8.3 Exploring Special Right Triangles (45-45-90)

Given the isosceles right triangle to the right…

1. What is the measure of each angle? Explain

\[ 180^\circ - 90^\circ = 90^\circ \]

\[ \frac{90}{2} = 45^\circ \]

\[ 45^\circ - 45^\circ - 90^\circ \]

2a. If the length of each leg is 1 unit, find the length of the hypotenuse. Leave your answer in simplified rational form.

\[ l^2 + l^2 = h^2 \]

\[ l + l = h^2 \]

\[ \sqrt{2} = h \]

\[ \sqrt{2} = h \]

2b. What are the side-length ratios of leg : leg : hypotenuse?

\[ 1 : 1 : \sqrt{2} \]

3. If the length of each leg is 2 unit, find the length of the hypotenuse. Leave your answer in simplified rational form.

\[ 2^2 + 2^2 = h^2 \]

\[ 4 + 4 = h^2 \]

\[ \sqrt{8} = h^2 \]

\[ 2\sqrt{2} = h \]

\[ 2\sqrt{2} = h \]
### Theorem 8.8 45°-45°-90° Triangle Theorem

In a 45°-45°-90° triangle, the legs $\ell$ are congruent and the length of the hypotenuse $h$ is $\sqrt{2}$ times the length of a leg.

**Symbols** In a 45°-45°-90° triangle, $\ell = \ell$ and $h = \ell \sqrt{2}$.

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**Example 1A:** Find $x$

\[ x = \ell \sqrt{2} \]
\[ \ell = 9 \]
\[ x = 9 \sqrt{2} \]

**Example 1B:** Find $x$

\[ x = \ell \sqrt{2} \]
\[ \ell = 6 \sqrt{2} \]
\[ x = 6 \sqrt{2} \sqrt{2} \]
\[ x = 12 \]

**Guided Practice 1A:** Find $x$

\[ x = \ell \sqrt{2} \]
\[ \ell = 7 \]
\[ x = 7 \sqrt{2} \]

**Guided Practice 1B:** Find $x$

\[ x = \ell \sqrt{2} \]
\[ \ell = 8 \sqrt{2} \]
\[ x = 8 \sqrt{2} \sqrt{2} \]
\[ x = 16 \]

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**Example 2:** Find $a$

\[ \ell \sqrt{2} = 8 \]
\[ \sqrt{2} \sqrt{2} \]
\[ \ell = 4 \sqrt{2} \]
\[ a = \ell \]
\[ a = 4 \sqrt{2} \]

**Guided Practice 2:** Find $b$

\[ \ell \sqrt{2} = 6 \]
\[ \ell = 3 \sqrt{2} \]