Grade 8 – Math Standard 4.2

Math.4.2 - Direct and indirect measurement can be used to describe and make comparisons.

Related Colorado Department of Education Sample Units:

- **It's All Greek To Me** (Concepts: Pythagorean Theorem, right triangle, indirect measurement, rational numbers, irrational numbers, division, integers, terminate, repeat, decimals, approximation, representation, number line)
- **Moving Mathematically** (Concepts: Volume, formulas, cones, cylinders, spheres, transversal, parallel lines, angles, relationships, rotations, reflections, translations, congruence, dilations, similarity, coordinates, symbolically, algebraic)

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<tr>
<th>Essential Questions - 21st Century Skills and Readiness Competencies (District):</th>
<th>Evidence Outcomes (District):</th>
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<tbody>
<tr>
<td>1. Why does the Pythagorean Theorem only apply to right triangles?</td>
<td>1. Explain a proof of the Pythagorean Theorem and its converse.</td>
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<tr>
<td>2. How can the Pythagorean Theorem be used for indirect measurement?</td>
<td>2. Apply the Pythagorean Theorem to determine unknown side lengths in right triangles in real-world and mathematical problems in two and three dimensions.</td>
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<tr>
<td>3. How are the distance formula and the Pythagorean theorem the same? Different?</td>
<td>3. Apply the Pythagorean Theorem to find the distance between two points in a coordinate system.</td>
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<tr>
<td>4. How are the volume formulas for cones, cylinders, prisms, and pyramids interrelated?</td>
<td>4. State the formulas for the volumes of cones, cylinders, and spheres and use them to solve real-world and mathematical problems.</td>
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<td>5. How is the volume of an irregular figure measured?</td>
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<td>6. How can cubic units be used to measure volume for curved surfaces?</td>
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<td>7. How can you find the distance between two points in a coordinate system using the Pythagorean Theorem?</td>
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<tr>
<th>Academic Vocabulary (District):</th>
<th>Assessment (District):</th>
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<tr>
<td>Pythagorean Theorem</td>
<td>All assessments are found in the suggested activities links, correlating with their numbers, unless listed below.</td>
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<tr>
<td>coordinate system</td>
<td>1. You can use any of the activities in the independent practice located toward the bottom of the lesson plan for an assessment.</td>
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<tr>
<td>volume</td>
<td>2. For assessing the Measure Up Activity, scroll to the bottom of the lesson and click the assessment icon.</td>
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<tr>
<td>cone</td>
<td>• 2. Measure Up Activity</td>
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<tr>
<td>cylinder</td>
<td>3. Print and use different worksheets to assess for correctness. Teacher can use individual sheets or create a packet. See links below.</td>
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<tr>
<td>sphere</td>
<td>• 3. Volume of Rectangular Prism Worksheet</td>
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<tr>
<td>converse</td>
<td>• 3. Volume of Cylinder Worksheet</td>
</tr>
<tr>
<td>right triangles</td>
<td>• 3. Volume of Cones and Pyramids Worksheet</td>
</tr>
<tr>
<td>indirect measurement</td>
<td>4. 5, 6, &amp; 7. Assessment is located under its own tab within each lesson.</td>
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<tr>
<td>distance formula</td>
<td>• Triangle Quizzes</td>
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<tr>
<th>Suggested Activities/Strategies (District):</th>
<th>Resources/Technology (District):</th>
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For all activities listed below, the links are numbered to correlate with each activity.

1. This lesson introduces and explores the Pythagorean Theorem. Three activities give students the opportunity to observe triangles, learn and use the Pythagorean Theorem, and practice different ways of determining areas of triangles.
   - **Pythagorean Theorem Activity**

2. Use the Measure Up Activity. Students extend their knowledge of proportions to solving problems dealing with similarity. They measure the heights and shadows of familiar objects and use indirect measurement to find the heights of things that are much bigger in size, such as a flagpole, a school building, or a tree.
   - **2. Measure Up Lesson Plan**

3. Conduct Drill and Practice with worksheets. See multiple examples of worksheets below.
   - 3. **Pythagorean Theorem Worksheet**
   - 3. **Distance Formula Worksheet**
   - 3. **Distance Formula Worksheet #2**
   - 3. **Volume of Prisms/Cylinders Worksheet**
   - 3. **Volume of Pyramids/Cones Worksheet**

4. Use the Corner to Corner Lesson Plan. Students further explore square roots using the diagonals of rectangles. Using measurement, students will discover a method for finding the diagonal of any rectangle when the length and width are known, which leads to the Pythagorean Theorem.
   - 4. **Exploring Diagonals and the Pythagorean Theorem**

5. Use the Polygon Capture Lesson. In this lesson, students classify polygons according to more than one property at a time. In the context of a game, students move from a simple description of shapes to an analysis of how properties are related.
   - 5. **Polygon Capture Lesson Plan**

6. If you have a SmartBoard or Airliner, go to Smart Exchange and there are several lessons on Volume.
   - 6. **Smart Exchange**

7. There are several 21st Century Lessons on Volume at Share My Lesson. Go to the site and choose a lesson.
   - 7. **Share My Lesson**

8. Use the Prove-It Lesson Plan. During this lesson, students will be introduced to the Pythagorean Theorem: \( a^2 + b^2 = c^2 \). They will construct a right triangle on graph paper and draw squares on each side of the triangle.
   - 8. **Prove It Lesson Plan**

   - **Resource for surface area of cone at** aboutmath
   - **Resource for explanation of Geometry at** shmoop.com
   - **Resource for distance formula at** purplemath
   - **Illuminations from NCTM** – Great Lessons and Units supporting all grades levels
     - Multiple Links to Games/Interactives
   - **PARCC** offers instructional and assessment support. Click on the tab “In the Classroom” and at the model frameworks for math.
   - **Illustrative Mathematics** contains examples of tasks designed by the makers of the CCSS-M (Common Core State Standards of Mathematics.)
   - **Inside Mathematics** has tasks, rubrics, and discussion questions that correlate with PARCC and Smarter Balance.
   - **Math Arizona** has explanations and overviews for how the mathematics strands progress from one year to the next.
   - **Math Shell** is Mathematics Assessment Resource Service (MARS) from the Shell Centre in Nottingham, England and it contains a number of performance tasks.
   - **Achieve the Core** is from Student Achievement Partners, a nonprofit organization that assembles educators and researchers to design actions based in evidence that will substantially improve student achievement.
   - **Balanced Assessments** is a site with free performance tasks to use in your classroom.
   - **Pythagorean Theorem Examples**
   - **8th Grade Interactive Activities for Pythagorean Theorem**
   - **Pythagorean Theorem Activities**
   - **Help with Math (Tutorial)**
   - **Slope Interactive Site**
   - **Measure Volume of Irregular Shape Experiment**
   - **Site with Multiple Geometry Lessons/Activities**
   - **How High Interactive Activity with Volume**
   - **Site with Links to Multiple Lesson Plans**
   - **Demonstration of Pythagorean Theorem**
   - **Pythagoras’ Theorem**
   - **Picking Pythagoras**
   - **Site with Multiple Pythagorean Theorem Resources**
   - **Video on Pythagorean Theorem**
   - **PBS Lesson Plan**
   - **Pythagorean Theorem with Jelly Beans**
   - **Site with Multiple Resources for Pythagorean Theorem #2**
   - **Another Pythagorean Theorem PowerPoint**
   - **Hands On Math/Real Life Applications**