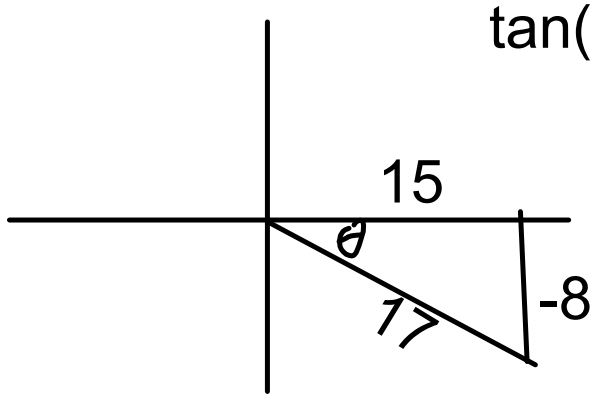
$\tan(\theta)=-8/15$



$15^2 + 8^2 = 289$

$\sin(\theta)= -8/17$

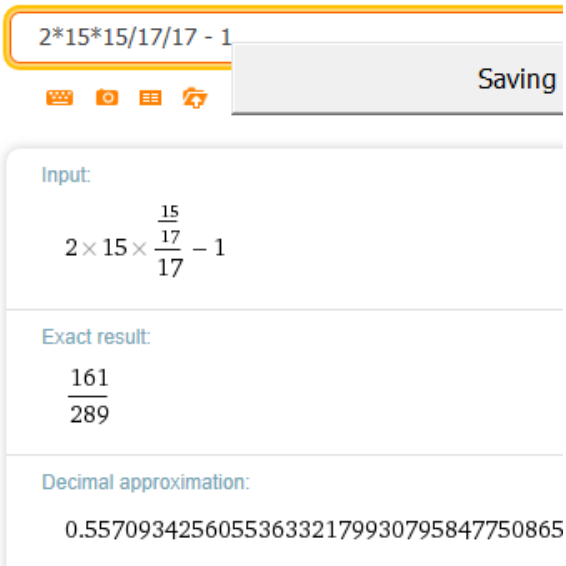
$\cos(\theta)=15/17$

$\sin(2\theta)=2(-8/17)(15/17)=-240/289$

$\cos(2\theta)=2(15/17)(15/17)-1=161/289$

$$\tan(2x)=\frac{\sin(2x)}{\cos(2x)} = \frac{-240}{161}$$

$$\begin{aligned}
\sin 2x &= 2\sin x\cos x \\
\cos 2x &= \cos^2 x - \sin^2 x \\
&= 1-2\sin^2 x \\
&= 2\cos^2 x - 1 \\
\tan 2x &= \frac{2\tan x}{1-\tan^2 x}
\end{aligned}$$



$\frac{\sin\left(x+\frac{\pi}{2}\right)}{\sin(\pi-x)}$	
$=\frac{\sin(x)\cos\left(\frac{\pi}{2}\right)+\cos(x)\sin\left(\frac{\pi}{2}\right)}{\sin(\pi-x)}$	Sum and Difference
$=\frac{\sin(x)\cos\left(\frac{\pi}{2}\right)+\cos(x)\sin\left(\frac{\pi}{2}\right)}{\sin(\pi)\cos(x)-\cos(\pi)\sin(x)}$	Sum and Difference
$=\frac{\sin(x)0+\cos(x)1}{0\cos(x)-(-1)\sin(x)}$	Evaluation
$=\frac{\cos(x)}{\sin(x)}$	Algebra
$=\cot x$	Quotient

$\frac{1}{\cot x(1-\cos 2x)}$	
$=\frac{1}{\cot x(2\sin^2 x)}$	Double-angle
$=\frac{1}{\frac{\cos x}{\sin x}(2\sin^2 x)}$	Quotient
$=\frac{1}{2\cos x\sin x}$	Algebra
$=\frac{1}{\sin(2x)}$	Double-angle
$=\csc(2x)$	Reciprocal

tan(105degrees)

Input:

$\tan(105°)$

Exact result:

$-$

Decimal approximation:

-3.732050807568877

tan(105degrees)

Input:

$\tan(105°)$

Exact result:

$-2-\sqrt{3}$

Half-angle identities: Problem type 1

Use a half-angle formula to find the exact value of $\tan 105°$.

We have the following trigonometric half-angle formulas.

$$\sin\frac{u}{2}=\pm\sqrt{\frac{1-\cos u}{2}}$$

$$\cos\frac{u}{2}=\pm\sqrt{\frac{1+\cos u}{2}}$$

$$\tan\frac{u}{2}=\pm\sqrt{\frac{1-\cos u}{1+\cos u}}=\frac{\sin u}{1+\cos u}=\frac{1-\cos u}{\sin u}$$

tan(210/2)=(1-cos(210))/sin(210)

$(1-(-\sqrt{3}/2))/-.5$

= -2 - sqrt(3)