Welcome!

- Intended outcomes

- Learning intentions and success criteria
Resources and Materials

Texas Gateway
http://www.texasgateway.org/

• Mathematics TEKS: Supporting Information
• Vertical Alignment Charts

Norms

• How do you celebrate accomplishments with your students?
• How have you encouraged all students to participate by asking questions in your classroom?
• How do you support students in their use of mathematics-specific academic vocabulary?
Equity Exercise Problem Three-act tasks Problem-solving model:
• Analyzing given information
• Formulating a plan
• Determining a solution
• Justifying the solution
• Evaluating the problem-solving process and the reasonableness of the solution

Mathematics TEKS K(1)(B)

Academy Celebrations

K(1)(B) The student is expected to use a problem-solving model that incorporates analyzing given information, formulating a plan or strategy, determining a solution, justifying the solution, and evaluating the problem-solving process and the reasonableness of the solution.
How many pizza slices are still in the box?

There were 10 pizza slices at the start.
Three-Act Tasks

Act 1:
- Provide the context for the inquiry through a picture or video.
- Invite students to share what they notice about the picture or video.
- Prompt students to generate questions through their observations.
- Complete the three questions to be explored.

Act 2:
- Provide more opportunities to help students answer the identified question.
- Facilitate conversations about answering the question.
- Allow students to explore and answer the question.

Act 3:
- React to the solution.
- Facilitate follow-up conversations as appropriate.

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Three-Act Tasks

K(1)(B) The student is expected to use a problem-solving model that incorporates analyzing given information, formulating a plan or strategy, determining a solution, justifying the solution, and evaluating the problem-solving process and the reasonableness of the solution.

Three-Act Tasks

Justifying the Solution and Evaluating the Problem-Solving Process

Angie had 7 books on her bed. Two of the books fell off. How many books are still on the bed?
I know there are ______ books still on the bed because . . .

Angie had 7 books on her bed. Two of the books fell off. How many books are still on the bed?

This strategy [will/will not] work because . . .

These strategies [do/do not] always work for separating problems because . . .
K(1)(B) The student is expected to use a problem-solving model that incorporates analyzing given information, formulating a plan or strategy, determining a solution, justifying the solution, and evaluating the problem-solving process and the reasonableness of the solution.

Justifying the Solution and Evaluating the Problem-Solving Process

What student responses do we anticipate?

What questions might we need to ask to support justifying the solution?

What questions might we need to ask to support evaluating the problem-solving process?

Does this strategy always work?

Would this work if the numbers were different?

How well did your plan work? Did you have to change your plan? Why?
How can you support students in justifying the solution and evaluating the problem-solving process?

What is the students’ role in justifying the solution and evaluating the problem-solving process?

What supports modeled today might benefit students who receive gifted and talented programming as they justify solutions and evaluate their problem-solving process?
Justifying the Solution and Evaluating the Problem-Solving Process

Problem-Solving Model

K(1)(B) The student is expected to use a problem-solving model that incorporates analyzing given information, formulating a plan or strategy, determining a solution, justifying the solution, and evaluating the problem-solving process and the reasonableness of the solution.

Mathematics TEKS, 2012

Problem-Solving Model

Students are expected to use this process in a grade-appropriate manner when solving problems that can be considered difficult relative to mathematical maturity.

Mathematics TEKS Supporting Information, 2019
What is Problem Solving?

- Flexible
- Persistent
- Engaged

Break

What are heuristics?

WHAT ARE HEURISTICS?
Problem solving means engaging in a task for which the solution method is not known in advance. In order to find a solution, students must draw on their knowledge, and through this process, they will often develop new mathematical understandings. Solving problems is not only a goal of learning mathematics, but also a major means of doing so.

NCTM, 2000, p. 52

What Is Problem Solving?

Exercise Versus Problem

An exercise asks a student to practice a familiar skill.

- Exercise allows students to:
  - practice a specific mathematical skill;
  - demonstrate what was just learned;
  - develop automaticity with a mathematical skill; and
  - practice a specific mathematical skill in a context related to real-life experiences.

A problem involves the application of previously learned mathematical skills, concepts, and/or procedures to a situation where a solution process is not immediately evident.

Problem-solving allows students to:

- apply a known mathematical concept or skill when a solution is not obvious;
- demonstrate an understanding of multiple mathematical concepts or ideas and their interrelationships;
- enter into a mathematical task with their current mathematical knowledge;
- build upon prior knowledge; and
- build new mathematical knowledge.

Exploring Problems

How might a proficient kindergarten problem solver solve the problem using the TEKS-based problem-solving model as a heuristic?
What do you notice?

Compare exemplars:
• How are they similar?
• How are they different?

Why might some components of the problem-solving model heuristic not be visible?

What is the benefit of calibrating exemplars?
Five Practices for Mathematical Discussions

How many bears are in the bag?
Five Practices for Mathematical Discussions

How many bears are in the bag?

Anticipate
Monitor
Select
Sequence
Connect
Five Practices for Mathematical Discussions

Anticipate: What are three solution strategies that you think your students might use?

<table>
<thead>
<tr>
<th>Strategy</th>
</tr>
</thead>
<tbody>
<tr>
<td>drawing and labeling objects</td>
</tr>
<tr>
<td>recording the total number without labels</td>
</tr>
<tr>
<td>grouping objects and counting-on</td>
</tr>
</tbody>
</table>

Monitoring/Selecting: What three or four strategies do you want to highlight?

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<td>artistic drawings</td>
</tr>
<tr>
<td>drawings without labeling</td>
</tr>
<tr>
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SF  SB  SA  SE  SD  SC
Five Practices for Mathematical Discussions

**Monitoring/Selecting:** What three or four strategies do you want to highlight?

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**Sequencing:** Circle numbers below to identify the order of the solution strategies or student thinking you want to highlight.

1. artistic drawings 2. drawings without labeling 3. drawings with labeling 4. grouping objects and counting-on

**Connecting:** What connection(s) do you want students to see?

1 and 2: artistic drawings and math drawings

2 and 3: labeling objects

3 and 4: labeling and grouping
Five Practices for Mathematical Discussions

- Anticipate
- Monitor
- Select
- Sequence
- Connect

Promoting Equity

“. . . students’ mathematical identities are affirmed by promoting their participation in classroom activities.”

Smith and Stein, 2018, 64

Promoting Equity

1. Co-Craft Questions
2. Discourse Opportunities
3. Three-Act Task
5. Problem-Solving Model
Promoting Equity

Putting It All Together

How might the academy activities we explored serve to increase mathematical understanding for each student?

Academy Post-Assessment
Exit Slip: Success Criteria