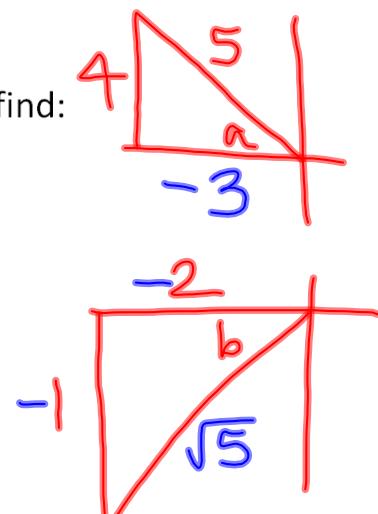


Review:

Given  $\csc a = \frac{5}{4}$ ,  $a \in QII$ , and  $\tan b = \frac{1}{2}$ ,  $b \in QIII$ , find:

$$\begin{aligned}\cos(a - b) &= \frac{\cos a \cos b + \sin a \sin b}{\sqrt{5}} \\ &= \left(\frac{-3}{5}\right)\left(\frac{-2}{\sqrt{5}}\right) + \left(\frac{4}{5}\right)\left(\frac{-1}{\sqrt{5}}\right) \\ &= \frac{6}{5\sqrt{5}} - \frac{4}{5\sqrt{5}} = \boxed{\frac{2}{5\sqrt{5}}} \\ \sin(2a) &= 2 \sin a \cos a \\ &= 2 \left(\frac{4}{5}\right)\left(\frac{-3}{5}\right) = \boxed{-\frac{24}{25}}\end{aligned}$$



$$\begin{aligned}\tan\left(\frac{a}{2}\right) &= \frac{1 - \cos a}{\sin a} = \frac{5}{4} \cdot \frac{1 - \left(-\frac{3}{5}\right)}{\frac{4}{5}} = \frac{\frac{5}{4} + \frac{3}{5}}{\frac{4}{5}} = \frac{\frac{25}{20} + \frac{12}{20}}{\frac{4}{5}} = \frac{\frac{37}{20}}{\frac{4}{5}} = \frac{37}{16} = \boxed{2}\end{aligned}$$

Prove:

1.  $\tan x + \cot x = \sec x \csc x$
2.  $\frac{\cos 2x}{\sin^2 x} = \csc^2 x - 2$
3.  $\frac{1}{2} \csc^2 \frac{x}{2} = \csc^2 x + \cot x \csc x$
4.  $\sec 2x = \frac{\sec^2 x}{2 - \sec^2 x}$
5.  $\tan \frac{x}{2} = \frac{\tan x}{\sec x + 1}$
6.  $\frac{1 + \cos 2x}{\sin 2x} = \cot x$
7.  $\frac{\sin x - \cos x}{\cos^2 x} = \frac{\tan^2 x - 1}{\sin x + \cos x}$
8.  $\sin 3x \cos 3x = \frac{1}{2} \sin 6x$

$$\begin{aligned}3. LHS &= \frac{1}{2} \left( \csc \frac{x}{2} \right)^2 \\ &= \frac{1}{2} \cdot \left[ \frac{1}{\sin \frac{x}{2}} \right]^2 = \frac{1}{2} \left[ \frac{1}{\sqrt{\frac{1-\cos x}{2}}} \right]^2 \\ &= \frac{1}{2} \cdot \frac{1}{\left( \frac{1-\cos x}{2} \right)} = \frac{1}{2} \cdot \frac{2}{1-\cos x} \\ &= \frac{1}{1-\cos x} \cdot \frac{1+\cos x}{1+\cos x} = \dots\end{aligned}$$

9.  $\cos^2 x - 2 \sin^2 x \cos^2 x - \sin^2 x + 2 \sin^4 x = \cos^2 2x$
10.  $\cos 3x = 4 \cos^3 x - 3 \cos x$