Southern New Hampshire University

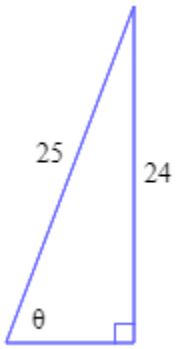
MAT 140 Final Project: Problem Walkthroughs

Alexander Ahmann

Southern New Hampshire University

Southern New Hampshire University

1. Given the following right triangle find cosθ, sinθ, tanθ, secθ, cscθ, and cotθ. Do not approximate: Find exact answers. Show all of your work and explain steps as necessary.



Before we can work out the trigonometric ratios for this triangle's θ, we must work out the length of the adjacent (a) value of the triangle. The Pythagorean theorem can be applied to work out the "a" value; given an opposite value (o) of 24 and a hypotenuse (h) value of 25, we have:

$$\begin{aligned} a^2 + o^2 &= h^2 \\ \Rightarrow a^2 + 24^2 &= 25^2 \\ \Rightarrow a + 576 &= 625 \\ \Rightarrow a &= 625 - 576 \\ \Rightarrow a &= \sqrt{49} \\ \Rightarrow a^2 &= 7 \end{aligned}$$

With an adjacent side of 7 units, we are now ready to work out the trigonometric ratios:

$\sin\theta = \frac{o}{h} = \frac{24}{25}$	$\csc\theta = \frac{h}{o} = \frac{25}{24}$
$\cos\theta = \frac{a}{h} = \frac{7}{25}$	$\sec\theta = \frac{h}{a} = \frac{25}{7}$
$\tan\theta = \frac{o}{a} = \frac{24}{7}$	$\cot\theta = \frac{a}{o} = \frac{7}{24}$

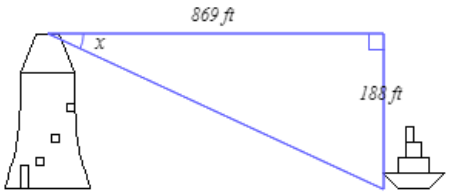
2. Prove the identity:

$$\frac{\sin(x-y)}{\cos x \cos y} = \tan x - \tan y$$

Statement	**Rule**
$\frac{\sin(x-y)}{\cos x \cos y}$	
$\frac{\sin x \cos y - \sin y \cos x}{\cos x \cos y}$	Sum differences
$\frac{\sin x \cos y}{\cos x \cos y} - \frac{\sin y \cos x}{\cos x \cos y}$	Algebra ("split" the fraction)
$\frac{\sin x}{\cos x} - \frac{\sin y}{\cos y}$	Algebra ("cancel out" unnecessary terms)
$\tan x - \tan y$	Quotient rule

3. Solve the following word problem for the angle *x*.

Find x, the angle of depression from the top of a lighthouse that is 188 ft above water level to the waterline of a ship 869 ft off shore. Round your answer to the nearest tenth of a degree.



Working out the "x," or the angle of depression, in this problem is fairly simple. We know the length of the adjacent line to "x" (a = 869 ft) and the length of the opposite line to "x" (o = 188 ft). So, we need to apply the tangent to work out

$$\tan x = \frac{o}{a}$$
$$\Rightarrow \tan x = \frac{188}{869}$$
$$\Rightarrow \tan x = 0.2°$$