Notes Section 7.2: Addition & Subtraction formulas

$$\sin(u+v) = \sin u\cos v + \cos u\sin v$$
$$\sin(u-v) = \sin u\cos v - \cos u\sin v$$
$$\cos(u+v) = \cos u\cos v - \sin u\sin v$$
$$\cos(u-v) = \cos u\cos v + \sin u\sin v$$

$$\tan(u+v) = \frac{\tan u + \tan v}{1 - \tan u\tan v}$$

$$\tan(u-v) = \frac{\tan u - \tan v}{1 + \tan u\tan v}$$

$$\sin(105^\circ) = \sin(60^\circ + 45^\circ) = \sin 60^\circ\cdot\cos 45^\circ + \cos 60^\circ\cdot\sin 45$$
$$\frac{\sqrt{3}}{2}\cdot\frac{\sqrt{2}}{2} + \frac{1}{2}\cdot\frac{\sqrt{2}}{2}$$
$$\frac{\sqrt{6}}{4} + \frac{\sqrt{2}}{4} = \frac{\sqrt{6}+\sqrt{2}}{4}$$

$$\cos\left(\frac{\pi}{12}\right) = \cos\left(\frac{4\pi}{12} - \frac{3\pi}{12}\right) = \cos\left(\frac{\pi}{3} - \frac{\pi}{4}\right)$$
$$= \cos\frac{\pi}{3}\cos\frac{\pi}{4} + \sin\frac{\pi}{3}\sin\frac{\pi}{4}$$
$$= \frac{1}{2}\cdot\frac{\sqrt{2}}{2} + \frac{\sqrt{3}}{2}\cdot\frac{\sqrt{2}}{2} = \frac{\sqrt{2}+\sqrt{6}}{4}$$

$$\tan\left(\frac{19\pi}{12}\right) = \tan\left(\frac{15\pi}{12} + \frac{4\pi}{12}\right) = \tan\left(\frac{5\pi}{4} + \frac{\pi}{3}\right)$$
$$= \frac{\tan\frac{5\pi}{4} + \tan\frac{\pi}{3}}{1 - \tan\frac{5\pi}{4}\cdot\tan\frac{\pi}{3}} = \frac{1+\sqrt{3}}{1-1\cdot\sqrt{3}}$$
$$-2-\sqrt{3} = \frac{4+2\sqrt{3}}{-2} = \frac{1+2\sqrt{3}+3}{1-3} = \frac{(1+\sqrt{3})}{(1+\sqrt{3})}\frac{1+\sqrt{3}}{1-\sqrt{3}}$$

Identity: $\cot\left(\frac{\pi}{2}-u\right) = \tan u$

$\frac{1}{\tan\left(\frac{\pi}{2}-u\right)}$ ← undefined won't work

use $\frac{\cos\left(\frac{\pi}{2}-u\right)}{\sin\left(\frac{\pi}{2}-u\right)}$

$$= \frac{\cos\frac{\pi}{2}\cos u + \sin\frac{\pi}{2}\sin u}{\sin\frac{\pi}{2}\cos u - \cos\frac{\pi}{2}\sin u}$$

$\cos\frac{\pi}{2} = 0$

$\sin\frac{\pi}{2} = 1$

$$= \frac{0\cdot\cos u + 1\cdot\sin u}{1\cdot\cos u - 0\cdot\sin u}$$

$$= \frac{\sin u}{\cos u} = \tan u$$

$A\sin x + B\cos x = k\sin(x+\theta)$ $\quad k = \sqrt{A^2+B^2}$

$\sin x + \cos x$

$\cos\phi = \frac{A}{\sqrt{A^2+B^2}} = \frac{A}{k}$ $\quad \sin\phi = \frac{B}{\sqrt{A^2+B^2}} = \frac{B}{k}$