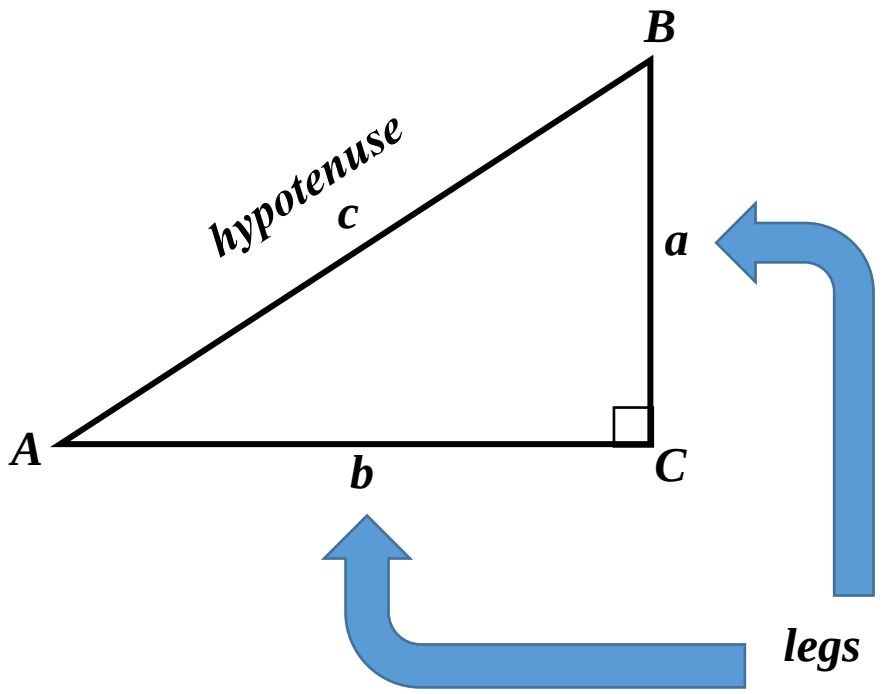
***Right Triangle Ratios:***

**For *A*, one of the acute angles in a right triangle, the trigonometric ratios-sine, cosine, and tangent of *A* are defined as follows.**

$$\sin A = \frac{\text{opposite}}{\text{hypotenuse}} = \frac{a}{c}$$

$$\cos A = \frac{\text{adjacent}}{\text{hypotenuse}} = \frac{b}{c}$$

$$\tan A = \frac{\text{opposite}}{\text{adjacent}} = \frac{a}{b}$$

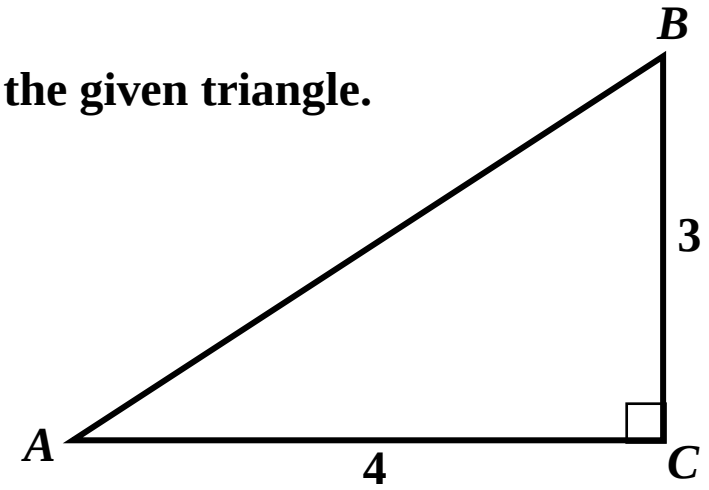


**Example:**

**Find the following trigonometric ratio values from the given triangle.**

*First, use the Pythagorean Theorem* $(a^2 + b^2 = c^2)$

*to find the length of the hypotenuse.*

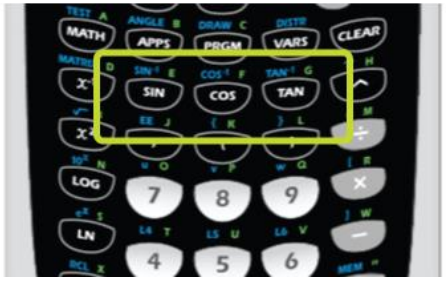



$\sin A =$ $\sin B =$

$\cos A =$ $\cos B =$

$\tan A =$ $\tan B =$

**The values of trigonometric ratios for specific angles can be determined using a scientific calculator. Just make sure that the angle measure on the calculator is set to *degrees*.**




**Examples: Find the values of the following trigonometric ratios to four decimal places.**

$sin10° =$ $sin80° =$

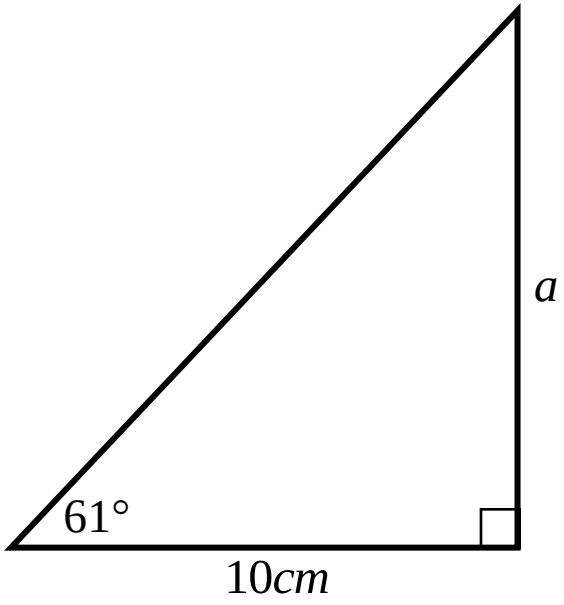
$cos15° =$ $cos\,75° =$

$tan\,25° =$ $tan\,65° =$

**Finding the length of a leg of a right triangle:**

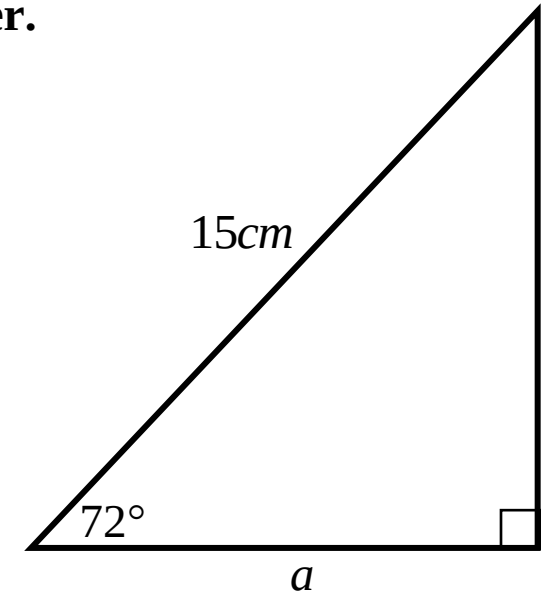
**1. Find the value of *a* to the nearest whole centimeter.**

$$tan\,61° = \frac{a}{10}$$

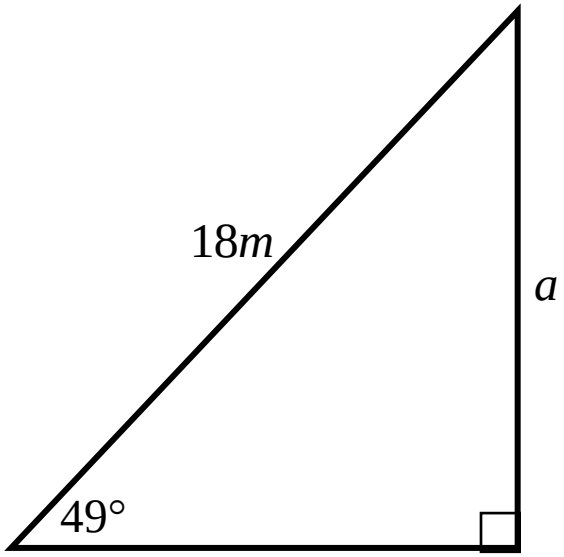


**2. Find the value of *a* to the nearest tenth of a centimeter.**

$$\cos 72° = \frac{a}{15}$$



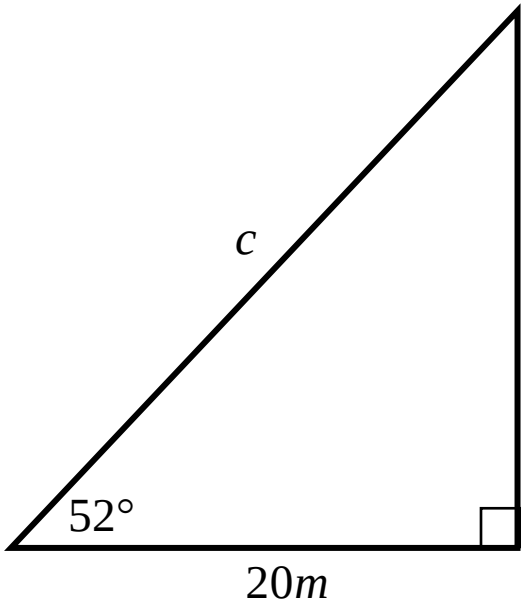
**3. Find the value of *a* to the nearest tenth of a meter.**




$$\sin 49° = \frac{a}{18}$$

**Finding the length of the hypotenuse of a right triangle:**

**Find the value of *c* to the nearest tenth of a meter.**

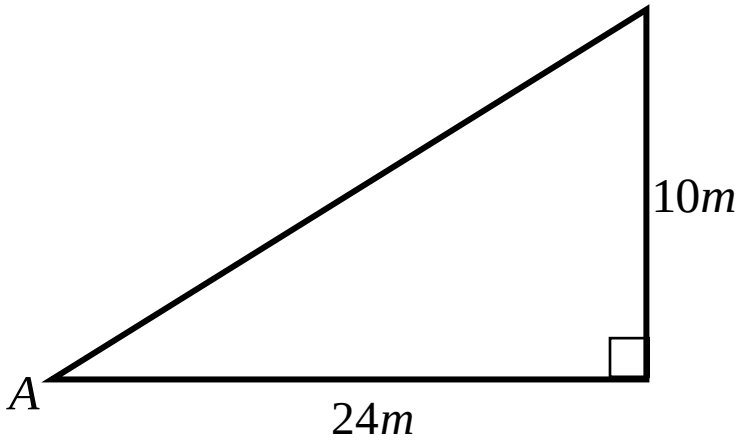



$$\cos 52° = \frac{20}{c}$$

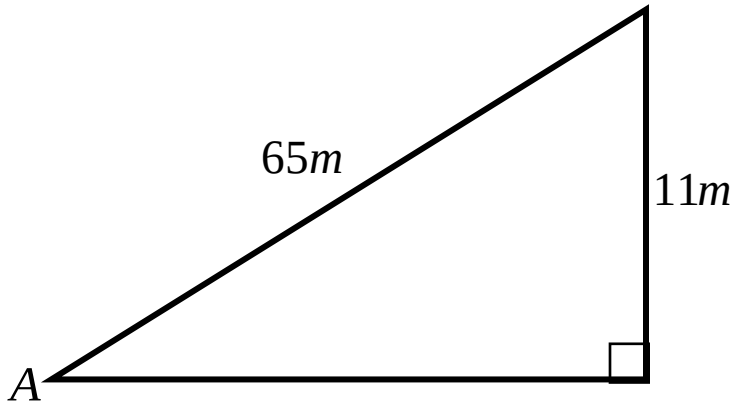
**Scientific calculators can also read a given trigonometric ratio value back to a specific angle value. These reversals are done by using one of the three inverse trigonometric keys:** $sin^{-1}, cos^{-1}, tan^{-1}$**.**


**1. Find the measure of angle *A* to the nearest tenth of a degree.**

$$\angle A = tan^{-1}\frac{\text{opposite}}{\text{adjacent}} = tan^{-1}\frac{\quad}{\quad} =$$

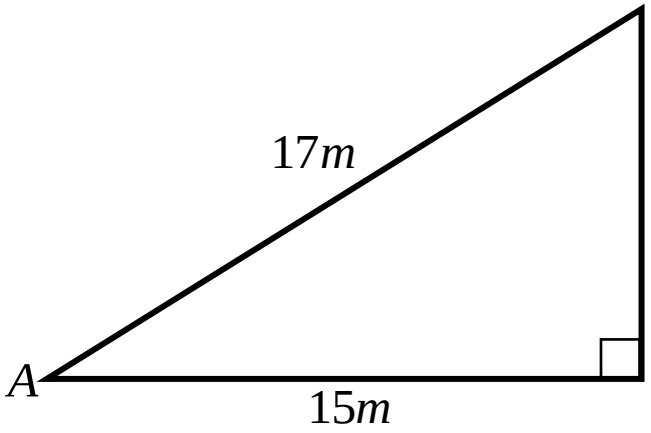


**2. Find the measure of angle *A* to the nearest tenth of a degree.**




$$\angle A = sin^{-1}\frac{\text{opposite}}{\text{hypotenuse}} = sin^{-1}\frac{\quad}{\quad} =$$

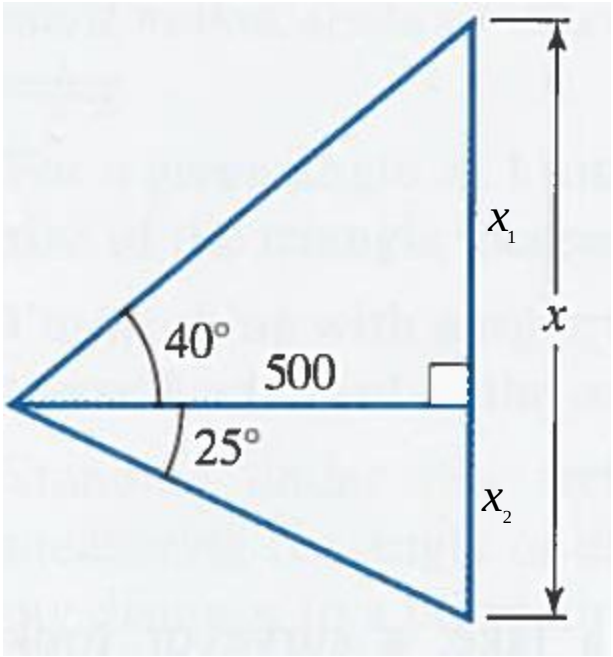
**3. Find the measure of angle *A* to the nearest tenth of a degree.**




$$\angle A = cos^{-1}\frac{\text{adjacent}}{\text{hypotenuse}} = cos^{-1}\frac{\quad}{\quad} =$$

**Finding missing measurements using more than one trigonometric ratio.**

**1. Find the value of *x* to the nearest whole number.**



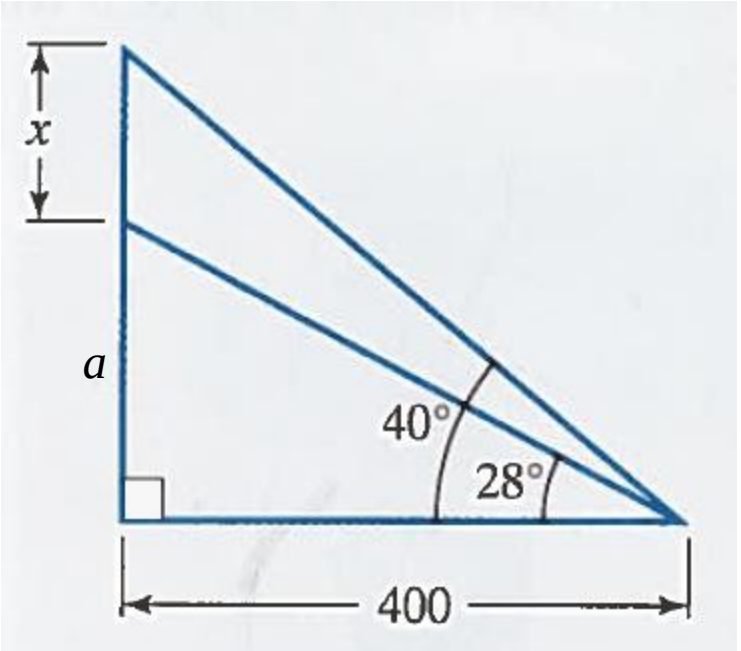

**Notice that** $x = x_1 + x_2$**, and that** $tan\,40° = \dfrac{x_1}{500}$

**and** $tan\,25° = \dfrac{x_2}{500}$**.**

**So** $x = 500\left(tan\,40°\right) + 500\left(tan\,25°\right)$

$=$

**2. Find the value of *x* to the nearest whole number.**



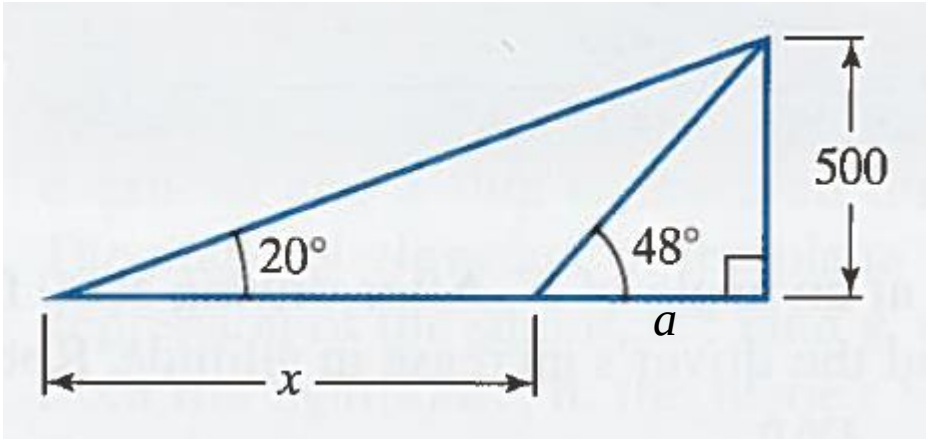

**Notice that** $x + a = 400\left(tan\,40°\right)$ **and**

$a = 400\left(tan\,28°\right)$**.**

**So** $x = 400\left(tan\,40°\right) - 400\left(tan\,28°\right)$

$=$

**3. Find the value of *x* to the nearest whole number.**




**Notice that** $\frac{500}{x+a} = tan\,20°$ **and**

$\frac{500}{a} = tan\,48°$**.**

**These lead to** $x + a = \frac{500}{tan\,20°}$ **and** $a = \frac{500}{tan\,48°}$**.**

**So** $x = \frac{500}{tan\,20°} - \frac{500}{tan\,48°}$

$=$