



# BetterLesson Professional Learning Webinar

Using Visual Representation to  
Support Math Reasoning



**Ohio Educational Service Center**

Date: June 27th, 2024

Lisa Fik

## Ways to Engage with Us Today



**Chat Box**

**Share your thoughts!  
Make sure the chat box says Send to 'Everyone'.**



**Q & A**

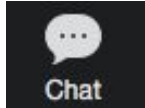
**Use the Q&A button to add your questions.**



**Handout**

**Click on the links shared in the chat.  
Slides will be shared with the recording.**

# Welcome!



Welcome!

Share in the chat:

- Where are you joining us from today?
- What is your current role?

# Your Hosts



**Annika Moore**

Math Consultant  
DEW



**Lisa Fik**

BetterLesson  
Instructional Coach

# Let's Check In!

Which math visuals have you used with students?



Number Lines



Bar Models or Tape Diagrams



Number Charts



Desmos



Manipulatives

# Aligned & Tailored for Ohio ESC Partnership



## Aligned

Our partnership is specifically designed to amplify the impact of other state-wide infrastructure and initiatives.

Our coaches will be familiar with key efforts, including:

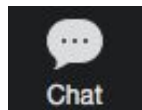
- Materials Matter
- HQIM-related work streams with EdReports & Instruction Partners
- Ohio Standards for Math Practice



## Tailored

Our team has worked with leadership from the ESC of Central Ohio, OESCA, and the Department of Education to tailor our workshop, coaching, and learning walk content to the unique needs of ESC Math Specialists

# Welcome!



# Our Series: Elements of Student-Centered Math Instruction



## Goal

Examine the importance of providing grade-level, high-quality instruction while being responsive to students' diverse backgrounds and experiences

DEFINE

Purpose of visual representations to support math reasoning.

EXPLORE

Strategies that provide visual representations of math concepts.

BUILD

A strategy into your practice.

TRY, MEASURE, LEARN



# Our Webinar Series: Elements of Student-Centered Math Instruction

- 1 Creating Positive Learning Experiences in Math
- 2 Developing Mathematical Fluency
- 3 Using Visual Representation to Support Math Reasoning
- 4 Developing Multiple and Varied Checks for Conceptual Understanding

# Qualities of a Powerful Math Classroom



## The Content

Students have opportunities to experience coherent and meaningful disciplinary ideas.



## Cognitive Demand

Students engage in productive struggle, grappling with challenging problems.



## Equitable Access to Content

Classroom structures invite and support active engagement of all students.



## Agency, Authority, Identity

Students provided opportunities to contribute to discussions and build on others' ideas.



## Formative Assessment

Instruction “meets students where they are” and gives them opportunities to deepen understanding.

# Define

## Visual Representations in Math

# What is one way you could represent this problem visually?



$$\frac{1}{4} \times \frac{1}{3}$$

**Sketch a  
representation on  
your paper**

# Share your thinking!

$$\frac{1}{4} \times \frac{1}{3}$$



How did you represent this expression?



# What exactly do we mean by "representations"?

Which of these is an example? Which is a non-example? Why?



**A**

$$\frac{12}{5} \div 5 = \frac{12}{5}$$
$$\frac{3}{5} \div \frac{1}{4}$$

**B**

Common denominator

$\frac{1}{4} = 5$  squares

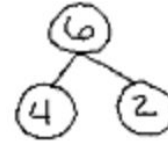
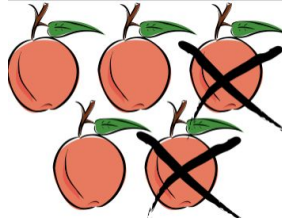
$$\frac{12}{5} = 2 \frac{2}{5}$$

## What exactly do we mean by “representations”?

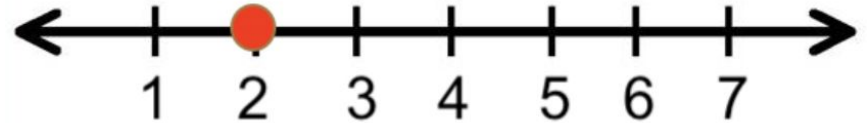
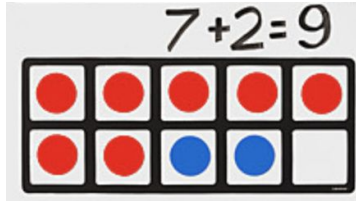
Representations include symbols, equations, words, pictures, tables, graphs, manipulative objects, and actions as well as mental, internal ways of thinking about a mathematical idea.

**What do these look like at different grade levels?**

# Early Grade Representations

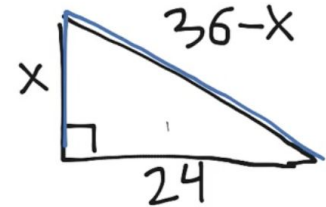
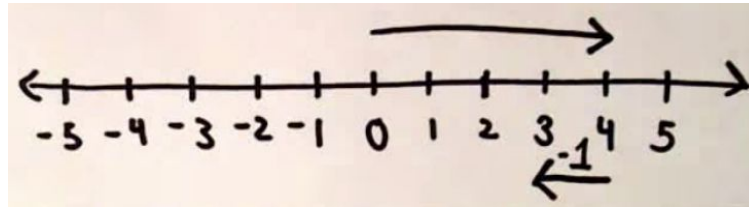
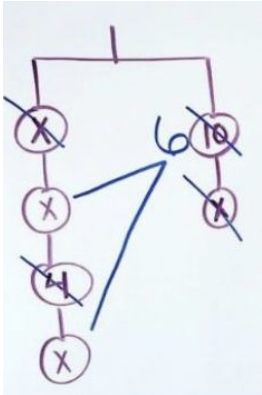
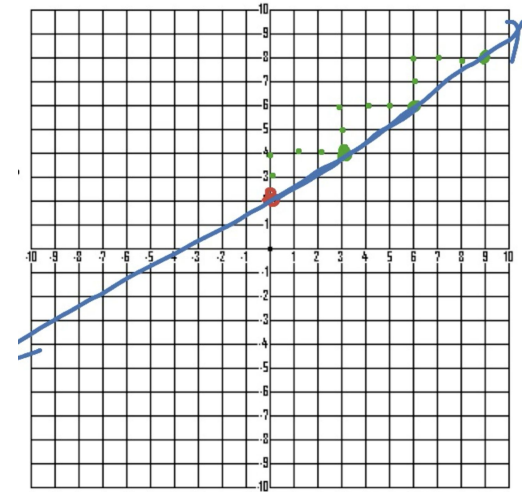
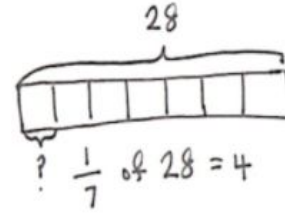
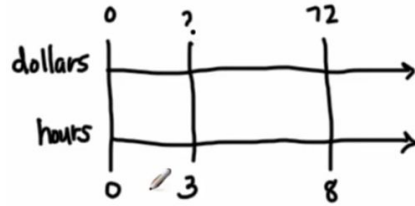
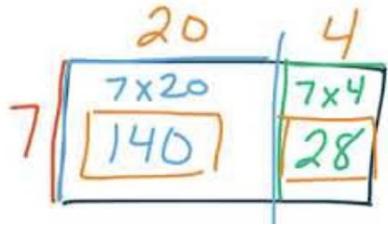


	I	<b>1</b>
	II	
	III	
	IIII	
	IIII I	
	IIII II	

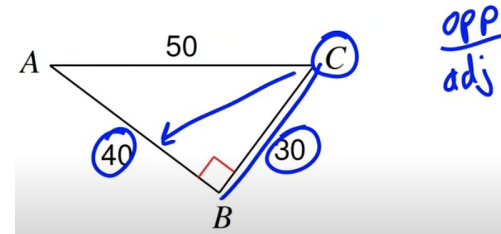
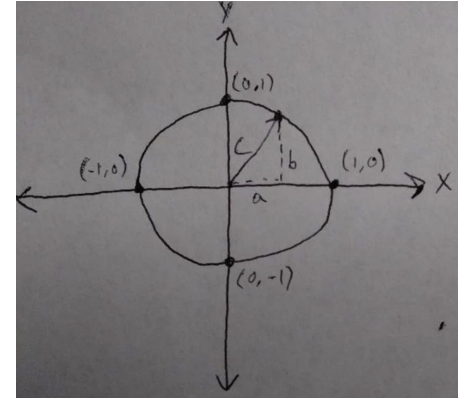
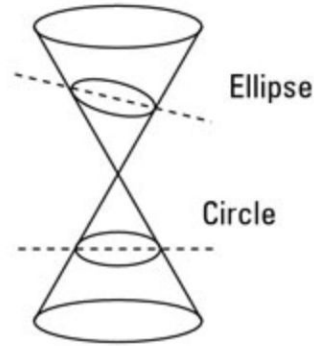
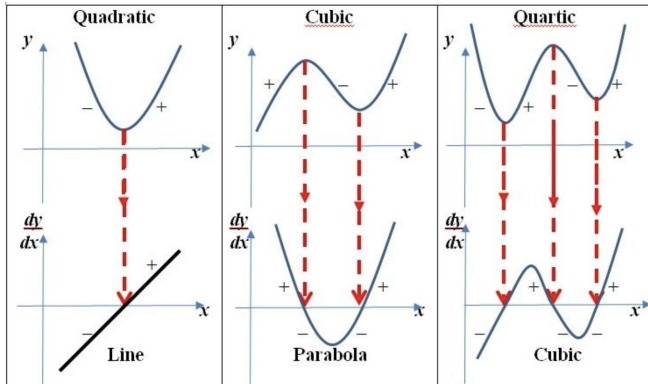
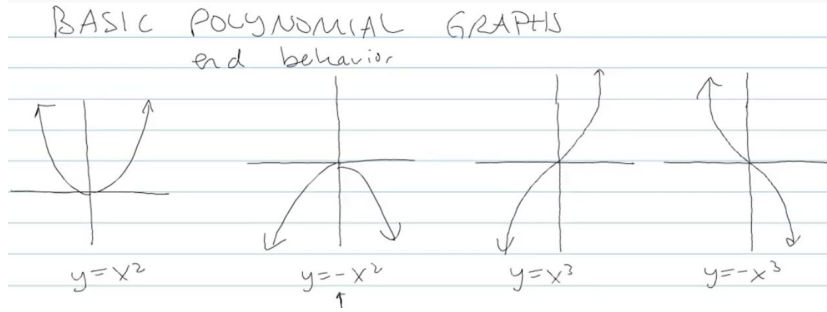




# Middle Grade Representations



# Upper Grade Representations



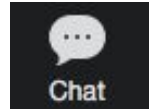
# Define

## Purpose of Visual Representations

# Importance of Representations?

Take a moment to reflect, then share your thoughts on this question:

Why is it important to use representations in math?



# Why are representations so important?

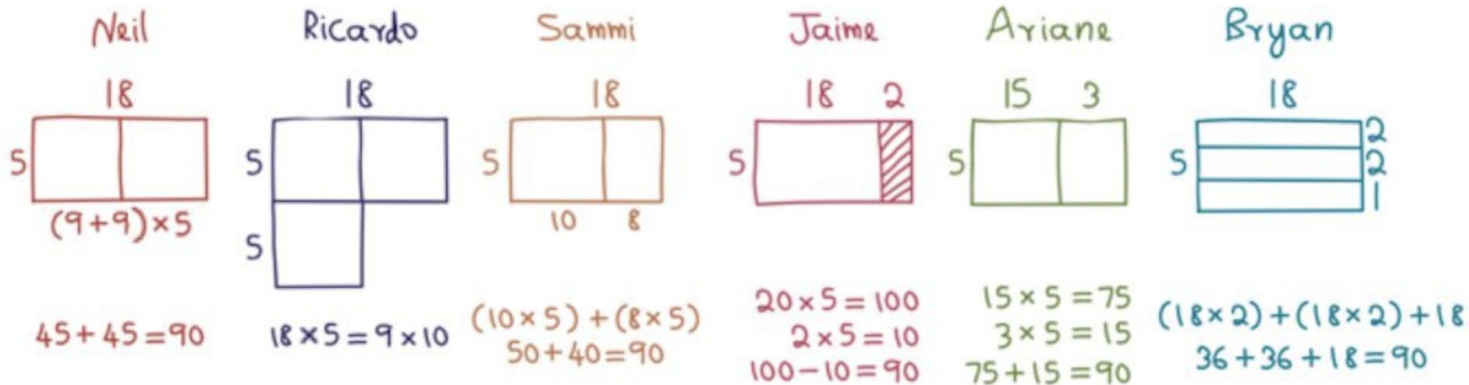


**“...the most powerful learning occurs when we use different areas of the brain. When students work with symbols, such as numbers, they are using a different area of the brain than when they work with visual and spatial information, such as an array of dots... researchers found that mathematics learning and performance was optimized when the two areas of the brain were communicating (Park & Brannon, 2013) ...Additionally, they found that **training students through visual representations improved students’ math performance significantly**, even on numerical math, and that the visual training helped students more than numerical training.”**

# Why are representations so important?

“

“...people are excited and inspired when they see mathematics as pictures, not just symbols. For example, consider how you might solve  $18 \times 5$ , and ask others how they would solve  $18 \times 5$ . Here are some different visual solutions of this problem:



## Why are representations so important?

“

...Visual mathematics also facilitates higher-level thinking, enables communication and helps people see the creativity in mathematics.”

*Visual Math Improves Math Performance,  
[youcubed.com](http://youcubed.com)*

# Models vs. Strategies

## Strategies

- How you mess with numbers
- Overall plan for how you will use the relationships.
- What you DO with the numbers.

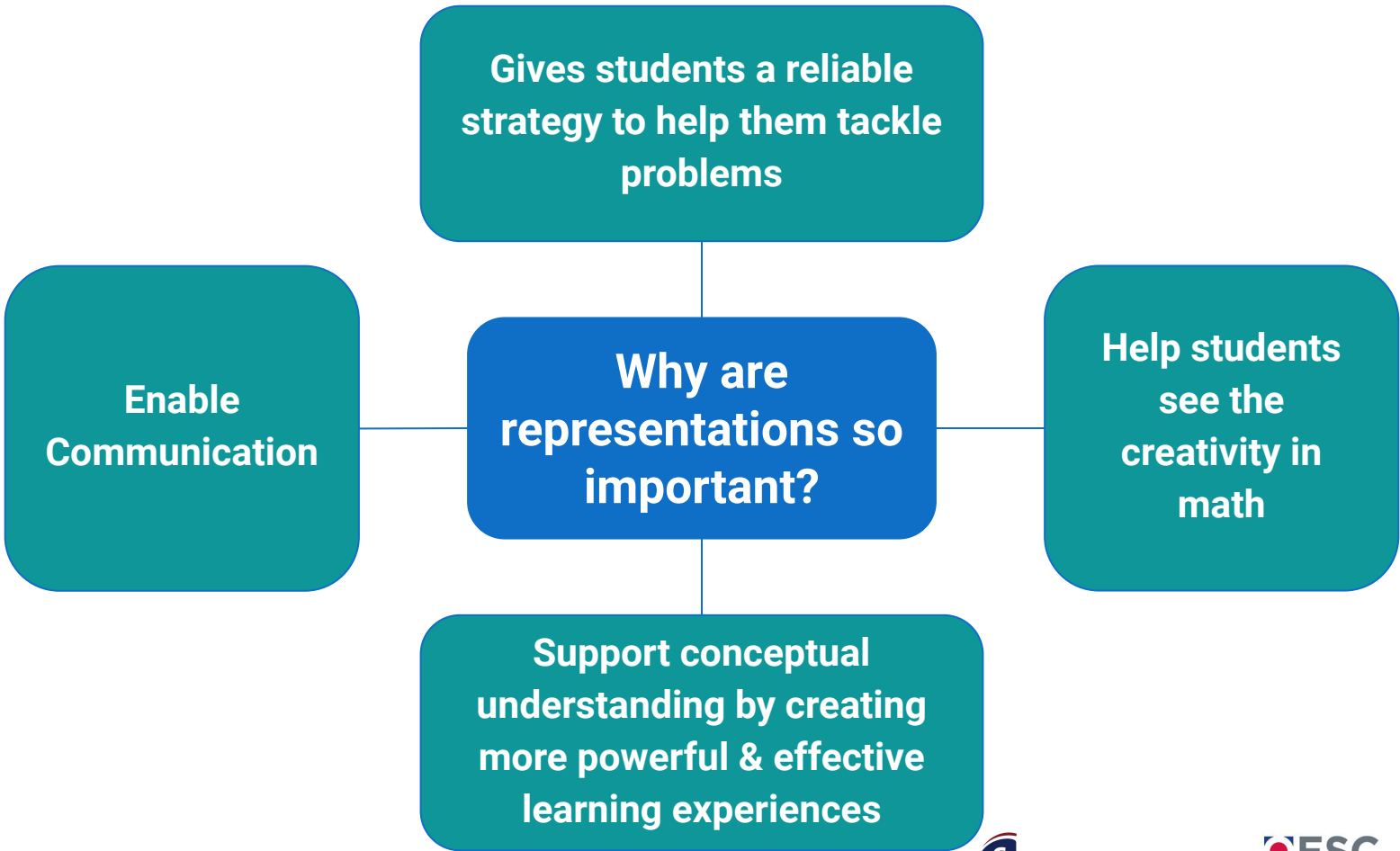
Example: Using a “splitting strategy” to add  $49 + 27$ .  
 $(50 + 26)$

## Models

- A representation of your strategy or the way it LOOKS.
- Makes your thinking more clear because it shows your thinking.

Example: Modeling  $49 + 27$  on a number line or an equation.  
 $49 + 27 = (49 + 1) + (27 - 1) = 50 + 26$





**Enable  
Communication**

**Gives students a reliable  
strategy to help them tackle  
problems**

**Why are  
representations so  
important?**

**Help students  
see the  
creativity in  
math**

**Support conceptual  
understanding by creating  
more powerful & effective  
learning experiences**





# Explore

## Experience a Strategy

In my math teaching ...	Seldom /Never	Occasionally	Regularly
I use representations regularly as central to developing math reasoning.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Students are given tasks that encourage the use of representations to reason, solve & explain thinking.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Students are given specific feedback about how their representations connect to the math they are trying to represent.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Students are encouraged to use a variety of representations to reason & solve.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Students discuss their representations with their peers.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

# Concrete-Representational-Abstract

## CONCRETE

The **DOING** stage  
using concrete objects  
to model problems.

## REPRESENTATIONAL

The **SEEING** stage  
where representations  
or pictures model  
problems.

## ABSTRACT

The **SYMBOLIC** stage  
using abstract  
symbols to model  
problems.



# SolveMe

Open the link in the chat and PLAY, then Reflect on these questions:

What is the purpose of this visual representation?

How does it support math reasoning?

# Progression of Multiplication

## Making Sense Series the progression of multiplication

created by Graham Fletcher  
 @gfletchy  
[www.gfletchy.com](http://www.gfletchy.com)

# Progression of Multiplication Across Grades

2nd  
Grade



Partition square or rectangle (repeated addition)

Rectangular arrays w/ manipulatives and context then relate to relationship of  $\times$  and  $\div$

4th  
Grade



Multiply 2-digit by 2-digit

Use 100s, 10s, and 1s to represent model.

5th  
Grade



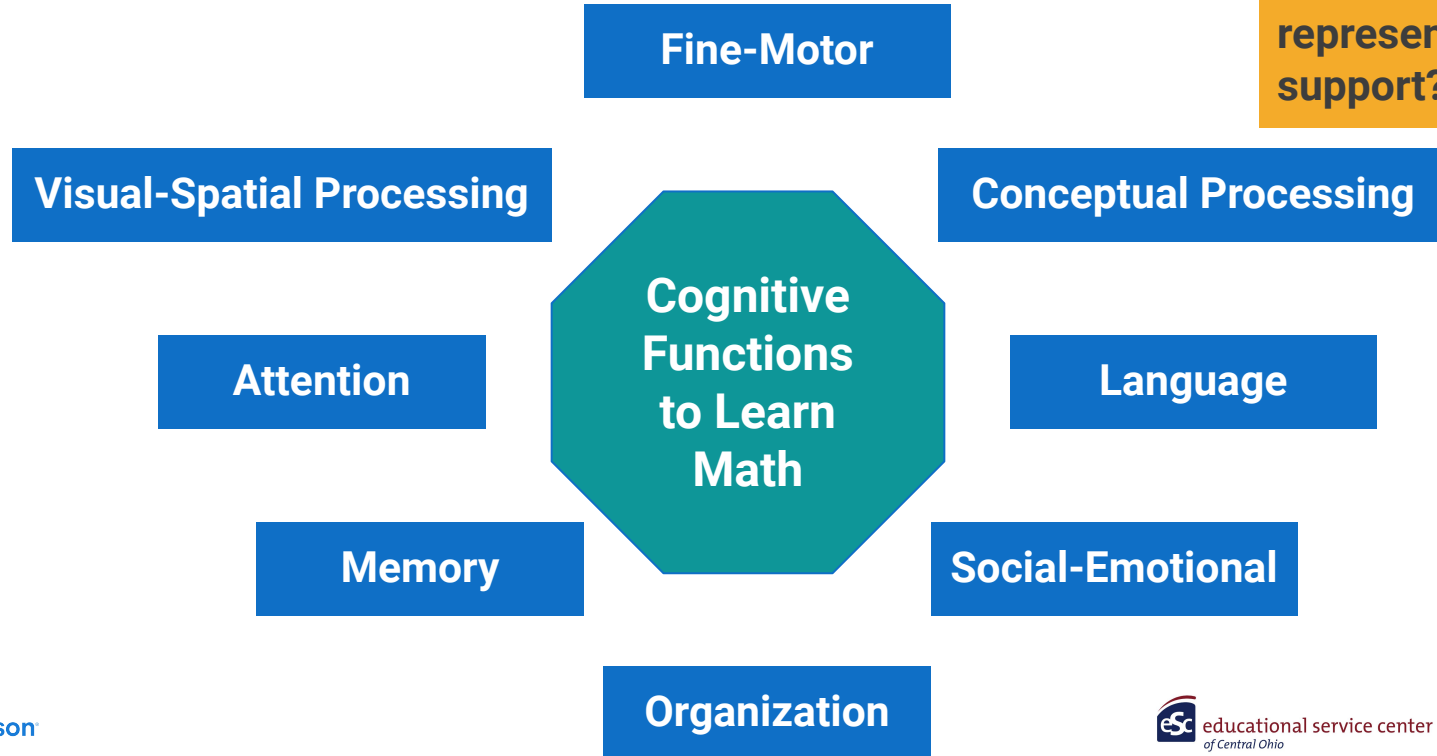
~~Box method~~  
Partial products

Algorithm OR repeated steps.



# Considering Cognitive Functions

Which Cognitive Functions do visual representations support?



# Build

How can we make this work actionable?

## Your Turn!

1. Choose an Ohio Critical Area of Focus Standard **Modeling Standard**.
2. Think of how you might use visual representations to support math reasoning of the math concept.



# Time to Plan



5 minutes

- Use the Representation Planning Guide to work out specific steps for using one of the strategies we explored or from the Choice Board. Plan from either a:
  - Lesson
  - Representation
  - Routine

# Let's Explore: Strategy Choice Board

Choose any of the sections below and explore the related BL resources & strategies.

**Visual  
Representations  
and Models**

**[BL Strategy](#)**

**Collect and  
Display  
(Language)**

**[BL Strategy](#)**

**Hanger  
Diagrams for  
Reasoning**

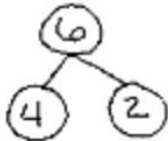
**[BL Strategy](#)**

**Visualizing  
Math Concepts  
with Desmos**

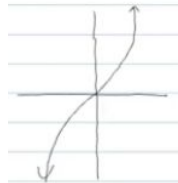
**[BL Strategy](#)**

# Representations can...

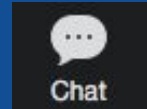
- Support conceptual understanding by creating more powerful & effective learning experiences
- Enable communication
- Help students see the creativity in math
- Give students a reliable strategy to help them tackle problems



A number line diagram for the problem  $28 \div 7 = ?$ . The number 28 is written above a horizontal bar divided into 7 equal segments. Below the bar, the equation  $? \frac{1}{7} \text{ of } 28 = 4$  is written.



**Share out!**  
What are you  
planning?



# Reflect and Make a Goal

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## Q & A

**What questions do you have about our conversation today?**







**We value your feedback!**

“

**Your input is important to us, please take a moment to complete our survey using the link in the chat.**

# Thank you!

