Examples of 45°-45°-90° (Find the missing lengths)

#1

$6\sqrt{2}$

6

$45°$

6

#2

3

3

$3\sqrt{2}$

#3

3

$\dfrac{6}{3\sqrt{2}}$

$45°$

3

$$\dfrac{6 \cdot \sqrt{2}}{\sqrt{2} \cdot \sqrt{2}} = \dfrac{6\sqrt{2}}{2}$$

$3\sqrt{2}$

#4

$\dfrac{16\sqrt{2}}{8\sqrt{2}}$

8

$45°$

8

#5

$\dfrac{5}{2}$

$5 = \dfrac{5}{2}\sqrt{2}$

$45°$

$\dfrac{5}{2}$

#6

$y = 25\sqrt{2}$

25

$45°$

$X = 25$
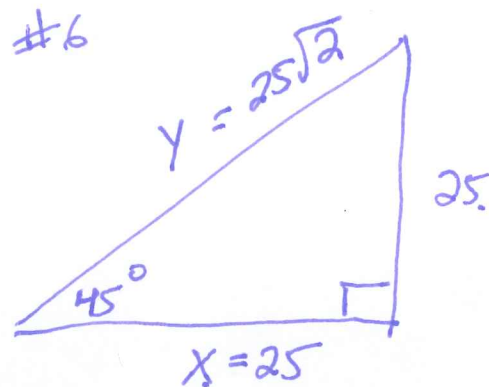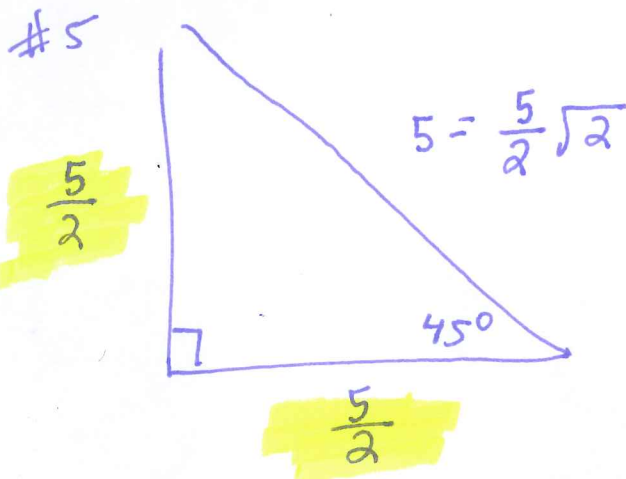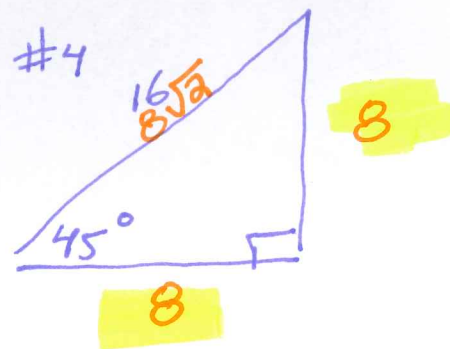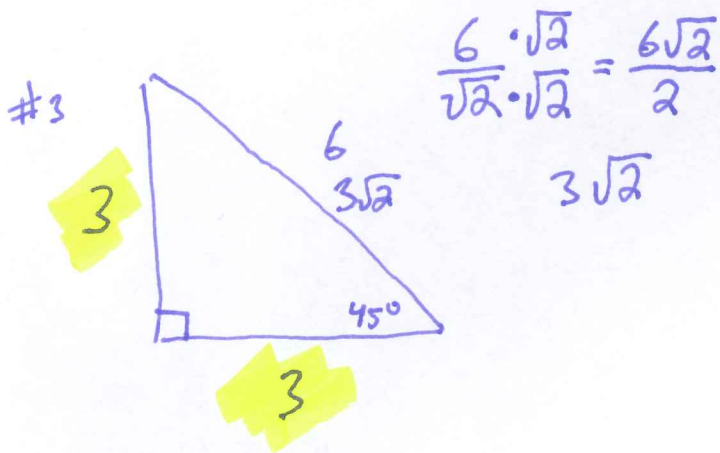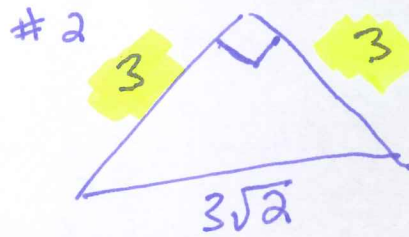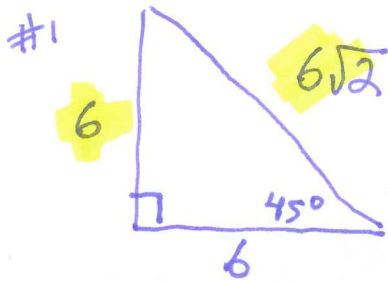
Your Turn

Find the unknown side lengths in each right triangle.

5.

L 30°

$4\sqrt{3}$

J 60° K

6.

Q 45°

$(2\sqrt{6})\sqrt{2}$
$2\sqrt{12}$
$2\sqrt{4}\sqrt{3}$
$4\sqrt{3}$

$2\sqrt{6}$

P 45° R
$2\sqrt{6}$

Exact Form
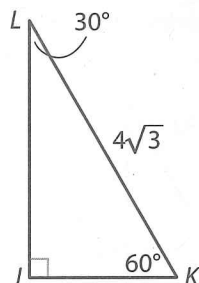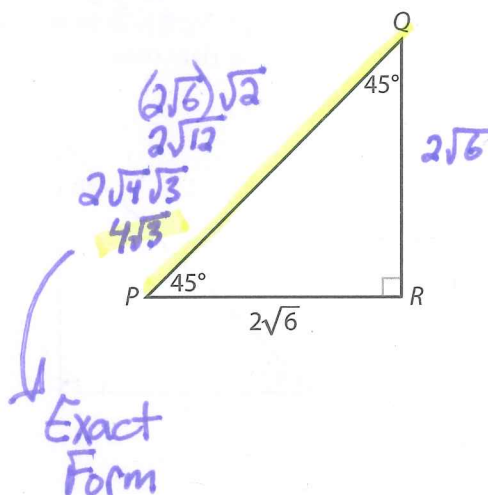
✏️ Explain 2   Trigonometric Ratios of Special Right Triangles

You can use the relationships you found in special right triangles to find trigonometric ratios for the angles 45°, 30°, and 60°.

Example 2   For each triangle, find the unknown side lengths and trigonometric ratios for the angles.

Ⓐ A 45°—45°—90° triangle with a leg length of 1

Step 1

Since the lengths of the sides opposite the 45° angles are congruent, they are both 1. The length of the hypotenuse is $\sqrt{2}$ times as long as each leg, so it is $1(\sqrt{2})$, or $\sqrt{2}$.

45°

$\sqrt{2}$ 1

45°
1
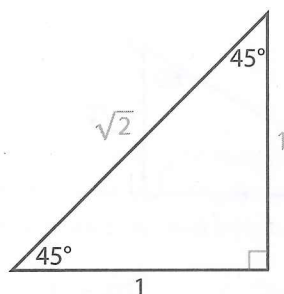
Step 2

Use the triangle to find the trigonometric ratios for 45°. Write each ratio as a simplified fraction.

Angle	Sine $= \dfrac{opp}{hyp}$	Cosine $= \dfrac{adj}{hyp}$	Tangent $= \dfrac{opp}{adj}$
45°	$\dfrac{\sqrt{2}}{2}$	$\dfrac{\sqrt{2}}{2}$	1

For each triangle, state whether the side lengths shown are possible. *pg 716*
Explain why or why not.

1.

6

$6\sqrt{3}$

60°

$3\sqrt{3}$

2.

$3\sqrt{3}$

45°

$3\sqrt{3}$ 45° $3\sqrt{6}$
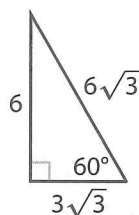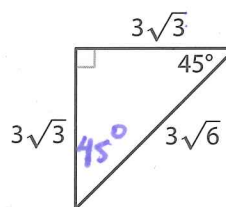
This is possible

45-45-90 ✓
legs ≅ ✓
hyp $3\sqrt{3} \cdot \sqrt{2} = 3\sqrt{6}$
$3\sqrt{6}$ True

3.
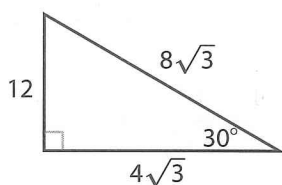
$8\sqrt{3}$

12

30°

$4\sqrt{3}$

4.

45-45-90 ✓
leg ≅ ✓
$6 = 2\sqrt{3} \cdot \sqrt{2}$?
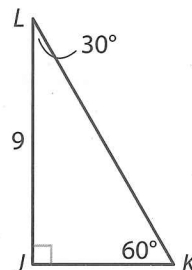$6 = 2\sqrt{6}$

6   $2\sqrt{3}$

False

45°

$2\sqrt{3}$

Find the unknown side lengths in each right triangle.

5.

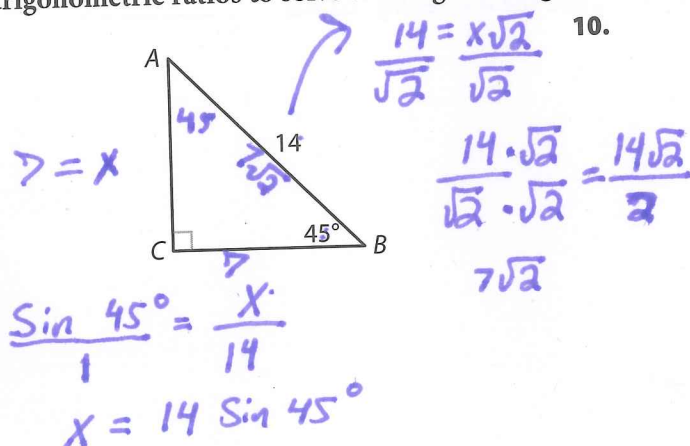$\dfrac{18 \cdot \sqrt{2}}{\sqrt{2} \cdot \sqrt{2}} = \dfrac{18\sqrt{2}}{2}$

$9\sqrt{2}$

A

45°   9

18   $\dfrac{18}{\sqrt{2}}$ B

45°   9

C

6.

L

30°

9

J   60°   K
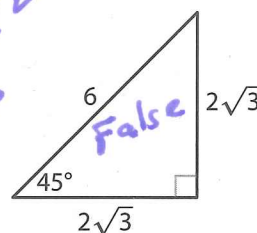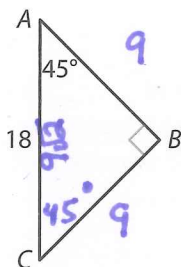
7. Right triangle UVW has acute angles U measuring 30° and W measuring 60°. Hypotenuse $\overline{UW}$ measures 12. (You may want to draw the triangle in your answer.)
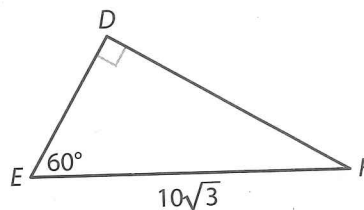
8. Right triangle PQR has acute angles P and Q measuring 45°. Leg $\overline{PR}$ measures $5\sqrt{10}$. (You may want to draw the triangle in your answer.)

Use trigonometric ratios to solve each right triangle.

9.

$$14 = \frac{x\sqrt{2}}{\sqrt{2}} \quad \frac{x\sqrt{2}}{\sqrt{2}}$$

$7 = x$

$$\frac{14 \cdot \sqrt{2}}{\sqrt{2} \cdot \sqrt{2}} = \frac{14\sqrt{2}}{2}$$

$7\sqrt{2}$

$$\frac{\sin 45°}{1} = \frac{x}{14}$$

$x = 14 \sin 45°$

Triangle ABC: angle $A = 45$, side 14, angle $B = 45°$, right angle at C.

10.

Triangle DEF: right angle at D, angle $E = 60°$, $EF = 10\sqrt{3}$.

11. Right $\triangle KLM$ with m∠$J = 45°$, leg $JK = 4\sqrt{3}$

$4\sqrt{3} \cdot \sqrt{2}$

$4\sqrt{6}$

$4\sqrt{3}$

Triangle JKL: angle $J = 45°$, angle $L = 45°$, right angle at K, $JK = 4\sqrt{3}$, $KL = 4\sqrt{3}$.

12. Right $\triangle PQR$ with m∠$Q = 30°$, leg $QR = 15$

Triangle PQR: angle $Q = 30°$, $QR = 15$, right angle at R.