3. Trigonometric Functions of Compound Angles

- **Trigonometric identities and formulas:**
  - $\operatorname{cosec} x = \frac{1}{\sin x}$
  - $\sec x = \frac{1}{\cos x}$
  - $\tan x = \frac{\sin x}{\cos x}$
  - $\cot x = \frac{1}{\tan x} = \frac{\cos x}{\sin x}$
  - $\cos^2 x + \sin^2 x = 1$
  - $1 + \tan^2 x = \sec^2 x$
  - $1 + \cot^2 x = \operatorname{cosec}^2 x$
  - $\cos(2n\pi + x) = \cos x, n \in Z$
  - $\sin(2n\pi + x) = \sin x, n \in Z$
  - $\sin(-x) = -\sin x$
  - $\cos(-x) = \cos x$
  - $\cos(x + y) = \cos x \cos y - \sin x \sin y$
  - $\cos(x - y) = \cos x \cos y + \sin x \sin y$
  - $\cos\left(\frac{\pi}{2} - x\right) = \sin x$
  - $\sin\left(\frac{\pi}{2} - x\right) = \cos x$
  - $\sin(x + y) = \sin x \cos y + \cos x \sin y$
  - $\sin(x - y) = \sin x \cos y - \cos x \sin y$
  - $\cos\left(\frac{\pi}{2} + x\right) = -\sin x$
  - $\sin\left(\frac{\pi}{2} + x\right) = \cos x$
  - $\cos(\pi - x) = -\cos x$
  - $\sin(\pi - x) = \sin x$
  - $\cos(\pi + x) = -\cos x$
  - $\sin(\pi + x) = -\sin x$
  - $\cos(2\pi - x) = \cos x$
  - $\sin(2\pi - x) = -\sin x$
  - If none of the angles x, y and $(x \pm y)$ is an odd multiple of $\frac{\pi}{2}$, then

$$\tan(x + y) = \frac{\tan x + \tan y}{1 - \tan x \tan y}, \text{ and } \tan(x - y) = \frac{\tan x - \tan y}{1 + \tan x \tan y}$$

  - If none of the angles x, y and $(x \pm y)$ is a multiple of π, then $\cot(x + y) = \frac{\cot x \cot y - 1}{\cot y + \cos x}$, and $\cot(x - y) = \frac{\cot x \cot y + 1}{\cot y - \cot x}$
  - $\cos 2x = \cos^2 x - \sin^2 x = 2\cos^2 x - 1 = 1 - 2\sin^2 x = \frac{1 - \tan^2 x}{1 + \tan^2 x}$
  - In particular, $\cos x = \cos^2 \frac{x}{2} - \sin^2 \frac{x}{2} = 2\cos^2 \frac{x}{2} - 1 = 1 - 2\sin^2 \frac{x}{2} = \frac{1 - \tan^2 \frac{x}{2}}{1 + \tan^2 \frac{x}{2}}$

- $\sin 2x = 2\sin x \cos x = \frac{2\tan x}{1+\tan^2 x}$
- In particular, $\sin x = 2\sin\frac{x}{2}\cos\frac{x}{2} = \frac{2\tan\frac{x}{2}}{1+\tan^2\frac{x}{2}}$
- $\tan 2x = \frac{2\tan x}{1-\tan^2 x}$
- In particular,