Lesson
# 2-12A
Action Fractions
Math+CT

# Fraction Circles 1

**Math Connections:** Children use Fraction Circle pieces to represent a fraction as a sum of unit fractions.

**CS Connections:** Children build scripts with a small set of custom instructions to get the computer to place fraction circle pieces. They navigate the Scratch environment, add, remove, and repeat blocks, and change arguments of custom blocks.

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### ▶ Before You Begin

Gather enough complete sets of fraction circle pieces for children to have at least one set per group or table. Be prepared with a master list of credentials for each child.

### ▶ Vocabulary

stage • argument

### Computational Thinking

- **REPETITION:** Repeating things can have a cumulative effect.
- **DECOMPOSITION:** Complex problems can be broken into smaller parts.
- **SEQUENCE:** Computers require specific instructions using limited commands.

## 1 Warm Up 5–10 min

| | Materials | |
|---|---|---|
| **Using Fraction Circles**<br>Children review using fraction circle pieces and writing fraction number sentences. | fraction circle pieces; *SRB* pp. 134–135 | 3.NF.1 |
| **"I Can ..." Statements**<br>Children read the explicit Math and CS goals. | | |

## 2 Focus 45–50 min

| | | |
|---|---|---|
| **Fraction Circles 1 *TIPP&SEE***<br>Children explore the project and figure out how each block works. | *Fraction Circles 1* project; *Fraction Circles 1 TIPP&SEE* journal page; *TIPP&SEE Poster* | |
| **Fraction Circles 1**<br>Children write, draw, and build scripts to represent fractions in words, fraction circle pictures, and fraction number sentences. | *Fraction Circles 1* journal page; *Fraction Circles 1* project; fraction circle pieces | 3.NF.1 |

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

- *I can write a number sentence using fractions.*
- *I can represent a fraction as a sum of unit fractions.*
- *I can use a Scratch project to place fraction circle pieces.*
- *I can use a Scratch project to help me solve the problems on my journal page.*
- *I can change values of arguments in Scratch blocks.*

## Anticipated Barriers

- Moving from physical manipulatives to virtual manipulatives in Scratch may be challenging for children who do not have a strong conception of fractional parts.
- Iterating the Scratch code to create fractional parts may be challenging for some children.
- Completing all the columns in the journal page may be challenging for some children.

## Student Options

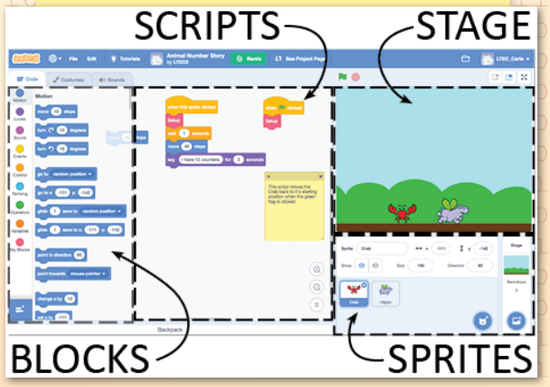
Consider these options for adapting the lesson to your students' preferences:

- Provide children with the physical manipulatives alongside the Scratch virtual manipulatives to have the concrete examples alongside the representational examples.
- Include video models of the correspondence between the Scratch blocks, fractional part circles, and number sentences.

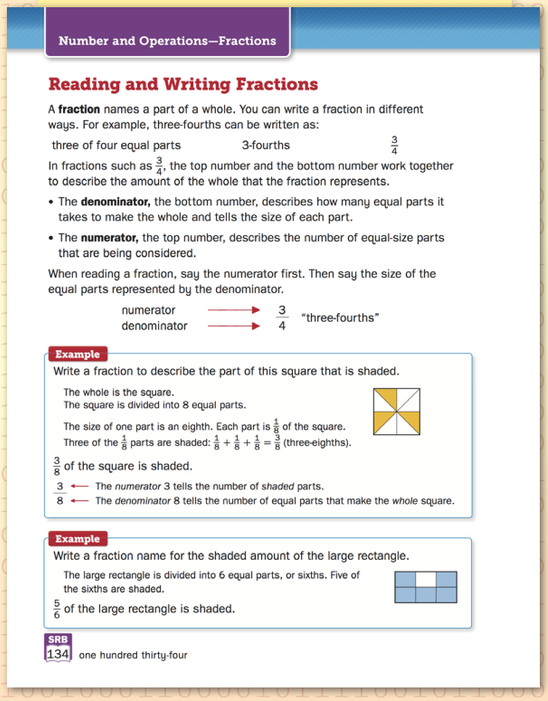
## "I Can ..." statements

- *I can write a number sentence using fractions.*
- *I can represent a fraction as a sum of unit fractions.*
- *I can use a Scratch project to place fraction circle pieces.*
- *I can use a Scratch project to help me solve the problems on my journal page.*
- *I can change values of arguments in Scratch blocks.*

## The Scratch Workspace




## *Student Reference Book* p. 134



Number and Operations—Fractions

**Reading and Writing Fractions**

A **fraction** names a part of a whole. You can write a fraction in different ways. For example, three-fourths can be written as:

three of four equal parts  3-fourths  $\frac{3}{4}$

In fractions such as $\frac{3}{4}$, the top number and the bottom number work together to describe the amount of the whole that the fraction represents.

- The **denominator,** the bottom number, describes how many equal parts it takes to make the whole and tells the size of each part.
- The **numerator,** the top number, describes the number of equal-size parts that are being considered.

When reading a fraction, say the numerator first. Then say the size of the equal parts represented by the denominator.

numerator → 3
denominator → 4
"three-fourths"

**Example**

Write a fraction to describe the part of this square that is shaded.

The whole is the square.
The square is divided into 8 equal parts.
The size of one part is an eighth. Each part is $\frac{1}{8}$ of the square.
Three of the $\frac{1}{8}$ parts are shaded: $\frac{1}{8} + \frac{1}{8} + \frac{1}{8} = \frac{3}{8}$ (three-eighths).

$\frac{3}{8}$ of the square is shaded.

$\frac{3}{8}$ ← The *numerator* 3 tells the number of *shaded* parts.
$\frac{3}{8}$ ← The *denominator* 8 tells the number of equal parts that make the *whole* square.

**Example**

Write a fraction name for the shaded amount of the large rectangle.

The large rectangle is divided into 6 equal parts, or sixths. Five of the sixths are shaded.

$\frac{5}{6}$ of the large rectangle is shaded.

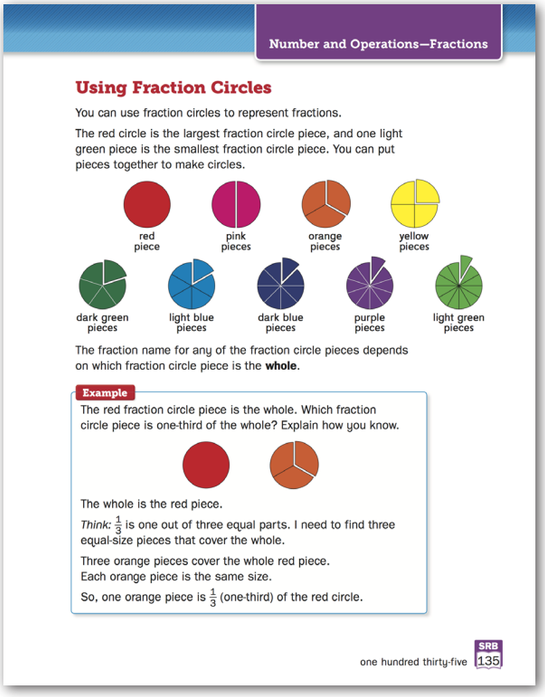
SRB 134 one hundred thirty-four

# 1 Warm Up 5–10 min

## Using Fraction Circles

*Student Reference Book,* p. 134–135

Distribute Fraction Circle pieces to children and display *Student Reference Book* pages 134–135. Read these pages together as a class. As needed, help children with the language for halves, thirds, fourths, fifths, sixths, eighths, tenths, and twelfths. Carefully go through the example on *SRB* page 135 using physical fraction circle pieces.



Number and Operations—Fractions

**Using Fraction Circles**

You can use fraction circles to represent fractions.

The red circle is the largest fraction circle piece, and one light green piece is the smallest fraction circle piece. You can put pieces together to make circles.

red piece, pink pieces, orange pieces, yellow pieces
dark green pieces, light blue pieces, dark blue pieces, purple pieces, light green pieces

The fraction name for any of the fraction circle pieces depends on which fraction circle piece is the **whole**.

**Example**

The red fraction circle piece is the whole. Which fraction circle piece is one-third of the whole? Explain how you know.

The whole is the red piece.

*Think:* $\frac{1}{3}$ is one out of three equal parts. I need to find three equal-size pieces that cover the whole.

Three orange pieces cover the whole red piece.
Each orange piece is the same size.

So, one orange piece is $\frac{1}{3}$ (one-third) of the red circle.

one hundred thirty-five SRB 135

As needed, use the fraction circle pieces to review fraction number sentences. Provide children with fraction circle pieces so they can use them when coming up with their answers or explanations. For example, hold up one dark green piece juxtaposed with the red piece as the whole. Ask: *What is the name of the dark green piece if the red piece is the whole? Explain how you know.* The dark green piece is ⅕, because five dark green cover the whole red piece. Now hold up three dark green pieces and ask children what fraction is shown. ⅗, because there are three ⅕ pieces. Ask children to help you write a number sentence for this on the board.
$\frac{3}{5} = \frac{1}{5} + \frac{1}{5} + \frac{1}{5}$

## 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.

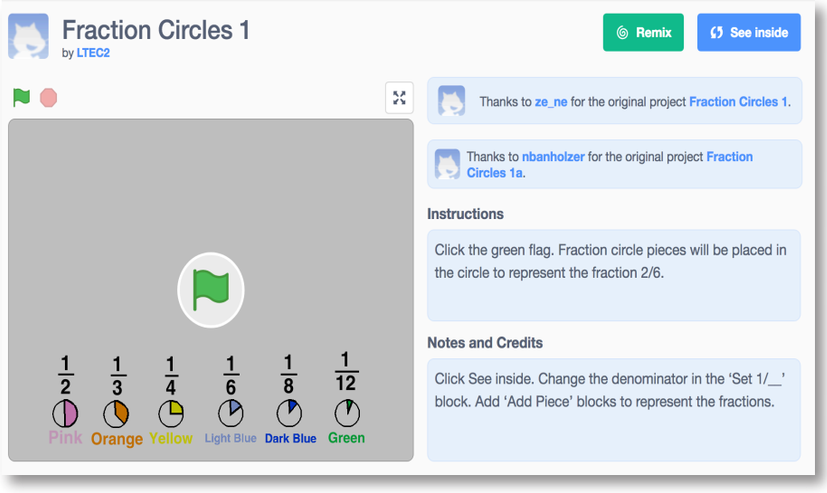
# 2 Focus 40–50 min

## Fraction Circles 1 *TIPP&SEE*

WHOLE CLASS | SMALL GROUP | **PARTNER** | **INDEPENDENT**

Open the Fraction Circles 1 project and remind children of the purpose of TIPP focus your attention on the project and SEE understand the code that makes the project work. Review each of the letters and their meanings. Before releasing children for individual exploration, explain that the part of the Scratch interface where the sprites do their actions is called the **stage**. Ask: *What do you notice on the stage that might help you identify the name of each fraction circle piece?* Sample answers: The fraction circle pieces labeled with unit fractions at the bottom of the stage; the denominator box has a 6 in it. Encourage children to use the term *unit fraction*. You may wish to prompt them by asking what all these fractions have in common. Provide the clue that they are all "unicorns" because they have 1 at the top! The words unicorn and unit both start with "uni-" which means one.

Distribute the TIPP&SEE journal page and tell children they will get a chance to explore the Scratch project. Explain that their goal is to figure out how each of the blocks works. Have children log in to Scratch and go to the *Fraction Circles 1* project (https://scratch.mit.edu/projects/211001031/).

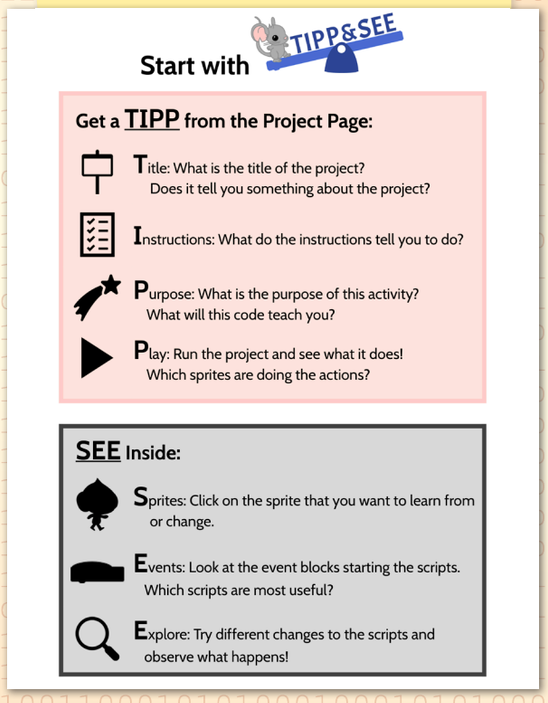



Once children have finished the Explore portion of the worksheet, bring them back together to go over each of the questions on the worksheet and discuss any challenges that arose. Then ask the questions below to check for overall understanding.

- *What does the Set 1/___ block do?* It chooses the fraction circle piece or sets the unit fraction denominator
- *What does the Add Piece block do?* It puts a fraction circle piece into the grey circle.

Explain to children that the white circle allows the programmer to type an **argument** for the set block. Ask children to think about what an appropriate argument might be – a whole number, decimal, word, etc. In this project, the denominator is the argument, so numbers go in the circle.

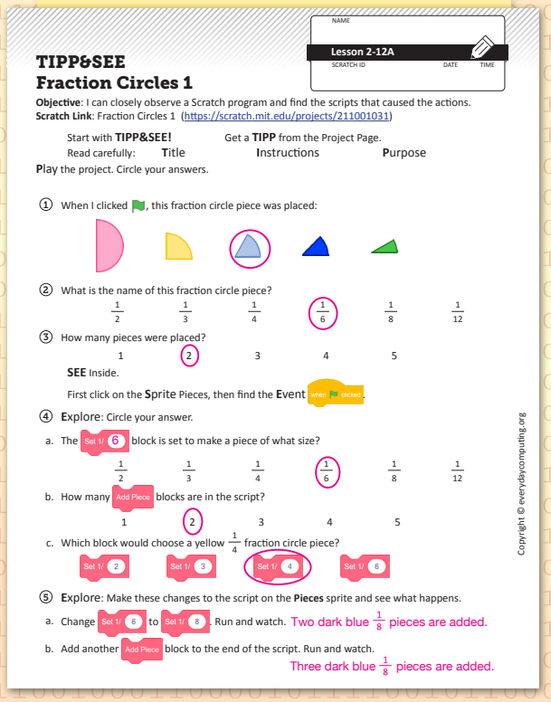
*TIPP&SEE* Poster




### Academic Language Development

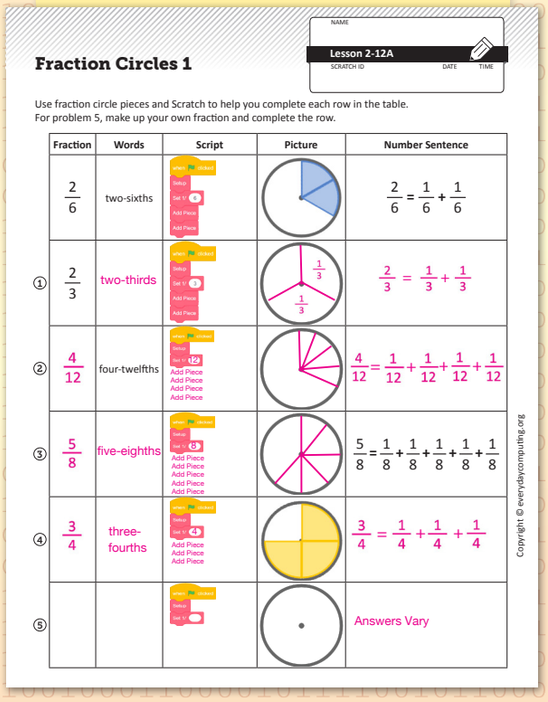
An **argument** is a number or other piece of information that is typed in a block to control what the block does.

*TIPP&SEE Fraction Circles 1*



**NOTE** In Lesson 1-12A, children learned how decomposition can be helpful when writing precise instructions for a computer. In this lesson, they build their understanding of decomposition by discussing it in the context of mathematics. Decomposition is a fundamental part of computational thinking, and children will continue to apply it as they program later in the year.

*Fraction Circles 1*



**Fraction Circles 1**

NAME

Lesson 2-12A

SCRATCH ID DATE TIME

Use fraction circle pieces and Scratch to help you complete each row in the table.
For problem 5, make up your own fraction and complete the row.

| | Fraction | Words | Script | Picture | Number Sentence |
|---|---|---|---|---|---|
| | $\frac{2}{6}$ | two-sixths | | | $\frac{2}{6} = \frac{1}{6} + \frac{1}{6}$ |
| ① | $\frac{2}{3}$ | two-thirds | | | $\frac{2}{3} = \frac{1}{3} + \frac{1}{3}$ |
| ② | $\frac{4}{12}$ | four-twelfths | | | $\frac{4}{12} = \frac{1}{12} + \frac{1}{12} + \frac{1}{12} + \frac{1}{12}$ |
| ③ | $\frac{5}{8}$ | five-eighths | | | $\frac{5}{8} = \frac{1}{8} + \frac{1}{8} + \frac{1}{8} + \frac{1}{8} + \frac{1}{8}$ |
| ④ | $\frac{3}{4}$ | three-fourths | | | $\frac{3}{4} = \frac{1}{4} + \frac{1}{4} + \frac{1}{4}$ |
| ⑤ | | | | | Answers Vary |



On the board, write the fraction number sentence first shown in the project: $2/6 = 1/6 + 1/6$

Explain that in this number sentence, we are decomposing or breaking down 2/6 into a sum of two 1/6 unit fractions. It is often helpful to break down a fraction into smaller parts when solving a problem. Remind children that earlier in the year, they learned that in programming, it is often helpful to break down a problem into smaller parts. Programmers break down a problem until it has small enough tasks to command the computer to do. In this program, we have made the computer program break down the tasks in the same way as you would break them down in math.

Explain to children that they will use the Scratch project with their journal pages to build scripts that will represent fractions in a fraction circle. They will then draw the fraction circle pieces and write the number sentences on their journal page.

## Fraction Circles 1

WHOLE CLASS | SMALL GROUP | **PARTNER** | **INDEPENDENT**

Display the Fraction Circles 1 journal page on the board. Work through the example problem with the class to demonstrate how children should fill out the journal page: write the fraction name in words in the Words column, draw the blocks and fill in the argument in the Scripts column, draw the fraction circle pieces in the Picture column, and write the number sentence in the Number Sentence column. As needed, refer to the earlier discussion of the TIPP&SEE page to be sure that children know what information to provide for each question. For example, ask:

- *What color pieces do we use to fill the whole?* light blue
- *What is the denominator for that piece?* 6
- *How many pieces would fill the whole? How do you know?* 6, because that is the denominator of the fraction, which tells us how many equal shares of the whole.
- *Where do we show what denominator we're using for our pieces in Scratch?* In the "Set 1/_" block. We put the number of pieces in the whole, or the denominator, in the small white circle (the argument).
- *How many of the 'Add Piece' blocks do we need to represent the fraction 2/6?* 2; Each Add Piece block places one 1/6 piece. We need two Add Piece blocks because we need two 1/6 pieces.

Give children time to complete the Fraction Circles 1 journal page on their own. Provide a reasonable amount of time for the children to discuss in partnerships, sketch, and use Scratch to complete the problems.

## Wrap Up

WHOLE CLASS | SMALL GROUP | PARTNER | INDEPENDENT

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

- *How could we change the what the computer would do when we clicked the green flag?* Sample answers: Change the argument. Change the number of Add Piece blocks.
- *How did breaking down the fraction help us in solving this problem?* Answers vary.
- *Why did it make sense to use more than one Add Piece block?* Sample answer: We needed one Add Piece block for each of the fraction circle pieces we needed.
- *Did the computer always do the same thing/what we expected?* 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.

**NOTE** Make sure that children have done Remix, Rename, Save, and Share on their projects (the orange Remix button will still be visible if they have not).