CARNEGIE LEARNING

Long Live Fractions, Bar Models, & Equations

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Which One Doesn’t Belong?

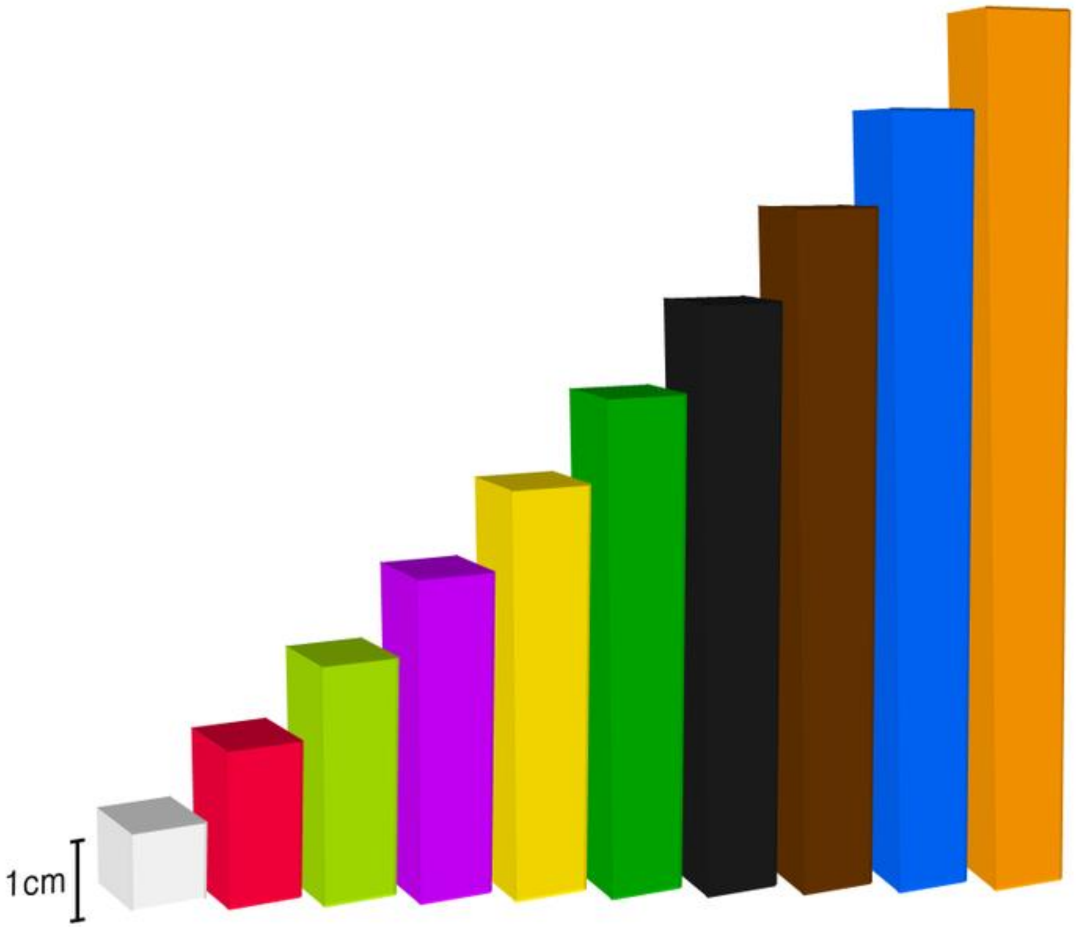
$y = 4x$	$y = x + 7$
$y = -2x + 4$	$y = 3x - 1$

Source: http://wodb.ca/

Learning Intentions

In this session, participants will…

- review using bar models (Cuisenaire Rods) to understand fraction equivalence and determining the whole when given a fractional piece
- transition from concrete representations (Cuisenaire Rods) of fractions to concrete representations of one-step equations
- use bar models and strategic problems to develop the algorithms for solving one-step addition and multiplication problems, including those involving fractions.
- discuss how the models empower students and promote classroom discourse.



Explore Cuisenaire Rods

- Take 3 minutes to load and explore Cuisenaire Rods online!
- http://www.learner.org/courses/learningmath/number/session8/part_b/try.html

Exploring Cuisenaire Rods

1. If **brown** is the whole, what is one-fourth?
2. If **white** is one-seventh, what is the whole?
3. If **orange** is one and one-fourth, what is the whole?

Exploring Cuisenaire Rods

Line up the following Cuisenaire Rods: **white**, **red**, **light green**, **purple**, **dark green**, and **brown**.

1. If the **white** is one, what's the length of the other rods?
2. If the **dark green** is one, what's the length of the other rods?
3. If the **brown** is one, what's the length of the other rods?

Reflection

- How is equivalency represented in this activity?
- Which problems were most challenging? Why?
- How can a color have a different fractional value in different problems?

Concrete-Representational-Abstract

- **Concrete**: Students manipulate concrete objects to model the concept or skill.
- **Representational** (semi-concrete): Students draw pictures that represent the concrete objects.
- **Abstract**: The teacher and students use operation symbols and numbers to indicate the concept or skill.

Using Rods to Solve Equations

A Strategic Addition Problem

Let's take a look at the addition equation

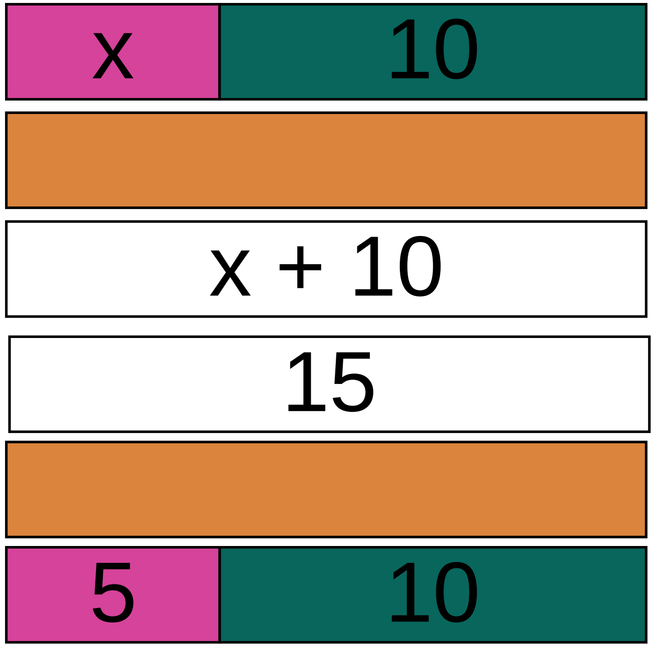
$$x + 10 = 15$$

- Model this equation using your Cuisenaire rods.
- How can you determine/prove the value of x using the model?
- Our focus here is on the *concrete* and then on the *representational*.

Keep in mind the values you already determined for white, red, light green, purple, dark green, and brown.

A Strategic Addition Problem

$x + 10 = 15$



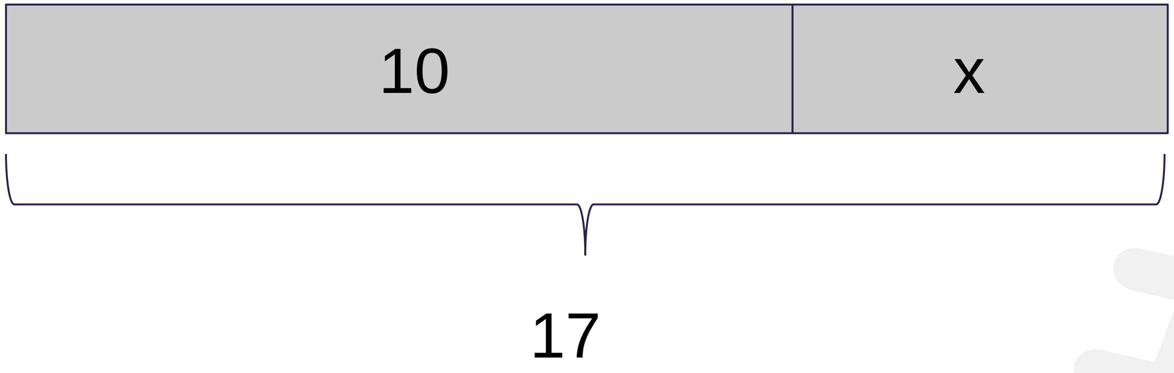
What must x equal?

What was “strategic” about this problem?

On what types of addition problems could you use the rods? When might you want to shift to bar models?

Representational Stage: Bar Models

Let's create a bar model for $x + 10 = 17$



Determine the value of x based on the model.

Be able to justify your reasoning.

A Strategic Multiplication Problem

Let's consider the multiplication equation

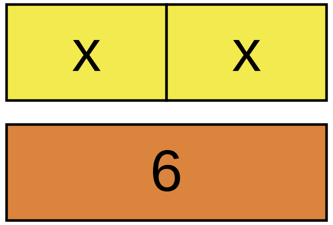
$$2x = 6$$

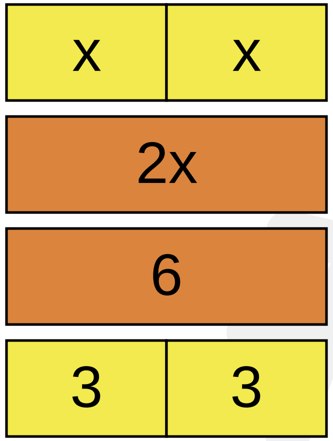
Build a model for the equation using the Cuisenaire rods. Determine the value of *x* based on the model. Be able to justify, using the rods, the value of *x*.

A Strategic Multiplication Problem

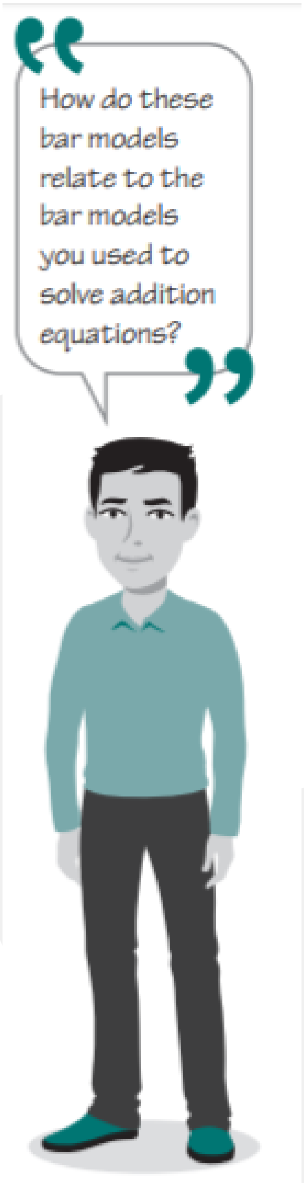
Let's consider the multiplication equation

$$2x = 6$$





What must x equal?



A Strategic Multiplication Problem

Let's consider the multiplication equation

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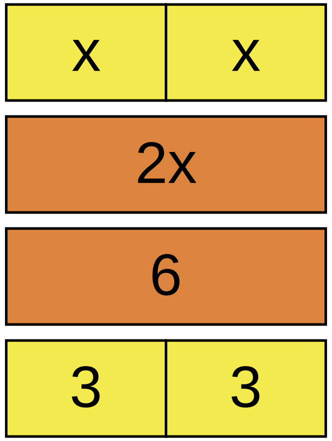


$$2x = 6$$
$$x + x = 6$$
$$x + x = 3 + 3$$
$$\text{so, } x = 3$$

Two More Similar Problems

Explore with these multiplication equations.

Build a model for the equation using the Cuisenaire rods. Determine the value of x based on the model. Be able to justify your answer.

1. $3x = 12$
2. $7x = 63$

In each bar model, how did you determine how to decompose or compose the given expression?

How are these three problems alike?

How does our process relate to the algorithm?

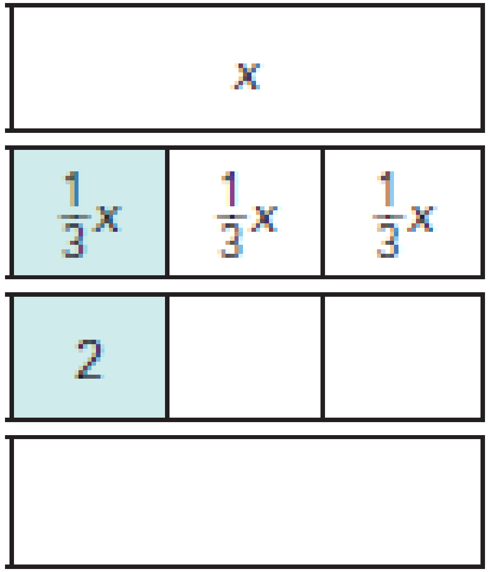
Equations of the Form: $\frac{1}{a}x = b$

$$\frac{1}{3}x = 2$$

How would you model this with the Cuisenaire rods?

- Determining the Whole:
- If red is $\frac{1}{3}$ of a whole, what color is 1 whole?

- Solve $\frac{1}{3}x = 2$:
- If the red has a value of 2 units, what is the value of the whole?



Equations of the Form: $\frac{1}{a}x = b$

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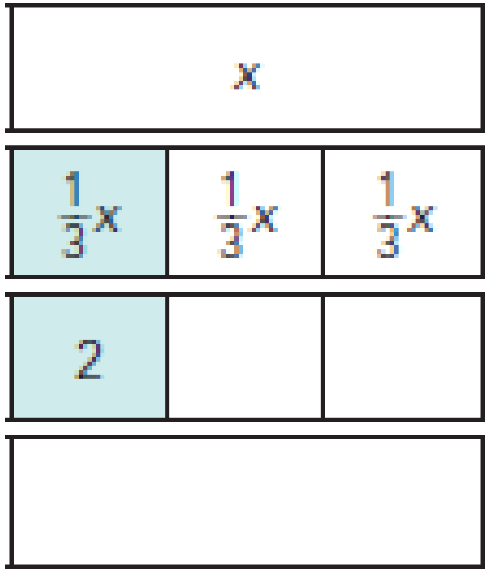


$$\frac{1}{3}x = 2$$

$$\frac{1}{3}x + \frac{1}{3}x + \frac{1}{3}x = 2 + 2 + 2$$

$$1x = 6$$

or

$$3\left(\frac{1}{3}x\right) = 3\,(2)$$

$$1x = 6$$

Equations of the Form: $\frac{1}{a}x = b$

- Build a model for each equation using the Cuisenaire rods. Determine the value of x based on the model. Be able to justify your answer.

1. $\frac{1}{4}x = 7$

2. $\frac{1}{2}x = 5$

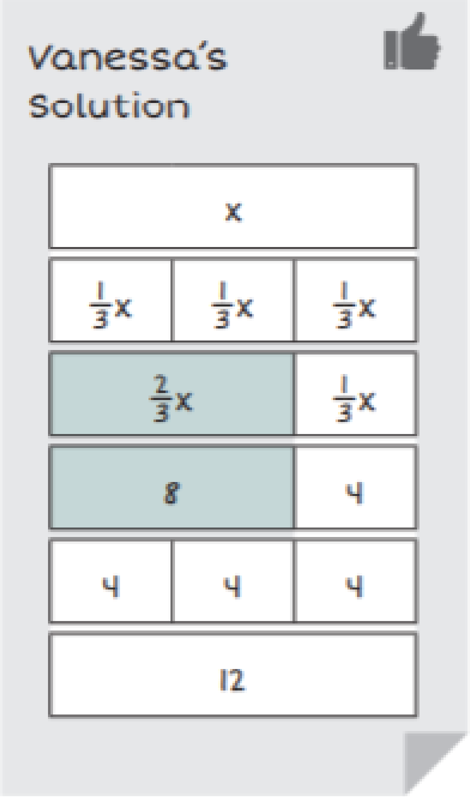
In each bar model, how did you determine how to decompose or compose the given expression?

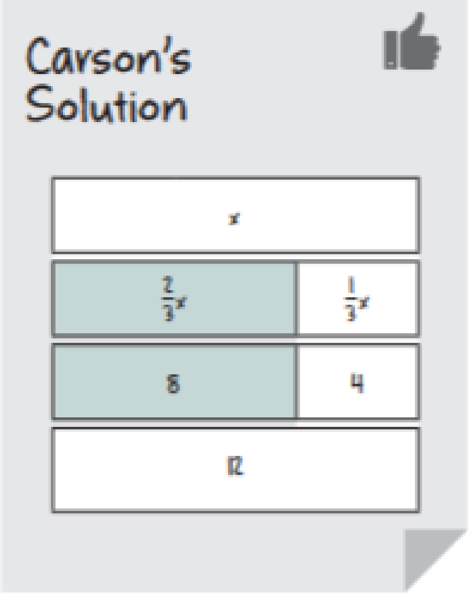
- Determine the Whole
- Solve the equation

- How does our process relate to the algorithm?

Equations of the form $\frac{a}{b}x = c$

Consider how to use Cuisenaire rods or bar models to solve $\frac{2}{3}x = 8$.





- Analyze each strategy.
- How are Vanessa's and Carson's strategies similar to your strategy?

Tweet Reflection

Tweet your response to...

How can using Cuisenaire rods empower students in your classrooms and promote discourse?

Tweet us!

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CARNEGIE LEARNING

LONG + LIVE + MATH

How can using Cuisenaire rods empower students in your classrooms and promote discourse?