Lesson
3-1A
Action Fractions
Math+CT

Pizza Sharing

Math Connections: Students practice dividing wholes into equal parts and sharing the parts equally to extend their understanding of fractions.
CS Connections: Students explore decomposition and how it can be used to help them apply their knowledge of repetition.

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Before You Begin
Open and review the scripts in the *Pizza Sharing* Scratch project in order to familiarize yourself with the custom blocks. You will use language similar to this when recording students' strategies.

Vocabulary
decompose • decomposition

Computational Thinking
- **DECOMPOSITION:** Problem decomposition is a useful early step in problem solving.
- **REPETITION:** Instructions like "Step 3 times" do the same thing as "Step, step, step."
- **SEQUENCE:** Different sets of instructions can produce the same outcome.

1 Warm Up 5 min

	Materials
"I Can ..." Statements Students read the explicit math and CS goals.	

2 Focus 35–40 min

Math Message Students solve an equal sharing problem.	*Sharing Pizzas* journal page
Sharing Pizzas Students compare and decompose strategies for sharing 2 pizzas among three siblings.	*Sharing Pizzas* journal page
Pizza Sharing Students build scripts to solve sharing problems.	*Pizza Sharing* project; *Pizza Sharing TIPP&SEE* journal page; *Sharing Pizzas* journal page

"I Can ..." statements

- *I can simplify a program by using a repeat block.*
- *I can decompose (break down) a task into smaller steps in sequential order.*
- *I can partition multiple wholes into equal shares.*
- *I can name my share of the whole using fractions.*

Anticipated Barriers

- Students may confuse words that are used interchangeably (repeat, loop).
- Students may have difficulty with the partitioning process.
- Visual representation of the pizzas may cause confusion when the share is larger than the whole. In the Scratch project, students can't see shares that are larger than the whole.

Student Options

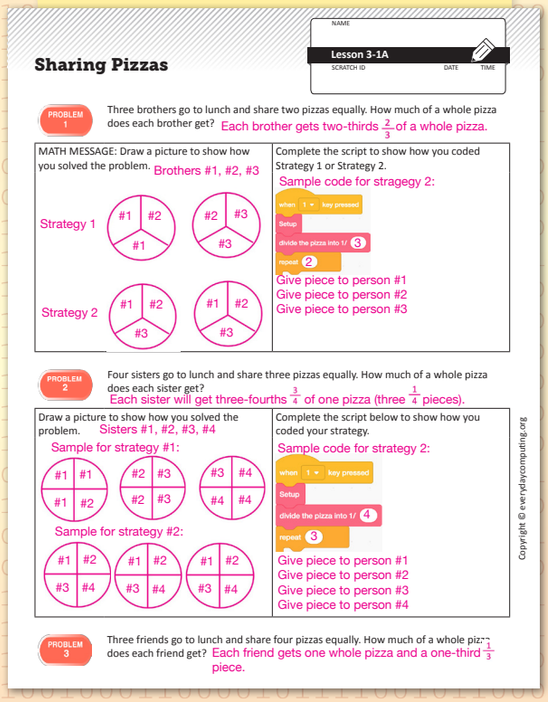
Consider these options for adapting the lesson to your students' preferences:

- Students may want to work with physical manipulatives along with the Scratch project.
- Students may need scaffolded worksheets to fill out when solving the problems.
- Students may want to work with a peer or a group.
- Students may want to physically act out the blocks in the activity.
- Students may need explicit connection to the math lesson in which they learned about equal sharing.

"I Can ..." statements

- *I can simplify a program by using a repeat block.*
- *I can break down a task into smaller steps in sequential order.*
- *I can partition multiple wholes into equal shares.*
- *I can name my share of the whole using fractions.*

Sharing Pizzas



Sharing Pizzas

NAME

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PROBLEM 1

Three brothers go to lunch and share two pizzas equally. How much of a whole pizza does each brother get? Each brother gets two-thirds $\frac{2}{3}$ of a whole pizza.

MATH MESSAGE: Draw a picture to show how you solved the problem. Brothers #1, #2, #3

Strategy 1

Strategy 2

Complete the script to show how you coded Strategy 1 or Strategy 2.

Sample code for stragegy 2:

when 1 key pressed

Setup

divide the pizza into 1/ 3

repeat 2

Give piece to person #1

Give piece to person #2

Give piece to person #3

PROBLEM 2

Four sisters go to lunch and share three pizzas equally. How much of a whole pizza does each sister get?

Each sister will get three-fourths $\frac{3}{4}$ of one pizza (three $\frac{1}{4}$ pieces).

Draw a picture to show how you solved the problem. Sisters #1, #2, #3, #4

Sample for strategy #1:

Sample for strategy #2:

Complete the script below to show how you coded your strategy.

Sample code for strategy 2:

when 1 key pressed

Setup

divide the pizza into 1/ 4

repeat 3

Give piece to person #1

Give piece to person #2

Give piece to person #3

Give piece to person #4

PROBLEM 3

Three friends go to lunch and share four pizzas equally. How much of a whole pizza does each friend get? Each friend gets one whole pizza and a one-third $\frac{1}{3}$ piece.

1 Warm Up 5 min

I Can ...

Display the "I Can ..." statements and remind students 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

Math Message

Three siblings go to lunch and share two pizzas equally. How much pizza does each sibling get? Draw a picture of how you solved the problem on your Sharing Pizzas *student page. (Do not complete the script yet.)*

Sharing Pizzas

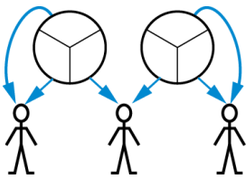
WHOLE CLASS | SMALL GROUP | PARTNER | INDEPENDENT

Math Message Follow-Up Ask: *How much pizza did each sibling get?* $\frac{2}{3}$ pizza Tell students that you will ask for volunteers to share their strategies. Explain that as each strategy is shared, you will work together as a class to **decompose** it. Remind students that they learned about **decomposition** in third grade. Ask: *What does it mean to decompose something?* Sample answer: To break it into smaller parts.

Ask volunteers to share their strategies. Record students' strategies using language that is similar to the Scratch blocks students will use later in the lesson. (Examples of such language are provided below.) Record all strategies, but make sure the following two strategies are shared and recorded where all students can see them.

Strategy 1: Dividing into thirds, then giving each person's pieces to them all at once

Students might explain this solution by saying they cut each of the two pizzas into thirds, then gave two pieces to person 1, two pieces to person 2, and two pieces to person 3. (Students might even specify which pizza the pieces should be coming from).

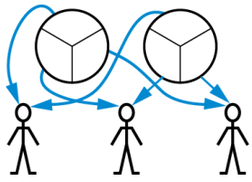


Record this strategy using language like what is below. If students say steps like "give two pieces to person 1," encourage them to decompose it even further (to think about handing out one piece at a time).

- Divide each pizza into thirds
- Give 1 piece to person 1
- Give 1 piece to person 1
- Give 1 piece to person 2
- Give 1 piece to person 2
- Give 1 piece to person 3
- Give 1 piece to person 3

Strategy 2: Dividing into thirds, then giving each person a piece cyclically

Students might explain this strategy by saying they cut the pizzas into thirds, then gave a piece to person 1, a piece to person 2, and a piece to person 3, a second piece to person 1, a second piece to person 2, and a second piece to person 3.



Record this strategy using language like the following:

- Divide each pizza into thirds
- Give 1 piece to person 1
- Give 1 piece to person 2
- Give 1 piece to person 3
- Give 1 piece to person 1
- Give 1 piece to person 2
- Give 1 piece to person 3

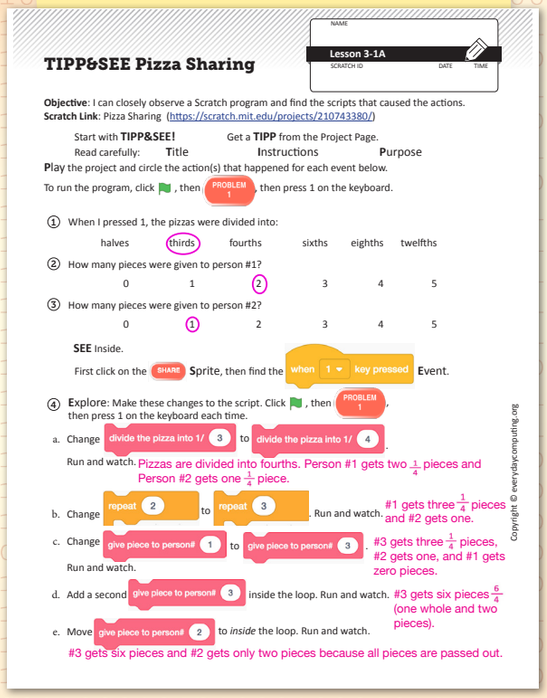
When all strategies have been shared and recorded, call students' attention to Strategies 1 and 2. Ask:

- *What do you notice that's the same about these two strategies?* Sample answers: They both start with the same step. They both have the same number of steps. They both end up giving two pieces to each person.
- *What do you notice that is different between these two strategies?* Sample answer: One gives pieces of pizza to each person one at a time, but the other gives each person two pieces together.
- *Was decomposing the strategies helpful for helping you see how they are alike and different? How?* Sample answer: Yes. When it was broken down into steps I could see how some of the steps lined up and some didn't.

Explain that computer scientists use decomposition to think about how to create code, too. For example, computer scientists break down problems so they can look for patterns. Ask: *Do you see any patterns in the instructions for Strategies 1 and 2?* Sample answers: In Strategy 1, each person gets 2 pieces of pizza in a row. In Strategy 2, each person gets 1 piece, and then that happens again. *Do the patterns you see remind you of something you have done in Scratch?* Sample answer: When something happens more than once in my code, I know I can use a Repeat block to make a loop.

NOTE If students do not make the connection between patterns in the code and loops on their own, remind them that one kind of pattern is something that repeats, or happens more than once. The idea of a loop should emerge from students' thinking. The purpose of this lesson is to help students discover how decomposition can help them see when they can use a loop.

Pizza Sharing TIPP&SEE p. 1



TIPP&SEE Pizza Sharing

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Objective: I can closely observe a Scratch program and find the scripts that caused the actions.
Scratch Link: Pizza Sharing (https://scratch.mit.edu/projects/210743380/)

Start with **TIPP&SEE!** Get a **TIPP** from the Project Page.
Read carefully: **T**itle **I**nstructions **P**urpose
Play the project and circle the action(s) that happened for each event below.

To run the program, click , then PROBLEM 1, then press 1 on the keyboard.

① When I pressed 1, the pizzas were divided into:
halves thirds fourths sixths eighths twelfths

② How many pieces were given to person #1?
0 1 2 3 4 5

③ How many pieces were given to person #2?
0 1 2 3 4 5

SEE Inside.
First click on the SHARE **S**prite, then find the when 1 key pressed **E**vent.

④ **E**xplore: Make these changes to the script. Click , then PROBLEM 1, then press 1 on the keyboard each time.

a. Change divide the pizza into 1/ 3 to divide the pizza into 1/ 4.
Run and watch. Pizzas are divided into fourths. Person #1 gets two $\frac{1}{4}$ pieces and Person #2 gets one $\frac{1}{4}$ piece.

b. Change repeat 2 to repeat 3. Run and watch. #1 gets three $\frac{1}{4}$ pieces and #2 gets one.

c. Change give piece to person# 1 to give piece to person# 3. Run and watch. #3 gets three $\frac{1}{4}$ pieces, #2 gets one, and #1 gets zero pieces.

d. Add a second give piece to person# 3 inside the loop. Run and watch. #3 gets six pieces $\frac{6}{4}$ (one whole and two pieces).

e. Move give piece to person# 2 to *inside* the loop. Run and watch.
#3 gets six pieces and #2 gets only two pieces because all pieces are passed out.

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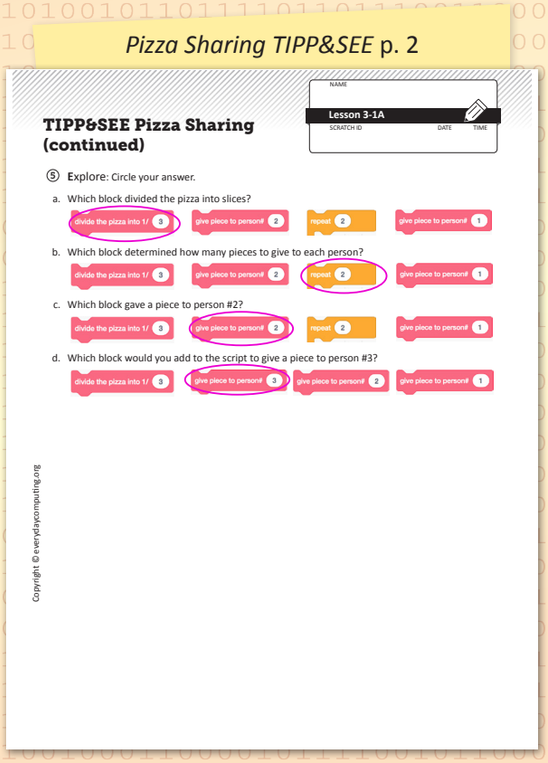
Pizza Sharing TIPP&SEE p. 2



TIPP&SEE Pizza Sharing (continued)

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⑤ **E**xplore: Circle your answer.

a. Which block divided the pizza into slices?
divide the pizza into 1/ 3 | give piece to person# 2 | repeat 2 | give piece to person# 1

b. Which block determined how many pieces to give to each person?
divide the pizza into 1/ 3 | give piece to person# 2 | repeat 2 | give piece to person# 1

c. Which block gave a piece to person #2?
divide the pizza into 1/ 3 | give piece to person# 2 | repeat 2 | give piece to person# 1

d. Which block would you add to the script to give a piece to person #3?
divide the pizza into 1/ 3 | give piece to person# 3 | give piece to person# 2 | give piece to person# 1

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Have students help you rewrite the instructions using Repeat steps, as shown below. Encourage students to carefully articulate both *what* is being repeated and *how many times* it is being repeated.

Strategy 1:

- Divide each pizza into thirds
- Repeat 2 times:
  - Give 1 piece to person 1
- Repeat 2 times:
  - Give 1 piece to person 2
- Repeat 2 times:
  - Give 1 piece to person 3

Strategy 2:

- Divide each pizza into thirds
- Repeat 2 times:
  - Give 1 piece to person 1
  - Give 1 piece to person 2
  - Give 1 piece to person 3

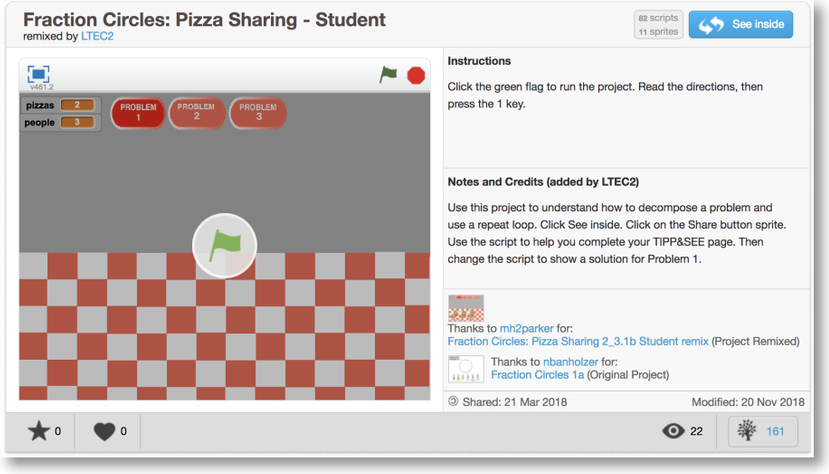
Point out that even though these instructions solve the problem differently, both of them equally share the pizza among the three friends.

Tell students that now they will have a chance to program one of these strategies in Scratch, and to use decomposition to help them code another problem.

Pizza Sharing

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

Distribute the *Pizza Sharing* TIPP&SEE journal page. Have students open the Fraction Circles: Pizza Sharing Scratch project. (https://scratch.mit.edu/projects/210743380/)



Students should work alone or in partnerships to complete the page. As they finish the TIPP&SEE page, briefly check that students understand what each block does. Then have them change the script so that the stage will show either Strategy 1 or Strategy 2. Encourage them to look at the instructions you created together to guide them. Students should draw their completed script at the top right of the Sharing Pizzas journal page.

Students should then solve Problem 2, drawing a picture on the journal page. Then they create code on the 'When 2 key pressed' event block to show their strategy for solving the problem. Encourage students to decompose their strategies to help them translate their strategies into code. If students have trouble getting started, suggest that they write

instructions on the back of the page like the ones you created for Strategies 1 and 2, and then look for patterns.

Students who finish quickly can solve and create code for Problem 3.

Wrap Up

WHOLE CLASS | SMALL GROUP | PARTNER | INDEPENDENT

When students have had sufficient time to work, bring them together for a whole class discussion. Ask students to Remix, Rename, Save, and Share their projects.

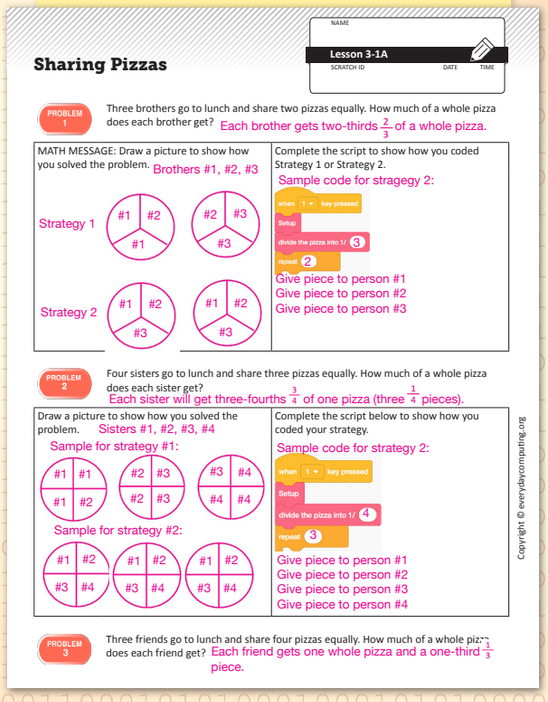
Suggested questions:

- *Why might it be helpful to decompose a problem?* Sample answers: It is easier to solve a problem if you break down it into smaller parts. It can help you see patterns in the steps and help you see when you can use a loop.
- *Look at your code for Problem 1. Compare it to your code from Problem 2. What do you notice?* Sample answers: They use mostly the same blocks, but they are in a different order. The numbers typed into the blocks are different.
- *Did your project do anything you were not expecting it to do?* Answers vary.
- *What were some things that were difficult or confusing?* Answers vary.

Point out that there are different ways to make different things happen using the same Scratch blocks. Sometimes, using blocks in a different order will make something different happen. Sometimes, changing the numbers in the Scratch blocks will change what happens. Tell students that they will continue exploring both order of blocks and the numbers in blocks in later lessons.

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

Sharing Pizzas



Sharing Pizzas

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MATH MESSAGE: Draw a picture to show how you solved the problem. Brothers #1, #2, #3

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Strategy 2

Complete the script to show how you coded Strategy 1 or Strategy 2.

Sample code for stragegy 2:

when 1 key pressed
Setup
divide the pizza into 1/ 3
repeat 2
Give piece to person #1
Give piece to person #2
Give piece to person #3

PROBLEM 2

Four sisters go to lunch and share three pizzas equally. How much of a whole pizza does each sister get?
Each sister will get three-fourths $\frac{3}{4}$ of one pizza (three $\frac{1}{4}$ pieces).

Draw a picture to show how you solved the problem. Sisters #1, #2, #3, #4

Sample for strategy #1:

Sample for strategy #2:

Complete the script below to show how you coded your strategy.

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PROBLEM 3

Three friends go to lunch and share four pizzas equally. How much of a whole pizza does each friend get? Each friend gets one whole pizza and a one-third $\frac{1}{3}$ piece.

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