Lesson
7-5A
Action Fractions
Math+CT

Fraction Number-Line Exploration

Math Connections: Children consider fractional distances on a number line.
CS Connections: Children build scripts with a small set of instructions and explore making changes to achieve the same outcome.

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Computational Thinking
- **SEQUENCE:** Different sets of instructions can produce the same outcome

1 Warm Up 5–10 min

	Materials	
Moving on a Number Line Children review interpreting numbers on a number line as distances from 0.		
"I Can ..." Statements Children read the explicit math and CS goals.		

2 Focus 35–40 min

Solving Fraction-Strip Problems Children discuss the same fraction-strip problem using a Math Masters page and using Scratch.	*Math Masters,* p. 238 ; *Fraction Number Line 1* project (for demonstration); fraction strips (optional); fractions circles (optional)	3.NF.2, 3.NF.2a, 3.NF.2b
TIPP&SEE Children explore the Scratch project and find different solutions for the same problem.	*Fraction Number Line 1* project; *Fraction Number Line 1 TIPP&SEE* journal pages	
Fraction Number-Line Exploration Children program Avery to walk particular distances in more than one way.	*Fraction Number Line 1* project; *Fraction Number-Line Exploration* journal pages	3.NF.2, 3.NF.2a, 3.NF.2b, 3.NF.3b

"I Can ..." statements

- *I can move a fractional distance on a number line.*
- *I can predict the result of a sequence of instructions in Scratch.*
- *I can test my predictions in Scratch.*
- *I can use different sequences of instructions to reach the same goal.*

Anticipated Barriers

- Students may struggle with working with fractions of different sizes (same whole partitioned into different fractional parts).
- Students may have trouble coming up with equivalent fractions for the shorter distances.

Student Options

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

- Some children may wish to work with physical fraction models such as fraction strips and fraction circle pieces.

"I Can ..." statements

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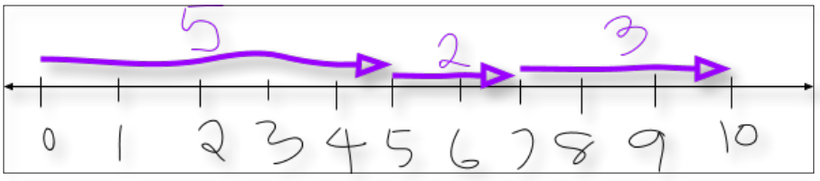
- *I can predict the result of a sequence of instructions in Scratch.*
- *I can test my predictions in Scratch.*
- *I can use different sequences of instructions to reach the same goal.*

1 Warm Up 5–10 min

Moving on a Number Line

To reinforce the notion of a number line as a model for thinking about fractions, remind children that fractions on a number line are numbers representing distances from 0 to an endpoint. Draw a number line on the board and label it from 0 to 10. Ask children to think about different ways to move to 10.

For example:



To explain this solution, say: *I started at 0. I moved 5, then moved 2, then moved 3 to get to 10.*

Ask children if there might be other ways to go the distance from 0 to 10 using two or three moves. Yes Ask a volunteer to describe a different way to move to 10. Sample answer: I started at 0. I moved 6 and then 4 to get to 10.

Next ask children to volunteer a way to get from 0 to 7 using two moves. Sample answer: I started at 0. I moved 5 and then 2 to get to 10.

Now ask children to imagine zooming in on the number line so it only shows the distance between 0 and 1. Ask: *Could we still move the distance from 0 to 1?* Yes *What kind of number could we use to describe the distance from zero or length of each move?* a fraction Remind students of the fractions they have used in previous lessons (halves, thirds, fourths, fifths, sixths, etc.). Tell them that today they will be thinking about moving the distance across a number line to get to specific points (or spots) along the number line.

I Can ...

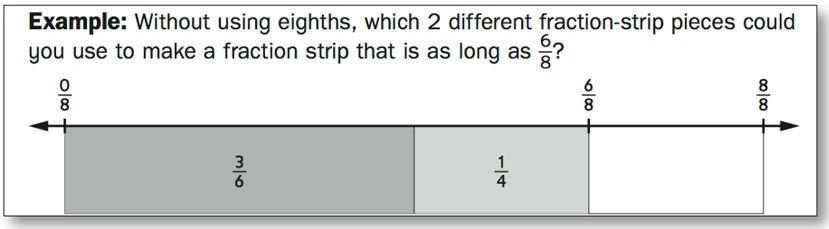
Display the "I Can ..." statements and remind children that these statements express the goals for today's lesson and can give them clues about what to expect. Carefully read each statement and ask them to use their thumbs to show how true they feel each statement is for them right now.

2 Focus 35–40 min

Solving Fraction-Strip Problems

WHOLE CLASS | SMALL GROUP | PARTNER | INDEPENDENT

Display the following example from *Math Masters*, page 238:



Move your finger along the number line to explain this solution to the class. For example: *I started at 0. I moved 3-sixths and then 1-fourth to get to 6-eighths.* Challenge students to work in partnerships to come up with another solution to the problem. Sample answer: I started at 0. I moved 1-fourth and then 1-half to get to 6-eighths.

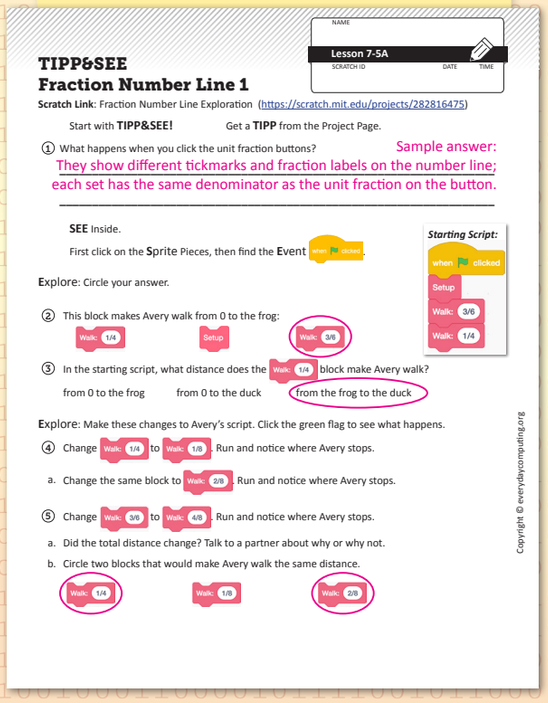
As needed, show children how to use different strategies to come up with different solutions. They may wish to use fraction strips, fraction circle pieces, or write equivalent fractions or different number names for the fractions (e.g., $\frac{6}{8}$ is another name for $\frac{3}{4}$).

Now open the Fraction Number Line 1 (https://scratch.mit.edu/projects/282816475) project and go over the project page with the class using TIPP.

After you Play the project, ask:

- *When we clicked the green flag, Avery walked the total distance to which animal?* the duck
- *Along the way, where did she pause?* the frog
- *Can we easily tell the fraction name for each animal's spot right now?* No; we could estimate but would need to measure or see labeled tickmarks on the number line.
- *What do you notice on the stage that might help you name the location of each animal's spot on the number line?* the unit fraction buttons

Fraction Number-Line 1 TIPP&SEE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TIPP&SEE
Fraction Number Line 1

Scratch Link: Fraction Number Line Exploration (https://scratch.mit.edu/projects/282816475)

Start with **TIPP&SEE!** Get a **TIPP** from the Project Page.

① What happens when you click the unit fraction buttons? Sample answer: They show different tickmarks and fraction labels on the number line; each set has the same denominator as the unit fraction on the button.

SEE Inside.

First click on the **Sprite** Pieces, then find the **Event**

Starting Script: when clicked, Setup, Walk: 3/6, Walk: 1/4

Explore: Circle your answer.

② This block makes Avery walk from 0 to the frog: Walk: 1/4 | Setup | Walk: 3/6

③ In the starting script, what distance does the Walk: 1/4 block make Avery walk?
from 0 to the frog | from 0 to the duck | from the frog to the duck

Explore: Make these changes to Avery's script. Click the green flag to see what happens.

④ Change Walk: 1/4 to Walk: 1/8. Run and notice where Avery stops.

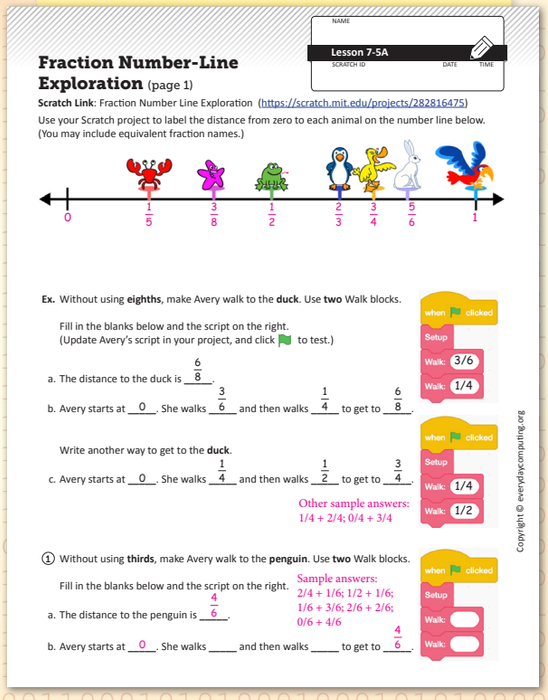
a. Change the same block to Walk: 2/8. Run and notice where Avery stops.

⑤ Change Walk: 3/6 to Walk: 4/8. Run and notice where Avery stops.

a. Did the total distance change? Talk to a partner about why or why not.

b. Circle two blocks that would make Avery walk the same distance.
Walk: 1/4 | Walk: 1/8 | Walk: 2/8

Fraction Number-Line Exploration, p. 1



Fraction Number-Line Exploration (page 1)

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Scratch Link: Fraction Number Line Exploration (https://scratch.mit.edu/projects/282816475)

Use your Scratch project to label the distance from zero to each animal on the number line below. (You may include equivalent fraction names.)

0, $\frac{1}{5}$, $\frac{3}{8}$, $\frac{1}{2}$, $\frac{2}{3}$, $\frac{3}{4}$, $\frac{5}{6}$, 1

Ex. Without using **eighths**, make Avery walk to the **duck**. Use **two** Walk blocks.

Fill in the blanks below and the script on the right.
(Update Avery's script in your project, and click to test.)

a. The distance to the duck is $\frac{6}{8}$.

b. Avery starts at 0. She walks $\frac{3}{6}$ and then walks $\frac{1}{4}$ to get to $\frac{6}{8}$.

when clicked / Setup / Walk: 3/6 / Walk: 1/4

Write another way to get to the **duck**.

c. Avery starts at 0. She walks $\frac{1}{4}$ and then walks $\frac{1}{2}$ to get to $\frac{3}{4}$.

Other sample answers: 1/4 + 2/4; 0/4 + 3/4

when clicked / Setup / Walk: 1/4 / Walk: 1/2

① Without using **thirds**, make Avery walk to the **penguin**. Use **two** Walk blocks.

Fill in the blanks below and the script on the right.

a. The distance to the penguin is $\frac{4}{6}$.

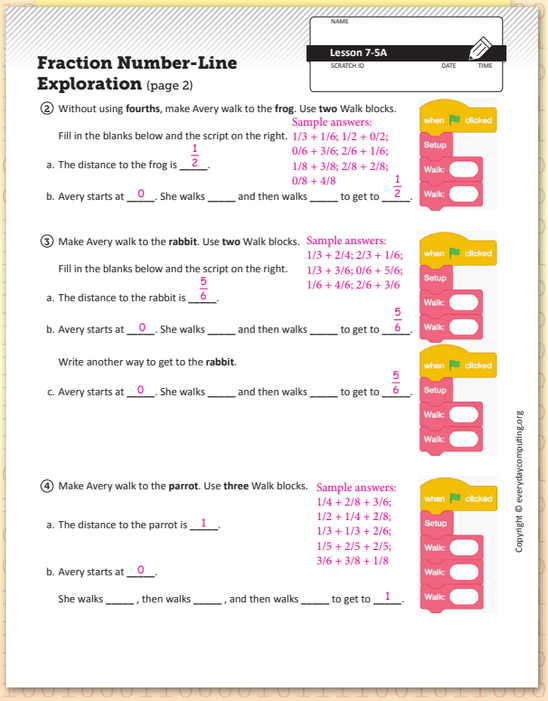
b. Avery starts at 0. She walks _____ and then walks _____ to get to $\frac{4}{6}$.

Sample answers: 2/4 + 1/6; 1/2 + 1/6; 1/6 + 3/6; 2/6 + 2/6; 0/6 + 4/6

when clicked / Setup / Walk: / Walk:

NOTE Children may not know where the "/" symbol is on the keyboard. It is next to the "shift" key on the right side of the keyboard. They will need to use this symbol when entering fractions in the Walk blocks.

Fraction Number-Line Exploration, p. 2



Fraction Number-Line Exploration (page 2)

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② Without using **fourths**, make Avery walk to the **frog**. Use **two** Walk blocks.

Fill in the blanks below and the script on the right.

a. The distance to the frog is $\frac{1}{2}$.

b. Avery starts at 0. She walks _____ and then walks _____ to get to $\frac{1}{2}$.

Sample answers: 1/3 + 1/6; 1/2 + 0/2; 0/6 + 3/6; 2/6 + 1/6; 1/8 + 3/8; 2/8 + 2/8; 0/8 + 4/8

when clicked / Setup / Walk: / Walk:

③ Make Avery walk to the **rabbit**. Use **two** Walk blocks.

Fill in the blanks below and the script on the right.

a. The distance to the rabbit is $\frac{5}{6}$.

b. Avery starts at 0. She walks _____ and then walks _____ to get to $\frac{5}{6}$.

Write another way to get to the **rabbit**.

c. Avery starts at 0. She walks _____ and then walks _____ to get to $\frac{5}{6}$.

Sample answers: 1/3 + 2/4; 2/3 + 1/6; 1/3 + 3/6; 0/6 + 5/6; 1/6 + 4/6; 2/6 + 3/6

when clicked / Setup / Walk: / Walk:

④ Make Avery walk to the **parrot**. Use **three** Walk blocks.

a. The distance to the parrot is 1.

b. Avery starts at 0.

She walks _____, then walks _____, and then walks _____ to get to 1.

Sample answers: 1/4 + 2/8 + 3/6; 1/2 + 1/4 + 2/8; 1/3 + 1/3 + 2/6; 1/5 + 2/5 + 2/5; 3/6 + 3/8 + 1/8

when clicked / Setup / Walk: / Walk: / Walk:

As needed, point out to children that the Scratch project is showing a solution to the same problem that they just solved using fraction strips: *Without using eighths, which 2 different fractions could Avery walk to get to* $\frac{6}{8}$*?* Say and write down the solution shown: Avery starts at 0. She walks 3-sixths and then walks 1-fourth to get to 6-eighths.

Ask children to tell you other ways the example problem is the same or different in Scratch than it was on the *Math Masters* page. Sample answer: Avery walks along a boardwalk that has animals on it. As she walks, a fraction-strip piece appears below her. When she pauses, a new fraction-strip piece starts.

TIPP&SEE

WHOLE CLASS | SMALL GROUP | PARTNER | INDEPENDENT

Distribute the Fraction Number Line 1 TIPP&SEE journal page and tell children that they will finish exploring the Scratch project on their own. Remind them that their goal is to figure out how the project works so they can use it to solve some math problems on their next journal pages. Have children log in to Scratch and go to the Fraction Number Line 1 project (https://scratch.mit.edu/projects/282816475). Children should work individually or in partnerships to complete the TIPP&SEE page.

When they have finished, bring children back together to go over the journal page and discuss any challenges that arose. Ask:

- *Why did Avery pause at certain animals?* Sample answer: Each Walk block makes Avery walk just the distance of that fraction. So if there are 2 walk blocks, she will pause once at the end of the first fraction.
- *Did Avery walk the same distance every time you changed the fraction in the Walk block? Why or why not?* Sample answer: Each Walk block makes Avery walk the distance of that fraction. So if I typed a different fraction in the walk block, Avery would walk a different distance, unless it was an equivalent fraction.
- *How could the unit fraction buttons help you find different ways to have Avery walk the same distance?* Sample answer: The unit fraction buttons could help me find equivalent fraction names for a distance, which might make it easier to find other smaller fractions.

Now display and work as a class to fill in the below table with the (eqivalent) fraction names for each animal's spot. Children may wish to use this table to label the number line at the top of their journal page.

$\frac{1}{2}$			$\frac{1}{2}$				$\frac{2}{2}$
$\frac{1}{3}$				$\frac{2}{3}$			$\frac{3}{3}$
$\frac{1}{4}$			$\frac{2}{4}$		$\frac{3}{4}$		$\frac{4}{4}$
$\frac{1}{5}$	$\frac{1}{5}$						$\frac{5}{5}$
$\frac{1}{6}$			$\frac{3}{6}$	$\frac{4}{6}$		$\frac{5}{6}$	$\frac{6}{6}$
$\frac{1}{8}$		$\frac{3}{8}$	$\frac{4}{8}$		$\frac{6}{8}$		$\frac{8}{8}$

Fraction Number-Line Exploration

WHOLE CLASS | SMALL GROUP | PARTNER | INDEPENDENT

Display the Fraction Number-Line Exploration journal page 1. Work through the example problem with the class to demonstrate how children should complete the journal pages. Remind children to fill in the arguments in the scripts to the right. Distribute the Fraction Number-Line Exploration journal pages. For each problem, children should attempt to come up with the fractions without the computer, then use the Scratch project to check their work. Remind children that they can use different strategies such as drawings or fraction strips to figure out which fractions to use.

Ex. Without using **eighths**, make Avery walk to the **duck**. Use **two** Walk blocks.

Fill in the blanks below and the script on the right.
(Update Avery's script in your project, and click ⚑ to test.)

a. The distance to the duck is $\frac{6}{8}$.

b. Avery starts at 0. She walks $\frac{3}{6}$ and then walks $\frac{1}{4}$ to get to $\frac{6}{8}$.

Write another way to get to the **duck**.

c. Avery starts at 0. She walks $\frac{1}{4}$ and then walks $\frac{1}{2}$ to get to $\frac{3}{4}$.

Other sample answers:
1/4 + 2/4; 0/4 + 3/4

Wrap Up

WHOLE CLASS | SMALL GROUP | PARTNER | INDEPENDENT

When children have had sufficient time to finish their journal pages, bring them together for a discussion. Ask children to Remix, Rename, Save, and Share their projects.

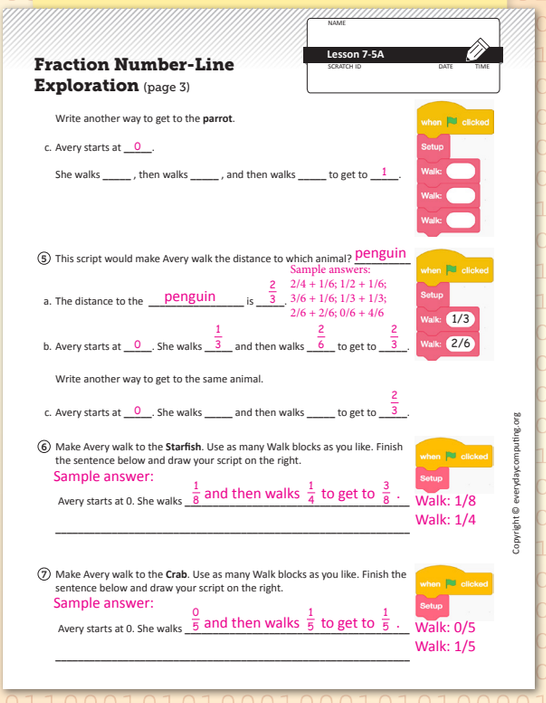
Explain that they have now shown that there may be different ways to get the same intended outcome in a computer program. Ask children to volunteer examples of changes they could make to this project and still get Avery to walk the same total distance.

Ask:

- *What was the same about solving fraction-strip problems on paper and in Scratch? What was different?* Answers vary.
- *What strategies did you use to find different ways to have Avery walk to the same animal?* Answers vary.
- *What are some other things you could program in Scratch where different instructions could do the same thing?* Answers vary.

Now "I Can ..." Review today's "I Can ..." statements and ask children to use their thumbs to show their opinion of each statement.

Fraction Number-Line Exploration, p. 3



Fraction Number-Line Exploration (page 3)

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Write another way to get to the **parrot**.

c. Avery starts at 0.

She walks ____, then walks ____, and then walks ____ to get to 1.

⑤ This script would make Avery walk the distance to which animal? penguin

a. The distance to the penguin is $\frac{2}{3}$. Sample answers: 2/4 + 1/6; 1/2 + 1/6; 3/6 + 1/6; 1/3 + 1/3; 2/6 + 2/6; 0/6 + 4/6

b. Avery starts at 0. She walks $\frac{1}{3}$ and then walks $\frac{2}{6}$ to get to $\frac{2}{3}$.

Write another way to get to the same animal.

c. Avery starts at 0. She walks ____ and then walks ____ to get to $\frac{2}{3}$.

⑥ Make Avery walk to the **Starfish**. Use as many Walk blocks as you like. Finish the sentence below and draw your script on the right.

Sample answer:

Avery starts at 0. She walks $\frac{1}{8}$ and then walks $\frac{1}{4}$ to get to $\frac{3}{8}$.

⑦ Make Avery walk to the **Crab**. Use as many Walk blocks as you like. Finish the sentence below and draw your script on the right.

Sample answer:

Avery starts at 0. She walks $\frac{0}{5}$ and then walks $\frac{1}{5}$ to get to $\frac{1}{5}$.

"I Can ..." statements

- *I can move a fractional distance on a number line.*
- *I can predict the result of a sequence of instructions in Scratch.*
- *I can test my predictions in Scratch.*
- *I can use different sequences of instructions to reach the same goal.*