# Soh Cah Toa

**Trigonometry Ratios:** sine, cosine, tangent, cotangent, secant, cosecant

*Sine*

$$\sin = \frac{opp}{hyp}$$

$$\cos = \frac{adj}{hyp}$$

$$\tan = \frac{opp}{adj}$$

*reciprocal functions*

$$\csc = \frac{hyp}{opp}$$

$$\sec = \frac{hyp}{adj}$$

$$\cot = \frac{adj}{opp}$$

*Cosecant*

*Secant*

*Cotangent*

**opposite leg**

**hypotenuse**

$\theta$
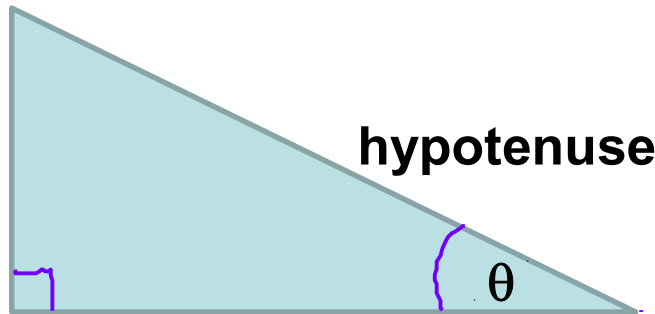
**adjacent leg**

**examples:**  given  find

a. $\tan\theta = \dfrac{1}{5}$     $\cot\theta = \dfrac{5}{1} = \boxed{5}$

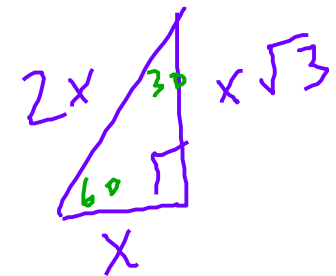b. $\sin\theta = 1.5 \quad \text{or} \quad \dfrac{3}{2}$     $\csc\theta = \boxed{\dfrac{2}{3}}$
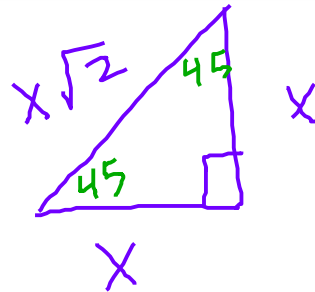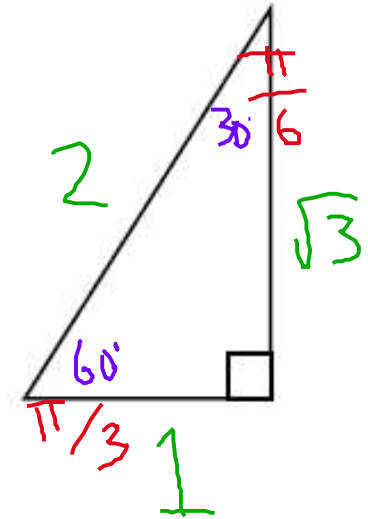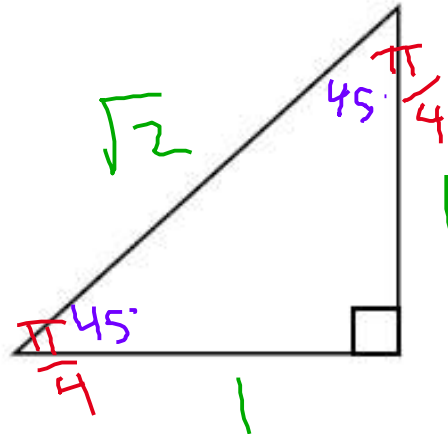
c. $\sec\theta = \dfrac{\sqrt{3}}{6}$     $\cos\theta = \dfrac{6}{\sqrt{3}}\cdot\dfrac{\sqrt{3}}{\sqrt{3}} = \dfrac{6\sqrt{3}}{3}$

$= \boxed{2\sqrt{3}}$

# Special Triangles

$30° - 60° - 90°$

$45° - 45° - 90°$

# Use your special triangles to complete chart:

| θ (degrees) | θ (radians) | sin θ | cos θ | tan θ | csc θ | sec θ | cot θ |
|---|---|---|---|---|---|---|---|
| 30° | $\dfrac{\pi}{6}$ | $\dfrac{1}{2}$ | $\dfrac{\sqrt{3}}{2}$ | $\dfrac{1}{\sqrt{3}} = \dfrac{\sqrt{3}}{3}$ | $\dfrac{2}{1} = 2$ | $\dfrac{2}{\sqrt{3}} = \dfrac{2\sqrt{3}}{3}$ | $\dfrac{\sqrt{3}}{1} = \sqrt{3}$ |
| 45° | $\dfrac{\pi}{4}$ | $\dfrac{\sqrt{2}}{2}$ ↔ | $\dfrac{\sqrt{2}}{2}$ | | | | |
| 60° | $\dfrac{\pi}{3}$ | $\dfrac{\sqrt{3}}{2}$ | $\dfrac{1}{2}$ | | | | |

*flip* → ... ← *flip*

Note: $\sin 30° = \cos \underline{\,60°\,}$     $\tan 30° = \cot \underline{\quad}$     $\sec 30° = \csc \underline{\quad}$

$\sin 45° = \cos \underline{\,45°\,}$     $\tan 45° = \cot \underline{\quad}$     $\sec 45° = \csc \underline{\quad}$

$\sin 60° = \cos \underline{\quad}$     $\tan 60° = \cot \underline{\quad}$     $\sec 60° = \csc \underline{\quad}$

# Check answers using this chart...or see textbook page 483 or ebook 6.2 "special triangles."

| θ in degrees | θ in radians | $\sin\theta$ | $\cos\theta$ | $\tan\theta$ | $\csc\theta$ | $\sec\theta$ | $\cot\theta$ |
|---|---|---|---|---|---|---|---|
| 30° | $\dfrac{\pi}{6}$ | $\dfrac{1}{2}$ | $\dfrac{\sqrt{3}}{2}$ | $\dfrac{\sqrt{3}}{3}$ | $2$ | $\dfrac{2\sqrt{3}}{3}$ | $\sqrt{3}$ |
| 45° | $\dfrac{\pi}{4}$ | $\dfrac{\sqrt{2}}{2}$ | $\dfrac{\sqrt{2}}{2}$ | $1$ | $\sqrt{2}$ | $\sqrt{2}$ | $1$ |
| 60° | $\dfrac{\pi}{3}$ | $\dfrac{\sqrt{3}}{2}$ | $\dfrac{1}{2}$ | $\sqrt{3}$ | $\dfrac{2\sqrt{3}}{3}$ | $2$ | $\dfrac{\sqrt{3}}{3}$ |

Note:

$\sin 30° = \cos \underline{\mathbf{60°}}$      $\tan 30° = \cot \underline{\mathbf{60°}}$      $\sec 30° = \csc \underline{\mathbf{60°}}$

$\sin 45° = \cos \underline{\mathbf{45°}}$      $\tan 45° = \cot \underline{\mathbf{45°}}$      $\sec 45° = \csc \underline{\mathbf{45°}}$

$\sin 60° = \cos \underline{\mathbf{30°}}$      $\tan 60° = \cot \underline{\mathbf{30°}}$      $\sec 60° = \csc \underline{\mathbf{30°}}$

$\sin 10° = \cos 80°$      $\sec 15° = \csc 75°$

Complementary angles add to 90° (equal ratios)

flip

$$\cot\theta = \frac{5}{3}$$

$$\tan\theta = \frac{3}{5}$$

first

$$c = \sqrt{34}$$

3

θ

5
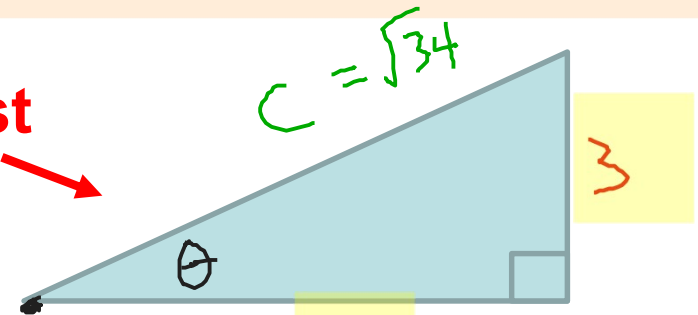
$$\sin\theta = \frac{3}{\sqrt{34}} = \frac{3\sqrt{34}}{34}$$

$$\csc\theta = \frac{\sqrt{34}}{3}$$

$$\cos\theta = \frac{5}{\sqrt{34}} = \frac{5\sqrt{34}}{34}$$

$$\sec\theta = \frac{\sqrt{34}}{5}$$

$$5^2 + 3^2 = c^2$$
$$25 + 9 = c^2$$
$$34 = c^2$$
$$\sqrt{34} = c$$

second

## 6.2 #38 Solve the right triangle. (Find all missing sides and angles.)


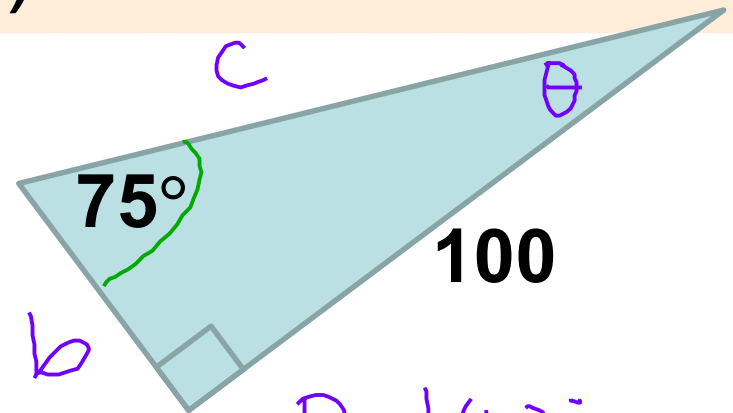
$$\frac{\sin 75}{1} = \frac{100}{c}$$

$$c \sin 75 = 100$$

$$c = \frac{100}{\sin 75}$$

$$\boxed{c \approx 103.53}$$

$$\tan 75 = \frac{100}{b}$$

$$b = \frac{100}{\tan 75}$$

$$\boxed{b \approx 26.79}$$

$$\theta = 180°$$
$$\underline{-165°}$$
$$\boxed{\theta = 15°}$$

Triangle labels: $c$, $\theta$, $75°$, $100$, $b$