

Mixin' It Up

FOCUS

Mathematics Objectives

- Use mathematical modeling to represent a problem situation and to propose a solution.
- Test and verify the appropriateness of math models.
- Explain why the results from mathematical models may not align exactly to the problem situation.

Language Objective Describe, orally and in writing, how to apply a mathematical model to solve a problem involving proportional relationships.

Essential Understanding Many real-world problem situations can be represented with a mathematical model, but that model may not represent a real-world situation exactly.

COHERENCE

Earlier in this topic, students:

- used equivalent ratios to understand and describe proportional relationships.

In this lesson, students:

- develop a mathematical model to represent and propose a solution to a problem situation involving proportions.

Later in this course, students will:

- refine their mathematical modeling skills.

Cross-Cluster Connection Analyzing proportional relationships connects to using ratios and percents to develop and evaluate probability models

RIGOR

Conceptual Understanding Students draw on their understanding of ratio and proportionality concepts to develop a representative model.

Application Students apply their mathematical model to test and validate its applicability to similar problem situations.

Materials

Provide manipulatives and other tools that students request.

**Student Resources**

 Family Engagement

Teacher Resources

 enVision on the Go



Act 1 The Hook



10-15 min



Act 1

Mixin' It Up


I can ... use mathematical modeling to solve problems.

Let's Model in 3 Acts

Lesson 2-7



ACT 1

- After watching the video, what is the first question that comes to mind?
- Write the Main Question you will answer.
- Construct Arguments** Predict an answer to this Main Question. Explain your prediction.
- On the number line below, write a number that is too small to be the answer. Write a number that is too large.
Too small Too large

- Plot your prediction on the same number line.

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Students are tasked with making the liquid in a water glass and in a large water cooler have the same flavor.

Play the Video

Take advantage of your students' reactions to watching the video. Ask: *What did you notice? What do you wonder?*

Brainstorm Questions WHOLE CLASS

Have students complete **Question 1**. Encourage them to ask any question that comes to mind. Listen for both mathematical and non-mathematical questions. Ask students what makes each question interesting.

- *What questions do you have?* [Sample questions: Who is going to drink all of that water? How much water is in the cooler? What is being added to the water? Why is it being added?]

Pose the Main Question WHOLE CLASS

After the question brainstorming, pose the Main Question students will be tasked with answering. Have students complete **Question 2**.

Main Question

- **How many drops are needed for the water in the cooler to have the same flavor as the water in the glass?**

Ask About Predictions WHOLE CLASS

Have students complete **Questions 3-5**. Survey the class about their predictions.

- *Why do you think your prediction is the solution to the Main Question?*
- *Who had predictions that are close?*
- *How many of you agree with that prediction?*
- *Who has a different prediction?*

Act 2 The Model



20-30 min

Act 2

ACT 2

6. What information in this situation would be helpful to know? How would you use that information?

7. **Use Appropriate Tools** What tools can you use to solve the problem? Explain how you would use them strategically.

8. **Model with Math** Represent the situation using mathematics. Use your representation to answer the Main Question.

9. What is your answer to the Main Question? Is it higher or lower than your prediction? Explain why.

Build G.R.I.T. Time Management
To better manage your time effectively, you can choose tools that help you work efficiently.

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Sample Student Work

1 gallon = 128 oz, so 10 gallons = 1,280 ounces

$$\frac{5 \text{ drops}}{12 \text{ oz}} = \frac{d \text{ drops}}{1,280 \text{ oz}}$$
$$\frac{5}{12} \times 1,280 = \frac{d}{1,280} \times 1,280$$
$$533 \approx d$$

The water cooler needs 533 drops.

Marco's Work

Marco uses equivalent ratios to write and solve a proportion.

unit rate: $\frac{12 \text{ oz}}{5 \text{ drops}} = 2.4 \text{ ounces per drop}$

$$w = 2.4d$$

w is water in ounces; d is number of drops

10 gallons is $10 \times 128 \text{ ounces}$

$$(10 \times 128) = 2.4d$$
$$533 \approx d$$

Vicki's Work

Vicki uses the constant of proportionality to write and solve a different form of the same proportion.

Identify Important Information WHOLE CLASS

Have students complete **Question 6**.

- What information do you need to know to solve the problem? [how much water is in the glass; how many drops are in the glass; how much water is in the water cooler]
- How could you get that information?
- Why do you need that information?

Reveal the Information WHOLE CLASS

As students identify needed information, you can use the online interactivity to estimate, reveal, and share the information.

Amount of water in the glass: 12 ounces
Number of drops added to glass: 5
Size of water cooler: 10 gallons
1 gallon = 128 ounces

MTP Develop a Model SMALL GROUPS

For **Question 7**, students might select pencil and paper, concrete models, a ruler, a calculator, a spreadsheet, digital software, or other grade-appropriate tools to solve the problem.

As students answer **Questions 8 and 9**, look for inefficient methods that they are using and prompt them to think about organizing the information before making a model.

For example, a student may create the following table:

Amount of Water	Number of Drops
12 oz	5
24 oz	10
36 oz	15
48 oz	20

- How can you show the relationship between the amount of water and the number of drops more efficiently? [Use a ratio.]

MTP Share Solution Strategies WHOLE CLASS

After students answer **Questions 8 and 9**, use the Sample Student Work as you facilitate a discussion about solution methods.

Act 3 The Solution

15-30 min

Act 3

ACT 3

10. Write the answer you saw in the video.
11. **Reasoning** Does your answer match the answer in the video? If not, what are some reasons that would explain the difference?
12. **Make Sense and Persevere** Would you change your model now that you know the answer? Explain.



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Reflect

13. **Model with Math** Explain how you used a mathematical model to represent the situation. How did the model help you answer the Main Question?
14. **Critique Reasoning** Choose a classmate's model. How would you adjust that model?

Create a Problem

15. Write your own problem related to the video in Act 1. Include any information needed to solve your problem. Explain how you would use a mathematical model to represent your situation. Then solve your problem.

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Use the Video to Reveal the Answer

WHOLE CLASS

The final part of the video shows the process of adding flavoring to the water cooler. Have students complete **Question 10**.

Main Question Answer
518 drops

MTP Validate Conclusions SMALL GROUPS

After **Questions 11 and 12**, discuss possible sources of error inherent in using math to model real-world situations. Point out that the models are still useful even though they are not perfect.

- Why does your answer not match the answer in the video? [The video shows that the water cooler is not completely full.]
- How useful was your model at predicting the answer?
- How could your model better represent the situation?

Reflect on Thinking SMALL GROUPS

Have students complete **Questions 13 and 14** as an extension. Discuss how students applied mathematical processes.

Create a Problem INDIVIDUAL

Use **Question 15** as an opportunity for students to revisit other questions they had during **Question 1** brainstorming.

Possible Student Solution

A classmate usually adds 6 drops to 16 ounces of water. How many drops would she use for the water cooler?

Amount of Water	Number of Drops
16 oz	6
32 oz	12
64 oz	24
128 oz	48
1,280 oz	480

The classmate would use 480 drops.