

A Closer Look at the Standards for Mathematical Practice - Grade 3

Grade 3 Sample Tasks

Task A:

Below is a table showing all the ways to add the numbers from 1 to 9.

- a. Each sum which is larger than 10 can be found by first making a 10.

For example, to find $8 + 5$, we can write

$$8+5=8+(2+3)=(8+2)+3=10+3=13.$$

- b. Explain why this reasoning works and apply this method to find $7 + 8$. How can you visualize these equations using the table?

- c. Adding 9 to another single digit number can also be done by first making a 10. For example

$$3+9=3+(10-1)=(3+10)-1=13-1=12.$$

- d. Explain why this reasoning works and apply this method to find $7+9$. How can you visualize these equations using the table?

+	1	2	3	4	5	6	7	8	9
1	2	3	4	5	6	7	8	9	10
2	3	4	5	6	7	8	9	10	11
3	4	5	6	7	8	9	10	11	12
4	5	6	7	8	9	10	11	12	13
5	6	7	8	9	10	11	12	13	14
6	7	8	9	10	11	12	13	14	15
7	8	9	10	11	12	13	14	15	16
8	9	10	11	12	13	14	15	16	17
9	10	11	12	13	14	15	16	17	18

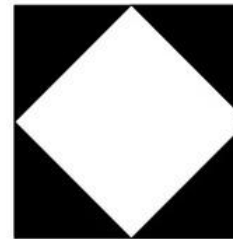
Grade 3 Sample Tasks

Task B:

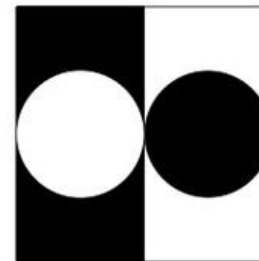
For each of the pictures, explain how you can see that half of the square is shaded:



a.



b.

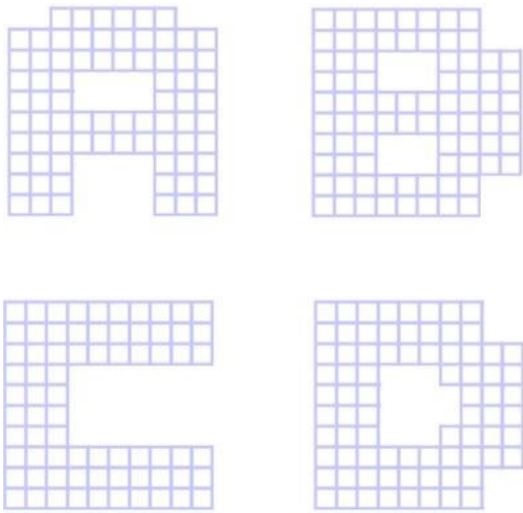


c.

A Closer Look at the Standards for Mathematical Practice - Grade 3

Task C:

Imagine that each square in the picture measures one centimeter on each side. What is the area of each letter? Try to work it out without counting each square individually.



Task D:

Alec and Felix are brothers who go to different schools. The school day is just as long at Felix' school as at Alec's school. At Felix' school, there are 6 class periods of the same length each day. Alec's day is broken into 3 class periods of equal length. One day, it snowed a lot so both of their schools started late. Felix only had four classes and Alec only had two. Alec claims his school day was shorter than Felix' was because he had only two classes on that day. Is he right?

A Closer Look at the Standards for Mathematical Practice - Grade 3

Task E:

Mrs. Frances drew a picture on the board.



Then she asked her students what fraction it represents.

- Emily said that the picture represents $\frac{2}{6}$. Label the picture to show how Emily's answer can be correct.
- Raj said that the picture represents $\frac{2}{3}$. Label the picture to show how Raj's answer can be correct.
- Alejandra said that the picture represents 2. Label the picture to show how Alejandra's answer can be correct.

Task F:

Mrs. Moore's third grade class wants to go on a field trip to the science museum.

- The cost of the trip is \$245.
 - The class can earn money by running the school store for 6 weeks.
 - The students can earn \$15 each week if they run the store.
- a. How much more money does the third-grade class still need to earn to pay for their trip?
 - b. Write an equation to represent this situation.

Task G:

- a. Juanita spent \$9 on each of her 6 grandchildren at the fair. How much money did she spend?
- b. Nita bought some games for her grandchildren for \$8 each. If she spent a total of \$48, how many games did Nita buy?
- c. Helen spent an equal amount of money on each of her 7 grandchildren at the fair. If she spent a total of \$42, how much did each grandchild get?

Task H:

- Presley has 18 markers. Her teacher gives her three boxes and asks her to put an equal number of markers in each box.
 - Anthony has 18 markers. His teacher wants him to put 3 markers in each box until he is out of markers.
- a. Before you figure out what the students should do, answer these questions:
What is happening in these two situations? How are they similar? How are they different?
 - b. Figure out how many markers Presley should put in each box. Show your work. Then figure out how many boxes Anthony should fill with markers. Show your work.

Please note that inclusion of these sample tasks does not represent that this task is endorsed by or rejected by the Kentucky Department of Education. Inclusion of these tasks was for the sole purpose of allowing participants the opportunity to investigate the practice standards within the *Kentucky Academic Standards for Mathematics* more closely. All tasks were selected from Illustrative Mathematics.

A Closer Look at the Standards for Mathematical Practice - Grade 3

Participant Guide

Directions: Match each task to the SMP targeted by the author of the task. While some tasks may connect to more than one SMP, there is one task that most closely aligns with each of the SMPs. Thus, each SMP will have one task to match and each task will only be used once.

Note: The Standards for Mathematical Practice focus on the nature of the learning experiences by attending to the thinking processes and habits of mind that students need to develop in order to attain a deep and flexible understanding of mathematics. Certain tasks lend themselves to the demonstration of specific practices by students. The practices that are observable during exploration of a task depend on how instruction unfolds in the classroom. While it is possible that tasks may be connected to several practices, only one practice connection will be discussed in depth. Possible secondary practice connections may be discussed but not in the same degree of detail.

Standards of Mathematical Practice (SMP)	Standards of Mathematical Practice (SMP)
MP.1. Make sense of problems and persevere in solving them.	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.	MP.7. Look for and make use of structure.
MP.4. Model with mathematics.	MP.8. Look for and express regularity in repeated reasoning.

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Facilitator's Guide

Throughout facilitation of this activity it will be important to remind participants:

- Use the cluster level narratives to better understand what attending to the mathematical practices might look like in the classroom.
- Emphasize to participants the statement at the end of each cluster within the *KAS for Mathematics*, "The identified mathematical practices, coherence connections, and clarifications are possible suggestions; however, they are not the only pathways."

Standards of Mathematical Practice (SMP)

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

Task H

This task helps illustrate MP.1. Problem solving is based upon students engaging in a task in which a solution pathway is not known in advance. As third graders approach these two problems, they will analyze the problems to make sense of what each is asking, working to understand the structures and the two interpretations of division. Through this analysis students will understand that the numbers and answers are the same, however, the actions or strategies students use for solving the two problems are quite different. A common misconception is that division can always be thought of as repeated subtraction. This works for "How many groups?" problem, but not for a "How many in each group?" problem, and only for whole numbers. Students need experience with both kinds of division problems to address this misconception; this will support students later when they divide fractions. As an extension, students can design story problems to match both the "How many groups?" and "How many in each group?" problem types.

MP.5. Use appropriate tools strategically.

Task B

This task helps illustrate MP.5. Third graders experience the fraction, one half, by exploring visually and kinesthetically with the ideas of area. Students use paper diagrams of shapes, which they can manipulate to determine if the shaded and unshaded portions each represent one half of the entire picture. As students become proficient in this practice, they will be able to consider the usefulness of this representation and consider its strengths and limitations, as well as know how to use it appropriately. The solution pathway that a student selects needs to make sense to him/her to be able to explain and justify (MP.3). Students will come to realize that certain methods/tools are more efficient, and they will abandon less useful tools in favor of more appropriate strategies/tools.

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MP.2. Reason abstractly and quantitatively. Task F This task helps illustrate MP.2. Students make sense of quantities and how they are related in a problem situation. In the task at hand, students first have to determine how much money they still need to earn to pay for their trip. They may represent what they have earned so far in several ways (creating an area model of multiplication or by breaking apart the multiplication problem into partial products). Then, they write an equation representing the problem situation. During this problem-solving process, students periodically contextualize the problem by connecting the mathematical symbols back to the context. Thus, students build meaning for the mathematical symbols by reasoning about the problem rather than memorizing an abstract set of rules or procedures. Problems that begin with a context and are represented with mathematical objects or symbols are also examples of modeling with mathematics (MP.4).	MP.6. Attend to precision. Task E This task supports the demonstration of MP.6. Students are faced with elements of ambiguity in deciding what encompasses the whole. The whole in turn impacts the representation of a specific fraction. Students learn to appreciate, understand, and use mathematical vocabulary more precisely in interpreting and describing the whole and its fractional parts. While using different representations, such as pictures, they use appropriate labels to communicate the meaning of their representation (in this task the whole fraction and its accompanying fractional part). Students also understand the possibility of different interpretations and therefore the necessity for precision in their work.
MP.3. Construct viable arguments and critique the reasoning of others. Task D This task helps to illustrate MP.3. Students are asked to critique the reasoning of Alec's claim that his school day was shorter than his brother's. This type of task provides students with an opportunity to distinguish a reasonable explanation from that which is flawed. If there is a flaw in the argument, they can further explain why it is flawed. Students will need to determine what information is necessary to calculate in order to support or dispute the claim. To distinguish if Alec's claim is true or false, students will have to uncover the fractional part of the day Alec and Felix were at school and not just rely on the number of classes they each attended. Learning how to argue whether a claim is true or false concisely and precisely becomes a routine part of a student's mathematical work.	MP.7. Look for and make use of structure. Task A This task helps illustrate MP.7. During this activity, third graders are actively connecting the strategy of make-a-ten along with properties of addition and subtraction to solve sums greater than 10. During this process they are looking at the structure of the base ten system and composing and decomposing numbers based on this structure. Students will have the opportunity to think about the meaning and usefulness of composing tens without struggling with the computations which for a third grader will not be challenging. They are asked to visualize this make-a-ten strategy using the addition table and explain why this reasoning works (MP.3). Through this in-depth exploration of the make-a-ten strategy, students are immersed in pattern-recognition and pattern-generalizing which not only develops a better understanding of our base ten structure but allows them to apply this understanding to solve other problems.

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MP.4. Model with mathematics.

Task G

This task helps illustrate MP.4. Third graders apply the mathematics they know to solve problems arising in everyday life. They identify the mathematical elements of each situation and determine the solution pathway that is best for them to follow. For these problems, students may use drawings or tape diagrams to depict each situation. They may also write a multiplication equation to represent how many altogether in part a or write multiplication or division equations to represent how many groups in part b and how many in each group in part c. Depending upon their solution pathways, students will have opportunities to explain their solutions to each other and critique each other's reasoning (Mathematical Practice Standard 3). For example, the teacher could pair students who have used different representations to represent each situation (one with an equation and one with a tape diagram) and have them describe how both representations depict (or do not depict) the same situation. Additionally, students can comment on why $? \times 8 = 48$ and $48 \div 8 = ?$ are equivalent expressions and can both provide the solution to the question.

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

Task C

This task helps illustrate MP.8. Third graders might begin to individually count the square units but will quickly notice that there are similar shapes in each of these letter configurations. They will build upon this observation of visible rectangles to find shortcut ways of determining the area of each configuration without counting every rectangle. Most students will use a combination of area calculations for larger rectangular blocks of squares, and simply counting squares for other parts as is shown in the solution method for "D." Some students may choose to use an additive perspective or other students may visualize the whole as a square and remove rectangles to determine total area. When students are engaged in MP.8, they purposely look for patterns/similarities, make conjectures about these patterns/similarities, consider generalities and limitations, and make connections over time about their ideas. They pay special attention to repeated logic that might be simplified to arrive at the solution more efficiently. As they begin to explain their processes to one another, they construct, critique, and compare arguments (MP.3).

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