Lesson 3 – Pre-Visit
Ballpark Figures – Part 3

**Objective:** Students will be able to:
- Know the Pythagorean Theorem and identify why it is used.
- Use the Pythagorean Theorem to find missing side lengths of various right triangles.

**Time Requirement:** 1 class period

**Materials Needed:**
- Pencils
- Paper (regular and graph paper)
- Calculators
- Students’ baseball field scale drawings used in Lessons 1 and 2 of this unit

**Vocabulary:**
- **Hypotenuse** - The side of a right-angled triangle that is opposite the right angle, also the longest side
- **Pythagorean Theorem** - A mathematical relationship between the sides of a right triangle
- **Right Triangle** - A triangle that includes a right angle
- **Triangle** - A three-sided polygon
Applicable Common Core State Standards:

**CCSS.Math.Content.7.G.A.1** Solve problems involving scale drawings of geometric figures, including computing actual lengths and areas from a scale drawing and reproducing a scale drawing at a different scale.

**CCSS.Math.Content.7.G.A.2** Draw (freehand, with ruler and protractor, and with technology) geometric shapes with given conditions. Focus on constructing triangles from three measures of angles or sides, noticing when the conditions determine a unique triangle, more than one triangle, or no triangle.

**CCSS.Math.Content.7.G.B.6** Solve real-world and mathematical problems involving area, volume and surface area of two- and three-dimensional objects composed of triangles, quadrilaterals, polygons, cubes, and right prisms.

**CCSS.Math.Content.8.G.B.7** Apply the Pythagorean Theorem to determine unknown side lengths in right triangles in real-world and mathematical problems in two and three dimensions.

**CCSS.Math.Content.6.EE.A.2** Write, read, and evaluate expressions in which letters stand for numbers.
  - **CCSS.Math.Content.6.EE.A.2a** Write expressions that record operations with numbers and with letters standing for numbers.

**CCSS.Math.Content.7.EE.B.4** Use variables to represent quantities in a real-world or mathematical problem, and construct simple equations and inequalities to solve problems by reasoning about the quantities.
1. To begin, review that a right triangle is a triangle which has an angle that measures 90 degrees. The two sides that make up the right angle are called legs, and the side opposite the right angle is called the hypotenuse.

2. Explain (or review) that if the lengths of the two legs of a right triangle are known, then the length of the hypotenuse can be calculated using the Pythagorean Theorem. Review the formula for the Pythagorean Theorem: \(a^2 + b^2 = c^2\).

3. The legs of the right triangle are marked with 'a' and 'b,' while the hypotenuse is marked with a 'c.' Draw a diagram to give students a visual aid.

4. Give students the following practice problem:
   - How do we find the length of the hypotenuse of a right triangle, if we know that the legs are 3\" and 4\"?

5. Go over the practice problem with students.
   - \(a^2 + b^2 = c^2\)
   - \(3^2 + 4^2 = c^2\)
   - \(9'' + 16'' = c^2\)
   - \(25'' = c^2\)
   - \(\sqrt{25''} = \sqrt{c^2}\)
   - \(5'' = c\)

6. Have students practice using the Pythagorean Theorem with the following word problems (round to the nearest whole number):
   - The Colorado Rookies are going on a road trip. First, they fly 564 miles east to play the Royals in Kansas City, Missouri. After a 3-game series, they fly to Minneapolis, Minnesota to play the Twins. Minneapolis is 415 miles north of Kansas City. After another 3-game series, the Rockies go back home. How many miles must they travel from Minneapolis back to Denver?
The Washington Nationals are going on a road trip. Their first series is against the Reds in Cincinnati, Ohio, 403 miles west of Washington, DC. Their second series is in Atlanta, Georgia where they play the Braves. Atlanta is 371 miles south of Cincinnati. The Nationals win both series and they want to get back home so that they can celebrate with their fans. How many miles must they travel from Atlanta to Washington, DC?

7. Review both practice problems with students.
   a. Colorado Rockies:
      • \(564^2 + 415^2 = c^2\)
      • \(318096 + 172225 = c^2\)
      • \(490321 = c^2\)
      • \(\sqrt{490321} = \sqrt{c^2}\)
      • 700 miles = c
   
   b. Washington Nationals:
      • \(403^2 + 371^2 = c^2\)
      • \(162409 + 137641 = c^2\)
      • \(300050 = c^2\)
      • \(\sqrt{300050} = \sqrt{c^2}\)
      • 548 miles = c

8. Introduce the activity
1. Provide students with the Little League ballpark scale drawings they have worked on during Lessons 1 and 2 of this unit.

2. Before proceeding, ensure that each student has a pencil, a calculator, regular paper, graph paper, and a ruler.

3. In parts 1 and 2 of this activity, students should have determined the following:
   - The area of the plot of land meant for the ballpark (Lesson 1)
   - The perimeter of the baseball field (Lesson 1)
   - The area of the infield (Lesson 1)
   - The area of the outfield (Lesson 1)
   - The area of the pitcher’s mound (Lesson 2)
   - The area of the circle surrounding home plate (Lesson 2)
   - The combined area of dirt-covered infield (Lesson 2)

4. Compile the area and perimeter answers from Lessons 1 and 2.

5. Now students must determine the cost to complete each part of the field. The following prices have been submitted by the contracting firm constructing the field. Write the following on the board or on a sheet of chart paper for reference.

<table>
<thead>
<tr>
<th>Material</th>
<th>Price Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grass Seed – Material</td>
<td>$60 for a 50 lb. bag Covers 3,000 square feet</td>
</tr>
<tr>
<td>Grass Seed – Labor</td>
<td>$0.10 per square foot</td>
</tr>
<tr>
<td>Infield Dirt – Material</td>
<td>$1.25 per square foot</td>
</tr>
<tr>
<td>Infield Dirt – Labor</td>
<td>$0.75 per square foot</td>
</tr>
<tr>
<td>Fencing – Material</td>
<td>$15 per foot</td>
</tr>
<tr>
<td>Fencing – Labor</td>
<td>$8.00 per foot</td>
</tr>
</tbody>
</table>

6. Have students use the given prices, along with the information on area and perimeter determined earlier, to calculate the cost of constructing the new Little League field. *Answers as follows:*
Infield Grass Seed - Material:
- $8100^2 \times 113.04$ feet$^2$ (Pitcher’s mound) = $7986.96$ feet$^2$
- $7986.96 / 3000 = 2.66$ (3) bags required
- $3 \times $60 = $180$

Infield Grass Seed - Labor:
- $8100^2 \times 113.04$ feet$^2$ (Pitcher’s mound) = $7986.96$ feet$^2$
- $7986.96 \times $0.10 = $798.70$

Outfield Grass Seed Material & Labor = TBD based on class field dimensions.

Infield Dirt - Material:
- $367.38$ feet$^2 \times $1.25 = $459.23$

Infield Dirt - Labor:
- $367.38$ feet$^2 \times $0.75 = $275.54$

Fencing Material & Labor = TBD based on class field dimensions.

7. Remind students that the city has budgeted $100,000 for the construction of the field. Based on your findings, did the city budget enough money to construct the field?

Conclusion:
To conclude this lesson and check for understanding, have students write a short reflection addressing other uses of geometry in everyday life.