STANDARD FOR MATHEMATICAL PRACTICE #7

LOOK FOR & MAKE USE OF STRUCTURE

I'M USING THIS SMP WHEN...

- I look for patterns and structures in mathematical objects, including numbers, expressions, equations, shapes, diagrams, and graphs.
- I use the structures of numbers, properties of operations, and the relationships between operations to efficiently compute expressions and solve (grade appropriate) equations.
- I can think of mathematical objects, such as numbers, expressions, shapes and graphs, as both a single object and composed of simpler objects.
- I look for mathematically meaningful "chunks" and consider how they are organized to predict patterns and make generalizations.
- I change the form of numbers, expressions, and other mathematical objects to make them easier to work with or to better understand the problem.

TEACHING ACTIONS TO ENGAGE STUDENTS IN THIS PRACTICE

- Encourage students to look for, describe, and use patterns and structures by posing questions such as:
  - Do you see a pattern?
  - How is this problem similar to the previous one?
  - What do you notice about the numbers in this problem that might help you?
  - How can you represent this problem with .... (a manipulative, a visual, an equation, etc.)?
- Ask students to reflect on how recognizing a structure can support the process of solving problems and help them move towards using more efficient strategies.
- Use representations (visual, physical, etc.) to help students understand and use properties such as the distributive, associative, and commutative properties.
- Use discussion and annotation to make connections between different representations of the same mathematical object, process, or idea.

SMP 7: Look for and make use of structure.

Mathematically proficient students look closely to discern a pattern or structure. Young students, for example, might notice that three and seven more is the same amount as seven and three more, or they may sort a collection of shapes according to how many sides the shapes have. Later, students will see 7×8 equals the well-remembered $7 \times 5 + 7 \times 3$, in preparation for learning about the distributive property. . . . They also are able to shift perspectives. They can see complicated things, such as some algebraic expressions, as single objects or as being composed of several objects. For example, they can see $5 - 3(x - y)^2$ as 5 minus a positive number times a square and use that to realize that its value cannot be more than 5 for any real numbers x and y.

Kentucky Department of Education (2019, p. 14)

- How is this problem behaving?
- Can I break this down into smaller, more familiar chunks?
- Does this remind me of a problem I've solved before?
- Can I use properties, like the commutative or distributive property, to simplify this problem?
- Is there a shortcut or strategy I can use based on the patterns I see?

STUDENT ASK-YOURSELF QUESTIONS
Adapted from Kelemanik et al. (2016, p. 179)

SMP#7