
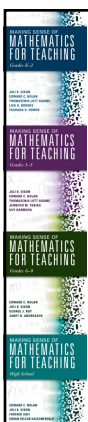


Making Sense of Mathematics for Teaching

Fostering Intentional Growth in Middle School Mathematics Teaching and Learning through the TQE Process: A Focus on Ratios & Rates



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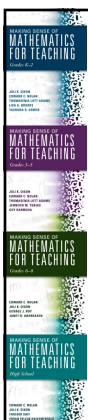


Representations

Your energy drink is made of 2 cups of carrot juice for every 7 cups of beet juice.

Create as many different representations for this relationship as you can.

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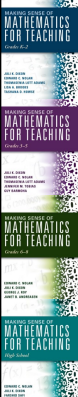
Representations

Your energy drink is made of 2 cups of carrot juice for every 7 cups of beet juice.

Create as many different representations for this relationship as you can.

How are the different representations related?

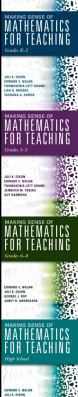
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Representations

Suppose carrot juice and beet juice are mixed in a ratio of 2 to 7 and we want to know how many cups of beet juice to mix with 12 cups of carrot juice so that the mixture will be in the same ratio.

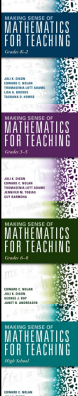
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Session Goals

- Explore representations for ratios and rates.
- Connect ratios and rates.
- Solve real-world problems using ratios and rates.

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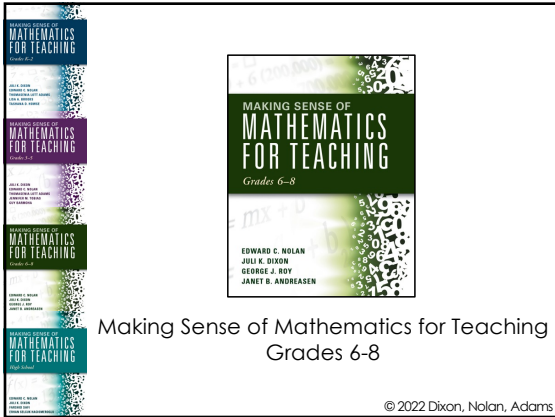
PROBLEM

You work in a grocery store. Your boss gives you the following table to make sure that the prices of various sizes of lemonade are proportional.

Fill in the missing values in order to determine the price or size of each lemonade container.

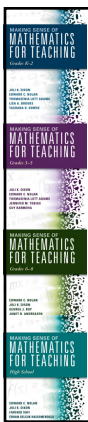
Price (\$)			1.50	3			9		16
Container Size (Oz)	8	10		24	32	64		116	

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Making Sense of Mathematics for Teaching
Grades 6-8

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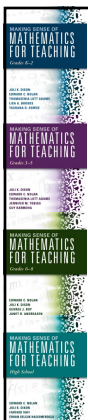


Five Instructional Shifts

1. Students provide strategies rather than learning them from the teacher.
2. Teacher provides strategies "as if" from students.
3. Students create the context.
4. Students do the sense making.
5. Students talk to students.

(Dixon, 2019)

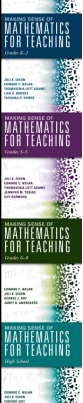
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Within and Between

$$\begin{array}{c} \text{Between } + 3 \\ \leftarrow \\ \frac{3}{24} = \frac{9}{72} \\ \rightarrow \\ \text{Between } \times 3 \end{array} \quad \begin{array}{c} \text{Within } \div 8 \\ \uparrow \\ \frac{3}{24} = \frac{9}{72} \\ \downarrow \\ \text{Within } \times 8 \end{array}$$

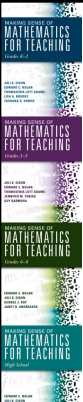
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Cultivating Perseverance

- Just-in-case scaffolding
- Just-in-time scaffolding

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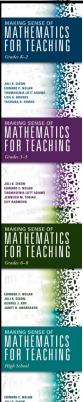


Which prices would you ...

- remove and why?
- add and why?

Price (\$)			1.50	3			9		16
Container Size (Oz)	8	10		24	32	64		116	

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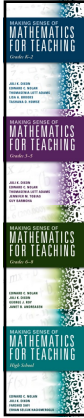
Ratio Comparison

✓ Discuss in small groups

Anna's recipe for lemonade calls for 2 cups of lemonade concentrate and 3 cups of water. Bailey's recipe calls for 3 cups of lemonade concentrate and 5 cups of water.

Whose recipe has a greater lemon taste?

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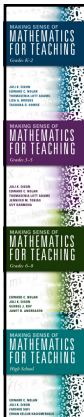


Ratio Comparison

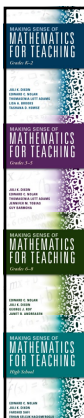
Anna's recipe for lemonade calls for 2 cups of lemonade concentrate and 3 cups of water. Bailey's recipe calls for 3 cups of lemonade concentrate and 5 cups of water.

How would you represent the relationships?

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Cultivating Perseverance

- Just-in-case scaffolding
- Just-in-time scaffolding

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Mathematics for Teaching

Within and Between

Between $\div 5$


Within $\div 1.5$ $\frac{2}{3} = \frac{10}{15}$ Within $\times 1.5$

Between $\times 5$

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Mathematics for Teaching

Plan with the TQE Process in Mind



- **Tasks** connect to learning goals and help identify student errors.
- **Questions** elicit mathematical understandings and common errors.
- **Evidence** drives scaffolding and guides extensions.

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Mathematics for Teaching

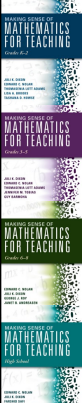
Representations

Create different representations for the following context:

Lily drives 90 miles in 2 hours.

Be sure to include equivalent ratios in your representations.

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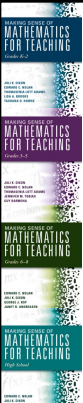


Question...

Create different representations for the following context:
Lily drives 90 miles in 2 hours.

What questions would be best answered using different representations?

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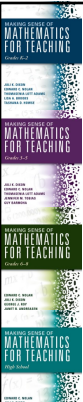


Unit Rate

Create different representations for the following context:
Lily drives 90 miles in 2 hours.

How can this context be used to develop the concept of unit rate?

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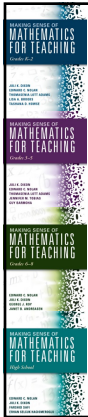


Unit Rate


What other contexts can be used to support making sense of unit rate?

Create a task using one of these contexts.

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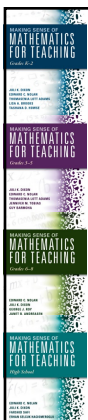
Plan with the TQE Process in Mind



Tasks

- Identify the learning goals.
- Select tasks to support the learning goals.
- Select tasks that will help uncover students' misconceptions.
- Show variation of cognitive demand among tasks.

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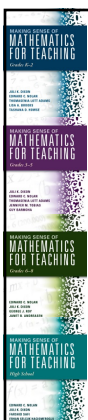


Unit Rate

What other contexts can be used to support making sense of unit rate?

Which representation would be helpful in solving your task?

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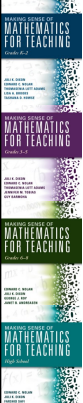


Unit Rate


What other contexts can be used to support making sense of unit rate?

What student errors are you anticipating?

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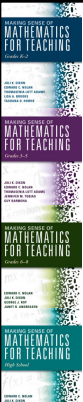


Plan with the TQE Process in Mind



- Select appropriate **T**asks to support identified learning goals.
- Facilitate productive **Q**uestioning to engage students in mathematical practices.
- Collect and use student **E**vidence in the formative assessment process.

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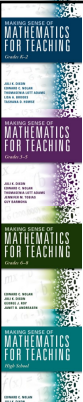


Content Connection

Grade 6

- Understand ratios and use ratio reasoning
 - Understand ratio concepts
 - Unit rate
 - Solve real-world and mathematical problems

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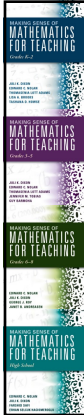


Content Connection

Grade 7

- Analyze proportional relationships
 - Unit rate
 - Determine proportionality
 - Solve real-world and mathematical problems involving ratio

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