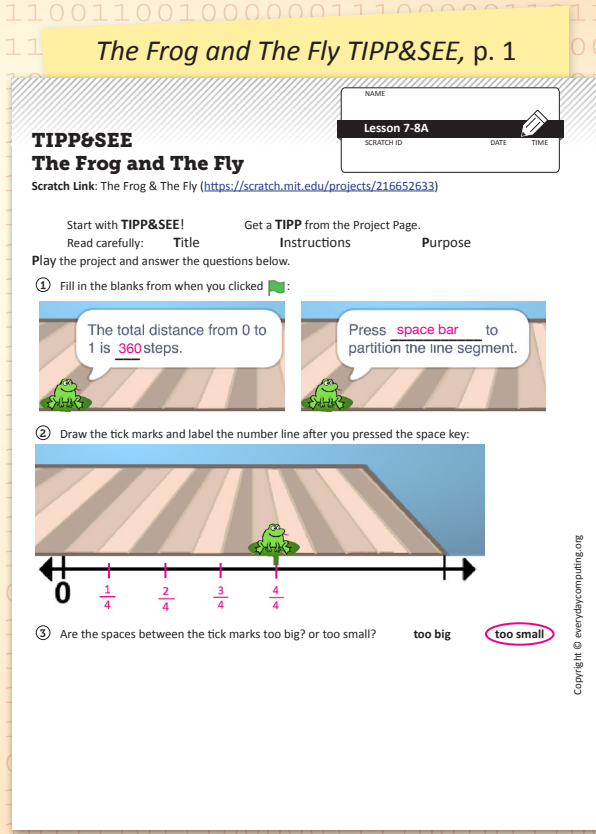
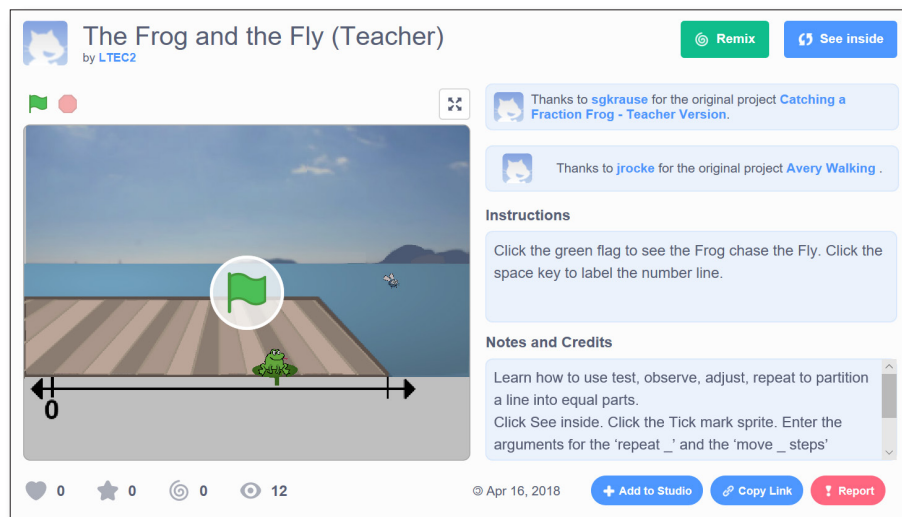
Finish partitioning the number line incorrectly and refer to this as your **output**. Ask children to give you suggestions about how you might improve your output if you tried again to a number line sketch for fifths. **Sample answer: Make your first tick mark closer to (or farther from) zero.**

Explain to children that today they will use Scratch to partition a line segment into equal parts, similar to the sketches you made on the board. Remind children that they have worked with line segments in Scratch before, exploring distance on a boardwalk using a number line segment that was already partitioned into equal parts (the Fraction Number Line Exploration project).

## ► Using Scratch to Sketch Number Lines

WHOLE CLASS   SMALL GROUP   PARTNER   INDEPENDENT

Distribute the TIPP&SEE journal pages and open today's project: The Frog and the Fly (<https://scratch.mit.edu/projects/216652633/>). Children should explore the Scratch project and complete the pages.



The Frog and The Fly, p. 1

**The Frog and The Fly**

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Carefully read the directions for each problem. Do Problems 1 to 4 without the computers.

1 Draw tick marks to partition the line segment below into fourths. Label each fraction tick mark.

2 We want the program to partition the line segment into fourths. The line segment below is 360 steps long. When the code below runs, it gives this output:

Are the spaces between the tick marks too big or too small?

3 For Problem 2, the number in the repeat block sets how far apart the tick marks are. Does the number in the repeat block need to be bigger or smaller?

4 Estimate what you think the numbers should be for fourths. Write them in the script on the right.

Answers will vary.  
Sample answers:  
 $90 + 90 = 180$  and  $180 + 180 = 360$   
 $90 + 90 + 90 + 90 = 360$   
 $360/4 = 90$ , so  $360/4 = 90$

5 Check your estimates for Problem 4. If those numbers do not partition the line into four equal parts, then adjust, observe, and test until the output is four equal parts. Write those numbers in the script at the right.

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**repeat**

1. test
2. observe
3. adjust

Ask: Did the program do exactly what you wanted it to do at first? **no**  
Did you just give up on the program and start over? **Sample answer: No, we modified the code by trying different values in the blocks until we got what we wanted.** Explain to children that in CS this is called **debugging**: observing an outcome, finding any errors, adjusting the program, and testing the program to see if it produces the expected outcome. When programmers design a program, they test, observe, and adjust the program, then repeat these three steps until they have an expected result or the problem is solved. So in this case, children suggested an argument, used it in their program to test their argument, observed that the line segment was not partitioned in equal parts, then adjusted the argument, and tried again, until the line segment was partitioned into equal parts. This is a process of debugging. Write the three steps (test, observe, adjust) on the board, then surround with a drawn repeat block (see margin art). Tell children now they will follow this process to complete the problems on their journal pages.

Display the journal page and walk through the directions for Problems 1–4. Point out that Problems 1–4 are to be completed without computers. Children should use their Scratch projects to complete Problems 5–10.

**Wrap Up**

- WHOLE CLASS
- SMALL GROUP
- PARTNER
- INDEPENDENT

When children have had sufficient time to modify their projects and finish their journal pages, bring them together for a discussion. Ask:

- What did you discover about the numbers you entered in the repeat and the move ( ) steps blocks? **Sample answers: The number you enter in the repeat block tells the program how many tick marks to put on the line segment and the number you put in the move ( ) steps block tells the program how much space to put between the tick marks.**
- What happens when you decrease the number you enter in the move ( ) steps block? **The space between the tick marks becomes smaller.**
- What pairs of numbers worked for the Frog to catch the Fly? **Answers vary.** Write these in a table.
- What do you notice about these pairs of numbers? **The product of each pair of numbers is 360.**
- Did anybody discover a different way to determine the number of steps to create equal parts? **Sample answers: Divide the total number of steps between the starting point and end point by the number of equal parts.**
- Where else do you think that you would use debugging? **Sample answers: On tests, when we get the wrong answer; when we are trying to predict something in science.**

**Now “I Can ...”** Review today’s “I Can ...” statements (see page 2) and ask children to use their thumbs to show their opinion of each statement.

The Frog and The Fly, p. 2

**The Frog and The Fly (continued)**

Lesson 7-8A

6 Draw tick marks to partition the line segment below into sixths. Label each fraction tick mark.

7 The output from the blocks below should place six tick marks and partition the line into six equal parts. Enter the arguments into your Scratch project and draw the output below.

Are the spaces between the tick marks too big or too small?

Does the number in the repeat block need to be bigger or smaller?

8 Estimate what you think the numbers should be for sixths. Write them in the script on the right.

Answers will vary.  
Sample answers:  
 $60 + 60 = 120$ ;  $120 + 120 + 120 = 360$   
 $60 + 60 + 60 + 60 + 60 + 60 = 360$   
 $360/6 = 60$ , so  $360/6 = 60$

9 Now try your program. Test, observe, modify, repeat until it is correct. Write your correct code on the right.

10 What other programs can you write to partition the number line? **Answers vary.**

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