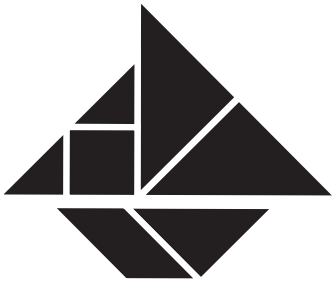


Teachers Guide

GRADE 3 – UNIT 2 – MODULE 2

BRIDGES®
IN MATHEMATICS

Module 2

Multiplying with Arrays & Number Lines

Teacher Masters

Pages renumber with each module.

Student Book Pages

Page numbers correspond to those in the consumable books.

Home Connections Pages

Page numbers correspond to those in the consumable books.

Module 2

Multiplying with Arrays & Number Lines

Overview

Students continue to deepen their understanding of multiplication. They make cube trains and paper strips to show the multiples of 2–10. These iterating units help them understand multiplication as comparison: multiplication is something times something else. Students solve puzzles where they use relationships to place either a multiplication problem or a product on a number line. They investigate arrays as they help a window washer count windowpanes. In Sessions 3 and 4, students explore doubling, using partial products, and making use of 5s and 10s facts. In the final session, they move from the discrete array structure of the paned windows to a contiguous array of mailboxes.

Planner

Session & Work Places Introduced	P&I	PS	MF	WP	A	HC	DP
Session 1 Count-Arounds This session begins with a count-around in which students count by 3s, 6s, and then 9s to 90, making predictions and observations as they go. Then, students complete a checkpoint to gauge their understanding of some of the skills and concepts presented in the unit thus far. Students spend the rest of the session visiting Work Places.	●			●	●		●
Session 2 Cube Trains & Multiples Strips This session begins with several count-arounds. The class discusses multiplication, and students work in pairs to build measuring strip made of cubes as well as matching paper strips for multiples from 2 through 10. Then two or three pairs look at their number lines together to discover relationships between multiples. The class reconvenes and looks at all of the number lines in order to find more number line relationships.	●					●	●
Session 3 Watertown's Window Washer This session is the first of a three-day investigation in Watertown. Today, students meet Wally and help him figure out how many windows he has to wash by looking at a visual problem string of arrays of windows. the teacher introduces Work Place 2B Frog Jump Multiplication, which involves multiplication on the number line. **Work Place 2B** Frog Jump Multiplication Players take turns rolling a die numbered 1–6 two times. The first roll tells how many jumps to take along the number line; the second roll tells how long each jump will be. Players mark their jumps on the number line and write a multiplication equation to show the results. Each player takes 4 turns and then adds their products to find the total sum. The player with the higher sum wins.	●	●		●			●
Session 4 Wally Keeps Washing Students continue to help Wally figure out numbers of windows in Watertown. Today's windows are designed to nudge students toward using what they know about the facts for 5 and 10 to solve problems efficiently. The session begins with a visual problem string of sets of windows. Students work with partners to figure out more number line puzzles and then share their thinking.	●	●				●	●
Session 5 The Watertown Post Office In the final Watertown session, students work with arrays of windows as a model of multiplication. Students begin by looking at small arrays of mailboxes and then at an entire wall of mailboxes. Then the teacher introduces Work Place 2C, which gives students more practice representing multiplication within 100 using arrays. **Work Place 2C** Cover Up Players take turns spinning two numbers, drawing an array with those dimensions on a 10-by-10 grid, and finding the product represented by the array (total area of the array). Each player takes four turns and then finds the total of their four products. The player whose total is closest to 100 wins.	●	●		●			●

P&I – Problems & Investigations, **PS** – Problem String, **MF** – Math Forum, **WP** – Work Place, **A** – Assessment, **DP** – Daily Practice, **HC** – Home Connection

Materials Preparation

Each session includes a complete list of the materials you'll need to conduct the session, as well as notes about any preparation you'll need to do in advance. If you would like to prepare materials ahead of time for the entire module, you can use this to-do list.

Task		Done
Copies	Run copies of Teacher Masters T1–T9 according to the instructions at the top of each master.	
	Run a single display copy of Student Book pages 47, 51, and 54.	
	If students do not have their own Student Books, run a class set of Student Book pages 45–56.	
	If students do not have their own Home Connections Books, run a class set of the assignments for this module using pages 27–30 in the Home Connections Book.	

Additional Resources

Please see this module's Resources section of the Bridges Educator site for a collection of resources you can use with students to supplement your instruction.

Session 1
Count-Arounds

Summary

This session begins with a count-around in which students count by 3, 6, and then 9 to 90, making predictions and observations as they go. Then, students complete a checkpoint to gauge their understanding of some of the skills and concepts presented in the unit thus far. Students spend the rest of the session visiting Work Places.

Skills & Concepts

- Interpret products of whole numbers (3.OA.1)
- Solve multiplication story problems with products to 100 involving situations of equal groups, arrays, and measurement quantities (3.OA.3)
- Identify patterns among basic multiplication facts (3.OA.9)
- Use and explain additive strategies (e.g., repeated addition and skip-counting) to demonstrate an understanding of multiplication (supports 3.OA)
- Look for and make use of structure (3.MP.7)
- Look for and express regularity in repeated reasoning (3.MP.8)

Materials

Copies	Kit Materials	Classroom Materials
Problems & Investigations Count-Arounds		
Assessment Multiplication Checkpoint		
TM T1 Multiplication Checkpoint	• One Hundred Grid (optional, for support suggestions) • colored tiles (optional, for support suggestion)	
Work Places in Use		
1D Subtraction Bingo (introduced Unit 1, Module 2, Session 4) **1E** Carrot Grab (introduced Unit 1, Module 3, Session 4) **1F** Rabbit Tracks (introduced Unit 1, Module 4, Session 1) **1G** Target One Hundred (introduced Unit 1, Module 4, Session 3) **1H** Anything but Five (introduced in Unit 1, Module 4, Session 5) **2A** Loops & Groups (introduced in Unit 2, Module 1, Session 5)		
Daily Practice		
SB 45 Toby Goes Shopping		

HC – Home Connection, **SB** – Student Book, **TM** – Teacher Master
Copy instructions are located at the top of each teacher master.

Preparation

- Post a few sheets of chart paper in your discussion area, or plan to use a whiteboard nearby. You will use it to record all of the multiples of 3, 6, and 9 through 90 during the count-arounds at the beginning of the session.
- Where all students can see it, write the list of Work Places that are available to students today. You can write out just the numbers, or write the full names if you have time.

Problems & Investigations

Count-Arounds

1 Open the lesson by gathering your students in the discussion area and having them sit in a circle. Then let them know that in today's session they will do a count-around, complete a short checkpoint assessment, and then learn a new Work Place game.

If your classroom does not have enough space to seat students in a circle, you can try having them sit in two circles or in a different shape. If they need to sit at desks or tables, be prepared to help them know whose turn it is in the count-around.

2 Explain to students that today they will do a different kind of count-around. In this count-around, students call out multiples of a particular number (skip-counting) and whisper all the other numbers as the whole class counts to a certain number.

3 Have the students get familiar with the new format by doing a count-around for 3s. Explain the following steps:

- Every student says a number as they go around the circle counting by 1s.
- Multiples of 3 get called out aloud while other numbers are whispered.
- All students need to watch and listen when it is not their turn and to be ready when it is their turn.
- Tell students they will stop when they get to 90.
- Ask if there are any questions, and then start the count-around.
- As students count, record the multiples of 3 where everyone can see.
- Invite a few students to make observations about the count-around.

4 Then, have the students do a count-around for 6s up to 90, just as they did for 3s. Record the multiples of 6 under the multiples of 3. At the end of this count-around, ask students what they notice.

3, 6, 9, 12, 15, 18, 21, 24, 27, 30, 33, 36, 39, 42, 45, 48, 51, 54, 57, 60, 63, 66, 69, 72, 75, 78, 81, 84, 87, 90
6, 12, 18, 24, 30, 36, 42, 48, 54, 60, 66, 72, 78, 84, 90

Have them explain and support their thinking by asking follow-up questions such as, "Why?" and, "What makes you think that?" When students notice that the multiples of 6 are also multiples of 3, be sure to discuss and emphasize the importance of this observation.

5 Tell students they will do one more count-around with 9s. Ask them the following questions:

- Will there be more multiples or fewer multiples of 9? Why?
- Will everyone get to call out a number? Why or why not?
- Can you estimate how many people will get to call out a number? Tell us more about your estimate.
- What happens as the number we are counting by gets bigger?

> ***Students*** *I think there will be more multiples of 9 because 9 is a bigger number.*
>
> *I think there will be less because there were less multiples of 6 than there were with 3.*

I think most people will get to shout out a number because we are going all the way to 90.

6 Do the count-around with 9s, counting up to 90.

3, 6, 9, 12, 15, 18, 21, 24, 27, 30, 33, 36, 39, 42, 45, 48, 51, 54, 57, 60, 63, 66, 69, 72, 75, 78, 81, 84, 87, 90
6, 12, 18, 24, 30, 36, 42, 48, 54, 60, 66, 72, 78, 84, 90
9, 18, 27, 36, 45, 54, 63, 72, 81, 90

SUPPORT Throughout the count-around, pause and give struggling students extra time to think. Ask them to reiterate why some people are whispering numbers and others are saying numbers out loud.

- Have the students turn to a partner to talk about what happened in the count, and to comment about any patterns they notice in the numbers you have recorded (e.g. odd/even patterns, patterns in overlap).
- Ask them if they were surprised by what happened and whether their thinking has changed now that they have done the count-around with 9s.
- After a few minutes, invite a few students to share from their conversations.
- Tell students you will be doing more of these count-arounds later.

SUPPORT Use the One Hundred Grid to help students find the patterns. You can also show the count-around as jumps on a number line, then circle jumps into groups to emphasize the patterns of 6s and 9s.

ELL Help students understand when to whisper a number and when to say a number out loud by bringing out the patterns as you record the numbers on the board.

CHALLENGE Encourage students to predict the pattern. Ask questions that encourage students to generalize, such as "Why is that happening? Do you think that will always happen? If you changed the pattern, what would happen?"

Assessment

Assessment Guide

See the Grade 3 Assessment Guide for scoring and intervention suggestions.

Multiplication Checkpoint

7 Tell students they will take a quick checkpoint that focuses on the multiplication concepts they have been working on.

Have students quietly return to their seats to get ready for the checkpoint.

8 Display the Multiplication Checkpoint, read the introductory text out loud, and then give students a moment to look it over and ask any questions.

SUPPORT Consider reading each prompt out loud as well. If students have trouble reading the prompts on their own, you'll probably need to re-read the prompts for them as they work through the checkpoint. Be sure students understand that you are available to read the prompts to them at any time.

9 Give students 15–20 minutes to complete the checkpoint.

- While students work, walk around the room to make observations and answer questions.
- If some students finish much earlier than others, ask them to begin Work Places quietly.
- This is not a timed test. If some students do not finish the checkpoint after 20 minutes, give them a chance to finish later.

SUPPORT Provide tiles and access to the One Hundred Grid for students to use for help with grouping during the assessment. Students might also use number lines to group jumps.

10 Collect students' checkpoints.

Work Places

11 As students finish the Multiplication Checkpoint, have them turn in their papers, get their folders, and choose a Work Place.

Have students pick up their Work Place folders and a pencil, and remind them to fill out their Work Place Logs as they finish each activity.

12 At the end of the session, have students clean up and put away materials.

Daily Practice

The optional Toby Goes Shopping Student Book page provides additional opportunities to apply the following skills:

- Solve multiplication story problems with products to 100 involving situations of equal groups, arrays, and measurement quantities (3.OA.3)
- Model story problems involving multiplication within 100 by writing expressions and equations with a symbol for the unknown number (supports 3.OA)

Session 2

Cube Trains & Multiples Strips

Summary

This session begins with several count-arounds. The class discusses a measuring strip made of cubes and how it relates to multiplication. Students work in pairs to build more measuring strips and matching number lines for multiples from 2 through 10. Then two or three pairs look at their number lines together to discover relationships between multiples. The class reconvenes and looks at all of the number lines in order to find more relationships within and between them. Finally, the teacher introduces and assigns the Stamp Challenges Home Connection.

Skills & Concepts

- Identify patterns among basic multiplication facts (3.OA.9)
- Use and explain additive (e.g., repeated addition and skip-counting) and multiplicative strategies (e.g., doubling, doubling and halving, and using partial products) to demonstrate an understanding of multiplication (supports 3.OA)
- Model with mathematics (3.MP.4)
- Look for and make use of structure (3.MP.7)

Materials

Copies	Kit Materials	Classroom Materials
Problems & Investigations Count-Arounds		
		• chart paper, a few sheets (see Preparation)
Problems & Investigations Cube Trains & Multiples Strips		
	• 30" strip of adding machine tape • a strip of adding machine tape for each student pair (see Preparation)	• paperclips, a few for each student • scissors • thumbtacks (optional) • student math journals • interlocking cubes such as Unifix cubes, 1 container for each student pair (see Preparation)
Home Connection		
HC 27–28 Skip-Counting & More		
Daily Practice		
SB 46 Seascape Challenges		

HC – Home Connection, **SB** – Student Book, **TM** – Teacher Master
Copy instructions are located at the top of each teacher master.

Vocabulary

An asterisk [*] identifies those terms for which Word Resource Cards are available.

equation*
factor*
measuring strip
multiple*
product*

Preparation

- Post a few sheets of chart paper in your discussion area or plan to use a nearby whiteboard to record the count-arounds.
- Create a measuring strip of 40 interlocking cubes using 2 different colors. Alternate colors in groups of 4 so that you have 4 of one color followed by 4 of the next color. Hang or tape your measuring strip on a whiteboard in or near the discussion area, leaving room underneath to add a 30" strip of adding machine tape later in the lesson.

- Assign partners and decide which number (between 2 and 10) each partnership will work with. Each student pair will build a measuring strip and create matching paper number lines to show the multiples of a number between 2 and 10. Think about assigning students who work more slowly a smaller number and students who work more quickly a larger number. If you have more than 18 students in your room, it's fine to have more than one pair work on a particular multiple. For instance, you might have three student pairs each make a measuring strip and paper number line for 2s, three more student pairs each make a strip and number line for 3s, and so on.
- Divide all of the interlocking cubes into containers. You'll need 1 container for every pair of students. Each container should contain equal numbers of cubes in two different colors. You'll need containers with the following total numbers of cubes: 20, 30, 40, 50, 60, 70, 80, 90, and 100. The numbers you assign to each pair of students will determine how many containers you should prepare with each total number of cubes.
- Cut a strip of adding machine tape for each student pair. Pairs working with multiples of 2 will need about 20 inches, pairs working with multiplies of 3 need 30 inches, pairs working with multiples of 4 need 40 inches and so on.
- During the lesson, you will post 9 number lines on the wall, each directly below the one above it. The shortest of the 9 lines will be 15" long. The longest will be 75" long. Have space and necessary materials prepared.
- Leave a number line for each multiple, 2–10, posted on the board at the end of this session. Collect and save any extra number lines for use in Module 2 and with individuals later in the year.

About This Session

Today, students continue the work they did with the Seascapes in the previous module, using a very different context. When using Chloe as a unit of measure, students were actually doing the work of iterating units, which is instrumental in building a deep understanding of multiplication. Because they were moving Chloe along incrementally (iterating), they were able to see how many times they had to move her. In doing so, they naturally used the language of multiplication. This will happen again today, as they build measuring strips of cubes and then on paper, considering how many times they make *n* cubes on each strip. Once the strips are made, students will continue to develop their understanding of multiplication as they find relationships between numbers on the measuring strips. Be sure to save the strips for later use.

Problems & Investigations

Count-Arounds

1 Set the stage for today's session by telling students that they will do a count-around and then do a measurement investigation. Gather your students in the discussion area and have them sit in a circle.

If your classroom does not allow for seating students in a circle, try having them sit in two circles or in a different shape. If they need to sit at desks or tables, be prepared to help them know whose turn it is in the count-around.

2 Count around by 2s up to 80.

- Explain to students that they are going to do a count-around for 2s, just as they did in the previous session for 3s, 6s, and 9s. Remind students of the norms for count-arounds.
  - » Every student says a number as they go around the circle counting by ones.
  - » Multiples of 2 get called out aloud while other numbers are whispered.
  - » All students need to watch and listen when it is not their turn, and to be ready when it is their turn.
  - » Ask if there are any questions, and then start the count-around.
  - » As students count, record the multiples of 2 where everyone can see.
  - » Invite a few students to make observations about the count-around.

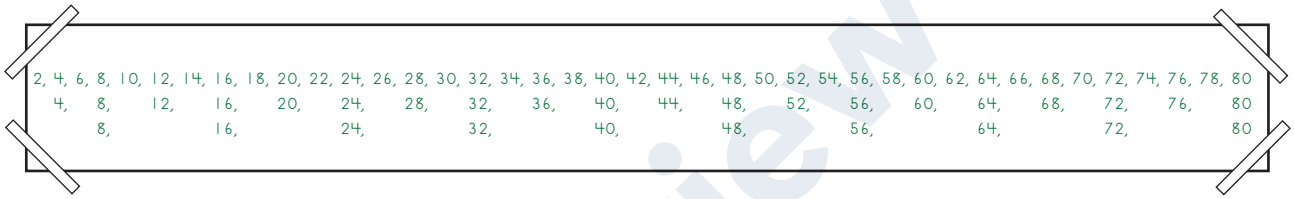
3 Then, have the students do a count-around for 4s up to 80, just as they did for 2s. Record the multiples of 4 under the multiples of 2. At the end of this count-around, ask students what they notice.

4 Tell students they will do one more count-around with 8s. Ask them the following questions:

- Will there be more multiples or fewer multiples of 8? Why?
- Will everyone get to call out a number? Why or why not?
- Can you estimate how many people will get to call out a number? Tell us more about your estimate.
- What happens as the multiples by which we are counting become larger?

> ***Sean*** *Yesterday, there were fewer multiples for 9 than for 6 or 3. I think there will be fewer for 8 too.*
>
> ***Grace*** *And, there were fewer multiples of 4 than there were with 2.*

5 Do the count-around with 8s up to 80. Then, have the students each turn to a partner to discuss what they noticed about the counting sequence.



- Ask them if they were surprised by what happened and if their thinking has changed now that they have done the count-around with 8s.

> ***Sean*** *There are a lot less for 8 than there were for 2 or 4. There are only 10.*
>
> ***Grace*** *Look! There are 20 numbers written down for the multiples of 4. That's twice as many.*
>
> ***Teacher*** *Can you talk more about that and get ready to share your thinking with the class? Why do you think there are twice as many multiples of 4 than there are of 8?*

- After a minute or two, invite a few students to share from their conversations.
  - » How many multiples of 4 did we list?
  - » How many multiples of 8 did we list?
  - » Why do you think that is?

Problems & Investigations

Cube Trains & Multiples Strips

6 Now, transition to the idea of measuring strips by drawing students' attention to the strip of 40 interlocking cubes you have posted. What do they notice about this set of cubes?

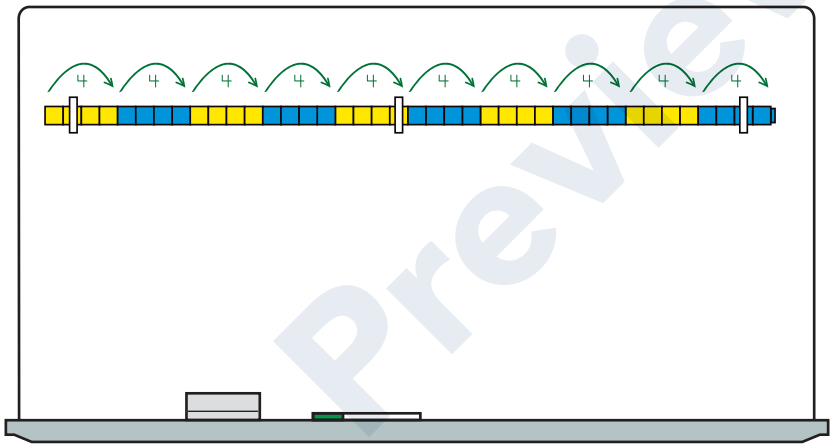
All observations are important, from noticing that there are two colors to noticing that the train of cubes arranged in repeating groups is a tool for skip-counting. You'll want students to share a variety of observations, but take care to emphasize those that will be especially helpful in understanding how to use a measuring strip.

- Invite a few volunteers to share their observations with the class. Record their observations where everyone can see. When students figure out that there are 10 groups of 4 showing, or 40 cubes, write $10 \times 4 = 40$ where everyone can see, and use the language "10 groups of 4 cubes make 40 cubes in all."

SUPPORT/ELL As you work through the rest of the session, point to the groups of cubes on the train. Use the physical models to help clarify student comments and your questions.

7 Focus on the groups of 4 cubes, asking questions to bring out relationships.

- Write a 4 above each set of 4 cubes, marking the groups as if they were jumps on a number line. Ask students how this measuring strip could be helpful to them.



- If no one makes a connection to the work they did with the seascape in the previous sessions (i.e., using Chloe's length of 4″ to measure other things), ask the following questions:
  - » Does this display of cubes remind you of anything we have done lately?
  - » This measuring strip counts by 4s. What might that help you with?
  - » Have we figured out anything else that was 10 times 4 recently? (The moray eel in the seascape was 10 times as long as Chloe.)

When students do make a connection to the work they did with Chloe, you may need to clarify the fact that your cube train is not on the same scale as Chloe.

- Discuss with the class how this cube train could help them figure out how many cubes are in 6 groups of 4.

> ***Adina*** *Well, I can see the 6 groups pretty easily because of the colors.*
>
> ***Teacher*** *What do you mean by that?*
>
> ***Adina*** *Each time the color changes, that's another group of 4. So I can skip-count using each color like this, the first yellow is 4, then the blue is 8, then the next yellow is 12, and then 16… and umm, 17, 18, 19, 20, OK the next one is 20 and then 24. Six groups of 4 are 24.*

Teacher *Does anyone see it a different way?*

Ruth *I looked at two groups of 4 at the same time.*

Teacher *Can you say more about that?*

Ruth *Well, I sort of thought about 2 colors together as 1 set. The first set of blue and red is 8 cubes. Another set of blue and red is 8 more. 8 and 8 are 16. Another set of blue and red is 8 more. 16 and 8 are 24.*

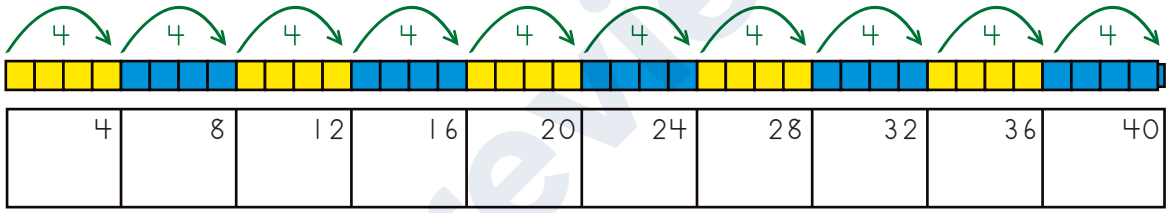
Teacher *How did you know to stop at 24?*

Ruth *I knew I had counted 6 groups because every time I counted a blue and a red, that was 2 groups of 4. I did that 3 times. 2 times 3 is 6.*

8 Ask students how they would add or change anything to make the cube train easier to use. Attach the length of adding machine tape you prepared to the board below the 40-cube train.

- Elicit from students that it would be helpful to have a system for keeping track of how many cubes there are after each group of 4. For example, students might talk about how you have to skip-count every time, and it would be easier to have the multiples of 4 recorded on or near the strip of cubes.
- Then, with students' input, mark the multiples of 4 on the adding machine tape.

If no one suggests a system to keep track of how many cubes there are, begin marking the multiples of 4 on the adding machine paper. Then, ask students to tell you what the rest of the multiples of 4 are and where to put them on the paper. Ask whether this makes it easier to use the measuring strip.



- Ask students how the strip can help them find how many cubes are in 5 groups of 4 and 9 groups of 4.
- Invite a few students to share. As they talk, record equations and verbal statements (i.e., $5 \times 4 = 20$ and 5 groups of 4 equals 20) to represent their thinking.
- Point to the equations and ask students if they know the names of the numbers in the multiplication problem.
- Show students the Word Resource Cards for *factor* and *product* as you teach or review which numbers are the factors and which are the products. Also make sure students understand the difference between a multiple and a product: a product is the result of multiplying two or more numbers, and a multiple is a number that can be evenly divided by another.

9 Now explain to the class that they are going to work in pairs to build their own cube trains and make paper multiples strips to match. Assign partners, and give each student pair a number between 2 and 10 to work with, along with the following directions:

- Make a cube train for your number. Be sure to use 2 colors to show groups of your number clearly.
- You need to have 10 groups of whichever number you are working on. For example, if you are working with 5s, you will have 10 groups of 5.
- Then, cut your piece of adding machine tape to match the length of the cube train, and mark off the multiples of the number you're working with.

- Figure out how you can help each other and work as a team.
- Write your names on the back of your paper multiples strip.
- Ask students if they have any questions about their work for today. When they understand what to do, have them get their materials and go to work.

SUPPORT Give struggling students the numbers 2, 3, 4, 5.

CHALLENGE Give students who need a challenge the numbers 6, 7, 8, and 9.

10 As students work, circulate around the room, observing and talking with small groups.

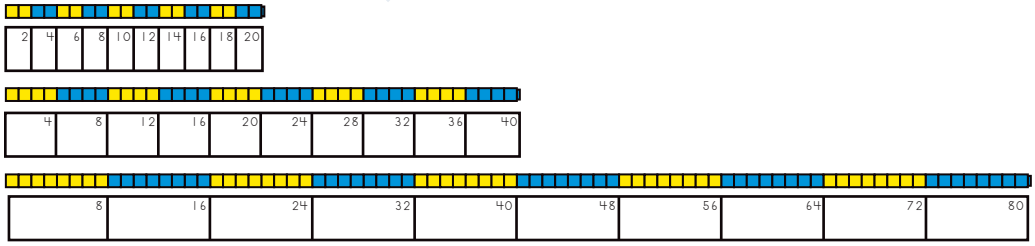
- As you observe students at work, you might see:
  - » Students using the interlocking cubes to count by 1s
  - » Students making mathematical observations about the cube trains and the paper multiples strips
  - » Students unitizing (talking about groups of cubes)
- Encourage students to think about the following questions:
  - » What do you notice about your cube train and paper multiples strip?
  - » How are they similar? How are they different?
  - » How can they help you with your multiplication facts?

11 When students have made and discussed their paper multiples strips, tell them that they will double or triple up with other partnerships to look at their strips together in the following ways:

- Pairs of students who worked on multiples of 2, 4, and 8 will join together.
- Pairs of students who worked on multiples of 3, 6, and 9 will join together.
- Pairs of students who worked on multiples of 5 and 10 will join together.

Only have one pair for each number get together—the new group size should be no more than 4 or 6 people. It is OK to have more than one group looking at the same multiples.

12 Tell students that they will get together with their new, bigger group and line up their strips so the smallest strip is at top and the biggest strip is at the bottom. Then, student groups will make as many observations as they can about the strips.



- As students work, listen in to find out what kinds of connections and relationships they are discussing. Encourage them to notice where multiples on the strips line up. For example, number lines for 2, 4, and 8 will all line up at 8 and 16. Challenge students to consider how many 2s, 4s, and 8s there are in 16, for instance, and why there are more 2s than 8s in 16.
- Ask them to think about how the strips could help them solve multiplication problems. Give them a few questions to solve with the number lines (e.g., 3×6, 4×7, depending on which strip they have.)
- Encourage students to notice and question the differences in lengths of the strips.

Quinn *All of our paper multiples strips are different sizes!*

Teacher *Why do you think that is?*

Yousef *Because they all show a different amount of cubes. This one shows 10 groups of 2 and this one shows 10 groups of 4.*

Teacher *How much is 10 groups of 2? How much is 10 groups of 4?*

Maria *10 groups of 2, that's 20. And, 10 groups of 4 is 40.*

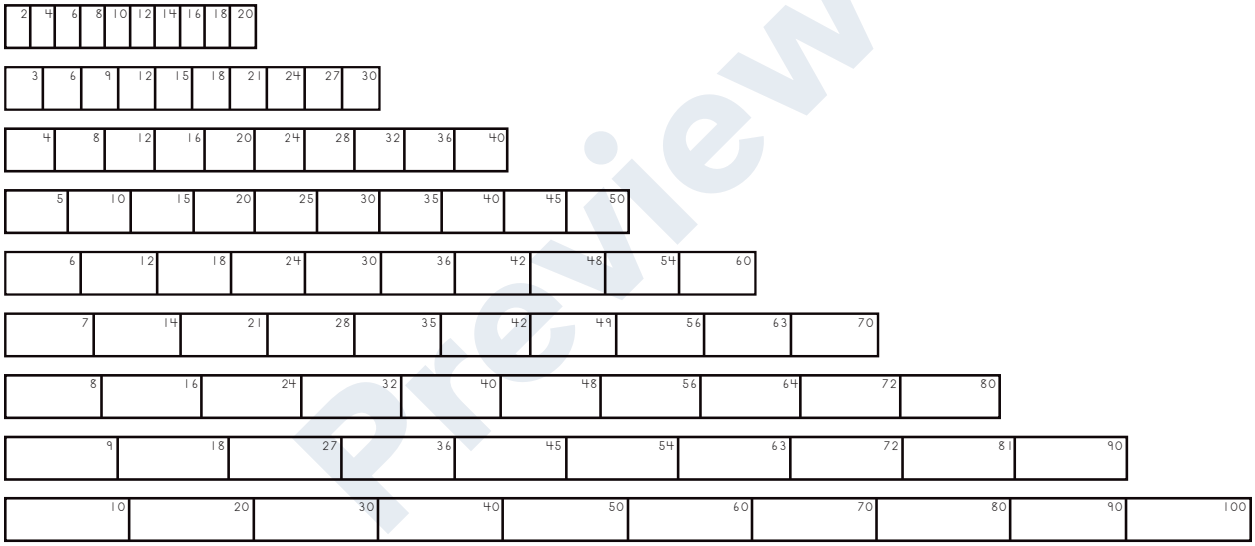
Teacher *I'm going to write a couple of equations to show what you just said.*

$2 \times 10 = 20$
$4 \times 10 = 40$

Quinn *Two is half of 4 so when you have 10 groups of 2 and 10 groups of 4, it makes sense that the 2s strip would be half as long as the 4s strip.*

Teacher *What about the strip for 8s?*

13 While groups are making observations, post one paper multiples strip for each multiple on the board, in order from 2 to 10, where everyone can see. When all groups have made at least a few observations, bring them back together in the discussion area with their journals and pencils.



14 Ask students what they notice when they see all of the paper multiples strips lined up together. Give them a minute to consider all of the strips and then have them share their thinking with a partner. Then, invite a few students to share their thinking with the class.

If no student brings up the many equivalent relationships on the multiples strips, help them see these relationships with the following questions:

- Do you see any numbers that appear on a lot of the paper multiples strips?
- Look for the number 24. How many strips have 24 on them?
- Why is 24 on so many multiples strips?

Ruby *It's on 5 different strips! I see it on the one for 2s, 3s, 4s, 6s, and 8s.*

David *But it takes a different amount of each number to get to the 24 on each multiples strip. It takes twelve 2s to get to 24, eight 3s to get to 24, six 4s, four 6s, and three 8s to get there.*

Math Practices in Action 3.MP.7

The multiples strips give students wonderful opportunities to look for and make use of structure among multiples of the same number and of different numbers. They can see, for example, that ten 7s is equal to seven 10s, which is one way to illustrate the commutative property.

Teacher *Does everyone see what David is talking about? Can you turn to the person next to you and build on this idea?… OK everyone, turn back from your partner. Who can tell me a multiplication equation that has a product of 24?*

Malik *2 × 12 = 24.*

Brandy *3 × 8 = 24 and 8 × 3 = 24.*

Katherine *And, 4 × 6 and 6 × 4 = 24.*

Teacher *Great. We can call these equivalent expressions, because they are all equal to 24. What else do you notice about the equations?*

Malik *Some of them have them same numbers. 4 × 6 and 6 × 4 both equal 24. They are the same numbers, just reversed.*

From here the discussion could go in a few different directions, depending on what you want to focus on and draw out with your students. You might return to the observation about 4 × 6 and 6 × 4 and bring up the commutative property. You might have students find other equivalent relationships on the number lines. Or, you might work with the class so they can see the double-half relationship between 4 × 6 and 8 × 3. (4 is half of 8 and 6 is 3 doubled. When you divide 1 factor in half and double the other, the product remains constant.)

15 If you have time, have students spend some time writing quietly in their journals about some of the discoveries they made today or about some of the relationships they can find among the number lines posted on the board.

- Remind students to write the date and a heading (Cube Trains & Multiples Strips) at the top of the next clean page in their journals.
- As students write, visit with individuals and use what they have written to start a conversation about their thinking.

You might ask questions, ask for examples, ask students to convince you of their ideas, press students to think more mathematically, ask students to generalize their observation, or help students expand or elevate their thinking.

Teacher *Can you tell me more about what you are writing?*

Kendra *I noticed that the last number on all of the number lines ended in zero.*

Teacher *That is interesting. Why do you think that happened?*

Kendra *I'm not sure yet. I'm still thinking about it.*

Teacher *Can we try to write it down in a different way? Let's try this. Tell me what each number line ended with.*

Kendra *The 2s number line ends in 20.* (The teacher writes "2s strip: 20.") *The 3s number line ends in 30. The 4s number line ends in 40. The 5s number line ends in 50.* (The teacher continues writing just as she did above.)

Teacher *Do you notice anything?*

Kendra *Yeah! The number that the number line is for is in the last number on the line. It's the same number with a zero next to it.*

Teacher *Why might that be happening?*

Kendra *I'm not sure but you told us to make 10 groups of each number and I know that 10 times 2 is 20. I think that has something to do with it.*

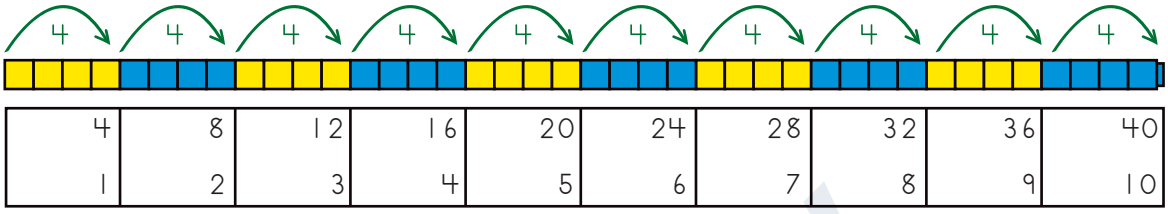
Teacher *I think you are right. Let's write that down too.* (The teacher writes 10 × 2 = 20.) *Can you write equations like these for the rest of the number lines and see if that helps you think more about this? I'll come back to check in with you in a few minutes.*

16 Draw students' attention to the 4s number line and ask the following questions:

- » How many 4s are in 16? How do you know?
- » How many 4s are in 28? How do you know?
- » How many 4s are in 36? How do you know?

17 Then explain that it would be very handy to have all these numbers written down somewhere so they would just know, for example, that there are nine 4s in 36, instead of counting all the 4s each time. Work with the students to add these numbers just below the multiples.

This model provides a nice preview of the ratio table, a tool and model for multiplication which students will use later in the year. You don't need to mention anything now, but having this preview will help students later.



18 Close the lesson by having students bring you chart paper and any multiples strips that were not posted on the wall and have them clean up the interlocking cubes and any other materials.

Note Be sure to save all of the paper number lines for use in Unit 4. You may also use these number lines from time to time to help students struggling with multiplication facts.

Home Connection

19 Introduce and assign the Skip-Counting & More Home Connection, which provides more practice with the following skills:

- Interpret products of whole numbers (3.OA.1)
- Solve for the unknown in a multiplication equation involving 3 whole numbers (a multiplicand, multiplier, and product) (3.OA.4)
- Solve two-step story problems using addition and division (3.OA.8)
- Solve story problems involving a multiplicative comparison using division (4.OA.2)

Daily Practice

The optional Seascape Challenges Student Book page provides additional opportunities to apply the following skills:

- Solve multiplication story problems with products to 100 involving situations of measurement quantities (3.OA.3)
- Model story problems involving multiplication within 100 by writing expressions and equations with a symbol for the unknown number (supports 3.OA)
- Use and explain additive (e.g., repeated addition and skip-counting) and multiplicative (e.g., doubling, doubling and halving, and using partial products) strategies to demonstrate an understanding of multiplication (supports 3.OA)

Session 3
Watertown's Window Washer

Summary

This session is the first of a three-day investigation in Watertown. Today, students meet Wally the window washer and help him figure out how many windows he has to wash by looking at a visual problem string of arrays of windows. Then students explore number line puzzles and the teacher introduces Work Place 2B Frog Jump Multiplication, which involves multiplication on the number line. Finally, the teacher introduces and assigns the Story Problems & Number Line Puzzles Home Connection.

Skills & Concepts

- Interpret products of whole numbers (3.OA.1)
- Solve for the unknown in a multiplication equation involving 3 whole numbers (3.OA.4)
- Fluently multiply with products to 100 using strategies (3.OA.7)
- Use and explain additive (e.g., repeated addition and skip-counting) and multiplicative (e.g., doubling, doubling and halving, and using partial products) strategies to demonstrate an understanding of multiplication (supports 3.OA)
- Make sense of problems and persevere in solving them (3.MP.1)
- Model with mathematics (3.MP.4)

Materials

Copies	Kit Materials	Classroom Materials
Problem String Watertown's Window Washer		
TM T2 Watertown **TM T3** Watertown School Windows		• a piece of paper to mask parts of the teacher masters • student math journals
Problems & Investigations Number Line Puzzles		
SB 47* Number Line Puzzles	• 60 interlocking cubes (see Preparation) • adding machine tape (see Preparation)	• paper multiples strip for 6s (from Session 2) • markers or whiteboard markers
Work Places Introduce Work Place 2B Frog Jump Multiplication		
TM T4 Work Place Guide 2B Frog Jump Multiplication **TM T5** 2B Frog Jump Multiplication Record Sheet **SB 48**** Work Place Instructions 2B Frog Jump Multiplication		
Daily Practice		
SB 49–50 Windows & Number Puzzles		

HC – Home Connection, **SB** – Student Book, **TM** – Teacher Master
Copy instructions are located at the top of each teacher master.
** Run 1 copy of this page for display.*
*** Run 1 copy to be kept in a clear plastic sleeve stored in the Work Place bin.*

Vocabulary

An asterisk [*] identifies those terms for which Word Resource Cards are available.

commutative property of multiplication*
equation*
factor*
measuring strip
multiple*
product*
variable*

Preparation

- Have the paper number lines for multiples of 2–10 from the previous session posted.
- Make a 60-cube train of interlocking cubes using two different colors. Alternate colors in groups of 6 so that you have 6 of one color followed by 6 of the next color.
- Be prepared to hang up your 60-cube train during the lesson. Ideally, you can hang it up on a whiteboard or chalkboard. If not, plan to hang it up on a bulletin board and post a 45" length of adding machine tape above the 60-cube train.
- Assign partners for Number Line Puzzles.
- In today's session, you'll introduce Work Place 2B Frog Jump Multiplication, which replaces Work Place 1D Subtraction Bingo. Before this session, you should review the Work Place Guide and Work Place Instructions and assemble the bin for Work Place 2B, using materials listed in the guide. The Work Place Guide also includes suggestions for differentiating the game to meet students' needs.

From the Number Line to the Array

In this session, students begin to transfer what they learned about multiplication on the number line to the array model. Traditionally, students often begin thinking about multiplication with the array model as it provides such a good visual image of multiplication. However, as students often begin solving multiplication problems by skip-counting, it makes sense to use a number line to build and show strategies. As students develop their understanding of multiplication, they become more able to use arrays to solve and represent multiplication problems (van Galen and Fosnot, 2007).

In this and the following sessions, students use linear models (cube measuring strips and paper number lines) and begin to look at arrays of windows and windowpanes to develop efficient strategies for multiplication.

Problem String

Watertown's Window Washer

As you go through this lesson, look for opportunities to write equations that show students' thinking. As the lesson progresses, find appropriate times to write equations using variables. As you write them, explain to students what you are doing and why. For example, "You saw 3 groups of 5. I can write that like this: 3 × 5 = ___ or 3 × 5 = t, *where* t *stands for total. This equation shows how you saw the problem," or, "You know there are 28 cubes in all and you know they are in groups of 4. So you need to figure out how many groups of 4 there are. I can write that like this:* g × 4 = 28 *or* 4 × g = 28. *I can use the variable* g, *groups, to show what I need to figure out."*

1 Have students join you in the discussion circle with their math journals, and then explain that today you'll begin with a visual problem string and then do something new called Number Line Puzzles.

ELL The instruction in Sessions 3, 4, and 5 relies heavily on story-telling, which may be challenging for your ELL students. Make use of the pictures to help ELL students understand the story of Wally and how the context of the story supports the mathematical learning in these sessions. If necessary, work with ELL students in a small group and retell the story, using as many props and pictures as possible. Write the most important parts in as few words as possible.

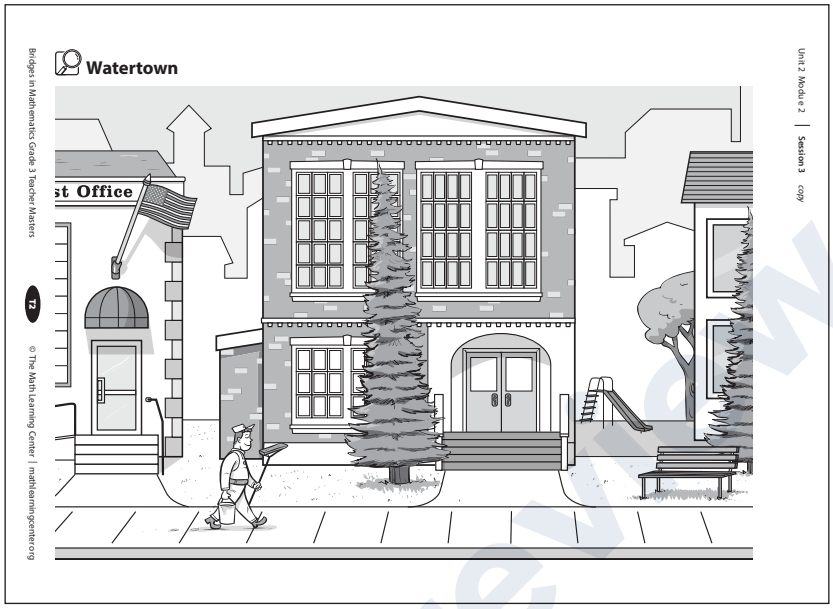
2 Display the Watertown Teacher Master where everyone can see it, and introduce Wally, the window washer of Watertown.

- Have students turn to a blank page and label it with the date and *Windows Problem String.*
- Give students a moment to study the picture and to make mathematical observations.
- Introduce Wally by reading the story below. Feel free to embellish it with any details that will make it more relevant to your students.

This is Wally the Window Washer. Wally lives in Watertown, where he is responsible for cleaning all of the windows in the town. He cleans the windows of the school, the post office, government buildings, stores, and more.

Some of the windows are made up of lots of little windowpanes, like the ones in the school. (Point to the windows in the school.)

One day, when Wally was at work washing windows, he began wondering about the number of windows and windowpanes in Watertown. At first he thought there were so many that he would never figure it out, but then he began thinking about the windows just a few at a time. He started with the windows in the Watertown School.



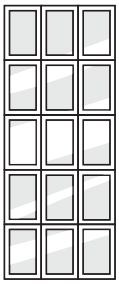
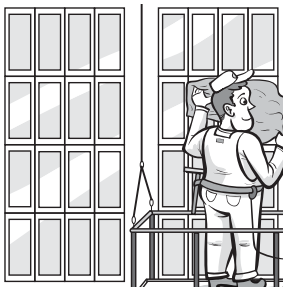
3 Deliver the string by revealing each window on the Watertown School Windows Teacher Master one at a time.

- After students have had adequate time to solve a problem, ask the class for the answer, and then invite two or three students to explain how they solved the problem.
- Represent students' strategies using equations involving multiplication and addition. Also draw loops on the teacher master to show the groups of rows and columns that students describe.
- Focus on choosing strategies that employ repeated addition, equal groups, and multiplication.
- Use the *commutative property of multiplication* Word Resource Card when discussing the commutative property.

Stories as Context

Mathematically, Sessions 3, 4, and 5 are structured to help students deepen their understanding of multiplication as they explore different models. The three sessions are linked by a story that provides the context for learning. The more authentic the story feels, the more willing students are to engage in the mathematics—so you should feel free to embellish the tale. Stories like this one are "hooks" that invite students into a mathematical investigation and motivate them to find strategies and answers.

Problem String Watertown's Window Washer

Problems	Sample Strategies & Recording	Connections
	3 columns of 5 panes $3 \times 5 = 15$ panes $5 + 5 + 5 = 15$ 5 rows of 3 panes $5 \times 3 = 15$ panes $3 + 3 + 3 + 3 + 3 = 15$	For the first problem, students might count all of the panes, use repeated addition, or think in terms of multiplication. The second problem shows a window with the same total number of panes, but some are hidden behind a tree. Students will not be able to count or add and instead will need rely on what they know about the number of rows and columns to determine that the total number of panes is equal to the first set. **Big Idea** Repeated addition can also be expressed as multiplication, and multiplication can be used to determine the total number of items (windowpanes) in an array. The commutative property of multiplication states that $3 \times 5 = 5 \times 3$, that is, that 5 rows of 3 have the same number of panes as 3 columns of 5.
		
	$4 \times 4 = 16$ $16 + 16 = 32$ ***Student*** *I counted by 4 to see how many were in one window.* 4, 8, 12, 16 *Then I doubled that to get the total.* $16 + 16 = 32$ ***Student*** *I found all of the panes that I could see. Then I figured out the panes I couldn't see. First I did 5 columns of 4; that's 20. Then I saw a row of 3 on the top. That's 23. Then, I knew there must be 3 more rows of 3 behind Wally. That's 9. 23 and 9 make 32. It's 32 windowpanes in all.*	Students' strategies will be inspired by how they see the picture. Many will figure out how many panes they see on the left and then double that number because the second window has the same number of panes as the first. Some students, however, may use the structure of rows and columns to figure out how many there are altogether. Others may use the problems they have solved before. Encourage students to solve the problem in whatever way makes sense to them, while pressing for efficiency. **Big Idea** Thinking about equal groups can help you find the total, especially when you can't see every pane to count them.

4 Have students record the equations for their work in their math journals and any other notes from the problem string.

Problems & Investigations

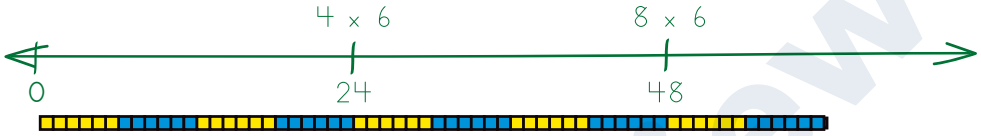
Number Line Puzzles

5 Introduce Number Line Puzzles by taping or hanging the 60-cube measuring strip on the whiteboard.

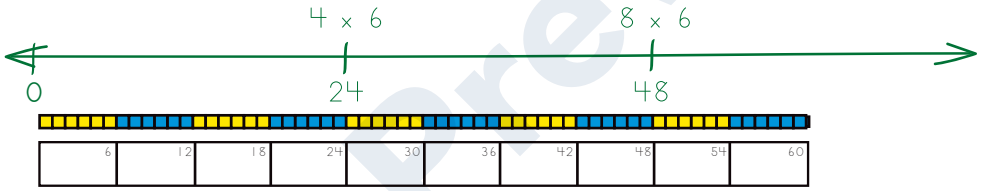
Note If it's not possible to fasten the 60-cube measuring strip to a whiteboard or a chalkboard, pin it or fasten it to a bulletin board and fasten a 45″ length of adding machine tape above it. Depending on your room set up, you may need to have students go back to desks or tables for this part of the session.

6 Have students watch and silently make observations as you:

- Draw an open number line above the cubes.
- Write 4 × 6 in the appropriate place above the number line and write 24 below the number line.
- Now write 8 × 6 in the appropriate place on the number line.
- Ask students if they can figure out what 8 × 6 is, without using the cube trains.
- Encourage students to think of a strategy from the work they just did with the windowpanes.



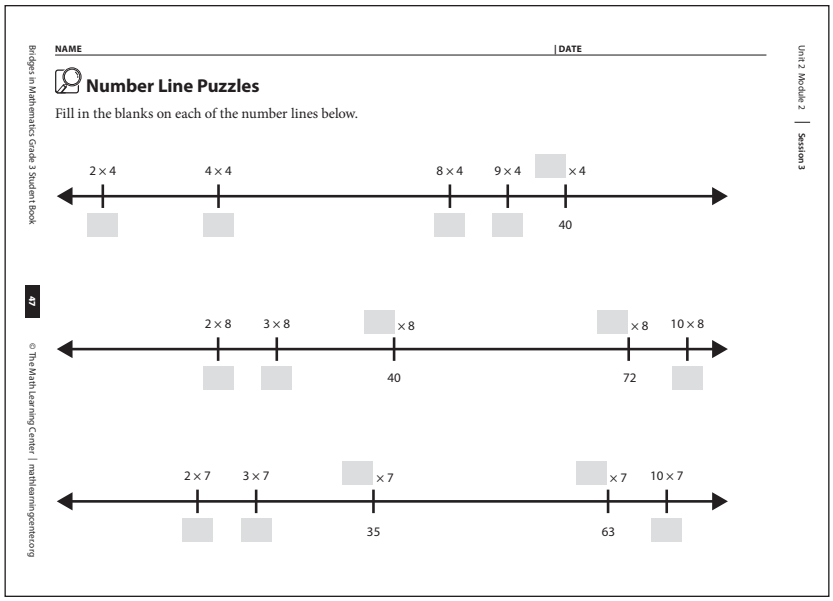
7 After a few minutes, invite two or three students to share their thinking. As they share, post the paper number line for 6s from the previous session below the strip of cubes.



- Emphasize the efficiency of using a doubling strategy. Many students will see that 8 × 6 is 4 × 6 doubled, so they will realize that they can double 24 to get 48.
- Use the paper number line for 6s to confirm students' answers and strategies.
- Explain that building the measuring strips with groups of cubes was an important way of helping students understand multiplication and learn multiplication facts, but now they can see the relationships on the paper number lines, they will need the cube strips less and less.

8 Now ask students to find the Number Line Puzzles page in their Student Books while you place a copy on display. Explain that the students will use the same kind of thinking they just did with the 60-cube measuring strip to figure out what numbers go in the boxes on the number lines.

Let the students know that the missing numbers have been chosen carefully so they can use the relationships they see on the number lines to help.


NAME | DATE

Number Line Puzzles

Fill in the blanks on each of the number lines below.

2 × 4, 4 × 4, 8 × 4, 9 × 4, ☐ × 4, 40

2 × 8, 3 × 8, ☐ × 8, ☐ × 8, 10 × 8, 40, 72

2 × 7, 3 × 7, ☐ × 7, ☐ × 7, 10 × 7, 35, 63

Bridges in Mathematics Grade 3 Student Book | 47 | © The Math Learning Center | mathlearningcenter.org | Unit 2 Module 2 | Session 3

9 Tell students that they will work with a partner to fill in the missing numbers on each number line. Ask them if they have any questions about their work. Then assign partners, and have students get to work.

SUPPORT Students who are struggling greatly with the Number Line Puzzles might use their cube trains or paper multiples strips from the previous session for help. Encourage them to try the puzzles without the cube trains and multiples strips first, however, as these tools enable students to count inefficiently rather than pursue more efficient strategies.

10 As students work, circulate to ask scaffolding questions and plan which students' strategies you'd like to feature in the brief group discussion.

- You might see students using some of the following strategies:
  - » Skip-counting
  - » Using various doubling strategies
  - » Using the distributive property
- Take time to confer with students, either to support students who are struggling or using inefficient strategies or to challenge students who know the answers quickly.

SUPPORT For students who are skip-counting, help them to see a few different ways to make their work more efficient. Emphasize how laborious it is to skip-count up every time. Ask them how they could make it any easier. Ask them if they can combine any of their "jumps" to make it easier. For example, when skip-counting by 4s to find 8 × 4, help students to see that they could double their jumps to take jumps of 8.

SUPPORT For students who are skip-counting, help them to use what they know or problems they have already solved to figure out new problems. For example, they could use 8 × 4 to figure out 9 × 4.

CHALLENGE Challenge students to use and explain partial products. Both the number lines for 8s and 7s have been designed so that students see that they can use the first two problems to solve the third. For example, 2 × 7 + 3 × 7 = 5 × 7.

CHALLENGE Challenge students to see how the distributive property works. You might focus on the 9 × *n* and 10 × *n* problems. Help students to see how knowing 10 × *n* helps them to figure out 9 × *n*.

11 Reconvene the class to discuss the ways in which a few pairs of students solved the problem you decided to feature.

You might choose to highlight especially efficient or creative and effective strategies. Conversely, if many students are routinely using skip-counting, you may want to focus on skip-counting strategies and elicit from students how and why they are not as efficient as some other strategies. Include an alternate strategy that is quick and easy.

- As students share about or discuss problems with unknown factors, show them how to write multiplication equations for these problems. Model writing equations with variables where everyone can see. For example, write ____ × 8 = 72 as $n \times 8 = 72$, and explain that the *n* stands for an unknown number. Students don't need to write equations like these on their own right now, but seeing many examples will help them become familiar with this notation.

Work Places

Introducing Work Place 2B Frog Jump Multiplication

Students play Frog Jump Multiplication in October's Number Corner. If you have already introduced the game in Number Corner, you can abbreviate or skip this introduction.

12 Gather students where they can see your displayed copy of the 2B Frog Jump Multiplication Record Sheet, and explain that they will play a new game that is a lot like Loops & Groups but on the number line.

13 Introduce Frog Jump Multiplication.

Players take turns rolling a die numbered 1–6 two times. The first roll tells how many jumps to take along the number line; the second roll tells how long each jump will be. Players mark their jumps on the number line and write a multiplication equation to show the results. Each player takes four turns and then adds their products to find the total sum. The player with the higher sum wins.

14 Play a few rounds of the game as a class.

While you play, emphasize that before they take their jumps, players should either determine or estimate where they will land. If students know the multiplication or repeated addition involved, they can calculate their final landing place precisely. If not, encourage them to make an estimate based on facts they do know.

> ***Teacher*** *OK, you all rolled a 3 and a 6, so you're going to take 3 jumps of 6. Where will you land? If you don't know exactly, use what you do know to make a good estimate. … Who'd like to share?*
>
> ***Ahmad*** *I don't know exactly, but I did know if it was 3 jumps of 5, we would land on 15. So it'll be a little more than 15.*
>
> ***Casey*** *Hey! It would be 3 more than that. It would be 18.*
>
> ***Teacher*** *Casey, when you said, 'Hey!' it sounded like you just thought of something new. What did you figure out?*
>
> ***Casey*** *Well, we're going to make 3 jumps. If each one was 5, like Ahmad said, it would be 15. But each jump is 6, that's 1 more than 5. So if you have 3 jumps and they're each 1 bigger, that's like adding 3 to 15. It's 18.*
>
> ***Kaitlyn*** *I agree that it will be 18, but I thought, OK, 2 jumps of 6 is 12, because 6 plus 6 is 12. Then 6 more is 12 plus 6. I know 2 plus 6 is 8, so 12 plus 6 has to be 18.*
>
> ***Teacher*** *Let's take the jumps. Help me count while I draw them here on the number line.*

Encouraging students to make an estimate is simply good practice: it builds strong number sense and helps them consider whether their answers are reasonable after they have made the calculations. In this game, it also nudges them toward using known multiplication facts to determine products they don't know automatically. It also helps them begin applying the distributive property to multiply with greater fluency.

15 Let students know that the next time they go to Work Places, they can play this game in pairs.

Daily Practice

The optional Windows & Number Puzzles Student Book page provides additional opportunities to apply the following skills:

- Interpret products of whole numbers (3.OA.1)
- Solve multiplication story problems with products to 100 involving situations of arrays (3.OA.3)
- Solve for the unknown in a multiplication equation involving 3 whole numbers (a multiplicand, multiplier, and product) (3.OA.4)
- Use and explain multiplicative strategies (e.g., doubling, doubling and halving, and using partial products) to demonstrate an understanding of multiplication (supports 3.OA)

Session 4
Wally Keeps Washing

Summary

Students continue to help Wally figure out numbers of windows in Watertown. Today's windows are designed to nudge students toward using what they know about multiplying by 5 and 10 to help them solve problems efficiently. The session begins with a visual problem string of sets of windows. Students work with partners to figure out more number line puzzles and then share their thinking. Finally, the teacher introduces and assigns the Story Problems & Number Line Puzzles Home Connection.

Skills & Concepts

- Write story problems or describe problem situations to match a multiplication expression or equation (3.OA.1)
- Solve for the unknown in a multiplication equation involving 3 whole numbers (3.OA.4)
- Fluently multiply with products to 100 using strategies (3.OA.7)
- Use and explain additive (e.g., repeated addition and skip-counting) and multiplicative (e.g., doubling, doubling and halving, and using partial products) strategies to demonstrate an understanding of multiplication (supports 3.OA)
- Solve problems involving a multiplicative comparison using multiplication (4.OA.2)
- Model with mathematics (3.MP.4)
- Look for and express regularity in repeated reasoning (3.MP.8)

Materials

Copies	Kit Materials	Classroom Materials
Problem String More Windows for Wally		
TM T6 More Watertown Windows		• student math journals
Problems & Investigations More Number Line Puzzles		
SB 51* More Number Line Puzzles		• adding machine tape measuring strips for 4s, 5s, 9s, 10s (see Preparation) • tape • markers or whiteboard markers • student math journals
Home Connection		
HC 29–30 Story Problems & Number Line Puzzles		
Daily Practice		
SB 52–53 The Watertown Bank		

HC – Home Connection, **SB** – Student Book, **TM** – Teacher Master
Copy instructions are located at the top of each teacher master.

** Run 1 copy of this page for display.*

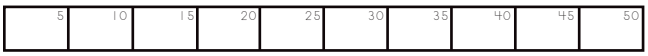
Vocabulary

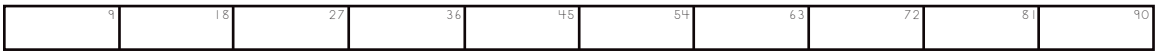
An asterisk [*] identifies those terms for which Word Resource Cards are available.

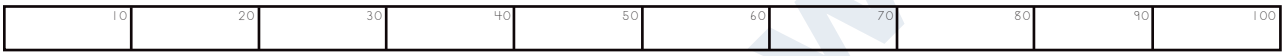
equation*
variable*

Preparation

- Create a paper measuring strip for 10 if you have not already done so.
- Post paper measuring strips for 4, 5, 9, and 10 on your whiteboard or chalkboard. Leave space between each one to draw a number line (see step 8). If you don't have a whiteboard or chalkboard, hang adding machine tape in between each measuring strip.







- Assign partners for pair work, using yesterday's partnerships or choosing different partners.

Problem String

More Windows for Wally

1 Open the session by gathering students together in the discussion area and making a connection to the work students did in the previous session.

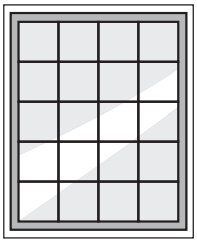
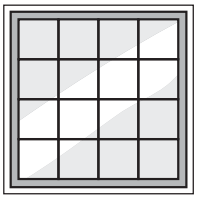
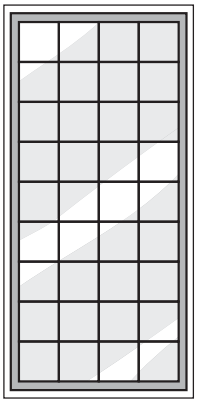
ELL The instruction in Sessions 3, 4, and 5 relies heavily on storytelling, which may be challenging for your ELL students. Make use of the pictures to help ELL students understand the story of Wally and how the context of the story supports the mathematical learning in these sessions. If necessary, work with ELL students in a small group and retell the story, using as many props and pictures as possible.

> ***Teacher*** *Yesterday you worked so hard to figure out how many windowpanes were in the front of the Watertown School. Today, Wally is cleaning the windows at the Post Office and he needs more help. He knows he can skip-count to found out how many windowpanes he needs to clean today, but he has a lot to do, so he wants to figure out the number of windowpanes quickly. Look at these windows. How could you figure out how many windowpanes there are?*

2 Deliver the string by revealing each window on the More Watertown Windows Teacher Master in succession.

- Once a window has been revealed, keep it uncovered.
- After revealing each window, give students a little time to study it, think about how it relates to the other windows, and talk in pairs about how they could find the total in a couple of different ways.
- After students have had adequate time to solve a problem, ask the class for the answer, and then invite two or three students to explain how they solved the problem.
- Represent students' strategies using equations involving multiplication and addition. Also motion with your hands to show the groups of rows and columns that students describe on the teacher master.
- Focus on choosing strategies that employ repeated addition, equal groups, and multiplication. Emphasize those strategies that use the total in one window to figure out the number of panes in the next window.

Problem String More Windows for Wally

Problems	Sample Strategies & Recording	Connections
	*I see 5 rows of 4 panes, so that's 4, 8, 12, 16, 20 panes.* 4, 8, 12, 16, 20 $5 \times 4 = 20$ *There are 4 columns of 5. Two 5s is 10, so it's 20 in all.* $4 \times 5 = (2 \times 5) + (2 \times 5) = 10 + 10 = 20$	Students might count by 4s or by 5s. At this point, multiplying and counting by 5 is likely easier for most third graders than is counting or multiplying by 4. Students might find the total number of panes in the 4-by-4 array in a variety of ways. Look for students who used their work on the 5-by-4 array to find the total in the 4-by-4 array.
	*The window above it was 5 rows of 4. This is only 4 rows of 4, so it's the same as the first window minus 1 row of 4.* $4 \times 4 = (5 \times 4) - (1 \times 4) = 16$	**Big Idea** You can use the facts and strategies that are easier for you (e.g., the times-5 facts) to solve for combinations that are not as easy.
	*This one has 9 rows of 4. That's like the first two put together. So 20 plus 16 equals 36.* $9 \times 4 = (5 \times 4) + (4 \times 4) = 20 + 16 = 36$ *I thought about a 10-times fact. If it had 10 rows of 4, that would be 40, and 1 row of 4 less than that is 36.* $9 \times 4 = (10 \times 4) - (1 \times 4) = 40 - 4 = 36$	Because they can see the two arrays they just solved for in this final array of window-panes, students can add the two totals to find the total number of panes in this array. Alternatively, students can think about a 10-by-4 array, because 10×4 is a straightforward fact. They can subtract 1 row of 4 to find the total of 36. **Big Idea** You can use related facts to find the total for combinations that you don't know right away. You can think about putting together or taking apart arrays that are easier to work with.

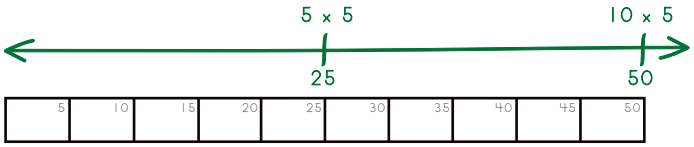
Problems & Investigations

More Number Line Puzzles

3 Draw students' attention to the paper multiples strips for 4, 5, 9, and 10. (If these are posted in a different location, have students move so everyone can see.)

In the next few minutes, you want students to become more familiar with two big ideas. First, you want them to see the double-half relationship between 5-times and 10-times. Second, you want to continue building their understanding of how knowing 5-times and 10-times can help them with their other facts, especially their 4s and 9s.

4 Draw an open number line above the 5s strip. Write 10 × 5 and 5 × 5 in the appropriate places on the line. Ask students for any observations about what they see.

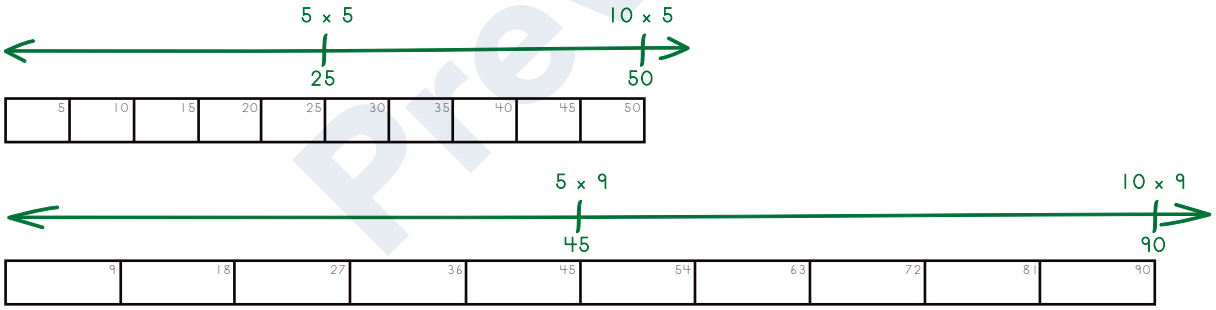


Students *10 × 5 is twice as much as 5 × 5.*

5 × 5 is half of 10 × 5.

It takes two 5 × 5s to get to 10 × 5.

5 Then, draw an open number line above the 9s strip. Write 10 × 9 and 5 × 9 in the appropriate places. Give students a minute to look at the line and then ask for observations.



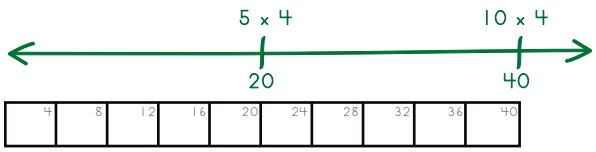
Students *5 × 9 is half as much as 10 × 9.*

5 × 9 is almost as much as 5 × 10.

10 × 9 is twice as much as 5 × 9 and almost twice as much as 5 × 10.

6 Next, draw an open number line above the 4s strip. Just as you did before, draw 10 × 4 and 5 × 4 on the line, bringing out through questioning that 10 × 4 is twice as much as 5 × 4 and vice versa.

- How does 10 × 4 relate to 5 × 4?
- How do you know?
- How can that help you figure 5 × 4 fast?



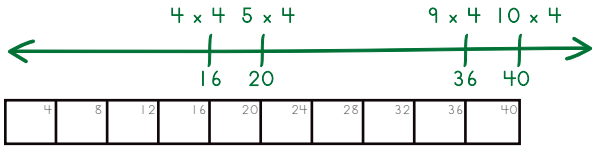
Math Practices in Action 3.MP.8

By repeating the process of multiplying by 10 and 5 with different strips, you are giving students the opportunity to look for and express regularity in repeated reasoning. Through this repetition, students begin to recognize generalized strategies for multiplying any number by 10 and by 5.

7 Then, add 9 × 4 and 4 × 4 to the line and ask students what they notice. Talk with students about how 10 × 4 can help them solve 9 × 4 and 5 × 4 can help with 4 × 4.

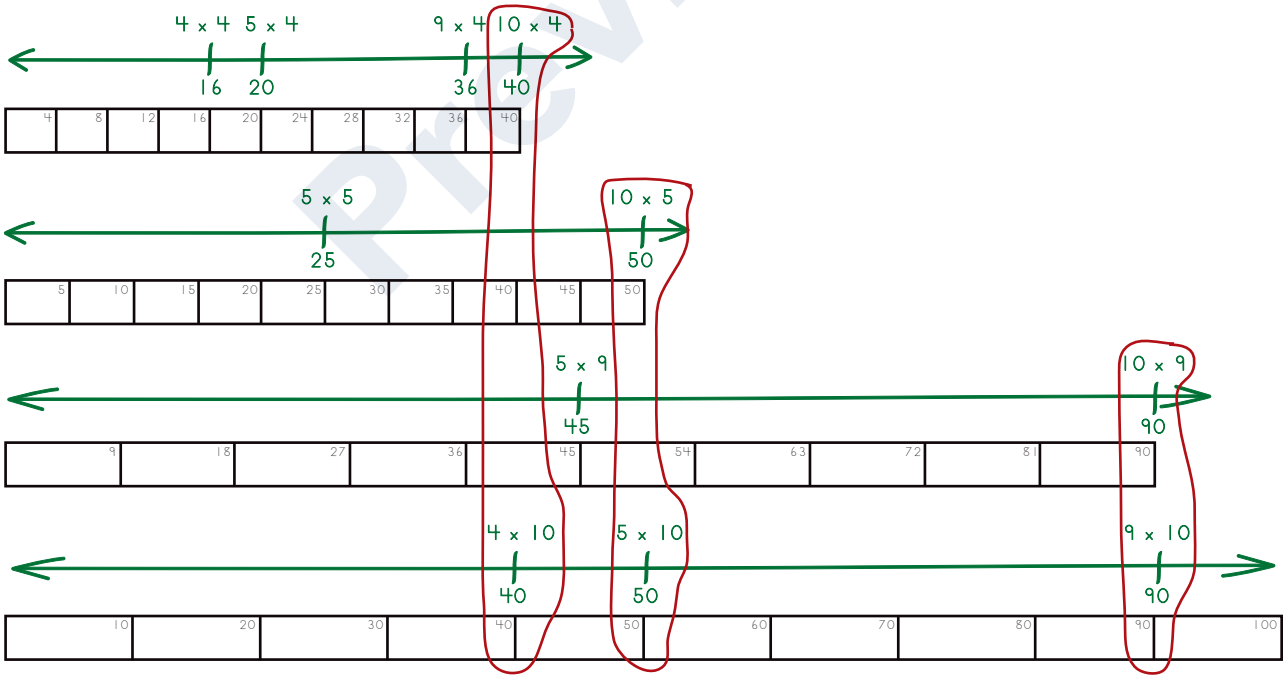
As you discuss the number line for 4s, connect what students are seeing and noticing to the work you just did with arrays of windows.

- Do any of these numbers sound familiar?
- Did Wally have some 4 × 4 and 5 × 4 and 10 × 4 windows?
- How were those windows related?
- Can you see those relationships on the number line and strip?



8 Now, draw an open number line above the 10s strip. With students' input draw 4 × 10, 5 × 10, and 9 × 10 on the line. Bring out through questioning that 4 × 10 = 10 × 4, 5 × 10 = 10 × 5, 9 × 10 = 10 × 9.

- Do you see any places that line up?
- What does that mean about the multiplication facts?
- What do we know about 10 × 4 and 4 × 10?
- What do we know about 10 × 5 and 5 × 10?
- What do we know about 10 × 9 and 9 × 10?
- Why do you think this is happening?



9 Display the More Number Line Puzzles page as students find the page in their Student Books. Give students a minute to look it over. Then ask them if they see opportunities where they can use a 5s fact or a 10s fact to help them solve another problem.

10 Ask students if they have any questions about the directions. Then, assign partners to work together at their desks or tables.

- As students work, move about the room, observing and taking notes. Look for students using the following strategies:
  - » Skip-counting
  - » Doubling and halving
  - » Doubling and halving and counting on or counting back
  - » Using the distributive property
  - » Using 5s and 10s facts

11 Confer with students as needed. Look for opportunities to challenge and support students.

SUPPORT If you see students who are still using skip-counting, help them to try out more efficient strategies. Let them show you how they solved the problem with skip-counting and recognize their effort while emphasizing how long it takes and how much work it is. Help them move toward faster and easier strategies such as skip-counting on from something they know or using doubling. You might also have them demonstrate their skip-counting method on a number line, then ask them to group their jumps.

CHALLENGE For students who are starting to use the distributive property, show them how to record their work on paper. Make a new open number line and model their work as they explain it to you. Show them how to write equations that show the distributive property (e.g., $5 \times 9 = (5 \times 10) - (5 \times 1)$ or $(6 \times 4) = (5 \times 4) + (1 \times 4)$.

12 As students finish their work on the Student Book page, have them reflect on their work in their student journals.

- Ask students to write about their experience with the number line puzzles. Help them get started by suggestiong a few topics they could write about, such as what they like about the puzzles, what is confusing about the puzzles, a question they have, or progress they made as they worked on the puzzles.
- Tell students that taking this time to write in their journals will help them participate fully in the forum.

13 Ask students to look over the More Number Line Puzzles page and their journals and prepare to share their thinking.

As the goal of today's session is for students to use their 5s and 10s facts to help them with other problems, you will want to have students who used this strategy share.

14 Invite a few students to share their thinking. Model students' work as they share.

SUPPORT If many students are struggling with idea of using 5s and 10s facts, provide a few opportunities for students to solve a problem with this strategy in pairs. (For example, have the whole class solve 5×7 and 10×7 and then have partners solve 6×7 and 9×7.) Be sure to model what students are doing on an open number line.

CHALLENGE If students see how to use their 5s and 10s facts easily, build in some challenges. Have students turn to a partner and solve some bigger problems. Try, for example, 9×7, 9×11 or 12×9.

Ask:

- How can you use 5×6 to help you with 6×6 or 4×6?
- How can you use 10×6 to help you with 9×6 or 11×6?
- Can you use similar strategies to help you with 4×4, 6×4 and 9×4, 11×4? How?
- What do you notice about this strategy?
- How does this strategy help solve problems quickly and easily?

- Could you use this strategy for other problems?
- What is confusing or unclear about this strategy?
- Could you explain this strategy to someone else?

15 After a few students have shared, challenge the students one more time. Write the problem $5 \times n = 20$ where everyone can see. Ask the students to make up a story problem for the equation.

- Let them know they can use ideas from the Pet Store, the stamps, the seascape, the measuring strips, or the windows, or they can make up their own story.
- If necessary, review what a variable is and what *n* means in the problem. You might provide a sample problem if students are confused. For example, you might say, "A group of stamps costs 20¢. Each stamp costs 5¢. How many stamps are there?" Or "A 20 inch parrot fish is 5 times as long as a sea urchin. How long is the sea urchin?"

16 Invite a couple of students to share. Let students know they will do more challenges like these in the future.

> ***Cameron*** *Wally is cleaning a window with 20 panes. There are 5 rows of windowpanes. How many panes are in each row?*
>
> ***Jiang*** *A bag of chew toys costs $20. There are 5 chew toys in the bag. How much does each toy cost?*

17 Close the session.

- Have students turn in anything you want to look over or keep for their files.
- Let them know they will have one more day to help Wally count the windows of Watertown.

Home Connection

18 Introduce and assign the Story Problems & Number Line Puzzles Home Connection, which provides more practice with the following skills:

- Solve multiplication story problems with products to 100 involving situations of measurement quantities (3.OA.3)
- Solve division story problems with dividends to 100 involving situations of equal groups (3.OA.3)
- Solve for the unknown in a multiplication equation involving 3 whole numbers (3.OA.4)
- Solve two-step story problems using addition and multiplication (3.OA.8)
- Write a multiplication equation to represent a verbal statement of a multiplicative comparison (4.OA.1)

Daily Practice

The optional The Watertown Bank Student Book page provides additional opportunities to apply the following skills:

- Solve multiplication story problems with products to 100 involving situations of arrays (3.OA.3)
- Model story problems involving multiplication within 100 by writing expressions and equations with a symbol for the unknown number (supports 3.OA)
- Use and explain multiplicative strategies (e.g., doubling, doubling and halving, and using partial products) to demonstrate an understanding of multiplication (supports 3.OA)

Session 5
The Watertown Post Office

Summary

In the final Watertown session, students work with arrays of windows as a model of multiplication. Students begin by looking at small arrays of mailboxes and then at an entire wall of mailboxes. Then the teacher introduces Work Place 2C, which gives students more practice representing multiplication within 100 using arrays.

Skills & Concepts

- Interpret products of whole numbers (3.OA.1)
- Use and explain multiplicative strategies (e.g., doubling, doubling and halving, and using partial products) to demonstrate an understanding of multiplication (supports 3.OA)
- Solve for the unknown in a multiplication equation involving 3 whole numbers (3.OA.4)
- Multiply using the commutative property (3.OA.5)
- Fluently multiply with products to 100 using strategies (3.OA.7)
- Solve story problems that call for finding the area of a figure that can be decomposed into non-overlapping rectangles (3.MD.7d)
- Reason abstractly and quantitatively (3.MP.2)
- Construct viable arguments and critique the reasoning of others (3.MP.3)

Materials

Copies	Kit Materials	Classroom Materials
Problem String The Watertown Post Office		
TM T7 Post Office Mailboxes		• 2 pieces of paper to mask portions of the teacher masters • student math journals
Problems & Investigations The Watertown Post Office Mailboxes		
SB 54* More Post Office Mailboxes		As needed: • markers • glue or tape • scissors
Work Places Introducing Work Place 2C Cover Up		
TM T8 Work Place Guide 2C Cover Up **TM T9** 2C Cover Up Record Sheet **SB 55**** Work Place Instructions 2C Cover Up	• spinner overlay	• colored pencils in 2 different colors
Daily Practice		
SB 56 Watertown Center		

HC – Home Connection, **SB** – Student Book, **TM** – Teacher Master
Copy instructions are located at the top of each teacher master. ** Run 1 copy of this page for display.*
*** Run 1 copy of this page to be kept in a clear plastic sleeve in the Work Place bin.*

Vocabulary

An asterisk [*] identifies those terms for which Word Resource Cards are available.

array*
equation*
variable*

Preparation

Assign partners for pair work, using yesterday's partnerships or choosing different partners.

In today's session, you'll introduce Work Place 2C Cover Up, which replaces Work Place 1E Carrot Grab. Before this session, you should review the Work Place Guide and Work Place Instructions. Make copies of the 2C Cover Up Record Sheet for use today, and store the rest in the Work Place 2A Loops & Groups bin, along with the materials listed on the guide. The Work Place Guide also includes suggestions for differentiating the game to meet students' needs.

Context

As you wrap up this 3-day investigation, stay true to the story of Wally as you launch the lesson, confer with students, and conduct the forum. Students are more compelled by the power of story and are more likely to be drawn into the mathematics. Feel free to add any details that will help make the story more convincing or more relevant to students' lives or your work in the classroom.

Problem String

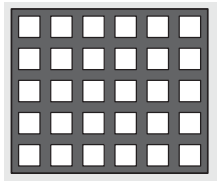
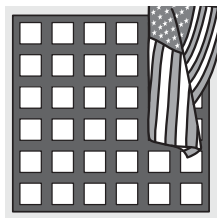
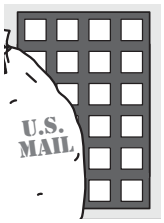
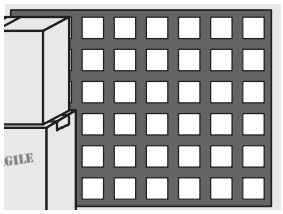
The Watertown Post Office

1 Open today's session by introducing the class to Wanda, Wally's wife. Wanda manages the Watertown Post Office. One of Wanda's jobs is to sort the mail into everybody's mailbox at the Post Office. In this session, students will help Wanda figure out numbers of mailboxes.

2 Deliver the string by revealing the first two arrays of mailboxes on the Post Office Mailboxes Teacher Master one at a time and then revealing the entire picture and asking students to determine the number of boxes in the bottom two arrays.

- Begin by asking students to turn to a new page in their journals and titling it Mailbox String.
- After revealing each array of mailboxes, give students a little time to study it, think about how it relates to the other arrays, and talk in pairs about how they could find the total in a couple of different ways.
- After students have had adequate time to solve a problem, ask the class for the answer, and then invite two or three students to explain how they solved the problem.
- Represent students' strategies using equations involving multiplication and addition. Also motion with your hands to show the groups of rows and columns that students describe on the teacher master.
- Focus on choosing strategies that use the total in one array to figure out the number of mailboxes in the next array, particularly those that rely on the 5s facts and doubling.

Problem String The Watertown Post Office

Problems	Sample Strategies & Recording	Connections
	*It has 5 rows of 6 mailboxes. That's 5 × 6, and we did that the other day. It's 30.* 5 × 6 = 30 *Two columns of 5 are 10. There are three 10s, so that's 30.* 5 × 6 = (5 × 2) + (5 × 2) + (5 × 2) = 10 + 10 + 10 = 30	Emphasize strategies that build upon what students know about multiplying by 5 or working with groups of 5. **Big Idea** You can use combinations (like 5s) that are easier for you to solve combinations that are more challenging.
	*The last one was five 6s. This one is six 6s, so it's 6 more than the last one. 30 plus 6 is 36.* 6 × 6 = (5 × 6) + (1 × 6) = 30 + 6 = 36 *Two 6s are 12 and 2 more 6s are 12. 12 and 12 are 24. Then there are just 2 more 6s for another 12. 24 and 12 more are 36.* 6 × 6 = (2 × 6) + (2 × 6) + (2 × 6) = 12 + 12 + 12 = 24 + 12 = 36	
 	*The one with the bag is 4-by-6. That means there are two 4-by-3 arrays put together. 4 times 3 is 12 and two of those makes 24.* 4 × 6 = (4 × 3) + (4 × 3) = 12 + 12 = 24 *The next one is an 8-by-6. That's like two of the 4-by-6s put together. So we just doubled to find the total. 48.* 8 × 6 = (4 × 6) + (4 × 6) = 24 + 24 = 48 *The 8-by-6 is like the 6-by-6 with two more 6s added to it. So I added 12 to 36 to get 48.* 8 × 6 = (6 × 6) + (2 × 6) = 36 + 12 = 48	Students might imagine a 5-by-6 array and then subtract a column of 6 to find the total for the 6-by-4 array. The 6-by-8 array is quite large, and not a familiar combination for third graders, so they will be challenged to find efficient strategies for finding the total. You might encourage them to think about how the other arrays can help them with this one. **Big Idea** Doubling and halving can make it easier to find the product when at least one of the numbers you are multiplying is even. You can find a product by thinking about the partial products in it (e.g., 8 × 6 is a combination of 6 × 6 and 2 × 6).

Math Practices in Action 3.MP.2

By covering parts of the arrays of mailboxes, we are pushing students to shift gradually from quantitative reasoning to more abstract reasoning. When it is impossible for them to count the mailboxes, they are nudged to multiply and to do so by thinking more symbolically.

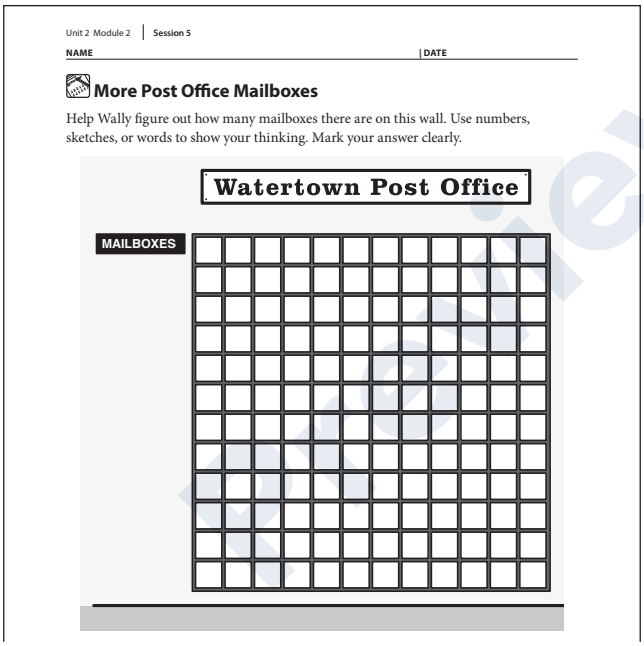
3 Ask students to make some brief notes in their math journals about what they learned in the string today.

Problems & Investigations

The Watertown Post Office Mailboxes

4 Have students put away their math journals and find More Post Office Mailboxes in their Student Books as you place a copy on display.

- Explain that some of the mailboxes in the Watertown Post Office are in small sections, as the students just saw. There is one wall at the Post Office that is entirely made up of mailboxes.
- Give students a minute to study the picture, and then ask them to think of efficient ways to figure out how many mailboxes there are in all. Challenge them to think of ways to make the problem easier.
- For the moment, steer students away from trying to find the answer, and toward making observations that might make the problem easier to solve.
  - » What do you notice about the picture?
  - » What relationships can you see that would help solve the problem?


Unit 2 Module 2 | Session 5

NAME | DATE

More Post Office Mailboxes

Help Wally figure out how many mailboxes there are on this wall. Use numbers, sketches, or words to show your thinking. Mark your answer clearly.

Watertown Post Office

MAILBOXES

Natasha *Whoa. That's a lot of mailboxes.*

Tyrone *I don't think I can ever figure that out.*

Will *Wait a minute. We don't have to do the whole thing. We could find out parts of wall first.*

Gabby *Oh yeah, I see a 6-by-6 group in there and we just did that one. It's 36. Maybe we could just do that first and then some more.*

(The teacher loops the 6-by-6 array and writes 36 inside it.)

Martin *Or we could find groups of 5-by-6 because 5s are easier.*

Ashley *Yeah, that would make groups of 30 and that would be easier too.*

Teacher (Loops a 5-by-6 array, then labels it with the factors and writes 30 on the inside) *There are lots of ways to look at this wall of mailboxes. Does anyone see it in a different way?*

5 Define *array* using the Word Resource Card as a set of objects arranged in equal rows and equal columns.

> ***Teacher*** *I want to teach you all a word that you can use when you are talking about these groups. Some of you may know it already. All of these groups we have been looking at are also called arrays. An array is a rectangle that shows rows and columns. Remember the first group of mailboxes? We can call that a 5-by-6 array. It has 5 equal rows and 6 equal columns.*

6 Ask students to work with a partner to figure out how many mailboxes there are altogether.

- Show students the materials they can use (their own copy of the mailboxes), student journals, markers, scissors, and glue or tape).
- Encourage students to use work or reflections already in their journals to help them and to write new observations in their journals.
- Ask students if they have any questions.
- Assign partners and have students get their materials and then get started on their challenge at their desks or tables.

While students work, circulate to make observations and confer with them.

- Ask scaffolding questions to push students' thinking.
- Help students figure out how to show their work clearly by writing and drawing directly on the page.
- Help students write equations to show their strategies.
- Identify students whose work you'd them to share with the group. Try to choose students who have used strategies that would be challenging but manageable for most of the class. Emphasize efficiency.

SUPPORT You may see students making lots of different small arrays. Talk with them about the efficiency of this approach and whether or not they are able to keep track of all of their arrays. Encourage them to have an organizational system for how they divide up the big array or push them to use larger arrays that are easier to manage.

SUPPORT You may see students trying to skip-count by 12s. If this is not fast and easy for them, help them make groups of 12 and then add these groups together. Or, help them find arrays that are easier for them to work with, such as arrays with 5 or 10 on one side.

SUPPORT Look for students who have made logical smaller arrays but are struggling to add the totals correctly. It may still be difficult for many 3rd graders to add several 2-digit numbers.

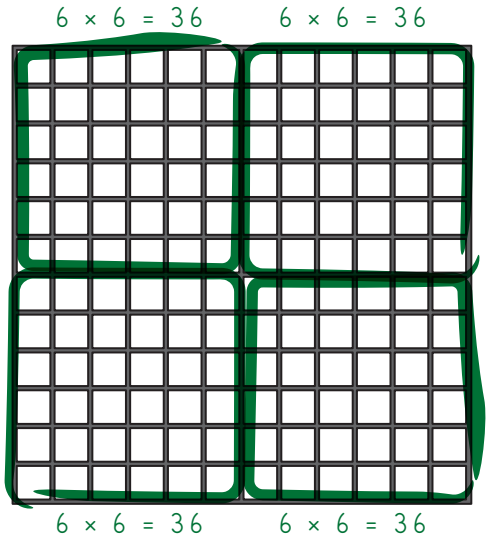
CHALLENGE For students who are able to divide up the array into logical smaller arrays and add them quickly, challenge them to see the relationships within their work. Push them to figure out why what they did worked and to generalize mathematical rules based on what they did.

CHALLENGE If students finish quickly, they can work on today's Daily Practice page, in which they will work with a 14-by-16 array.

7 Invite the students you selected to share their work.

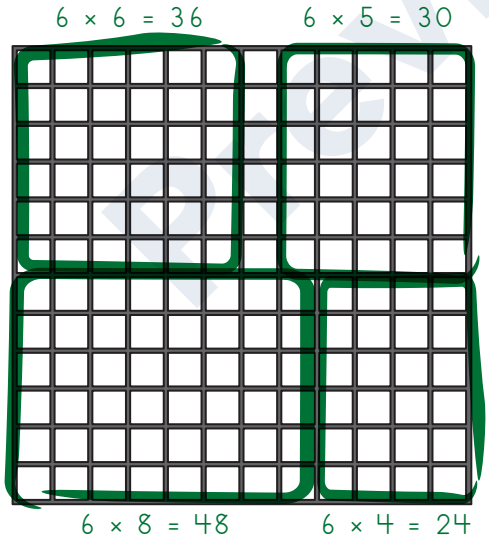
Using Four 6-by-6 Arrays

Students identify four 6-by-6 arrays in the 12-by-12 array. They add 36 four times for a total of 144.



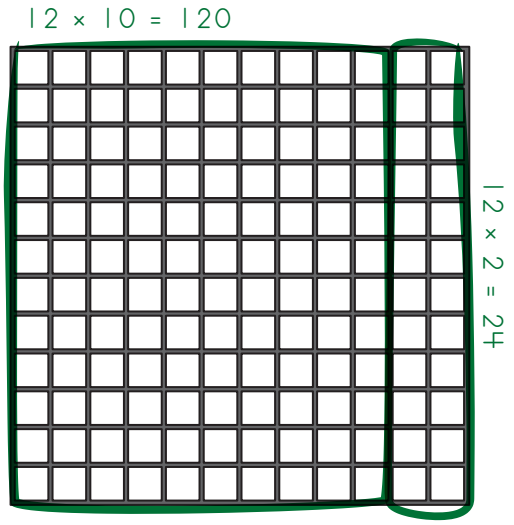
Using Familiar Arrays

Students identify the four arrays they already worked with, find the total of their products, and then add the 6 remaining mailboxes.



Using a 12-by-10 Array and a 12-by-2 Array

The student identifies a 12-by-10 array and a 12-by-2 array and adds their products (120 + 24) for a total of 144.



- As students share, look for opportunities to use the word *array*.
- Help everyone stay within the context of the investigation by asking students how many mailboxes are on the wall. Continue to be specific with your language throughout the forum. For example, as students share their answers, have them say "144 mailboxes" rather than just 144.

Work Places

Introduce Work Place 2C Cover Up

8 Gather students where they can see your displayed copy of the 2C Cover Up Record Sheet, and explain that they will play a new game in which they will think more about arrays.

9 Introduce Cover Up.

Players take turns spinning two numbers, drawing an array with those dimensions on a 10-by-10 grid, and finding the product represented by the array (total area of the array). Each player takes four turns and then finds the total of their products. The player whose total is closest to 100 wins.

10 Play a few rounds of the game as a class.

- While you play, emphasize that if students don't know a product right away, they can use the arrays to help. They can count by a number, perform repeated addition, and use facts they already know to help. For example, to find the product of 4 × 7, students might recognize the 4 × 5 (20) and 4 × 2 (8) arrays in the 4 × 7 array. Adding the two products 20 and 8 yields the product of 4 × 7: 28.
- When you find the sum of your products, model how to use the associative property of addition to make adding four numbers easier by combining numbers that are easier to add first. For example, if you might add 36, 28, 18, and 12 in the following ways:

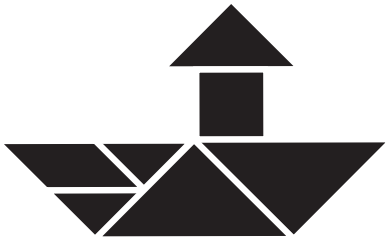
36 + 28 + 18 + 12	= 36 + 18 + 28 + 12		
	= 36 + 18 + 40	or	= 36 + 18 + 40
	= 34 + 2 + 18 + 40		= 9 × 4 + 9 × 2 + 40
	= 34 + 20 + 40		= 9 × 6 + 40
	= 34 + 60		= 54 + 40
	= 94		= 94

11 Let students know that the next time they go to Work Places, they can play this game in pairs.

Daily Practice

The optional Watertown Center Student Book page provides additional opportunities to apply the following skills:

- Solve for the unknown in a multiplication equation involving 3 whole numbers (a multiplicand, multiplier, and product) (3.OA.4)
- Fluently multiply with products to 100 using strategies (3.OA.7)
- Use and explain multiplicative strategies (e.g., doubling, doubling and halving, and using partial products) to demonstrate an understanding of multiplication (supports 3.OA)



Teacher Masters

GRADE 3 – UNIT 2 – MODULE 2

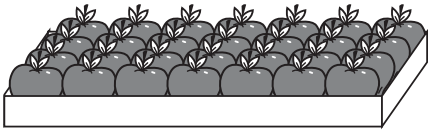
BRIDGES®
IN MATHEMATICS

NAME | **DATE**

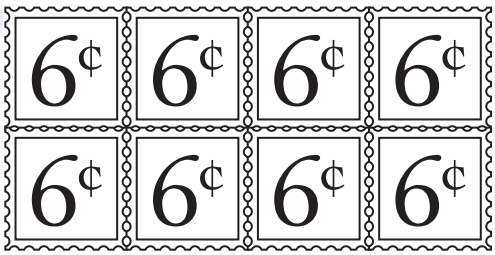
Multiplication Checkpoint

Pablo lives in New York City. He likes to walk around the city and look at all the people, places, and things. Solve the following problems about Pablo's adventures. Label each answer with the correct units. Use numbers, sketches, or words to show your thinking.

1 Pablo walked past a fruit market with boxes of apples, oranges, lemons, and more. How many apples are on display at the fruit market?

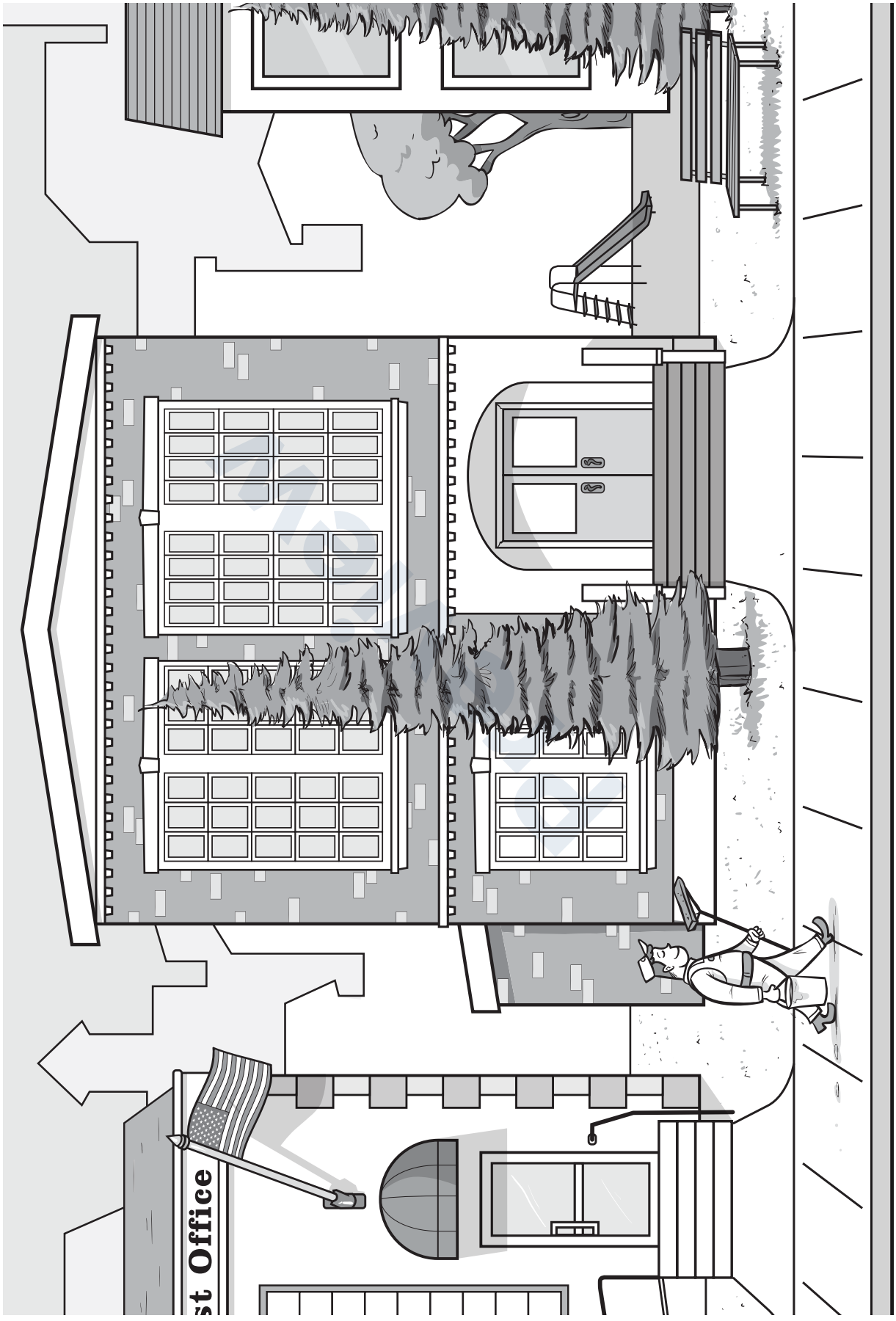


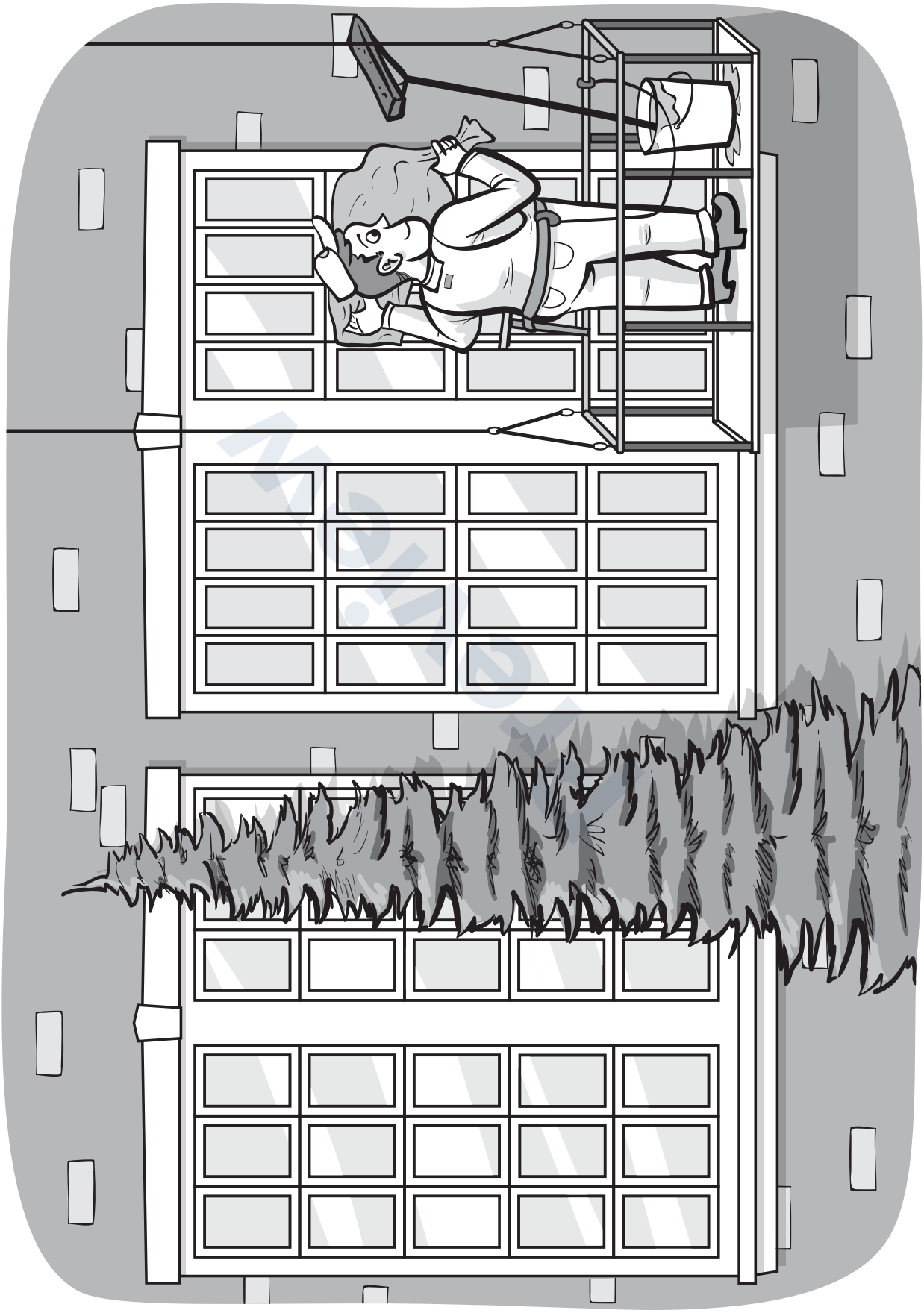
2 Pablo went into the Post Office to buy these 8 stamps. How much did Pablo pay for his stamps?



3 Pablo watched people getting on and off the subway at the Times Square station. He saw 8 people wearing coats. Each coat had 5 buttons on it. How many buttons did Pablo see?

4 Pablo walked up to Central Park. He saw a trash can that was 3 feet tall. Then, he saw a lamppost that was 4 times as tall as the trash can. How tall was the lamppost?





Watertown School Windows

Work Place Guide 2B Frog Jump Multiplication

Summary

Players take turns rolling a die numbered 1–6 two times. The first roll tells how many jumps to take along the number line; the second roll tells how long each jump will be. Players mark their jumps on the number line and write a multiplication equation to show the results. Each player takes 4 turns and then adds their products to find the total sum. The player with the higher sum wins.

Skills & Concepts

- Interpret products of whole numbers (3.OA.1)
- Describe problem situations to match a multiplication expression or equation (3.OA.1)
- Use and explain additive strategies (e.g., repeated addition and skip-counting) to demonstrate an understanding of multiplication (supports 3.OA)
- Use strategies based on place value, properties of operations, or the relationship between addition and subtraction to add fluently with sums to 1,000 (3.NBT.2)

Materials

Copies	Kit Materials	Classroom Materials
TM T4 Work Place Guide 2B Frog Jump Multiplication **TM T5** 2B Frog Jump Multiplication Record Sheet **SB 48** Work Place Instructions 2B Frog Jump Multiplication	• 3 dice numbered 1–6	

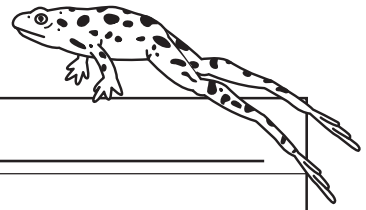
Assessment & Differentiation

Here are some quick observational assessments you can make as students begin to play this game on their own. Use the results to differentiate as needed.

If you see that…	Differentiate
Students are struggling to write equations.	SUPPORT Help students see how the equation matches the jumps they drew on the number line. Emphasize the words that describe the pictures—4 *jumps of* 3.
Students are struggling to add many numbers.	SUPPORT Review addition strategies with these students. Encourage them to use combinations of 10 or friendly numbers. For example, when adding 12 + 16 + 15 + 24, they could add 16 + 24 to get 40. Then 12 + 16 = 28. Then 28 + 40 = 68.
Students can efficiently multiply single-digit numbers.	CHALLENGE Encourage students to use a 4–9 die for larger numbers. They will need to draw open number lines to show many of these combinations.
English-Language Learners Use the following adaptations to support the ELL students in your classroom.	
• Play the game with ELL students, modeling how to play and what to do. Focus on showing students how the equation and phrases (such as 2 jumps of 5) match the number lines on the record sheet. • Encourage ELL students to play with same-language peers in their own language.	

NAME | DATE

2B Frog Jump Multiplication Record Sheet



Round 1

_____ jumps of _____ I think I will land on _____ Multiplication equation: _____

0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36

Round 2

_____ jumps of _____ I think I will land on _____ Multiplication equation: _____

0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36

Round 3

_____ jumps of _____ I think I will land on _____ Multiplication equation: _____

0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36

Round 4

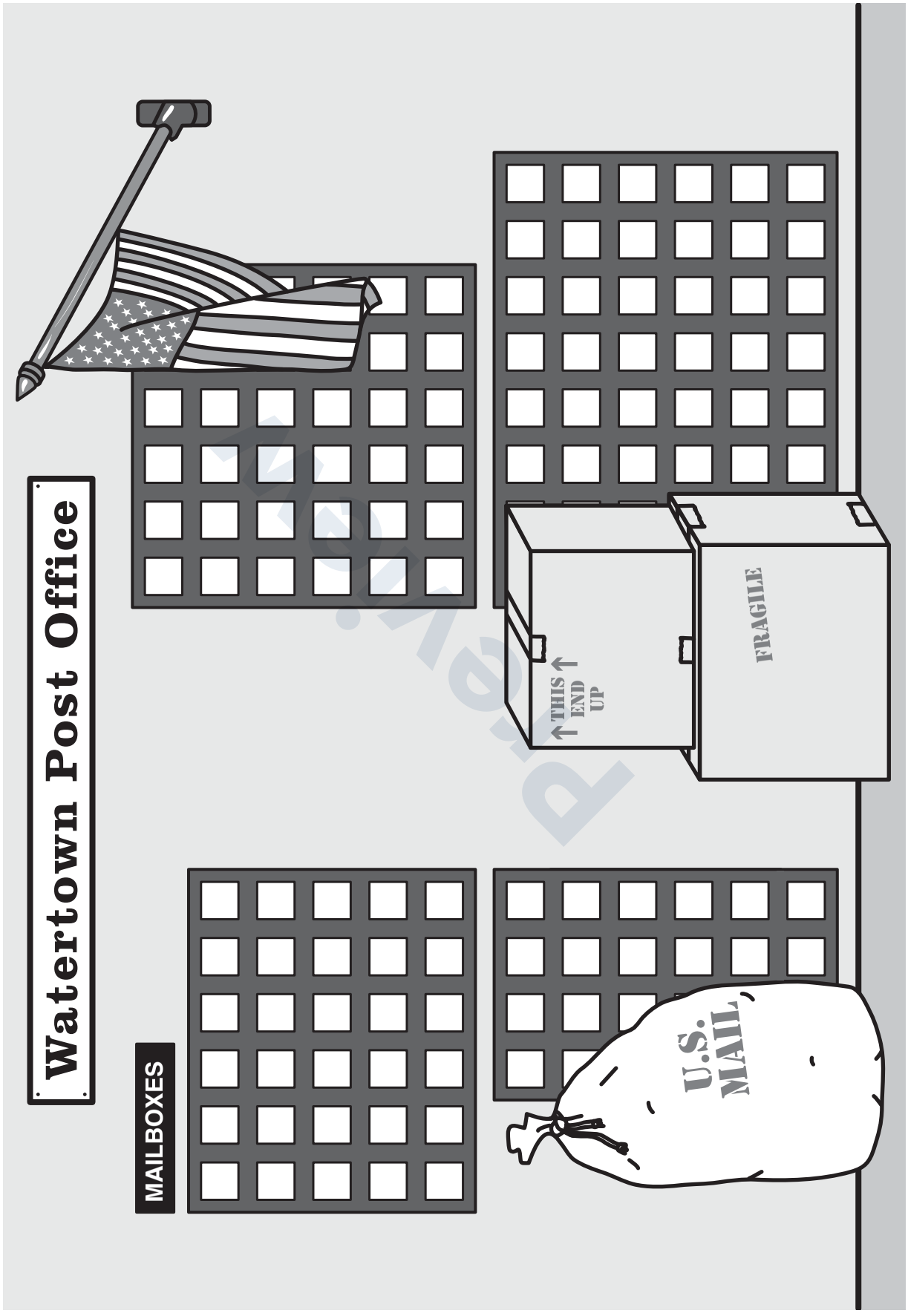
_____ jumps of _____ I think I will land on _____ Multiplication equation: _____

0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36

My Score (Add all 4 products.)	My Partner's Score (Add all 4 products)

More Watertown Windows

Post Office Mailboxes



Work Place Guide 2C Cover Up

Summary

Players take turns spinning two numbers, drawing an array with those dimensions on a 10-by-10 grid, and finding the product represented by the array (total area of the array). Each player takes four turns and then finds the total of their four products. The player whose total is closest to 100 wins.

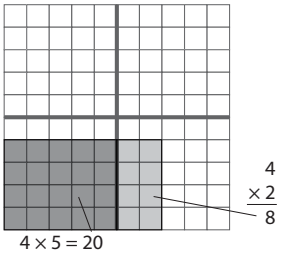
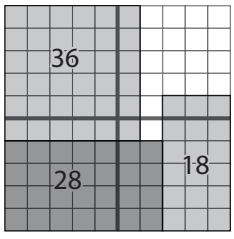
Skills & Concepts

- Interpret products of whole numbers (3.OA.1)
- Apply properties of operations as strategies to multiply (3.OA.5)
- Fluently multiply with products to 100 using strategies (3.OA.7)
- Use strategies based on place value, properties of operations, or the relationship between addition and subtraction to add fluently with sums to 1,000 (3.NBT.2)
- Represent the product of two numbers as the area of a rectangle with side lengths equal to those two numbers, and find the area of the rectangle by multiplying the side lengths (3.MD.7b)
- Use the area model for multiplication to illustrate the distributive property (3.MD.7c)
- Use and explain additive strategies (e.g., repeated addition and skip-counting) to demonstrate an understanding of multiplication (supports 3.OA)

Materials

Copies	Kit Materials	Classroom Materials
TM T8 Work Place Guide 2C Cover Up **TM T9** 2C Cover Up Record Sheet **SB 55** Work Place Instructions 2C Cover Up	• 3 spinner overlays	• colored pencils or markers in 2 different colors

Assessment & Differentiation

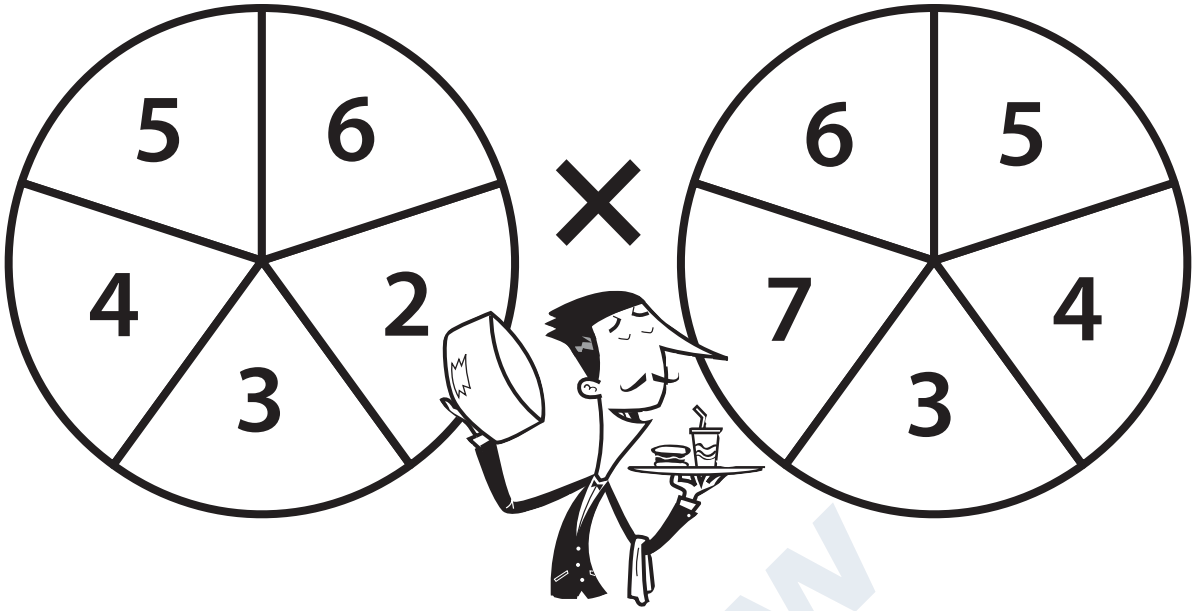
If you see that…	Differentiate	Example
Students are struggling to find the products.	**SUPPORT** Help students use the structure of the arrays to help find the products. Can they locate a fact they do know in the array and use it to find the total product? You won't want to encourage students to count the squares in the arrays by 1s, but using the facts they do know and the arrays they do recognize can help them develop mental strategies that contribute to fluency with the multiplication facts.	 You would not want to encourage students to count the 28 squares in this array one-by-one. However, breaking the array into a 4-by-5 and a 4-by-2 array results in two easier products, the sum of which is the product of 4 × 7: 28.
Students are struggling to add many numbers.	**SUPPORT** Review addition strategies with these students. Encourage them to use combinations of 10 or friendly numbers. For example, when adding 12 + 16 + 15 + 24, they could add 16 + 24 to get 40. Then 12 + 16 = 28. Then 28 + 40 = 68.	
Students can efficiently multiply single-digit numbers.	**CHALLENGE** Invite students to draw either the array with the exact dimensions they spun, or an array with the same product by different dimensions. This can help students fit an array on their grid that otherwise might not fit and gives them the opportunity to consider a variety of multiplication and division facts.	 At this point in the game, if a student spun a 6 and a 2, they would not be able to fit a 6-by-2 array in the space available on the grid. They could, however, fill in a 3-by-4 or 4-by-3 array to represent that product of 12.

English-Language Learners Use the following adaptations to support the ELL students in your classroom.

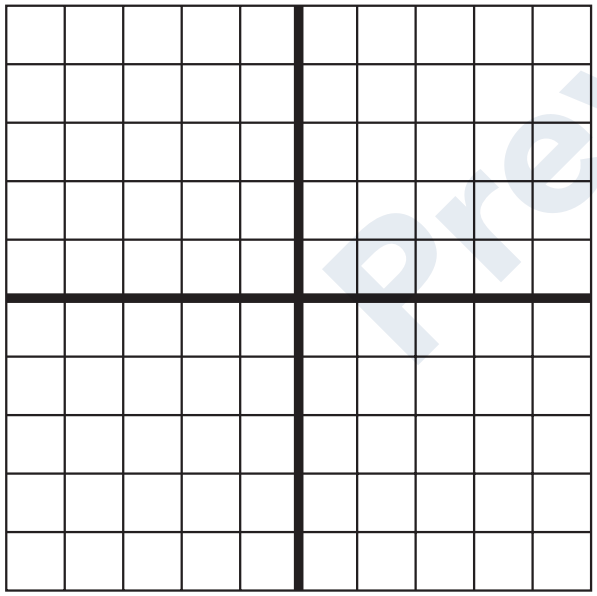
Encourage ELL students to play with same-language peers in their own language.

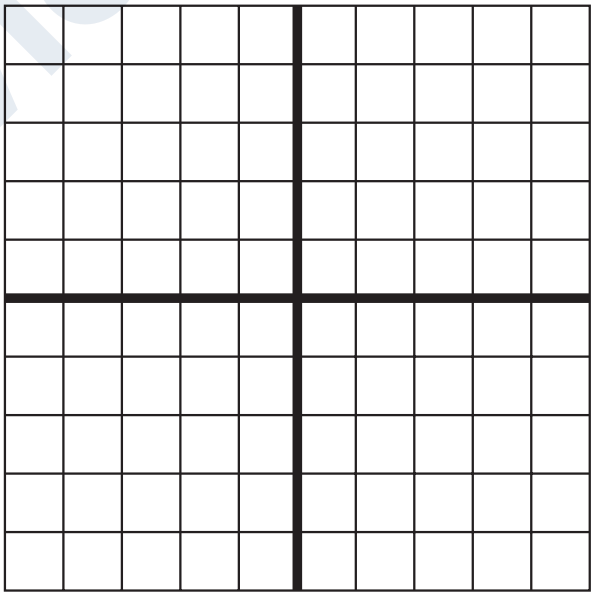
NAME | **DATE**

2C Cover Up Record Sheet



Player 1 _____ Player 2 _____





First Array _____ First Array _____

Second Array _____ Second Array _____

Third Array _____ Third Array _____

Fourth Array _____ Fourth Array _____

Total Total

Student Book

GRADE 3 – UNIT 2 – MODULE 2

BRIDGES®
IN MATHEMATICS

NAME | DATE

Toby Goes Shopping

Toby went shopping with some of his classmates.

1 Toby's classmates split up into 4 groups of 5 students. Which equation matches that situation?

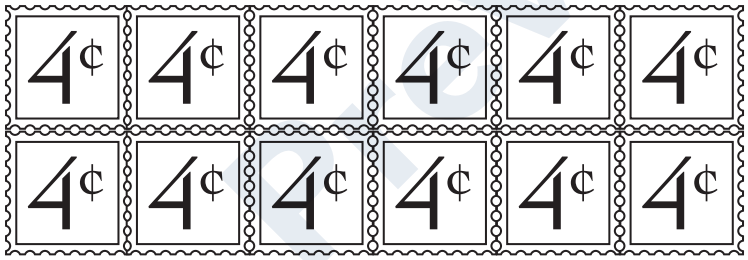
○ $4 \times 5 = 20$ ○ $4 + 9 = 5$ ○ $4 + 5 = 9$ ○ $5 - 4 = 1$

2 Use numbers, sketches, or words to show your thinking.

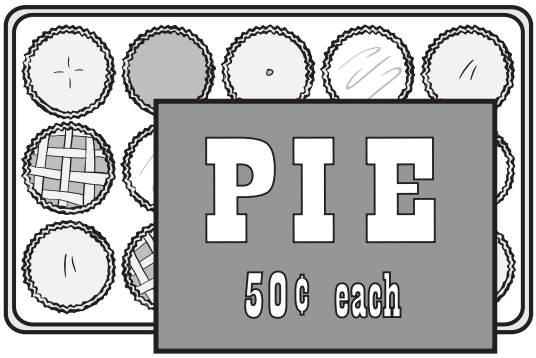
a Toby saw fruit at the store. There were 6 rows of 3 peaches in a box. How many peaches were in the box?

b Toby's sister picked up a loaf of bread that was 20 inches long. The basket is 3 times as long as the bread. How long is the basket?

c Toby bought some stamps. How much did he pay for these stamps?



d **CHALLENGE** Toby saw a tray of little pies. How much does the whole tray of pies cost?



NAME | DATE

Seascape Challenges

1 Chloe the Clownfish is 4 inches long. She swims past a vase sponge that is 7 times as wide as she is long.

a How wide is the vase sponge? Use pictures, numbers, or words to show your work.

b Write an equation for this problem. _____

2 Chloe swims through some sea grass. The sea grass is 9 times taller than Chloe's length.

a How tall is the sea grass? Use pictures, numbers, or words to show your work.

b Write an equation for this problem. _____

3 Chloe swims away from an octopus. One of its arms is 24 inches long.

a How many times longer than Chloe is the arm of the octopus? Use pictures, numbers, or words to show your work.

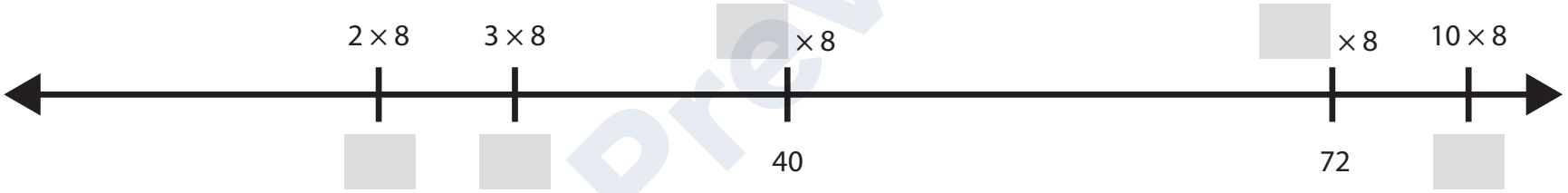
b Write an equation for this problem. _____

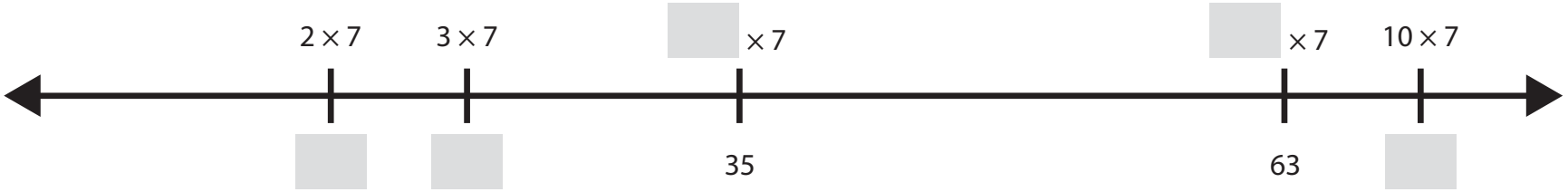
4 Write your own Chloe story problem. Include an equation with the problem and the answer.

NAME | DATE

Number Line Puzzles

Fill in the blanks on each of the number lines below.





Work Place Instructions 2B Frog Jump Multiplication

Each pair of players needs:

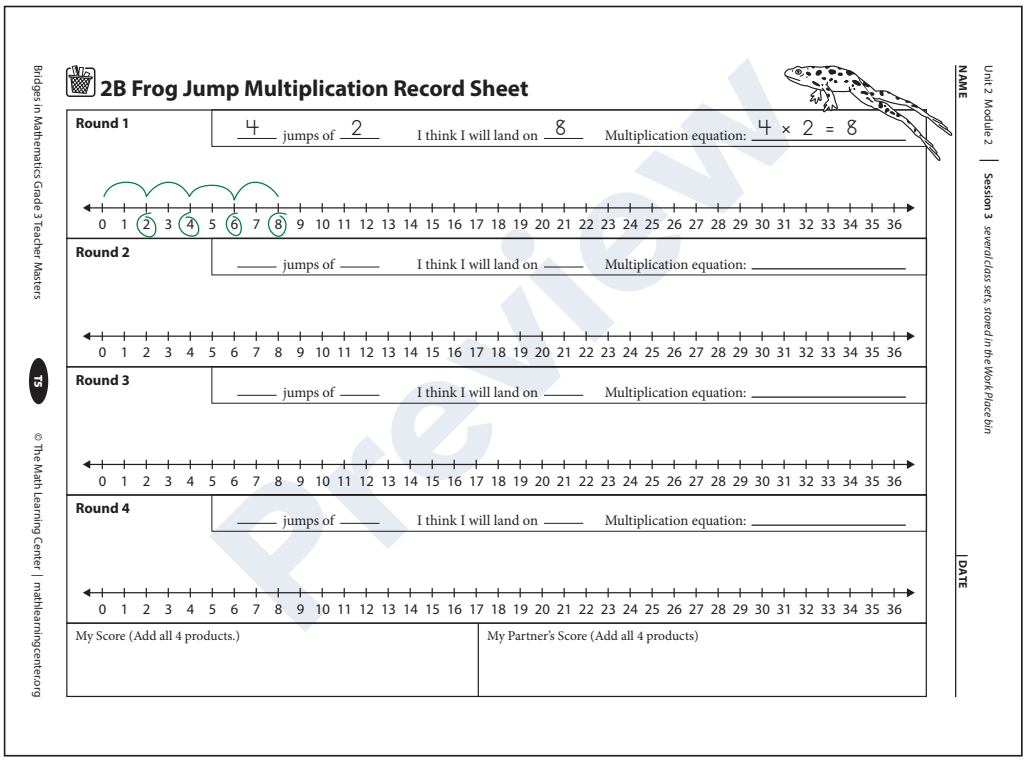
- 1 die numbered 1–6
- their own Work Place 2B Frog Jump Multiplication Record Sheets

1 Each player takes a turn rolling the die. The player with the higher roll goes first.

2 The first player rolls the die twice and records the rolls. The first number shows how many jumps to take along the number line. The second number shows the size of each jump.

3 The player predicts (or determines) where they will land after taking the jumps and explains their prediction to their partner.

4 The player makes the jumps and writes a multiplication equation to show the results.



2B Frog Jump Multiplication Record Sheet

NAME | DATE

Round 1: 4 jumps of 2 | I think I will land on 8 | Multiplication equation: 4 × 2 = 8

Round 2: ____ jumps of ____ | I think I will land on ____ | Multiplication equation: ____

Round 3: ____ jumps of ____ | I think I will land on ____ | Multiplication equation: ____

Round 4: ____ jumps of ____ | I think I will land on ____ | Multiplication equation: ____

0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36

My Score (Add all 4 products.) | My Partner's Score (Add all 4 products)

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Unit 2 Module 2 | Session 3 *several class sets, stored in the Work Place bin*

5 Players take turns until each player has had four turns.

6 At the end of the game, players add their four products. They player with the higher sum wins.

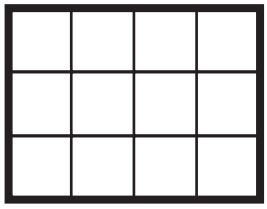
NAME | DATE

Windows & Number Puzzles page 1 of 2

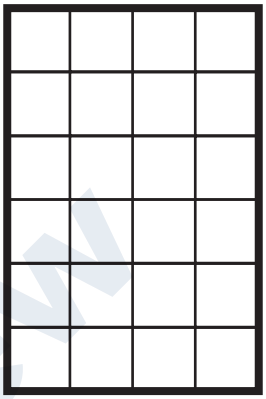
Windows

1 Find the number of panes in each window. Show your thinking with words, numbers, or pictures. Write an equation that shows your thinking for each window.

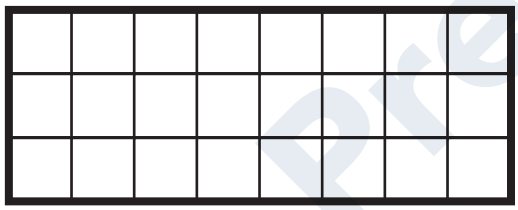
a Equation _____



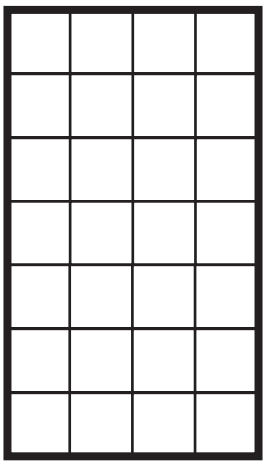
b Equation _____



c Equation _____



d Equation _____



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NAME | DATE

Windows & Number Puzzles page 2 of 2

Number Puzzles

2 Find the missing numbers in the equations below.

$2 \times \_\_\_\_ = 12$

$\_\_\_\_ + 3 = 11$

$10 \times 3 = \_\_\_\_$

$5 + \_\_\_\_ = 14$

$17 - 9 = \_\_\_\_$

$\_\_\_\_ - 3 = 9$

$6 \times 3 = \_\_\_\_$

$16 - \_\_\_\_ = 8$

$\_\_\_\_ + 6 = 13$

NAME | DATE

More Number Line Puzzles

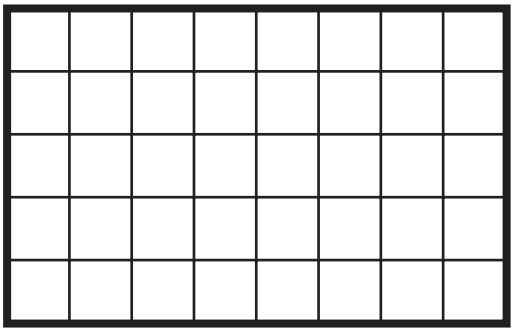
Use multiplication to help solve these puzzles. Fill in each of the blanks on both lines.

NAME | DATE

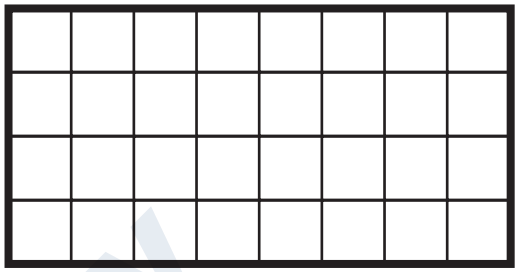
The Watertown Bank page 1 of 2

1 On Wednesday, Wally was cleaning the windows at the bank. He counted the windowpanes as he cleaned, but he kept losing track of how many panes he had counted. Help Wally figure out how many windowpanes there are at the bank. As you solve each problem below, show your work with numbers, sketches, or words.

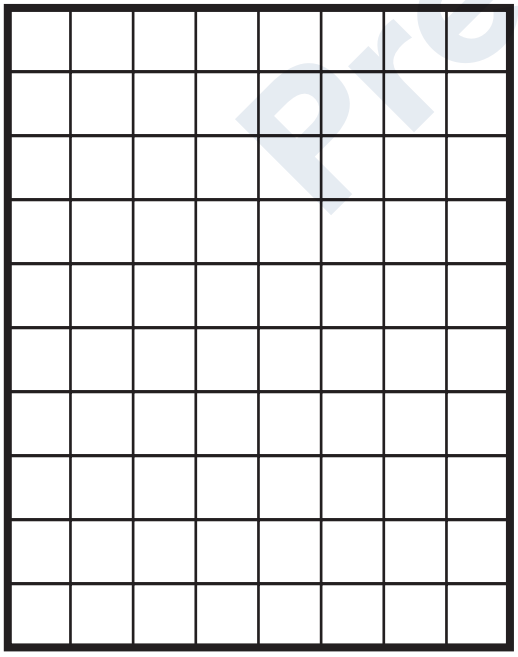
a



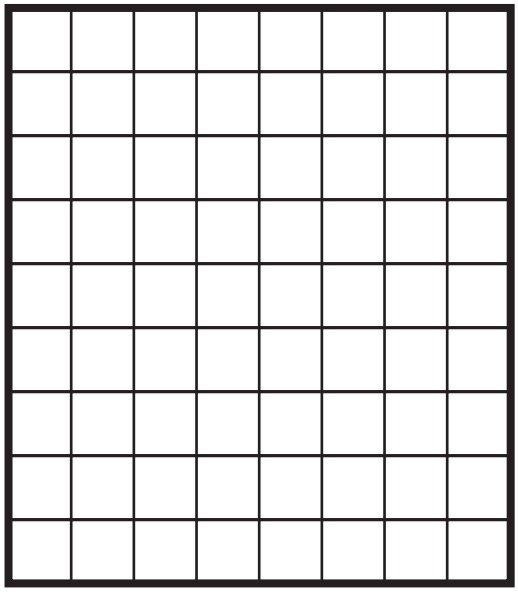
b



c



d



(continued on next page)

NAME | DATE

The Watertown Bank page 2 of 2

2 Wally cleaned a window that had 4 windowpanes. Then he cleaned 9 more windowpanes. Which equation describes the number of panes he cleaned?

- ◯ $4 \times 9 = w$
- ◯ $4 + 9 = w$
- ◯ $9 - w = 4$
- ◯ $4 \times w = 9$

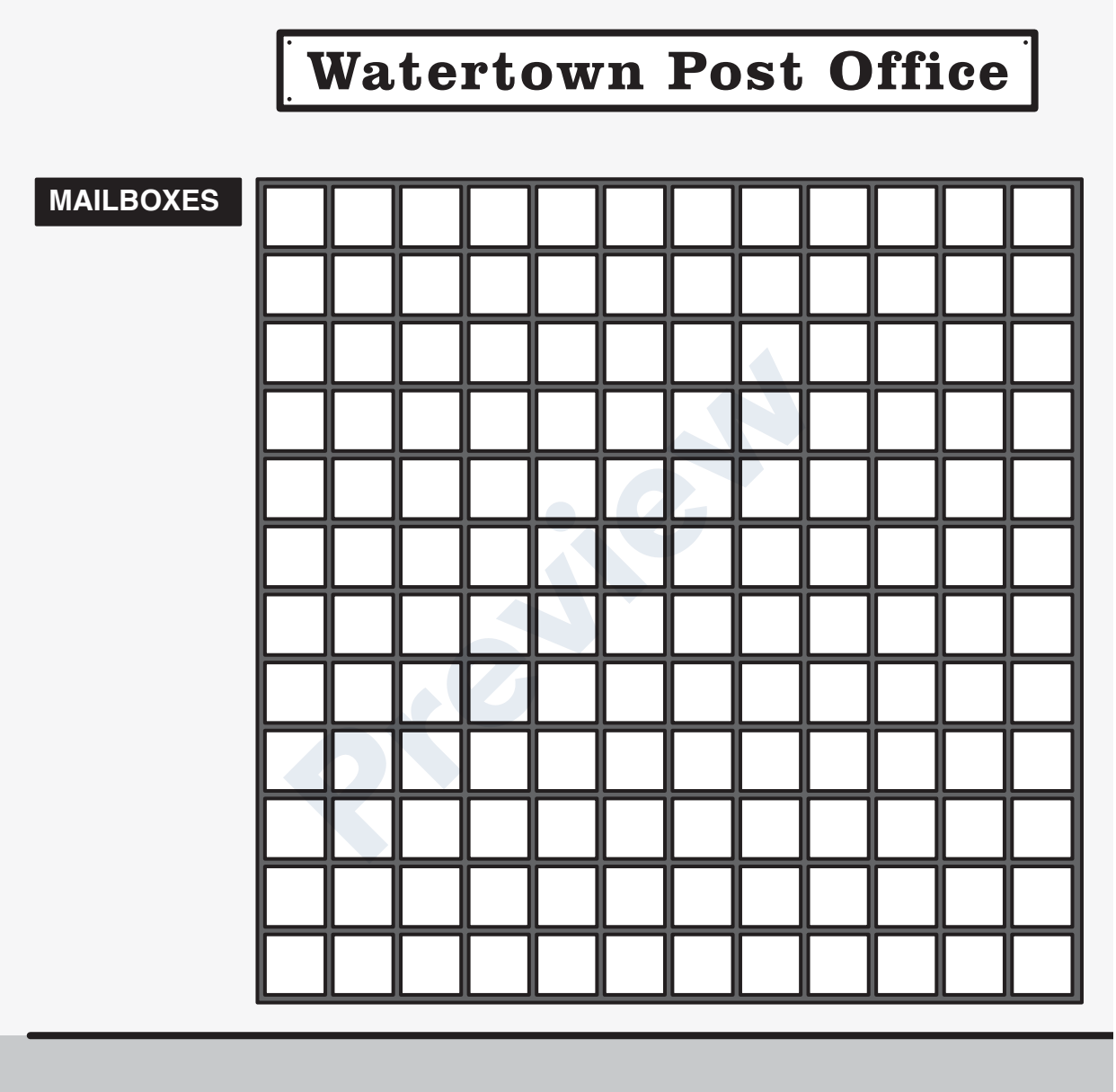
3 Wally cleaned a window that had 4 rows of windowpanes with 9 panes in each row. Which equation describes the number of panes in the window?

- ◯ $4 \times 9 = w$
- ◯ $4 + 9 = w$
- ◯ $9 - w = 4$
- ◯ $4 \times w = 9$

NAME | DATE

More Post Office Mailboxes

Help Wally figure out how many mailboxes there are on this wall. Use numbers, sketches, or words to show your thinking. Mark your answer clearly.



Work Place Instructions 2C Cover Up

Each pair of players needs:

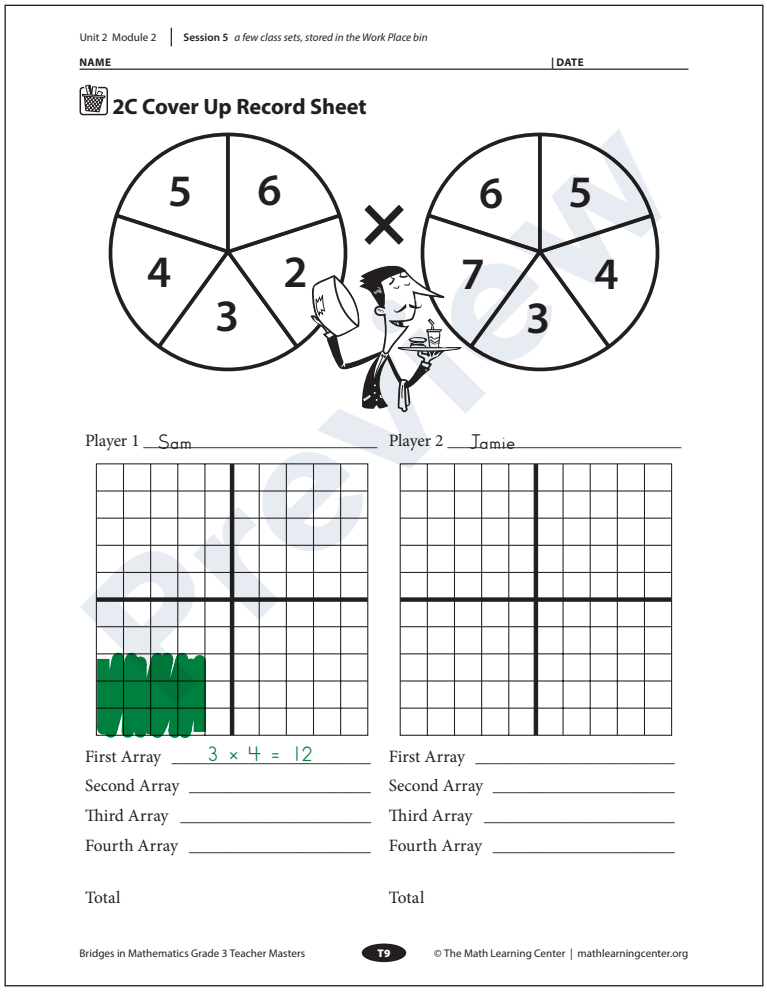
- 1 spinner overlay to share
- their own 2C Cover Up Record Sheets

1 Players take turns spinning the same spinner. The player with the higher spin goes first.

2 The first player spins both spinners and draws an array with those dimensions on their grid.

3 The player explains to their partner how to find the product represented by the array (the area of the array).

4 The player writes the total product on the array and writes an equation on the line under the grid.


Unit 2 Module 2 | **Session 5** *a few class sets, stored in the Work Place bin*

NAME | DATE

2C Cover Up Record Sheet

Player 1 Sam | Player 2 Jamie

First Array 3 × 4 = 12
Second Array
Third Array
Fourth Array

Total

First Array
Second Array
Third Array
Fourth Array

Total

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5 Play continues until each player has had four turns.
If a player spins dimensions for an array that will not fit on the grid, they lose that turn.

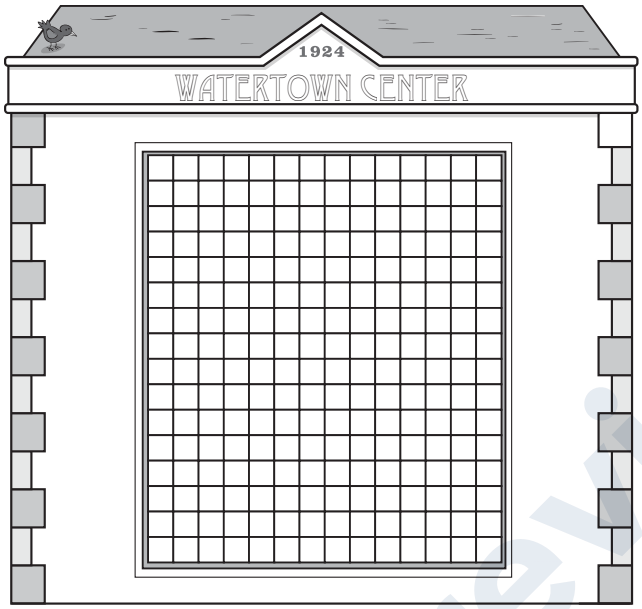
6 At the end of the game, players add their products. The player whose total is closest to 100 wins.

NAME | DATE

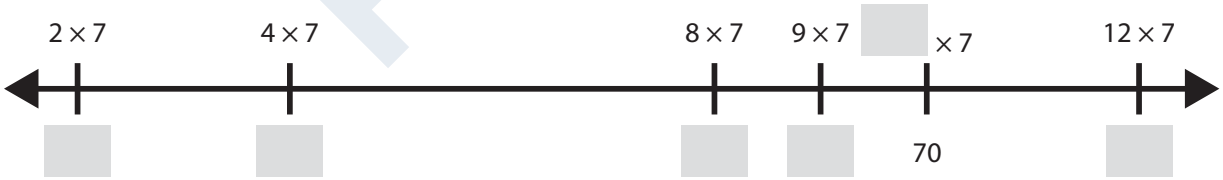
Watertown Center

Watertown Center is the biggest building in Watertown. There are many businesses, offices, and stores inside Watertown Center.

1 On Thursday, Wally was cleaning the windows of Watertown Center. There were so many windowpanes that he had no idea how to count them all. Help Wally figure out how many windowpanes are in the front of Watertown Center. Show your work.



2 Fill in the missing numbers.



3 Solve the following problems.

2 × 9 = _____ 4 × 9 = _____ 8 × 9 = _____

10 × 9 = _____ 9 × 9 = _____

Home Connections

GRADE 3 – UNIT 2 – MODULE 2

BRIDGES®
IN MATHEMATICS

NAME | DATE

Skip-Counting & More page 1 of 2

1 Skip-count forward from each number. A few of the numbers have been filled in for you.

3	6	9						
4	8					28		
5					30			45

2 a Solve the following problems.

$2 \times 10 =$ _____ $4 \times 10 =$ _____ $8 \times 10 =$ _____

b What do you notice about these problems?

3 a Solve the following problems.

$4 \times 6 =$ _____ $3 \times 8 =$ _____ $2 \times 12 =$ _____

b What do you notice about these problems?

(continued on next page)

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Skip Counting & More page 2 of 2

4 Solve the following problems. Show your thinking using equations, sketches, or words.

a The greater roadrunner bird can run 14 miles per hour. That's 7 times faster than an ostrich can walk. How fast does an ostrich walk?

b **CHALLENGE** The body of a greater roadrunner is 16 inches long. Its tail is another 8 inches. The total length of a greater roadrunner is 4 times longer than a lovebird. How many inches long is the lovebird?

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Story Problems & Number Line Puzzles page 1 of 2

Story Problems

1 Solve each problem. Use pictures, numbers, or words to show your thinking. Then write an equation for the problem.

a Roza is 4 years old. Her sister Elsa is twice as old as Roza. How old is Elsa?

Equation: _____

b Theo's baby brother, Thomas, is 24 inches tall. Theo is twice as tall as Thomas. How tall is Theo?

Equation: _____

c Savannah has read 4 pages in her new book. Carlos has read 4 times as many pages as Savannah. How many pages has Carlos read?

Equation: _____

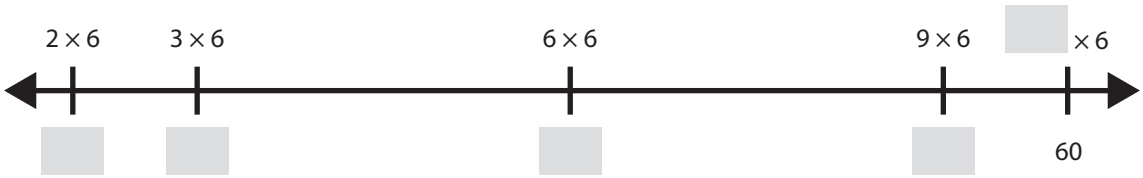
(continued on next page)

NAME | DATE

Story Problems & Number Line Puzzles page 2 of 2

Number Line Puzzles

2 Here is a number line puzzle. Use what you know about multiplication to fill in the blanks.



3 Use pictures, numbers, and words to solve the problem. Then select the equations that represent the problem.

a Tim saw some monkeys sitting in trees at the zoo. There were 6 monkeys sitting in each tree. There were 24 monkeys in all. How many trees were there?

b Which two equations describe the situation in problem 3a?

○ $24 + 6 = n$ ○ $6 \times n = 24$ ○ $24 - 6 = n$ ○ $24 \div 6 = n$

4 **CHALLENGE** The Turner family went bike camping at a state park near their city. It took them 4 hours of riding to get there from their house. For the first 2 hours they rode 12 miles per hour. For the last 2 hours they rode 9 miles per hour. How far is the state park campground from their house?