Lesson 24: Special Right Triangles and Pythagorean Theorem

Exploratory Challenge/Exercises 1-2

1. An equilateral triangle has sides of length 2 and angle measures of 60°, as shown below. The altitude from one vertex to the opposite side divides the triangle into two right triangles.

   a. Are those triangles congruent? Explain.

   b. What is the length of the shorter leg of each of the right triangles? Explain.

   c. Use the Pythagorean Theorem to determine the length of the altitude.

   d. Write the ratio that represents shorter leg: hypotenuse.

   e. Write the ratio that represents longer leg: hypotenuse.

   f. Write the ratio that represents shorter leg: longer leg.

   g. By the AA criterion, any triangles with measures 30-60-90 will be similar to this triangle. If a 30-60-90 triangle has a hypotenuse of length 16, what are the lengths of the legs?
2. An isosceles right triangle has leg lengths of 1, as shown.

![Diagram of an isosceles right triangle with legs and hypotenuse labeled 1]

a. What are the measures of the other two angles? Explain.

b. Use the Pythagorean Theorem to determine the length of the hypotenuse of the right triangle.

c. Write the ratio that represents $\text{leg : hypotenuse}$.

d. By the AA criterion, any triangles with measures $45-45-90$ will be similar to this triangle. If a $45-45-90$ triangle has a hypotenuse of length 20, what are the lengths of the legs?
Examples

Determine the value(s) of the missing variable(s).

1. \[
\begin{array}{c}
45^\circ \quad x \\
\quad 45^\circ \quad 8
\end{array}
\]

2. \[
\begin{array}{c}
45^\circ \\
3\sqrt{2} \\
\quad x
\end{array}
\]

3. \[
\begin{array}{c}
18 \\
x \\
x \\
x
\end{array}
\]

4. \[
\begin{array}{c}
y \\
60^\circ \\
\quad x \\
8
\end{array}
\]

5. \[
\begin{array}{c}
60^\circ \\
y \\
\quad x \\
12
\end{array}
\]

6. \[
\begin{array}{c}
y \\
30^\circ \\
\quad x \\
9\sqrt{3}
\end{array}
\]
Geometry M2L24 Special Right Triangles and the Pythagorean Theorem HW

1. Each row in the table below shows the side lengths of a different 30-60-90 right triangle. Complete the table with the missing side lengths in simplest radical form. Use the variable in each box in the proportion as the missing length.

<table>
<thead>
<tr>
<th>Shorter Leg (1)</th>
<th>Longer Leg ($\sqrt{3}$)</th>
<th>Hypotenuse (2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>25</td>
<td>(x)</td>
<td>50</td>
</tr>
<tr>
<td>15</td>
<td>(y)</td>
<td>(z)</td>
</tr>
<tr>
<td>(w)</td>
<td>3</td>
<td>2$\sqrt{3}$</td>
</tr>
</tbody>
</table>

Determine the value(s) of the missing variable(s).

2. 

3. 

4. 

5. 

© 2014 Common Core, Inc. Some rights reserved. commoncore.org

This work is licensed under a Creative Commons Attribution-NonCommercial-ShareAlike 3.0 Unported License.
For Exercises 6-8 use the figure at the right.

6. If \( a = 4\sqrt{3} \), find \( b \) and \( c \).

7. If \( x = 3\sqrt{3} \), find \( a \) and \( CD \).

8. If \( a = 4 \), find \( CD \), \( b \), and \( y \).

Hint: Re-draw each triangle below the original: \( \triangle ACB \), \( \triangle ADC \) and \( \triangle CDB \)