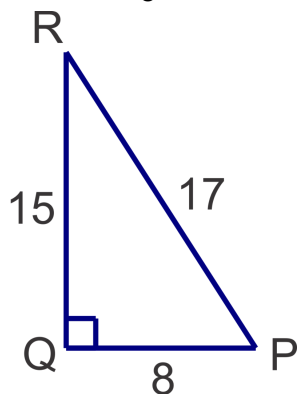


Example A

Find the trig ratios for the acute angles R and P in $\triangle PQR$.



Solution: From angle R , $O = 8$; $A = 15$; and $H = 17$. Now the trig ratios are:

$$\sin R = \frac{8}{17}; \cos R = \frac{15}{17}; \tan R = \frac{8}{15}$$

From angle P , $O = 15$; $A = 8$; and $H = 17$. Now the trig ratios are:

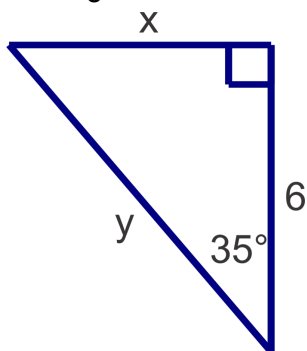
$$\sin P = \frac{15}{17}; \cos P = \frac{8}{17}; \tan P = \frac{15}{8}$$

Do you notice any patterns or similarities between the trigonometric ratios? The opposite and adjacent sides are switched and the hypotenuse is the same. Notice how this switch affects the ratios:

$$\sin R = \cos P \quad \cos R = \sin P \quad \tan R = \frac{1}{\tan P}$$

Example B

Use trigonometric ratios to find the value of x and y .



Solution: First identify or label the sides with respect to the given acute angle. So, x is opposite, y is hypotenuse (note that it is the hypotenuse because it is the side opposite the right angle, it may be adjacent to the given angle but the hypotenuse cannot be the adjacent side) and 6 is the adjacent side.

To find x , we must use the given length of 6 in our ratio too. So we are using opposite and adjacent. Since tangent is the ratio of opposite over adjacent we get:

$$\tan 35^\circ = \frac{x}{6}$$

$$x = 6 \tan 35^\circ \quad \text{multiply both sides by 6}$$

$$x \approx 4.20 \quad \text{Use the calculator to evaluate-type in } 6\tan(35) \text{ ENTER}$$

NOTE: make sure that your calculator is in DEGREE mode. To check, press the MODE button and verify that DEGREE is highlighted (as opposed to RADIAN). If it is not, use the arrow buttons to go to DEGREE and press ENTER. The default mode is radian, so if your calculator is reset or the memory is cleared it will go back to radian mode until you change it.

To find y using trig ratios and the given length of 6, we have adjacent and hypotenuse so we'll use cosine:

$$\cos 35^\circ = \frac{6}{y}$$

$$\frac{\cos 35^\circ}{1} = \frac{6}{y} \quad \text{set up a proportion to solve for } y$$

$$6 = y \cos 35^\circ \quad \text{cross multiply}$$

$$y = \frac{6}{\cos 35^\circ} \quad \text{divide by } \cos 35^\circ$$

$$y = 7.32 \quad \text{Use the calculator to evaluate-type in } 6/\cos(35) \text{ ENTER}$$

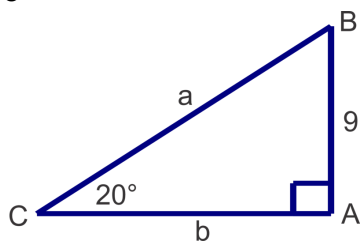
Alternatively, we could find y using the value we found for x and the Pythagorean theorem:

The downside of this method is that if we miscalculated our x value, we will double down on our mistake and guarantee an incorrect y value. In general you will help avoid this kind of mistake if you use the given information whenever possible.

Example C

Given $\triangle ABC$, with $m\angle A = 90^\circ$, $m\angle C = 20^\circ$ and $c = 9$, find a and b .

Solution: Visual learners may find it particularly useful to make a sketch of this triangle and label it with the given information:



To find a (the hypotenuse) we can use the opposite side and the sine ratio: $\sin 20^\circ = \frac{9}{a}$, solving as we did in Example B we get $a = \frac{9}{\sin 20^\circ} \approx 26.31$. To find b (the adjacent side) we can use the opposite side and the tangent ratio: $\tan 20^\circ = \frac{9}{b}$, solving for b we get $b = \frac{9}{\tan 20^\circ} \approx 24.73$.