Theorem 9.9
In a $30^\circ$-$60^\circ$-$90^\circ$ triangle, the hypotenuse is twice as long as the shorter leg, and the longer leg is $\sqrt{3}$ times as long as the shorter leg.
Remember!

When going from a **short** side to a **long** side... **MULTIPLY**!

When going from a **long** side to a **short** side... **DIVIDE**!

**Example 1**

Find the value of $x$ and $y$. Leave your answer in radical form.

\[ 15\sqrt{3} = x \]

\[ 15 \times 2 = 30 = y \]
Example 2
Find the value of $x$ and $y$. Leave your answer in radical form.

\[
\frac{7 \cdot \sqrt{3}}{\sqrt{3} \cdot \sqrt{3}} = \frac{7\sqrt{3}}{3} = x
\]

\[
\frac{2 \cdot 7\sqrt{3}}{1 \cdot \frac{7\sqrt{3}}{3}} = \frac{14\sqrt{3}}{3} = y
\]

Example 3
Find the value of $x$ and $y$. Leave your answer in radical form.

\[
\frac{22 \cdot \frac{\sqrt{3}}{\sqrt{3}}}{\sqrt{3} \cdot \sqrt{3}} = \frac{22\sqrt{3}}{3} = x
\]

\[
\frac{2 \cdot 22\sqrt{3}}{1 \cdot \frac{22\sqrt{3}}{3}} = \frac{44\sqrt{3}}{3} = y
\]
Example 4
Find the value of x and y. Leave your answer in radical form.

\[
\frac{15\sqrt{3}}{\sqrt{3}} = 15 = x
\]

2 \cdot 15 = 30 = y

Example 5
Find the value of x and y. Leave your answer in radical form.

\[
\frac{78}{2} = 39 = y
\]

39\sqrt{3} = x
1. Find the value of x.

   A. 9
   B. $9\sqrt{2}$
   C. $9\sqrt{3}$
   D. 18

2. Find the value of y.

   A. 25
   B. $25\sqrt{2}$
   C. $25\sqrt{3}$
   D. 50
3. What is the value of $x$?

- **A** $42$
- **B** $42\sqrt{3}$
- **C** $21\sqrt{2}$
- **D** $21$

4. Find the value of $y$.

- **A** $11$
- **B** $11\sqrt{3}$
- **C** $44\sqrt{3}$
- **D** $44$

\[
\frac{22}{2} = 11
\]
5. The hypotenuse of a $30^\circ$-$60^\circ$-$90^\circ$ triangle measures 16. What is the measure of the shortest side?

- A. $16\sqrt{3}$
- B. $16\sqrt{2}$
- C. $8\sqrt{3}$
- D. 8

6. The measure of an altitude of an equilateral triangle is $4\sqrt{3}$. Find the perimeter.

- A. 24
- B. $12 + 4\sqrt{3}$
- C. $12\sqrt{3}$
- D. 36