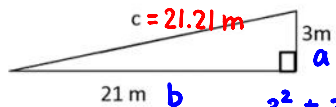


Finding Side Lengths in Right Triangles

Given 2 sides of a right triangle it is always possible to find the 3rd side using Pythagorean Theorem.

Examples

$$a^2 + b^2 = c^2$$

$$\begin{array}{ccc} \uparrow & \uparrow & \uparrow \\ 3 & 21 & c \end{array}$$


$$3^2 + 21^2 = c^2$$

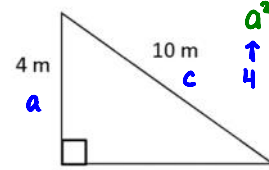
$$9 + 441 = c^2$$

$$450 = c^2$$

$$\sqrt{450} = c$$

$$21.21 \hat{=} c$$

$$a^2 + b^2 = c^2$$

$$\begin{array}{ccc} \uparrow & \uparrow & \uparrow \\ 4 & x & 10 \end{array}$$


$$4^2 + x^2 = 10^2$$

$$16 + x^2 = 100$$

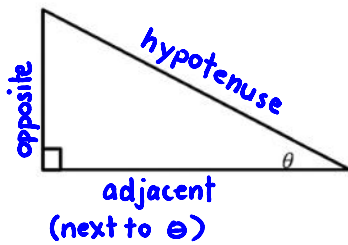
$$-16 \quad -16$$

$$x^2 = 84$$

$$x = \sqrt{84}$$

$$x \hat{=} 9.17 \text{ m}$$

If we know the value of one of the angles of a right triangle (other than the 90° angle) then we may use the sine, cosine and tangent ratios to find the other sides in the triangle. SOH CAH TOA



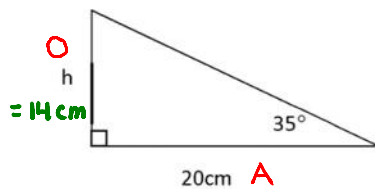
$$\sin \theta = \frac{\text{opposite}}{\text{hypotenuse}}$$

$$\cos \theta = \frac{\text{adjacent}}{\text{hypotenuse}}$$

$$\tan \theta = \frac{\text{opposite}}{\text{adjacent}}$$

Examples

Find the unknown side in each triangle below.



$$20 \cdot \tan 35^\circ = \frac{h}{20} \cdot 20$$

$$20 \tan 35 = h$$

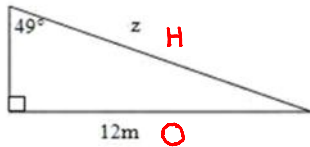
$$14 \text{ cm} = h$$



$$15 \cdot \sin 31^\circ = \frac{h}{15} \cdot 15$$

$$15 \sin 31 = h$$

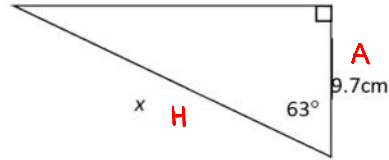
$$7.73 \text{ cm} = h$$



$$\sin 49^\circ = \frac{12}{z}$$

$$z = \frac{12}{\sin 49^\circ}$$

$$z \approx 15.9 \text{ m}$$

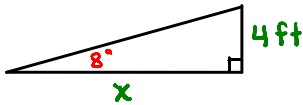


$$\cos 63^\circ = \frac{9.7}{x}$$

$$x = \frac{9.7}{\cos 63^\circ}$$

$$\approx 21.37 \text{ cm}$$

A wheelchair ramp is required to have an angle of elevation (inclination) that is not greater than 8° . Suppose a wheelchair ramp needs to reach an entranceway that is 4 feet off the ground. What horizontal length does the wheelchair ramp need to have?



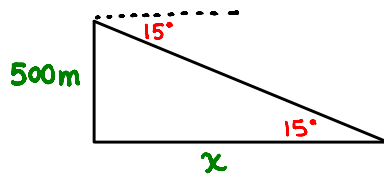
$$\tan 8^\circ = \frac{4}{x}$$

$$x = \frac{4}{\tan 8^\circ}$$

$$\approx 28.5 \text{ ft}$$

The wheelchair ramp needs to have a horizontal length of at least 28.5 ft.

A helicopter spots a boat that needs rescuing. The helicopter is flying at an elevation of 500m. The angle of depression to the boat is 15° . How far does the helicopter need to fly so it is directly over top of the boat?



angle of depression = angle of elevation

$$\tan 15^\circ = \frac{500}{x}$$

$$x = \frac{500}{\tan 15^\circ}$$

$$\approx 1866 \text{ m}$$

The helicopter needs to fly 1866 m.