Do Now

Solve for $x$ in the following equation

$$5(x + 3.5) - 3\left(\frac{7}{2} + x\right) + 1 = 17$$
Routines for Reasoning
Fostering the Mathematical Practices in ALL Students

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Goal # 1

Learn the Instructional Routine, Contemplate then Calculate.
You will know your learning is on track if you can:

- Articulate the flow of the Instructional Routine
- Leave ready to enact CthenC with a visual pattern
Agenda

- Opening Goals and Agenda
- Instructional Routines
- Contemplate then Calculate
  - Experience and unpack
  - Experience and analyze deeper
  - Talk tasks
  - Plan
  - Rehearse
- Next Steps
Instructional Routines

“Designs for interaction that organize classroom activities” – Magdalene Lampert, NCSM 2015

- Predictable design
- Repeatable nature
Instructional Routines that Develop Mathematical Practices

- Capturing Quantities (MP2)
- Connecting Representations (MP7)
- Recognizing Repetition (MP8)
- Three Reads (MP1)
- Decide and Defend (MP3)
- Contemplate then Calculate (MP7)

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Structural Reasoning
Avenue of Thinking

Ask yourself…
• Is this behaving like something else I know?
• How can I use properties to uncover structure?
• How can I change the form to make it easier to work with?
• How can I “chunk” this to make sense of it?
• How can I connect this to math I know?

Attend to…
Organization and Properties of Number and Space
Structural Thinking Actions

- *Chunk* complicated objects
- *Connect* math ideas and representations
- *Change* the form of objects
- Recall and use properties, rules of operations, and geometric relationships
- Shift perspective
Structural Thinking Shifts

A collection of unrelated results and procedures to know → A set of interconnected ideas that build on each other and make sense
Structural Thinking supports ALL students....especially

- Students who lose track of their work and/or calculations
- Students who see the ‘big picture’
- Students who benefit from multiple representations
Why focus on structural thinking?

- Structure is mathematical “glue” that helps students connect disparate math ideas, concepts, and representations.
- Apply and extend…
  - …previous understandings of multiplication and division to divide fractions by fractions.
  - …previous understandings of operations with fractions to add, subtract, multiply, and divide rational numbers.
  - …previous understandings of arithmetic to algebraic expressions.
Structural Thinking

How do we teach it?
Contemplate then Calculate

An Instructional Routine to Develop ALL Students’ Structural Thinking

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Contemplate then Calculate

**WHAT:** Quick count by chunking, changing the form and connecting to math you know.

**WHY:** To “think like mathematicians”, to use mathematical structure to find shortcuts.
Contemplate then Calculate

Notice
Find counting shortcut
Share & study shortcut
Reflect on learning
What do you notice?

ASK YOURSELF: What might be mathematically important?
What do you notice?
I noticed…

What did you notice?
Find counting shortcut

• With your partner, use one or more noticings to develop a shortcut to find the total number of circles.
Find counting shortcut

• With your partner, use one or more noticings to develop a shortcut to find the total number of circles.
Share and study shortcuts

PRESENTER
• We noticed…so we…
• We knew…so we…

AUDIENCE
• They noticed…so they…
• They knew…so they…
Reflect on learning

a) To find a shortcut look for _______________.

b) Noticing _______________ helped me count quickly because______________.

c) Knowing _______________ comes in handy when counting quickly because______________.
Reflect on CthenC Instructional Routine

What did you notice?
What do you wonder?
Contemplate then Calculate

- **WHAT:** Calculate quickly by chunking, changing the form and connecting to math you know.

- **WHY:** To “think like mathematicians”, to use mathematical structure to find shortcuts.
Contemplate then Calculate

Notice
Find calculation shortcut
Share & study shortcut
Reflect on learning

FOSTERING MATH PRACTICES
What do you notice?

ASK YOURSELF:
What might be mathematically important?
What do you notice?

81 − 72 + 63 − 54 + 45 − 36 + 27 − 18 + 9
I noticed…

What did you notice?
Find calculation shortcut

• With your partner, use one or more noticings to develop a shortcut to find the value of the expression
Find calculation shortcut

• With your partner, use one or more noticing to develop a shortcut to find the value of the expression

\[ 81 - 72 + 63 - 54 + 45 - 36 + 27 - 18 + 9 \]
Share and study shortcuts

81 – 72 + 63 – 54 + 45 – 36 + 27 – 18 + 9

PRESENTER
• We noticed…so we…
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AUDIENCE
• They noticed…so they…
• They knew...so they…
Reflect on learning

a) To find a shortcut look for ______________.

b) Noticing ______________ helped me calculate quickly because ______________.

c) Knowing ______________ comes in handy when calculating because ______________.
Contemplate Then Calculate

1. Launch Routine
   - THINKING GOAL
   - Reason structurally

2. Notice
   - Individual Think Time
   - Pairs
   - Share & Record

3. Develop Shortcut
   - Pairs

4. Discuss Shortcuts
   - Share, Discuss, & Annotate

5. Reflect on Your Thinking
   - Individual Write Time
   - Pairs
   - Share & Record
<table>
<thead>
<tr>
<th>4 Essential Instructional Strategies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Keeping the focus on the mathematical thinking while providing access for a wide range of learners</td>
</tr>
</tbody>
</table>

- Ask-yourself questions
- Annotation
- Sentence frames and starters
- The Four Rs – repeat, rephrase, reword, record
Why develop the capacity to think structurally through C then C?

\[5(x + 3.5) - 3\left(\frac{7}{2} + x\right) + 1 = 17\]

Contemplate. What do you notice?
Ask yourself...

- How can I “chunk” this to make sense of it?
- How can I change the form to make it easier to work with?
- How can I connect this to math I already know?
- How can I use properties to uncover structure?
Video Analysis: Collect evidence of teacher and student actions/statements/utterances that demonstrate development or promotion of structural thinking

- Student Lens
- Teacher Lens
CthenC in Action: Classroom Video
Teaching Stances that Develop Mathematical Identity, Agency, & Authority

- **Start with student thinking:** Teachers shift away from a predetermined strategy or line of reasoning and toward the range of student thinking in the room.

- **Structure productive struggle:** Teachers shift away from providing hints and help to students when they get stuck and toward providing processing time, structures, and supports for mathematical thinking to develop so they won’t get stuck.

- **Step out of the middle:** Teachers shift away from explaining to individual students and toward facilitating student-to-student discourse and collaborative sense-making.
How does CthenC support teachers to Develop Mathematical Identity, Agency, & Authority?

- Start with student thinking
- Structure productive struggle
- Step out of the middle
Let’s get practical…

- Build Identity, Agency, & Authority
- Support All Learners
- Plan your first five lessons!!
First Five Tasks

- 3 Visuals – counting tasks to develop students’ structural thinking and language (chunk, change, connect)
- 2 Number tasks to apply similar structural thinking in a new mathematical context
- Content directly relevant to upcoming units or current units
Contemplate then Calculate

Planning
Contemplate then Calculate

Work with a partner to plan for the Castle Turrets task

Goal: Acquaint yourselves with the planner and the planning process

By the end of planning, you should be ready to take a ‘slow drive’ of Contemplate then Calculate’
C then C Planning Part 1

- Do the Math
- Anticipate Noticings
- Anticipate Strategies
- Anticipate Annotations
- Anticipate Reflections
C then C Planning Part 2

- Work through the planner to prepare what you’ll say
- Adjust Slides
- Rehearse
Contemplate then Calculate

Group Rehearsal
Contemplate then Calculate

An Instructional Routine to Develop ALL Students’ Structural Thinking

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Contemplate then Calculate

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View Tasks

Tasks & Discussion

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For More on C then C and Other Instructional Routines

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