Grade 7 Sample - Roadmap to Implementing High Quality Mathematics Instruction

The Roadmap to Implementing High Quality Mathematics Instruction seeks to **ground instruction in the *Kentucky Academic Standards (KAS) for Mathematics*, thus reaffirming a commitment to equitable learning opportunities for all Kentucky students.**

How did we get here:

As much of the information in this first section of the Roadmap relates to clarity around the standard and ensuring the learning experience is aligned to grade-level *KAS for Mathematics*, educators might begin by exploring the connection between these two resources:

- Grade 7 Breaking Down a Standard sample for KY.7.EE.4:
  Designed to mirror the architecture of the *KAS for Mathematics*, the Breaking Down a Mathematics Standard resource supports clarity by guiding educators to look deeply at the components of the architecture of the standards, contributing to a holistic understanding of the *KAS for Mathematics*, and the instructional implications resulting from that exploration, including the impact on student learning.
- Grade 7 Assignment Review Protocol for the Desmos task: Pentomino Puzzles:
  A protocol intended to help answer the question, "Does this task give students the opportunity to meaningfully engage in worthwhile grade-appropriate content?"

KAS for Mathematics	Cluster:	Learning Experience:
KY.7.EE.4	Solve real-life and mathematical problems using numerical and algebraic expressions and equations	Desmos Activity: Pentomino Puzzles

Identify the Target of the Standard(s):

☐ **Conceptual Understanding** refers to understanding mathematical concepts, operations and relations. Conceptual understanding is more than knowing isolated facts and methods; students should be able to make sense of why a mathematical idea is important and the kinds of contexts in which it is useful. Conceptual understanding allows students to connect prior knowledge to new ideas and concepts.

☐ **Procedural Skill/Fluency** is the ability to apply procedures accurately, efficiently, flexibly and appropriately. It requires speed and accuracy in calculation while giving students opportunities to practice basic skills. Students' ability to solve more complex application and modeling tasks is dependent on procedural skill and fluency

✓ **Application** provides a valuable context for learning and the opportunity to solve problems in a relevant and a meaningful way. It is through real-world application that students learn to select an efficient method to find a solution, determine whether the solution(s) makes sense by reasoning and develop critical thinking skills.

Identify the Practice Standard(s):

May reference *Engaging the SMPs: Look fors & Question stems*

✓ MP.1. Make sense of problems and persevere in solving them.
Students consider analogous problems to gain insight into its solutions and check their answers using a different method.

☐ MP.5. Use appropriate tools strategically.

☐ MP.2. Reason abstractly and quantitatively.	☐ MP.6. Attend to precision.
✓ MP.3. Construct viable arguments and critique the reasoning of others. Students justify their conclusions, communicate them to others and respond to the arguments of others.	☐ MP.7. Look for and make use of structure.
☐ MP.4. Model with mathematics.	✓ MP.8. Look for and express regularity in repeated reasoning. Students notice if calculations are repeated and look for general methods and shortcuts.

How did we get here: As educators begin considering what this learning experience might look like and feel like with students, the *Engaging the SMPs: Look fors and Question Stems* can be a really great place to start. For this learning experience, questions from MP.1, MP.3 and MP.8 felt like a natural fit to keep in mind when considering how to move student thinking forward while not taking away the thinking away from the student.

The Roadmap to Implementing High Quality Mathematics Instruction seeks to **support intentional integration of evidence-based instructional practices.**

Identify Evidence-based Instructional Practice(s) May reference *Effective Mathematics Teaching Practices (NCTM)*	
☐ EMTP 1: Establish mathematics goals to focus learning.	☐ EMTP 5: Pose purposeful questions.
☐ EMTP 2: Implement tasks that promote reasoning and problem solving.	☐ EMTP 6: Build procedural fluency from conceptual understanding.
☐ EMTP 3: Use and connect mathematical representations.	✓ EMTP 7: Support productive struggle in learning mathematics.
☐ EMTP 4: Facilitate meaningful mathematical discourse.	☐ EMTP 8: Elicit and use evidence of student thinking.

Teacher Actions:	**Student Actions:**
✓ Anticipating what students might struggle with during a lesson and being prepared to support them productively through the struggle. The Teacher Guide provided with the activity has embedded supports throughout the Teacher Moves, such as the following from Screen 1: *As students complete the puzzles on Screens 1-3, we anticipate they'll begin to notice the relationships between the numbers covered by the pentomino. Watch for their informal and formal descriptions of those relationships. We recommend waiting until Screen 3 to discuss them so students have time to refine them.*	✓ Struggling at times with mathematics tasks but knowing that breakthroughs often emerge from confusion and struggle. Using the Teacher Dashboard to display snapshots of students' answers or provide personalized feedback helps motivate students to continue persevering through the activity. ✓ Asking questions that are related to the sources of their struggles will help them make progress in understanding and solving tasks. Once students have explored the given pentomino, looking for ways in

✓ Giving students time to struggle with tasks, and asking questions that scaffold students' thinking without stepping in to do the work for them. Embedded Teacher Moves include suggestions for when to check student progress, offer individual support where needed or lead a brief whole-class discussion if enough students are struggling. ○ What do you think about what ___ said? Do you agree? Why or why not? (MP.1, MP.3) ○ What if you had started with ___ rather than ___? (MP.6) ○ Did you try a method that did not work? Why didn't it work? Would it ever work? Why or why not? (MP.3) ☐ Helping students realize that confusion and errors are a natural part of learning, but facilitating discussions on mistakes, misconceptions and struggles. ☐ Praising students for their efforts in making sense of mathematical ideas and perseverance in reasoning through problems.	which that reasoning is repeated in other situations will help move thinking forward. On Screen 11, the Desmos Activity prompts: *The shapes we've used in this activity are all pentominoes – figures with five equal squares joined edge to edge.* (1) Sketch a new pentomino. (2) Write an algebraic expression for the sum of the numbers your pentomino will cover. ☐ Persevering in solving problems and realizing that it is acceptable to say, "I don't know how to proceed here," but it is not acceptable to give up. ✓ Helping one another without telling their classmates what the answer is or how to solve the problem. On Screen 4, students create a challenge for a partner to try. As students engage with the challenges created by their peers, providing students with supports for student discourse can deepen the discussion more about the mathematical ideas.

How did we get here:

EMTP 7 feels like a natural fit for this Desmos activity as the nature of the activity is a "puzzle". This lesson specifically "helps students realize that confusion and errors are a natural part of learning" as they begin informally (and rather inefficiently), later developing and applying an algebraic approach. Sometimes students may memorize terms and definitions or learn how to manipulate symbolic forms without ever drawing connections among them. As a result, students cannot easily apply that knowledge beyond the specific examples or situations used in instruction. This task focuses on that shift from informal thinking to formal mathematical representations. Perseverance will be key as students extend that idea to new puzzles. The Teacher Guide provided with the activity offers recommendations for supporting student success and ideas on how to leverage the features within the Teacher Dashboard to enhance student learning.

The Roadmap to Implementing High Quality Mathematics Instruction seeks to **expand educator familiarity with strategies to interweave the development of social emotional competencies with development of mathematics content.**

Identify the Competency Intended to Support the Evidence-Based Instructional Practice: May reference *Integrating SEAD within the KAS for Mathematics* resource library				
☐ SELF-AWARENESS	☐ SELF-MANAGEMENT	☐ SOCIAL AWARENESS	✓ RELATIONSHIP SKILLS	☐ RESPONSIBLE DECISION-MAKING
Specific Design Considerations from *Integrating SEAD within the KAS for Mathematics* Grade Level Resource				

- Consider what teacher moves might help students strengthen reasoning and communication skills, along with ways to empower students to use similar strategies in collaborative groups. Attend to the ways in which students position one another as capable or not capable of doing mathematics, such as strategically sharing student work, student thinking and solutions (MP.3).
- Use team-based, collaborative teaching practices to provide students with opportunities to develop and practice communication and social skills. Collaborative learning experiences also can serve to reinforce self-management skills. One way to do this might be to urge students to continually evaluate and talk to their peers about the reasonableness of their results.
- Position students as mathematically competent by encouraging students to construct mathematical arguments and engage in the reasoning of others. Empower students to give and receive constructive feedback. As students engage in learning experiences that require them to listen to the argument of others, decide if they make sense and ask useful questions to clarify or improve the argument, it may be useful to implement discussion protocols to provide a safe environment for students to share their developing thinking (MP.3).

Teacher Reflection Questions from *Integrating SEAD within the KAS for Mathematics* Grade Level Resource

What strategies do I have for facilitating productive mathematics discussions? What steps do I take to plan for sharing student responses according to different methods and solution pathways, instead of randomly calling on students? Is there anything I might want to shift about my current approach?

This task includes specific supports for facilitating productive mathematics discussion within the Teacher Dashboard. For example,

- The *Anonymize* feature attends to classroom culture, offering students a safe space to share their thinking by swapping out student names and replacing them with the names of famous mathematicians. This allows incorrect solutions to be discussed from an asset lens while not singling students out.
- The Snapshot feature allows student thinking to shape discussions as it can be selected and sequenced for sharing to guide the discussion.

I'm wondering how this learning experience could be captured for students who might be engaging asynchronously or might have been absent for the live discussion.

How might I support students in giving feedback in specific situations? Are there specific strategies I might employ to help students improve their communication skills?

Supporting students in giving and receiving quality peer feedback is an area I still want to grow in. Moving forward, I'd like to incorporate opportunities like a Peer Feedback Choice Board more often with my students. Building a classroom culture of feedback requires scaffolding and a safe, nurturing environment, but it's worth the effort.

How did we get here:

Within the competency of Relationship Skills, two key elements include *communicating effectively* and *practicing teamwork and collaborative problem-solving*. Both are critical to getting the most out of this particular learning experience on Desmos. Both elements are also key to equipping students to engage in meaningful, vibrant learning experiences in mathematics.

Note: The Kentucky Department of Education's Evidence-Based Instructional Practice series includes Discussion and the KAS for Mathematics which examines how educators might foster meaningful mathematical discourse to support students in reaching the intended learning outcomes within the *KAS for Mathematics*.