# TEKSpectations

**Purpose:**
Participants will analyze the TEKS to see how the problem-solving model is addressed and how the expectations change as students' progress through the grades.

**Overview:**
Participants will analyze the changes by grade level in the Underlying Processes and Mathematical Tools section of the TEKS. The four-stage problem-solving model will be introduced. Participants will have an opportunity to work two problems to see how the four stages are addressed.

**TExES Mathematics 4-8 Competencies.** The beginning teacher:

III.008.A Selects and uses appropriate units of measurement (e.g., temperature, money, mass, weight, area, capacity, density, percents, speed, acceleration) to quantify, compare, and communicate information.
III.008.B Develops, justifies, and uses conversions within measurement systems.
III.008.E Applies the Pythagorean theorem, proportional reasoning, and right triangle trigonometry to solve problems.
III.010.A Uses and understands the development of formulas to find lengths, perimeters, areas, and volumes of basic geometric figures.
V.015.D Applies knowledge of the use of formal and informal reasoning to explore, investigate, and justify mathematical ideas.
V.015.E Recognizes that a mathematical problem can be solved in a variety of ways and selects an appropriate strategy for a given problem.
V.015.F Evaluates the reasonableness of a solution to a given problem.
V.016.C Expresses mathematical statements using developmentally appropriate language, standard English, mathematical language, and symbolic mathematics.
V.016.D Communicates mathematical ideas using a variety of representations (e.g., numeric, verbal, graphic, pictorial, symbolic, concrete).
V.016.E Demonstrates an understanding of the use of visual media such as graphs, tables, diagrams, and animations to communicate mathematical information.
V.016.F Uses the language of mathematics as a precise means of expressing mathematical ideas.
V.016.G Understands the structural properties common to the mathematical disciplines.
VI.017.A Applies theories and principles of learning mathematics to plan appropriate instructional activities for all students.
VI.017.D Understands how learning may be assisted through the use of mathematics manipulatives and technological tools.
VI.017.E Understands how to motivate students and actively engage them in the learning process by using a variety of interesting, challenging, and worthwhile mathematical tasks in individual, small-group, and large-group settings.
VI.017.G Recognizes the implications of current trends and research in mathematics and mathematics education.

**TEKS Mathematics Objectives.** The student is expected to:

6.3 A Use ratios to describe proportional situations.
6.3 C Use ratios to make a prediction in proportional situations
6.5 Formulate an equation from a problem situation.
6.8 B Select and use appropriate units, tools or formulas to measure and to solve problems involving length (including perimeter and circumference), area, time, temperature, capacity, and weight.
6.11A Identify and apply mathematics to everyday experiences, to activities in and outside of school, with other disciplines, and with other mathematical topics
6.11B Use a problem-solving model that incorporates understanding the problem, making a plan,

carrying out the plan, and evaluating the solution for reasonableness.

6.11C Select or develop an appropriate problem-solving strategy from a variety of different types, including drawing a picture, looking for a pattern, systematic guessing and checking, acting it out, making a table, working a simpler problem, or working backwards to solve a problem.

6.11D Select tools such as real objects, manipulatives, paper/pencil, and technology or techniques such as mental math, estimation, and number sense to solve problems.

6.12A Communicate mathematical ideas using language, efficient tools, appropriate units, and graphical, numerical, physical, or algebraic mathematical models.

6.12B Evaluate the effectiveness of different representations to communicate ideas.

6.13A Make conjectures from patterns or sets of examples and nonexamples.

6.13B Validate his/her conclusions using mathematical properties and relationships.

7.2 D Use division to find the rate and ratios in proportional relationships such as speed, density, recipes, and student-teacher ratios;

7.2 F Select and use appropriate operations to solve problems and justify selections; and

7.2 G Determine the reasonableness of a solution to a problem.

7.3 B Estimate and find solutions to application problems involving proportional relationships such as similarity, scaling, unit costs, and related measurement units.

7.4 A Generate formulas involving conversions, perimeter, area, circumference, volume, and scaling.

7.4 C Describe the relationship between the terms in the sequence and their positions in the sequence.

7.13A Identify and apply mathematics to everyday experiences, to activities in and outside of school, with other disciplines, and with other mathematical topics

7.13B Use a problem-solving model that incorporates understanding the problem, making a plan, carrying out the plan, and evaluating the solution for reasonableness.

7.13C Select or develop an appropriate problem-solving strategy from a variety of different types, including drawing a picture, looking for a pattern, systematic guessing and checking, acting it out, making a table, working a simpler problem, or working backwards to solve a problem.

7.13D Select tools such as real objects, manipulatives, paper/pencil, and technology or techniques such as mental math, estimation, and number sense to solve problems.

7.14A Communicate mathematical ideas using language, efficient tools, appropriate units, and graphical, numerical, physical, or algebraic mathematical models.

7.14B Evaluate the effectiveness of different representations to communicate ideas.

7.15A Make conjectures from patterns or sets of examples and nonexamples.

7.15B Validate his/her conclusions using mathematical properties and relationships.

8.3 B Estimate and find solutions to application problems involving percents and proportional relationships such a similarity and rates.

8.5 A Estimate, find, and justify solutions to application problems using appropriate tables, graphs, and algebraic equations; and

8.5 B Use an algebraic expression to find any term in a sequence.

8.14A Identify and apply mathematics to everyday experiences, to activities in and outside of school, with other disciplines, and with other mathematical topics

8.14B Use a problem-solving model that incorporates understanding the problem, making a plan, carrying out the plan, and evaluating the solution for reasonableness.

8.14C Select or develop an appropriate problem-solving strategy from a variety of different types, including drawing a picture, looking for a pattern, systematic guessing and checking, acting it out, making a table, working a simpler problem, or working backwards to solve a problem.

8.14D Select tools such as real objects, manipulatives, paper/pencil, and technology or techniques such as mental math, estimation, and number sense to solve problems.

8.15A Communicate mathematical ideas using language, efficient tools, appropriate units, and graphical, numerical, physical, or algebraic mathematical models.

8.15B Evaluate the effectiveness of different representations to communicate ideas.

8.16A Make conjectures from patterns or sets of examples and nonexamples.

8.16B Validate his/her conclusions using mathematical properties and relationships.

Terms: patterns, perimeter, relationships, ratios, proportions

**Materials**
Highlighters
Chart paper
Markers
Tape

**Transparencies.**

- Don't Fence Me In
- Limo Limits
- Four Stage Problem Solving Model
- Problem Solving Strategies
- Problem Solving Tools
- Gallery Tour

**Activity Sheet(s).**

- K-8 Underlying Processes and Mathematical Tools TEKS (Sets 1, 2, and 3)
- Don't Fence Me In
- Limo Limits

## Procedure:

| Steps | Questions/Math Notes |
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| 1. Distribute the K-8 Underlying Processes and Mathematical Tools TEKS and a highlighter to each participant. Explain to participants that Set 1 addresses the application of mathematics, Set 2 addresses communication of learning, and Set 3 addresses reasoning about their learning. | |
| **Use Set 1 (Applications within mathematics, in other disciplines, and in everyday life):**<br>2. Ask participants to read the Knowledge and Skills statements (the stems) for Set 1 and highlight where the statements change from grade level to grade level. Discuss their findings. | The change occurs at Grade 6 where students are expected to apply mathematics to investigations in other disciplines. |
| 3. Ask participants to read Section A of the student expectations for Set 1 and highlight the changes from grade level to grade level. Discuss the findings. | *What is the primary focus of this section?* This section is about applying mathematics.<br>*Where do the changes occur?*<br>The change occurs at Grade 6 where students apply mathematics in more areas than everyday situations. |

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| 4. Ask participants to read Section B of the student expectations for Set 1 and highlight the changes from grade level to grade level. Discuss the findings and display the Four-stage Problem Solving Model transparency. | *What is the primary focus of this section?* This section is about the problem solving model<br>*Where do the changes occur?*<br>The change first occurs at Grade 1 when students use a problem-solving model, *with guidance as needed*. From Grade 2 on, the guidance as needed is removed |
| 5. Ask participants to read Section C of the student expectations for Set 1 and highlight the changes from grade level to grade level. Discuss the findings and display the Problem Solving Strategies transparency. | *What is the primary focus of this section?* This section is about problem solving strategies.<br>*Where do the changes occur?*<br>This expectation changes at Grade 3 where two additional strategies are added (working a simpler problem and working backwards). No other changes occur. |
| 6. Ask participants to read Section D of the student expectations for Set 1 and highlight the changes from grade level to grade level. Discuss the findings and display the Problem Solving Tools transparency. | *What is the primary focus of this section?* This section is about the tools used to solve problems.<br>*Where do the changes occur?*<br>This expectation does not change until Grade 6 where students are expected to *select* the tools they will use to solve problems. Another change that occurs at Grade 6 is the inclusion of techniques such as mental math, estimation, and number sense. |

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| **Use Set 2 (Communication):**<br>7. Ask participants to read the Knowledge and Skills statements (the stems) for Set 2 and highlight where the statements change from grade level to grade level. Discuss their findings. | Again, this change first occurs at Grade 6 where students are expected to communicate about mathematics using something other than informal language (*mathematical language, representations, and models*). |
| 8. Ask participants to read Section A of the student expectations for Set 2 and highlight the changes from grade level to grade level. Discuss their findings. | *Where do the changes occur?*<br>This expectation changes for the first time in Grade 6 as students communicate mathematical ideas using language, efficient tools, appropriate units, and graphical, numerical, physical, or algebraic mathematical models. |
| 9. Ask participants to read Section B of the student expectations for Set 2 and highlight the changes from grade level to grade level. Discuss their findings. | *Where do the changes occur?*<br>One change occurs at Grade 1 where students use informal language rather than everyday language. This changes at Grade 6 also, where students are to evaluate the effectiveness of different representations to communicate ideas. |
| **Use Set 3 (Reasonableness and** | Again, this change first occurs at Grade 6 |

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| **Justification):**<br>10. Ask participants to read the Knowledge and Skills statements (the stems) for Set 3 and highlight where the statements change from grade level to grade level. Discuss their findings. | where students use logical reasoning to make conjectures and verify conclusions rather than just using logical reasoning to make sense of his or her world. |
| 11. Ask participants to read Section A of the student expectations for Set 3 and highlight the changes from grade level to grade level. Discuss their findings. | This again changes for the first time in Grade 6, where students are expected to make conjectures, not just generalizations, from patterns or sets of examples and nonexamples. |
| 12. Ask participants to read Section B of the student expectations for Set 3 and highlight the changes from grade level to grade level. Discuss their findings. | This changes in Grade 6 where students are expected to validate his/her conclusions using mathematical properties and relationships. |
| 13. Ask participants to share the implications this has on their grade level. | *All of the strategies have been taught by the time students enter middle school. However, students must be given the opportunity to practice and refine their strategies.* |

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| 14. Discuss with participants that all three sets are equally important. Remind them that Set 1 addresses selecting a strategy and carrying out a plan, Set 2 addresses the communication of their plan, and Set 3 addresses the evaluation of their work. They will now have an opportunity to attend to all three of these areas with a problem. | |
| 15. Distribute Don't Fence Me In. Read the problem aloud from the transparency. Ask participants to work quietly on their own on this problem for about 5 minutes. This is called "productive silence" and it gives everyone the opportunity to understand and explore the problem on his/her own. This will allow everyone to get their own "feel "for the problem before the group is formed. | |
| 16. Within their groups, ask that each participant share their thoughts and strategy for the problem. Allow the group to work together to find a solution(s) and communicate it on large poster paper. Direct groups to hang their solutions up around the room when they are finished. | |
| 17. After all groups have displayed their work, lead participants on a Gallery Tour. Each group will spend 2-3 minutes at each poster, discussing the different ways the same problem was solved. Have them return to their seats to discuss all the strategies and solutions. | How did you feel about doing a gallery tour?<br>What would be some advantages and disadvantages of using gallery tour?<br>How would you begin to teach your students how to use the gallery tour in your classroom? List them.<br>What observations did you make as you analyzed each group's work? |
| 18. Ask participants to share comments about the different strategies they saw and the different ways the solution was communicated. | Describe how you arrived at your answer.<br>Can you write an equation that describes your solution? Show how.<br>Did you see a strategy that was different than yours? If so, which strategy did you like the most? Explain your reasoning. |
| 19. Distribute Limo Limits and read the problem from the transparency. Again, allow for about five minutes of productive silence. Ask the groups to work together to solve the problem. Again, ask that each group member be given the opportunity to share his/her thoughts. | |
| 20. When the group has worked together to find the solutions, have them communicate it on chart paper. Direct the groups to display their solution next to their previous solution. Ask groups to do another gallery tour using Limo Limits. | |

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| 21. Ask participants to share their solution strategies for Limo Limits. | *Express how you arrived at your answer.*<br>*Can you solve the problem using different strategies and get the same results? Explain.*<br>*Were their any new strategies introduced in Limo Limit that was not used in the first problem? If so, what were they?* |
| 22. Lead a discussion on the quality of work from Problem 1 to Problem 2. | *How does the quality of work compare between the two problems?*<br>*Did the way another group presented their work influence your work on Problem 2? If so, how?*<br>*What does this tell you about the importance of allowing students to analyze each other's work?*<br>*What are some different ways that students can show their solutions?* Chart paper, Gallery Tour, overhead transparencies |
| 23. Display Gallery Tour Transparency. Ask participants to share advantages and disadvantages of using the Gallery Tour. List these on the transparency. | *What are some advantages and disadvantages of using the gallery tour?*<br>*Ask participants for some solutions or strategies to overcome the disadvantages.* |
| 24. Debrief participants on the objective – Participants will analyze the TEKS to see how the problem-solving model is addressed and how the expectations change as students move through the grade levels. | *Distinguish between a problem and an exercise.*<br>*Describe what problem solving is and is not.*<br>*Why do we need to teach problem solving?*<br>*Describe how you can incorporate problem solving into your lessons.*<br>*How do problem-solving skills carry over into other disciplines and everyday life?*<br>*Why do students need a variety of strategies for problem solving?*<br>*Differentiate between application, communication, and justification of a solution within the TEKS.*<br>*What is the relationship between application, communication, and justification of a solution?* |