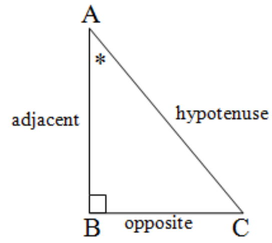
# Lesson 2: Trig Ratios & Special Angles

**Recall:** Primary Trigonometric Ratios

sine of ∠A ⟶ $\sin A = \frac{\text{opposite}}{\text{hypotenuse}}$ ⟶ $\sin A = \frac{O}{H}$

cosine of ∠A ⟶ $\cos A = \frac{\text{adjacent}}{\text{hypotenuse}}$ ⟶ $\cos A = \frac{A}{H}$

tangent of ∠A ⟶ $\tan A = \frac{\text{opposite}}{\text{adjacent}}$ ⟶ $\tan A = \frac{O}{A}$




** The easiest way to **MEMORIZE** these ratios is to use:

| SOH, CAH, TOA |
|---|

**NEW:** Reciprocal Trigonometric Ratios

cosecant of ∠$A$ ⟶ $\csc A = \frac{1}{\sin A}$ ⟶ $\csc A = \frac{H}{O}$

secant of ∠$A$ ⟶ $\sec A = \frac{1}{\cos A}$ ⟶ $\sec A = \frac{H}{A}$

cotangent of ∠$A$ ⟶ $\cot A = \frac{1}{\tan A}$ ⟶ $\cot A = \frac{A}{O}$

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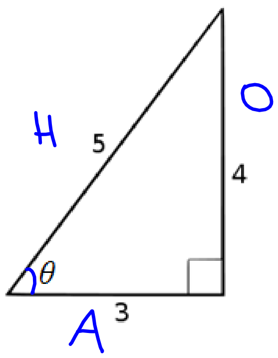
Ex 1) Determine the 6 trigonometric ratios for $\theta$.




$\sin\theta = \frac{4}{5}$ $\csc\theta = \frac{5}{4}$

$\cos\theta = \frac{3}{5}$ $\sec\theta = \frac{5}{3}$

$\tan\theta = \frac{4}{3}$ $\cot\theta = \frac{3}{4}$

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## Special Triangles

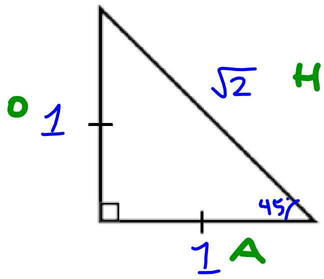
Special triangles are used to determine **exact ratios** for certain special angles. **(no calculators!)**

### 45-45-90 triangle

Consider a **right isosceles** triangle, with legs measuring 1 unit. Label the angles.

Determine the exact measure of the hypotenuse.

$a^2+b^2=c^2$
$1^2+1^2=c^2$
$2=c^2$
$\sqrt{2}=c$




From this we can determine the **exact values** of

sin 45° = $\frac{O}{H}$

$\sin 45° = \frac{1}{\sqrt{1}}$

cos 45° = $\frac{A}{H}$

$\cos 45° = \frac{1}{\sqrt{2}}$

tan 45° = $\frac{O}{A}$

$= \frac{1}{1}$

$\tan 45° = 1$

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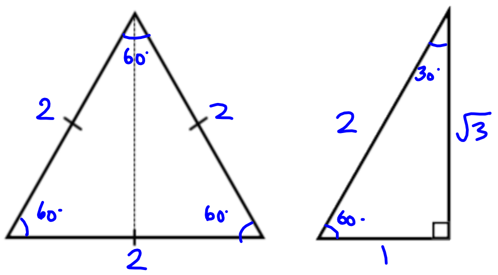
### 30-60-90 triangle

Consider an **equilateral** triangle, with sides measuring 2 units. Divide into 2 congruent right triangles (along the altitude). Determine the interior angles & the exact measure of each side.

$a^2+b^2=c^2$
$1^2+b^2=2^2$
$1+b^2=4$
$b^2=3$
$b=\sqrt{3}$




From this we can determine the **exact values** of

sin 30° = $\frac{1}{2}$

cos 30° = $\frac{\sqrt{3}}{2}$

tan 30° = $\frac{1}{\sqrt{3}} \cdot \frac{\sqrt{3}}{\sqrt{3}} = \frac{\sqrt{3}}{3}$

sin 60° = $\frac{\sqrt{3}}{2}$

cos 60° = $\frac{1}{2}$

tan 60° = $\sqrt{3}$

For all triangles, the ***smallest side*** is across from the ***smallest angle*** and the ***largest side*** is across from the ***largest angle***.

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"Rationalizing the denominator" is a process that is used to change a rational expression so it does *not* have a radical in the denominator. It uses the ***identity property of 1*** (any number multiplied by 1 retains its value.)

*NOTE: $\sin^2\theta = (\sin\theta)^2$ in both cases we are squaring the ratio, not the angle*
*($\sin^2\theta \neq \sin\theta^2$)*

Ex 2) Determine the exact value of $\boxed{\sin^2 60° \times \sin 45°.}$ Rationalize the denominator, if necessary.

$$= \left(\frac{\sqrt{3}}{2}\right)^2\left(\frac{\sqrt{2}}{2}\right)$$

$$= \left(\frac{3}{4}\right)\left(\frac{\sqrt{2}}{2}\right)$$

$$\boxed{= \frac{3\sqrt{2}}{8}}$$

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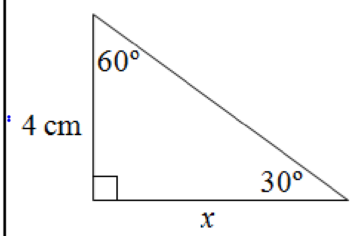
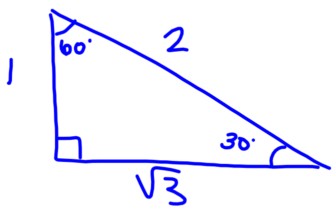
Ex 4) Use special triangles to determine the exact length of side *x*.




$$\frac{1}{\sqrt{3}} = \frac{4}{x}$$

$$\boxed{x = 4\sqrt{3}}$$

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HW U3L2:

1. p.280 #1-3, 5a)i,iv, 9

2. p.286 #3, 4, 5a, 6b, 8, 11

3. sign & correct tests