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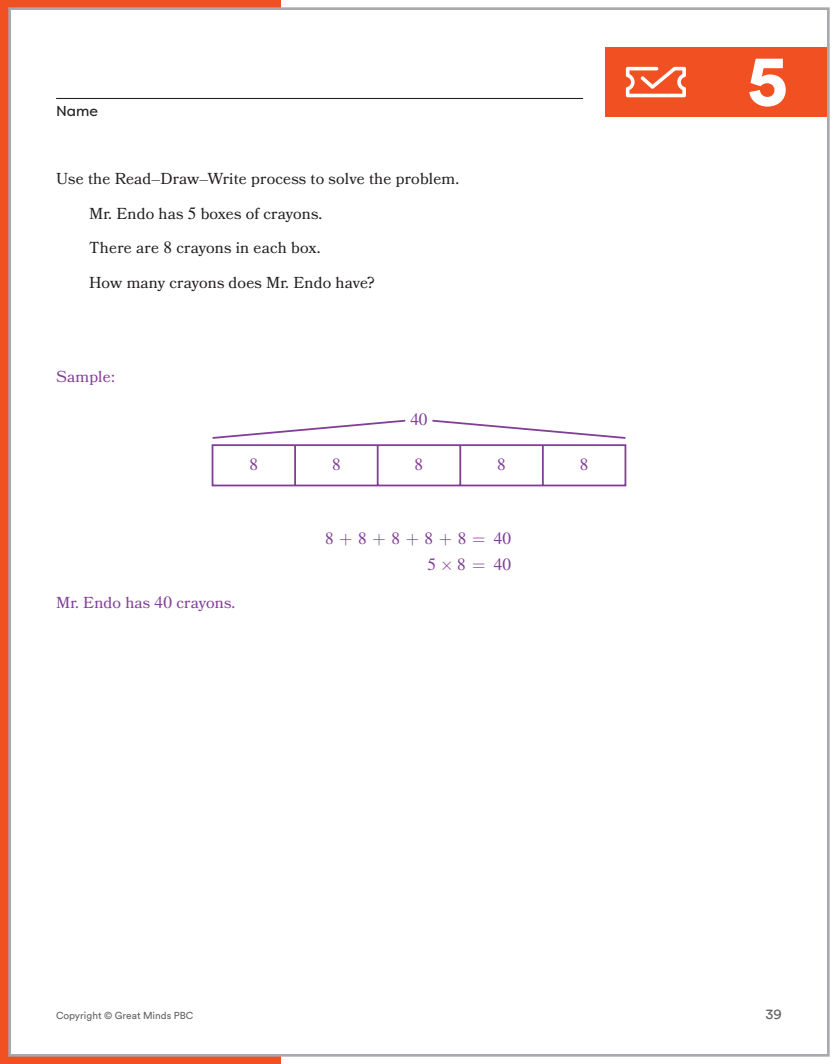
LESSON 5

Represent and solve multiplication word problems by using drawings and equations.



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Name

Use the Read–Draw–Write process to solve the problem.

Mr. Endo has 5 boxes of crayons.

There are 8 crayons in each box.

How many crayons does Mr. Endo have?

Sample:

$8 + 8 + 8 + 8 + 8 = 40$

$5 \times 8 = 40$

Mr. Endo has 40 crayons.

Lesson at a Glance

Students select strategies to represent and solve multiplication word problems by using drawings and equations. A video provides context for the word problems. After working independently to solve the problems, students share their work to compare and connect various representations and strategies.

Key Questions

- How is a tape diagram a useful model to use when solving multiplication word problems?
- How do you decide which model to use when solving a multiplication word problem?

Achievement Descriptor

3.Mod1.AD3 **Solve** one-step word problems by using multiplication and division within 100, involving factors and divisors 2–5 and 10. (3.OA.A.3)

Agenda

Fluency 5 min

Launch 5 min

Learn 40 min

- Equal Groups Word Problem
- Equal Groups: Share, Compare, and Connect
- Array Word Problem
- Array: Share, Compare, and Connect
- Problem Set

Land 10 min

Materials

Teacher

- None

Students

- Interlocking cubes, 1 cm (45)

Lesson Preparation

None

Fluency

5

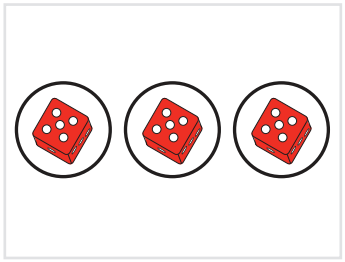
Choral Response: Relating Multiplication Models

Students relate an equal groups picture, an array, or a tape diagram with a unit of 5 or 10 to a repeated addition expression, a unit form, and a multiplication equation to develop an understanding of multiplication.

After asking each question, wait until most students raise their hands, and then signal for students to respond.

Raise your hand when you know the answer to each question. Wait for my signal to say the answer.

Display the picture of 3 dice.



What repeated addition expression represents this picture?

$5 + 5 + 5$

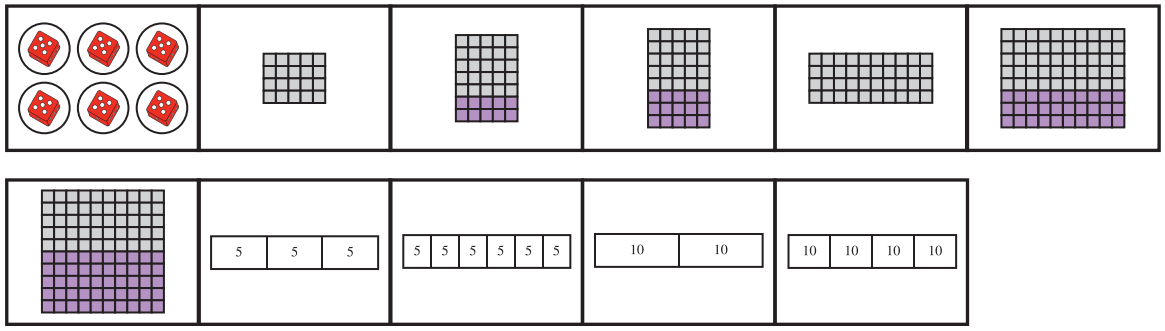
How do you represent the picture in unit form?

3 fives

What multiplication equation represents this picture?

$3 \times 5 = 15$

Repeat the process with the following sequence:



Teacher Note

Arrays in the sequence of pictures with more than 5 rows are shaded to support students in quickly determining the number of rows in each array without having to count each one.

Launch

5

Students work together to determine which picture accurately represents a given multiplication scenario.

Display the picture of 3 card arrangements and read the following problem aloud to the class.

> Casey plays a card matching game. To start the game, Casey puts her cards in 5 rows with 4 cards in each row. How many total cards does Casey use to play the matching game?

Picture A

Picture B

Picture C

Invite students to turn and talk about whether picture A, picture B, or picture C accurately represents the problem about Casey's cards. Have students turn and talk to respond to the following questions:

- How are the cards represented in picture A? Picture B? Picture C?
- Where do you see 5 in picture A? Picture B? Picture C?
- Where do you see 4 in picture A? Picture B? Picture C?
- How are the pictures similar? How are they different?

Ask which picture represents the problem about Casey's cards.

How many total cards does Casey use to play the matching game?

Which picture shows a total of 20 cards?

Since all three pictures show a total of 20 cards, any picture can be used to find the total.

If all three pictures show the same total, why did you choose picture B?

All three pictures show 5 fours, just in different ways. Since the problem said Casey makes 5 rows of 4, we chose picture B because it is an array with 5 rows of 4.

Transition to the next segment by framing the work.

Today, we will solve word problems and share and compare our strategies.

Learn 40

Equal Groups Word Problem

Students collect information from a video and solve an *equal groups with unknown product* word problem.

Play part 1 of the Amusement Park video. If necessary, replay the video and ask students to note any details.

Give students 1 minute to turn and talk about what they noticed.

Engage students in a brief conversation about the video. Discuss student observations and any relevant questions they have. Guide the conversation to problem 1. Consider the following possible sequence of questions to ask students:

What do you notice?

I saw people getting on a roller coaster.

The roller coaster had 10 cars.

There were 3 people in each car.

Read–Draw–Write (RDW)

Read the problem all the way through. Then reread a chunk at a time. As you reread, ask yourself, "*Can I draw something?*" then "*What can I draw?*"

Draw to represent the problem as you reread. Add to or revise your drawing as you uncover new information or discover what is unknown. As you draw, label what is known and what is unknown.

When you finish rereading and drawing, ask yourself, "*What does my drawing show me?*" Let your drawing help you find a way to solve.

Write number sentences or equations to represent your thinking.

Solve.

Then use your solution to **write** a statement that answers the original question.

Teacher Note

This is the first use of a context video. It is shown before a related word problem to build familiarity and engagement with the context. It also allows students to visualize and discuss the situation before being asked to interpret it mathematically.

What do you wonder?

How many people fit on the roller coaster?

There are many mathematical questions we could ask. Let's use what we saw in the video to help us understand and solve a word problem.

Direct students to problem 1, and chorally read the problem with the class. Have students work independently to use the Read–Draw–Write process to solve the problem. Provide materials such as interlocking cubes for student use. Encourage students to self-select their tools and strategies.

Use the Read–Draw–Write process to solve the problem.

1. A roller coaster has 10 cars.

   There are 3 people in each car.

   How many people are on the roller coaster?

   $10 \times 3 = 30$

   There are 30 people on the roller coaster.

Circulate and observe student strategies. Select two or three students to share in the next segment. Look for work samples that help advance the lesson's objective of using different multiplication models, such as equal groups, arrays, and tape diagrams.

The following student work samples demonstrate using equal groups and a tape diagram to represent multiplication.

UDL: Action & Expression

Some students may benefit from using cubes to model the problem.

Prompt students who use repeated addition to transition to multiplication by using unit form with the sentence frame:

I see ____ threes.

Then follow up by asking: How many times do you see 3?

Use the equation frame: ____ × ____ = ____.

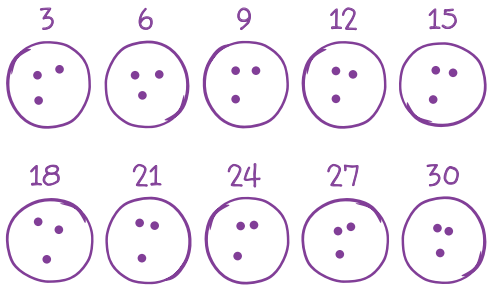
Promoting the Standards for Mathematical Practice

Students model with mathematics (MP4) as they iteratively create a drawing and equation to represent and solve a word problem (i.e., the Read–Draw–Write process).

Ask the following questions to promote MP4:

- What can you draw to help you understand the roller coaster problem?
- What kind of math could you use to represent your model?
- What key pieces of information from the roller coaster problem should be in your model and your equation?

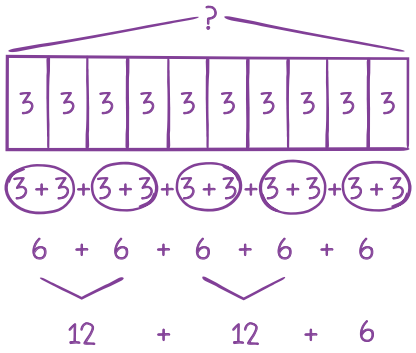
Equal Groups



10 x 3 = 30

There are 30 people on the roller coaster.

Tape Diagram



24 + 6 = 30

10 x 3 = 30

There are 30 people on the roller coaster.

Teacher Note

The sample student work shows common responses. Look for similar work from your students, and encourage authentic classroom conversations about the key concepts.

If your students do not produce similar work, choose one or two pieces of their work to share, and highlight how it shows movement toward the goal of this lesson. Then select one work sample from the lesson that works best to advance student thinking. Consider presenting the work by saying, "This is how another student solved the problem. What do you think this student did?"

Equal Groups Word Problem: Share, Compare, and Connect

Students share solutions for problem 1 and reason about their connections.

Gather the class, and invite the students you identified in the previous segment to share their solutions one at a time. Consider intentionally ordering shared student work from a representational model, such as an equal groups drawing, to a more abstract model, such as a tape diagram.

As each student shares, ask questions to elicit their thinking and clarify the model used to represent the problem. Ask the class questions to make connections between the different solutions and their own work. Encourage students to ask questions of their own.

Teacher Note

Throughout module 1, students are encouraged to complete tape diagrams by labeling all components; the number of groups, the number in each group, and the product. This supports their understanding of the problems and validates their solutions.

In module 3, as the size of factors increases and students gain fluency with their multiplication facts, they transition to using a symbol to identify the unknown.

Equal Groups (Luke's Way)

What did Luke do in his drawing?

He drew 10 equal groups to represent the 10 roller coaster cars. Then he drew 3 dots in each group to represent the 3 people in each car.

What strategy did Luke use?

He skip-counted by threes like this: 3, 6, 9, 12, …, 30.

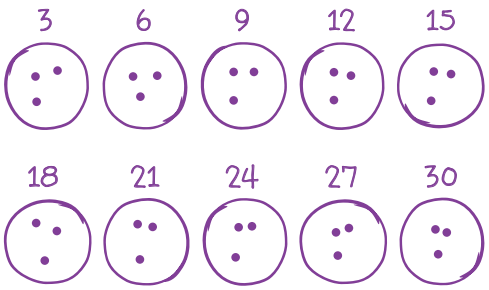
Why did you decide to represent the problem with equal groups?

When I read the problem, I thought about equal groups because I pictured 10 cars with 3 people in each group. That's the same as 10 groups with 3 in each group.

What multiplication equation represents the problem? Why?

$10 \times 3 = 30$ because the number of groups is 10, the number in each group is 3, and the total number of people is 30.

Invite students to turn and talk about the similarities and differences between Luke's work and their work.



10 x 3 = 30

There are 30 people on the roller coaster.

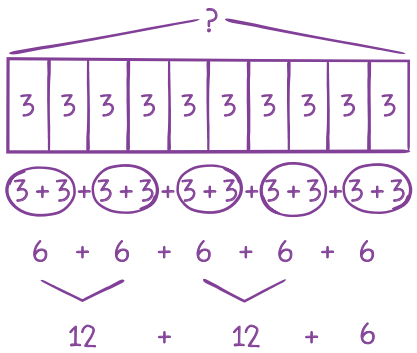
Language Support

Students may need support in sharing their thinking using detail and academic language. Consider modeling a think aloud for a solution strategy.

Also consider posting sentence frames for students to reference until they are more comfortable sharing their thinking in a way that allows other students to follow their solution sequence. Sentence frames could include:

- First, I drew a _____ to represent the problem.
- I chose to draw a _____ because _____.
- I wrote the equation _____ because _____.
- My strategy to find the total was to _____.
- My strategy is similar to/different from _____ because _____.

Tape Diagram (Eva's Way)



What did Eva do in her drawing?

She drew a tape diagram with 10 parts to represent the 10 roller coaster cars. She wrote the number 3 in each part to represent the 3 people in each car. She wrote a question mark to show that she needed to find the total number of people.

What strategy did Eva use?

She used doubles facts and added one extra 6 at the end to get 30.

Why did you decide to represent the problem with a tape diagram?

I used a tape diagram because I thought about equal groups. The tape diagram shows the equal groups.

What multiplication equation represents the problem? Why?

$10 \times 3 = 30$ because 10 represents the 10 roller coaster cars, 3 represents the 3 people in each car, and 30 represents the total number of people.

How is Luke and Eva's thinking similar?

They both thought about equal groups.

Invite students to turn and talk about the similarities and differences between Eva's work and their work.

Array Word Problem

Students collect information from a video and solve an *array with unknown product* word problem.

Play part 2 of the Amusement Park video. If necessary, replay the video, and ask students to note any details.

Give students 1 minute to turn and talk about what they noticed.

Engage students in a brief conversation about the video. Discuss student observations and any relevant questions they have. Guide the conversation to problem 2. Consider the sequence of questions used in part 1.

Direct students to problem 2. Chorally read the problem with the class. Prompt students to use the Read–Draw–Write process to solve the problem. Provide materials such as interlocking cubes for student use. Encourage students to self-select their tools and strategies.

Use the Read–Draw–Write process to solve the problem.

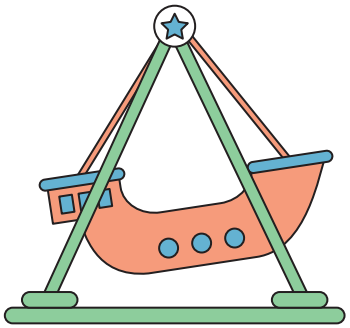
2. The swinging ship ride has 9 rows of seats.

   Each row has 5 seats.

   How many seats are on the swinging ship ride?

   $9 \times 5 = 45$

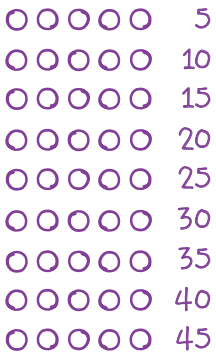
   There are 45 seats on the swinging ship ride.



Circulate and observe student strategies. Select two or three students to share in the next segment. Look for work samples that help advance the lesson's objective of using different multiplication models, such as equal groups, arrays, and tape diagrams.

The student work samples demonstrate using an array and a tape diagram to represent multiplication.

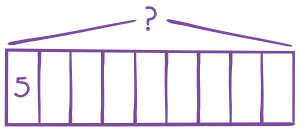
Array



9 x 5 = 45

There are 45 seats on the swinging ship ride.

Tape Diagram



9 x 5 = 45

There are 45 seats on the swinging ship ride.

Array Word Problem: Share, Compare, and Connect

Students share solutions for problem 2 and reason about their connections.

Gather the class, and invite the students you identified in the previous segment to share their solutions one at a time. Consider intentionally ordering shared student work from a representational model (array) to a more abstract model (tape diagram).

As each student shares, ask questions to elicit their thinking and clarify the model used to represent the problem. Ask the class questions to make connections between the different solutions and their own work. Encourage students to ask questions of their own.

Array (Mia's Way)

What did Mia do in her drawing?

She drew 5 circles in each row to represent the 5 seats in each row. She continued to draw rows of 5 until she had 9 rows because there are 9 rows of seats on the ride.

What strategy did Mia use to solve the problem?

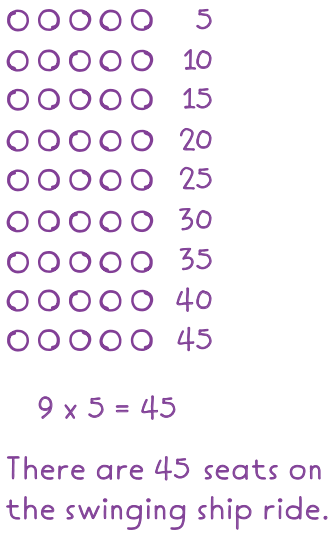
She skip-counted by fives. I can see it at the end of each row.

What is useful about representing the problem with an array?

It helps me imagine all the parts of the problem.

What equation represents the problem? Why?

$9 \times 5 = 45$ because the number of rows is 9, the number in each row is 5, and the total is 45.

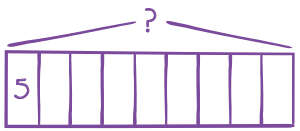


Invite students to turn and talk about the similarities and differences between Mia's work and their work.

Teacher Note

Students may represent their work differently than the sample, such as by drawing an array with 5 rows of 9 circles and writing the equation $5 \times 9 = 45$. Accept other answers as long as they accurately represent the problem.

Tape Diagram (Pablo's Way)



9 x 5 = 45

There are 45 seats on the swinging ship ride.

What did Pablo do in his drawing?

He drew a tape diagram with 9 parts to represent the 9 rows of seats. He wrote 5 in one of the parts because he knew each row has the same number of seats, so he didn't need to keep writing 5 in every part. He drew a question mark to show that he needed to find the total number of seats.

How is the total number of seats represented in the tape diagram?

The total number of seats is represented by the 9 parts in the tape diagram.

What strategy did Pablo use to solve the problem?

I think he skip-counted by fives 9 times.

What is useful about representing the problem with a tape diagram?

It is quicker to draw a tape diagram than an array.

What equation represents the problem? Why?

$9 \times 5 = 45$ because there are 9 rows with 5 in each row, which makes a total of 45.

Invite students to turn and talk about the similarities and differences between

- Mia's work and Pablo's work, and
- Pablo's work and their work.

To support the discussion in Land, save two or three student solutions that use tape diagrams.

Problem Set

Differentiate the set by selecting problems for students to finish independently within the timeframe. Problems are organized from simple to complex.

UDL: Action & Expression

Consider reserving time for students to self-reflect on their experience solving multiplication word problems.

- How did your drawing help you understand the problem better?
- Did you try any new strategies today? How did you feel trying them?
- What did you feel successful with today?
- What do you think you need more support with? Why?

Land 10

Debrief 5 min

Objective: Represent and solve multiplication word problems by using drawings and equations.

Use the following prompts to guide a discussion about the usefulness of equal groups, arrays, and tape diagrams to represent different multiplication scenarios. To support this discussion, display selected student work that uses tape diagrams.

How is the tape diagram a useful model to use when solving multiplication word problems?

Tape diagrams help me make sense of the problem.

I can see the equal groups and the number in each group with a tape diagram.

How can you use a tape diagram to find the total in a multiplication problem?

You can skip-count.

You can add all the parts together.

You can use repeated addition or doubles to add all the parts together.

How do you decide which model to use when solving a multiplication word problem?

I draw an equal groups picture or an array so I can count to find the total.

I read the problem and picture what it is about. Like in problem 2, it said 9 rows with 5 seats in each row. The word *row* helped me picture an array.

I like to draw tape diagrams because they can show equal groups or equal rows.

Exit Ticket 5 min

Provide up to 5 minutes for students to complete the Exit Ticket. It is possible to gather formative data even if some students do not complete every problem.

Sample Solutions

Expect to see varied solution paths. Accept accurate responses, reasonable explanations, and equivalent answers for all student work.

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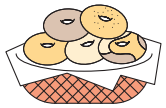
Use the Read–Draw–Write process to solve each problem.

1. Oka has 4 baskets.
   Each basket has 5 bagels.
   How many bagels does Oka have?



   $4 \times 5 = 20$

   Oka has 20 bagels.

2. A muffin pan has 5 rows.
   Each row has 3 muffins.
   How many muffins are in the pan?

   $5 \times 3 = 15$

   There are 15 muffins in the pan.

3. Mr. Lopez has 10 packs of cups.
   Each pack has 6 cups.
   How many cups does Mr. Lopez have?

   $10 \times 6 = 60$

   Mr. Lopez has 60 cups.

4. Ivan has 6 packs of tomatoes.
   Each pack has 5 tomatoes.
   How many tomatoes does Ivan have?

   $6 \times 5 = 30$

   Ivan has 30 tomatoes.

5. A garden has 4 rows of beets.
   Each row has 10 beets.
   How many beets are in the garden?

   $4 \times 10 = 40$

   There are 40 beets in the garden.

6. Mrs. Smith has 10 boxes of books.
   Each box has 10 books.
   How many books does Mrs. Smith have?

   $10 \times 10 = 100$

   Mrs. Smith has 100 books.