

## Mathematical Practices Look Fors

### Student Behaviors

#### 1. Make sense of problems and persevere in solving them.

*Students are:*

- Working and reading rich problems carefully (TKES 3)
- Drawing pictures, diagrams, tables, or using objects to make sense of the problem (TKES 3)
- Discussing the meaning of the problem with classmates (TKES 4)
- Making choices about which solution path to take (TKES 5)
- Trying out potential solution paths and making changes as needed (TKES 8)
- Checking answers and making sure solutions are reasonable and make sense (TKES 6)
- Exploring other ways to solve the problem (TKES 8)
- Persisting in efforts to solve challenging problems, even after reaching a point of frustration. (TKES 8)

#### 2. Reason abstractly and quantitatively.

*Students are:*

- Using mathematical symbols to represent situations (TKES 3)
- Taking quantities out of context to work with them (decontextualizing) (TKES 3)
- Putting quantities back in context to see if they make sense (contextualizing) (TKES 3)
- Considering units when determining if the answer makes sense in terms of the situation (TKES 3)

#### 3. Construct viable arguments and critique the reasoning of others.

*Students are:*

- Making and testing conjectures (TKES 8)
- Explaining and justifying their thinking using words, objects, and drawings (TKES 6)
- Listening to the ideas of others and deciding if they make sense (TKES 4)
- Asking useful questions (TKES 3)
- Identifying flaws in logic when responding to the arguments of others (TKES 4)
- Elaborating with a second sentence (spontaneously or prompted by the teacher or another student) to explain their thinking and connect it to their first sentence. (TKES 8)
- Talking about and asking questions about each other's thinking, in order to clarify or improve their own mathematical understanding. (TKES 4)
- Revising their work based upon the justification and explanations of others. (TKES 8)

#### 4. Model with mathematics.

*Students are:*

- Using mathematical models (i.e. formulas, equations, symbols) to solve problems in the world (TKES 3)
- Using appropriate tools such as objects, drawings, and tables to create mathematical models (TKES 3)
- Making connections between different mathematical representations (concrete, verbal, algebraic, numerical, graphical, pictorial, etc.) (TKES 8)
- Checking to see if an answer makes sense within the context of a situation and changing the model as needed (TKES 8)

#### 5. Use appropriate tools strategically.

*Students are:*

- Using technological tools to explore and deepen understanding of concepts (TKES 3)
- Deciding which tool will best help solve the problem. Examples may include: (TKES 3)
  - Calculator
  - Concrete models
  - Digital Technology
  - Pencil/paper
  - Ruler, compass, protractor
- Estimating solutions before using a tool (TKES 3)
- Comparing estimates to solutions to see if the tool was effective (TKES 3)

#### 6. Attend to precision.

*Students are:*

- Communicating precisely using clear language and accurate mathematics vocabulary (TKES 1)
- Deciding when to estimate or give an exact answer (TKES 1)
- Calculating accurately and efficiently, expressing answers with an appropriate degree of precision (TKES 1)
- Using appropriate units; appropriately labeling diagrams and graphs (TKES 1)

#### 7. Look for and make use of structure.

*Students are:*

- Finding structure and patterns in numbers (TKES 1)
- Finding structure and patterns in diagrams and graphs (TKES 1)
- Using patterns to make rules about math (TKES 1)
- Using these math rules to help them solve problems (TKES 1)

#### 8. Look for and express regularity in repeated reasoning.

*Students are:*

- Looking for patterns when working with numbers, diagrams, tables, and graphs (TKES 1)
- Observing when calculations are repeated (TKES 8)
- Using observations from repeated calculations to take shortcuts (TKES 8)

\*Please note that most of the teacher and student behaviors listed can be paired with more than one TKES indicator.

## Mathematical Practice Teacher Behaviors

### 1. Make sense of problems and persevere in solving them.

*Teachers are:*

- Providing rich problems aligned to the standards (TKES 1)
- Providing appropriate time for students to engage in the productive struggle of problem solving (TKES 8)

*Teachers ask:*

- What information do you have? What do you need to find out? What do you think the answer might be?
- Can you draw a picture? How could you make this problem easier to solve?
- How is \_\_\_'s way of solving the problem like/different from yours? Does your plan make sense? Why or why not?
- What tools/manipulatives might help you? What are you having trouble with? How can you check this?

### 2. Reason abstractly and quantitatively.

*Teachers are:*

- Providing a variety of problems in different contexts that allow students to arrive at a solution in different ways (TKES 4)
- Using think aloud strategies as they model problem solving (TKES 3)
- Attentively listening for strategies students are using to solve problems (TKES 5)

*Teachers ask:*

- What does the number \_\_\_ represent in the problem? How can you represent the problem with symbols and numbers?
- Can you make a chart, table or graph?

### 3. Construct viable arguments and critique the reasoning of others.

*Teachers are:*

- Posing tasks that require students to explain, argue, or critique (TKES 8)
- Providing many opportunities for student discourse in pairs, groups, and during whole group instruction (TKES 4)

*Teachers ask:*

- Why or why not? How do you know? Can you explain that? Do you agree?
- How is your answer different than \_\_\_'s? What math language will help you prove your answer?
- What examples could prove or disprove your argument? What questions do you have for \_\_\_?

### 4. Model with mathematics.

*Teachers are:*

- Providing opportunities for students to solve problems in real life contexts (TKES 3)
- Identifying problem solving contexts connected to student interests (TKES 4)

*Teachers ask:*

- Can you write a number sentence to describe this situation? What do you already know about solving this problem?
- What connections do you see? Why do the results make sense? Is this working or do you need to change your model?

### 5. Use appropriate tools strategically.

*Teachers are:*

- Making a variety of tools readily accessible to students and allowing them to select appropriate tools for themselves (TKES 3)
- Helping students understand the benefits and limitations of a variety of math tools (TKES 8)

*Teachers ask:*

- How could you use manipulatives or a drawing to show your thinking?
- Which tool/manipulative would be best for this problem? What other resources could help you solve this problem?

### 6. Attend to precision.

*Teachers are:*

- Explicitly teaching mathematics vocabulary (TKES 1)
- Insisting on accurate use of academic language from students (TKES 8)
- Modeling precise communication (TKES 10)
- Requiring students to answer problems with complete sentences, including units (TKES 10)
- Providing opportunities for students to check the accuracy of their work (TKES 5)

*Teachers ask:*

- What does the word \_\_\_ mean? Explain what you did to solve the problem.
- Compare your answer to \_\_\_'s answer. What labels could you use?
- How do you know your answer is accurate? Did you use the most efficient way to solve the problem?

### 7. Look for and make use of structure.

*Teachers are:*

- Providing sense making experiences for all students (TKES 2)
- Allowing students to do the work of using structure to find the patterns for themselves rather than doing this work for students (TKES 8)

*Teachers ask:*

- Why does this happen? How is \_\_\_ related to \_\_\_? Why is this important to the problem?
- What do you know about \_\_\_ that you can apply to this situation? How can you use what you know to explain why this works?
- What patterns do you see?

### 8. Look for and express regularity in repeated reasoning.

*Teachers are:*

- Providing sense making experiences for all students (TKES 2)
- Allowing students to do the work of finding and using their own shortcuts rather than doing this work for students (TKES 8)

*Teachers ask:*

- What generalizations can you make? Can you find a shortcut to solve the problem?
- How would your shortcut make the problem easier? How could this problem help you solve another problem?