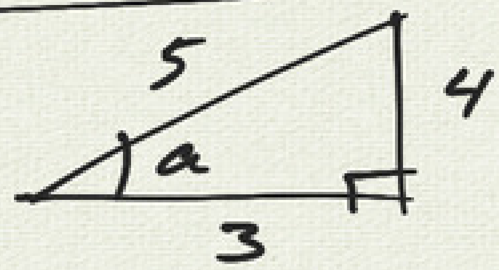
7.2 (21) $\sin a = \frac{4}{5}$ find $\sin(a-b)$

$\cos b = \frac{1}{3}$ $\cos(a+b)$

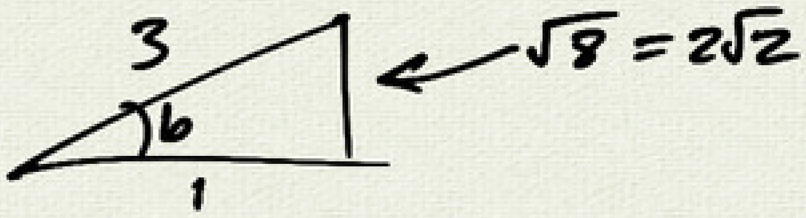
$$\boxed{\begin{aligned} \sin(a+b) &= \sin a \cos b + \cos a \sin b \\ \cos(a+b) &= \cos a \cos b - \sin a \sin b \end{aligned}}$$

sum formulas



$\cos a = \frac{3}{5}$

$\sin b = \frac{2\sqrt{2}}{3}$



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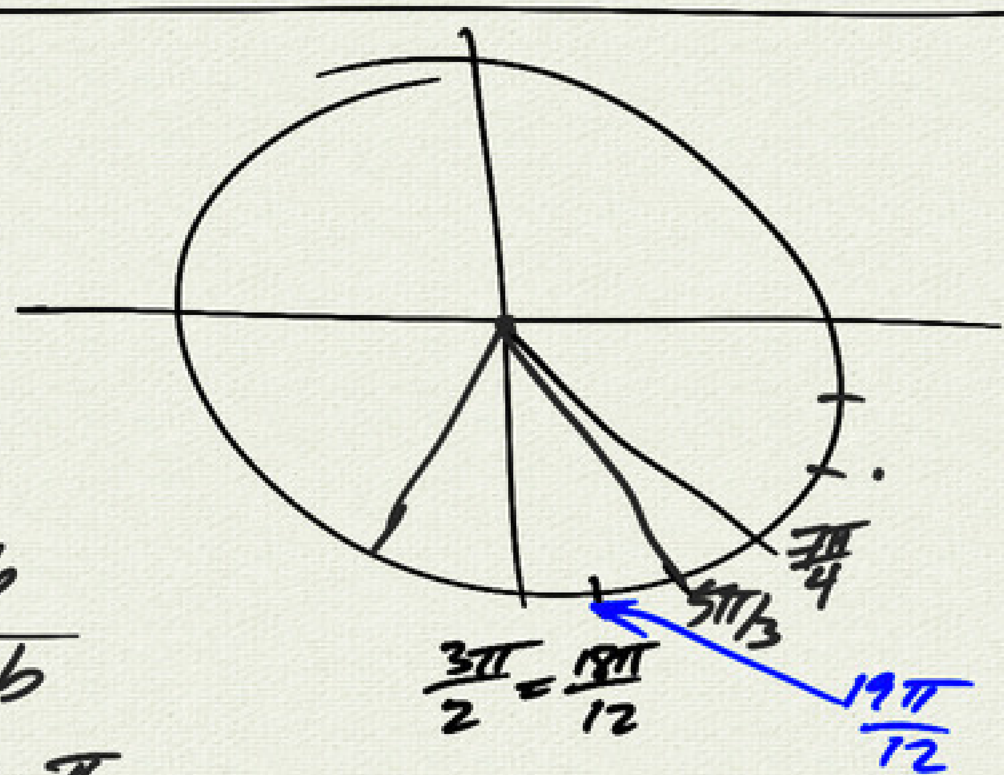
(9) $\tan \frac{19\pi}{12}$



$\boxed{\frac{7\pi}{4} - \frac{\pi}{6}} = \frac{21\pi}{12} - \frac{2\pi}{12}$

$= \frac{19\pi}{12}$

$\tan(a+b) = \dfrac{\tan a \pm \tan b}{1 \mp \tan a \tan b}$

$\tan\left(\frac{7\pi}{4} - \frac{\pi}{6}\right) = \dfrac{\tan\frac{7\pi}{4} - \tan\frac{\pi}{6}}{1 + \tan\frac{7\pi}{4}\tan\frac{\pi}{6}}$

$= \dfrac{-1 - \frac{1}{\sqrt{3}}}{1 + (-1)(\frac{1}{\sqrt{3}})} \cdot \dfrac{\sqrt{3}}{\sqrt{3}}$

$= \dfrac{-\sqrt{3} - 1}{\sqrt{3} - 1}$

$= -\dfrac{(\sqrt{3}+1)}{\sqrt{3}-1} = \dfrac{1+\sqrt{3}}{1-\sqrt{3}}$

$\boxed{7.1}$ $\boxed{\#29-33}$ verify identies

verify

(30) $\cos x\left(\tan x-(\sec(-x))\right)=\sin x-1$

$$\cos x\left(\tan x-(\sec(-x))\right)=\cos x\left(\frac{\sin x}{\cos x}-\frac{1}{\cos(-x)}\right)$$

$$=\cos x\left(\frac{\sin x}{\cos x}-\frac{1}{\cos x}\right) \quad \left(\begin{matrix}\text{cos}\\ \text{is}\\ \text{even}\end{matrix}\right)$$

$$=\sin x-1 \quad \checkmark$$

2.3 Multiple Angle Identities

$$\boxed{\begin{aligned} \sin(u+v) &= \sin u \cos v + \cos u \sin v \\ \cos(u+v) &= \cos u \cos v - \sin u \sin v \end{aligned}}$$

sum formulas

$u = v$

$$\sin(2u) = \sin(u+u)$$
$$= \sin u \cos u + \cos u \sin u$$
$$\boxed{\sin 2u = 2 \sin u \cos u}$$

double angle formula

$$\cos 2u = \cos(u+u)$$
$$= \cos u \cos u - \sin u \sin u$$
$$\boxed{\cos 2u = \cos^2 u - \sin^2 u}$$
$$= 2\cos^2 u - 1$$
$$= 1 - 2\sin^2 u$$

$$\sin^2 u + \cos^2 u = 1$$
$$\sin^2 u = 1 - \cos^2 u$$
$$\cos^2 u = 1 - \sin^2 u$$

$$\cos 2u = 2\underline{\cos^2 u} - 1$$
$$2\cos^2 u = 1 + \cos 2u$$
$$\cos^2 u = \frac{1 + \cos 2u}{2}$$

power reducing

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

half angle formula

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

e.g. $\cos 15^\circ = \pm \sqrt{\dfrac{1 + \cos 30^\circ}{2}}$

$$= \pm \sqrt{\frac{1 + \sqrt{3}/2}{2} \cdot \frac{2}{2}}$$
$$= \pm \sqrt{\frac{2 + \sqrt{3}}{4}}$$
$$= \pm \frac{\sqrt{2 + \sqrt{3}}}{2} \overset{?}{=} \frac{\sqrt{2} + \sqrt{6}}{4}$$

challenge: show these are equal