Special Right Triangles

Lesson Summary:
Students will investigate the special right triangles: 45-45-90 and 30-60-90 using geometry software.

Key Words:
Right triangle, special right triangle, isosceles right triangle

Existing Knowledge:
Students should be familiar with the geometry software and with special right triangles.

Learning Objectives:
1. Students will be able to construct an isosceles right triangle.
2. Students will be able to make conjectures and describe relationships between the ratios of the sides of special right triangles.

Materials:
1. Laboratory worksheet
2. Access to computer lab or calculator equipped with Cabri Geometry II.

Procedure:
Split the class into groups of two or three. Have them complete the worksheet and extensions.

Assessment:
Choices for the types of assessment are left to the discretion of the instructor. Some examples might include: the completed lab questions, class participation (student explanations of the lab, conjectures, answers and/or processes in finding solutions to the extension problems or student created extensions), and peer or self-evaluation. Keep in mind that several forms of assessment should be utilized when lessons are inquiry/discovery based.
**Special Right Triangles**

**Team Members’ Names** ________________________________________________

**File Name** _______________________________________________

**Goal 1:** To discover the relationship between the sides of a $45^\circ/45^\circ/90^\circ$ triangle.

1. Draw a square. Measure one of the sides. Adjust the size of the square until the length of the sides are integers.  
   [Use *Regular Polygon, Distance and Length, and Pointer* tools.]

2. Construct a diagonal.  
   [Use *Segment* tool.]

3. Use the Pythagorean Theorem to find the exact length of the diagonal. Then measure the diagonal of the square. Compare the exact to the measured length.  
   [Use *Distance and Length* tool.]

4. Construct two more squares with sides of integral lengths, and find the exact and measured lengths for each.

5. Complete the table then answer the questions below.

<table>
<thead>
<tr>
<th></th>
<th>Side Length</th>
<th>Exact Diagonal Length</th>
<th>Measured Diagonal Length</th>
</tr>
</thead>
<tbody>
<tr>
<td>Square #1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Square #2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Square #3</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

a. What kinds of triangles are formed by drawing the diagonal of a square? Classify the triangles according to its sides and its angles.

__________________________________________________________________

b. What are the angle measures in the two triangles formed by the diagonal?

__________________________________________________________________

c. If you know the length of one side of a square, how could you find the length of a diagonal without using the Pythagorean Theorem or measuring?

__________________________________________________________________

d. If you know the length of the diagonal, how could you find the length of a side without using the Pythagorean Theorem or measuring?

__________________________________________________________________
Goal 2: To discover the relationship between the sides of a $30^\circ/60^\circ/90^\circ$ triangle.

1. Draw an equilateral triangle. Measure one of the sides. Adjust the size of the triangle until the length of the sides are integers.  
   [Use Regular Polygon, Distance and Length, and Pointer tools.]

2. Construct an altitude from one of the vertices.  
   [Use Perpendicular Line and segment tool.]

3. Use the Pythagorean Theorem to find the exact length of the altitude. Then measure the length of the altitude of the triangle. Compare the exact length to the measured length.  
   [Use Distance and Length tool.]

4. Construct two more equilateral triangles with sides of integral lengths, and find the exact and measured lengths for each.

5. Complete the table, and then answer the questions below.

<table>
<thead>
<tr>
<th></th>
<th>Side Length</th>
<th>Exact Altitude Length</th>
<th>Measured Altitude Length</th>
</tr>
</thead>
<tbody>
<tr>
<td>Triangle #1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Triangle #2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Triangle #3</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

a. What kinds of triangles are formed by drawing the altitude of an equilateral triangle? Classify the triangles according to its sides and its angles.

b. What are the angle measures in the two triangles formed by the altitude?

c. If you know the length of one side of an equilateral triangle, how could you find the length of an altitude without using the Pythagorean Theorem or measuring?

d. If you know the length of an altitude, how could you find the length of a side of an equilateral triangle without using the Pythagorean Theorem or measuring?
Extension:

In Quesada Baseball Stadium, the distance between each of the bases is 90 feet, the baselines are perpendicular to one another, the right and left field foul poles are 330 feet from home plate, the furthest point in center field is equidistant to the foul poles, and the lines connecting the foul poles to this point in center field are perpendicular.

a. If the catcher wants to throw out a runner heading towards second base, how far will the catcher have to throw the ball?

b. If the third baseman is standing on third base and wants to throw out a runner heading towards first base, how far will the third baseman have to throw the ball?

c. Compare the distances that the catcher and third baseman must throw the ball. Explain your findings.

d. What is the furthest distance a ball must travel to be a homerun?