

The background is a dark teal color with vertical dashed lines. It is decorated with various mathematical and financial symbols in lighter teal and yellow-green. These include numbers (1, 2, 3, 4, 5, 6, 7, 8, 9, 0), currency symbols (\$, €, ¥, £), and arrows (upward and downward pointing).

# PROBLEM SOLVING CIRCLES

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Jot down some ideas:

*Why are word problems so challenging?*

*What is the importance of learning to solve word problems?*



# Welcome!

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# Learning Intentions

We are learning to...

- Develop reasoning and discourse skills in our students
- Build disciplinary literacy skills in mathematics
- Implement the Problem-Solving Circles process



# CCSS - Standards for Mathematical Practice

- 1) Make sense of problems and persevere in solving them.
- 2) Reason abstractly and quantitatively.
- 3) Construct viable arguments and critique the reasoning of others.



# CCSS - Disciplinary Literacy

## Reading

1) Read closely, cite textual evidence

## Language

6) Correct use of academic and domain-specific vocabulary

## Speaking/Listening

1) Prepare/participate in range of conversations

3) Evaluate speaker's point of view, reasoning, evidence

4) Present information clearly



# RICH TASKS

What is it?

Where can I find it?

How do I implement it?

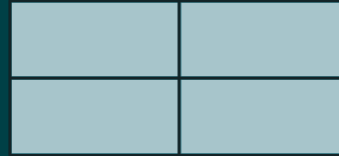
*“...the task features include the following: the extent to which the task lends itself to multiple solution strategies, the extent to which the task encourages multiple representations, and the extent to which the task demands explanations from the students.”*



# Example of a rich task?

Non-example:

What fraction is the notecard cut into?

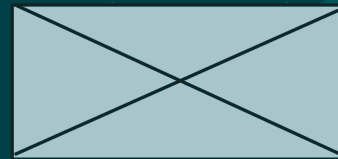


Example:

Is this notecard cut into fourths? Prove it.

OR

Cut a notecard into fourths as many ways as you can. Prove each way works.



*“Curiosity ... may put the brain in a state that is more likely to retain new information, even if that information is not what got you curious in the first place.”*

Matthias Gruber, University of California, Davis





# NORM SETTING

Why “norms” and not “rules”?

## Problem Solving Circle Norms

\* Trust among members

(wrong answers = We won't make fun.)  
→ We learn from our mistakes!

\* Respectful (nice, not fake)

→ We can agree or/and disagree!

→ We listen and respond or ask questions!

→ We stay focused on the learning!

→ Use materials appropriately & put back.

\* Focus on the learning

→ Don't give answers away (blurt out)!

→ Think why/how you get the answers!

\* Keep noise level appropriate



# DISCOURSE

What is real discourse and what is it not?

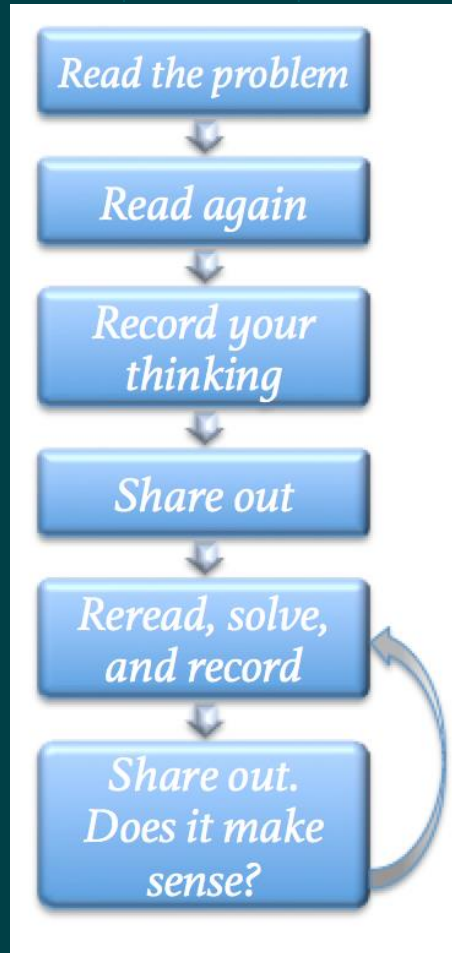
# MTP: Facilitate Meaningful Mathematical Discourse

*Effective teaching of mathematics facilitates discourse **among students** to build shared understanding of mathematical ideas by analyzing and comparing student approaches and arguments.*

*Principles to Actions (NCTM, 2014, p.10 )*



# PSC Process



## Thinking Prompts & Discussion

Thinking (with prompts): Fractions in math mean when  
Some thing is cut by something like  $\frac{2}{16}$  means some  
one eat two of something and there were 16  
pieces

Thinking (with prompts): I know that  $\frac{16}{16}$  is a full  
pizza and  $\frac{8}{16}$  is half a pizza

I notice that the pizza is bigger than  
the medium size pizza



## Solution & Discussion Prompts

We have to get beyond “I agree or disagree with \_\_\_\_\_’s thinking because... I want to share my own way of doing this.”



# YOUR TURN

INDIVIDUAL problem-solving process, NOT COLLABORATIVE!

The share-outs are to extend thinking and promote discourse, not to solve.



*Read the problem*

Purpose: Just to read to get the feel for the problem - start to visualize it.

*Read the problem*

*Read again*

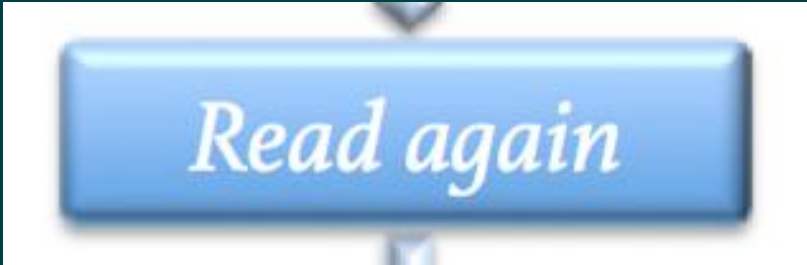
*Record your thinking*

*Share out*

*Reread, solve, and record*

*Share out.  
Does it make sense?*





Purpose: To find what is important - star, circle, highlight



*Record your thinking*

*Read the problem*

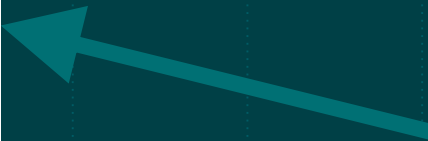
*Read again*

*Record your thinking*

*Share out*

*Reread, solve, and record*

*Share out.  
Does it make sense?*



# Thinking Prompts

I notice...

A question I have is...

I need to know...

One pattern I see is...

\_\_\_\_\_ in math means...

I need to draw...

A strategy to use is...

I already knew...

It is important to

This reminds me of...

remember...

I am confused by...

**YOUR OWN**

My first step is...



*Share out*

*Read the problem*

*Read again*

*Record your  
thinking*

*Share out*

*Reread, solve,  
and record*

*Share out.  
Does it make  
sense?*

Why did you think that was important?

How will you use that strategy?

I saw something similar...

*Reread, solve,  
and record*

*Read the problem*

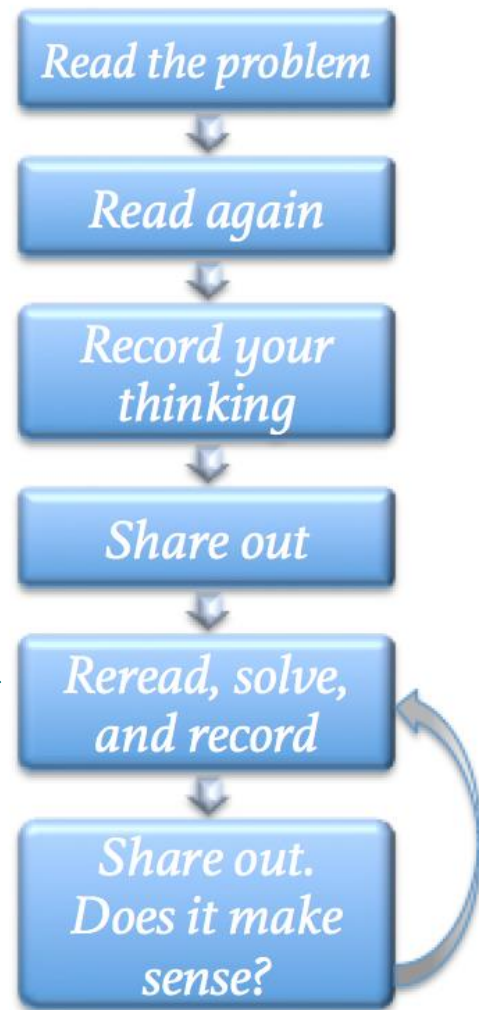
*Read again*

*Record your  
thinking*

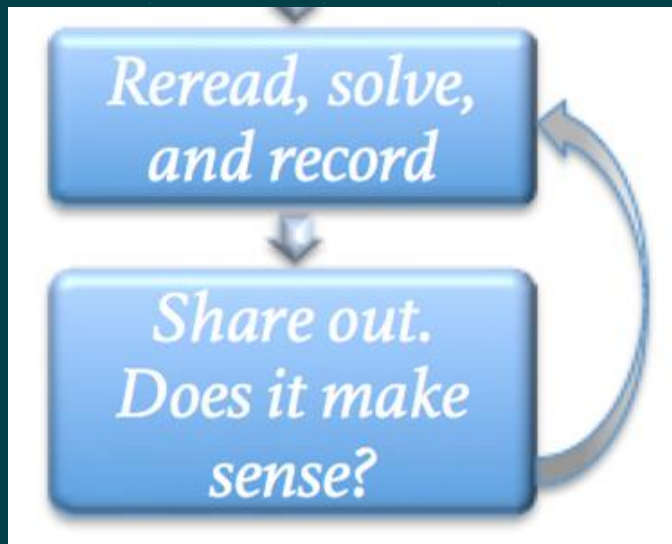
*Share out*

*Reread, solve,  
and record*

*Share out.  
Does it make  
sense?*







# Solution Responses

I agree/disagree with \_\_\_\_\_'s thinking because...

How do you know that?

How did you figure that out?

Can you explain that in another way?

How does your visual support your thinking?

\_\_\_\_\_ (this part) really helped me understand your thinking.

What if

\_\_\_\_\_?

Is that what the problem was really asking?

However, it says in the problem \_\_\_\_\_.



## Thoughts to take with you...

- What did you like about PSC?
- What did you struggle with in PSC?
- What effect did PSC have on reasoning process?
- What role could you see this process playing in your classroom?



# Learning Intentions - Revisited

We are learning to...

- Develop reasoning and discourse skills in our students
- Build disciplinary literacy skills in mathematics
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# Thank you!

Any questions?

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SlidesCarnival icons are editable shapes.

This means that you can:

- Resize them without losing quality.
- Change fill color and opacity.
- Change line color, width and style.

Isn't that nice? :)

Examples:

