

Day 34 Notes - Sum/Diff Identities

Sum/Difference Formulas

$$\sin(x \pm y) = \sin x \cos y \pm \cos x \sin y$$

$$\cos(x \pm y) = \cos x \cos y \mp \sin x \sin y$$

$$\tan(x \pm y) = \frac{\tan x \pm \tan y}{1 \mp \tan x \tan y}$$

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Example 1: Find the exact values of $\sin/\cos/\tan$.

$$15^\circ = 45^\circ - 30^\circ$$

a) $\sin(45-30)$

$$\sin 45 \cos 30 - \cos 45 \sin 30$$

$$\left(\frac{\sqrt{2}}{2}\right)\left(\frac{\sqrt{3}}{2}\right) - \left(\frac{\sqrt{2}}{2}\right)\left(\frac{1}{2}\right)$$

$$\frac{\sqrt{6}}{4} - \frac{\sqrt{2}}{4}$$

$$\boxed{\frac{\sqrt{6}-\sqrt{2}}{4}}$$

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b) $\cos(45-30)$

$$\cos 45 \cos 30 + \sin 45 \sin 30$$

$$\left(\frac{\sqrt{2}}{2}\right)\left(\frac{\sqrt{3}}{2}\right) + \left(\frac{\sqrt{2}}{2}\right)\left(\frac{1}{2}\right)$$

$$\frac{\sqrt{6}}{4} + \frac{\sqrt{2}}{4}$$

$$\boxed{\frac{\sqrt{6}+\sqrt{2}}{4}}$$

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c) $\tan(45-30)$

$$= \frac{\tan 45 - \tan 30}{1 + \tan 45 \tan 30}$$

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

$$= \frac{\frac{3}{3} - \frac{\sqrt{3}}{3}}{\frac{3}{3} + \frac{\sqrt{3}}{3}} = \frac{3-\sqrt{3}}{3+\sqrt{3}}$$

$$= \frac{3-\sqrt{3}}{3+\sqrt{3}} \cdot \frac{3-\sqrt{3}}{3-\sqrt{3}}$$

$$= \boxed{\frac{3-\sqrt{3}}{3+\sqrt{3}}}$$

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Example 2: Rewrite the expression

$$\sin 340^\circ \cos 50^\circ - \cos 340^\circ \sin 50^\circ$$

$$\sin(340^\circ - 50^\circ)$$

$$\boxed{\sin(290^\circ)}$$

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Example 3: $\sin \alpha = \frac{3}{13}$ where $0 < \alpha < \frac{\pi}{2}$

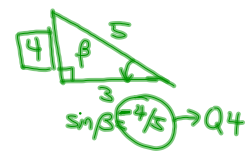
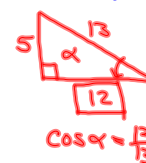
$\cos \beta = \frac{3}{5}$ where $\frac{3\pi}{2} < \beta < 2\pi$

Q1 $\rightarrow \cos, \sin +$
Q4 $\rightarrow \cos +, \sin -$

Find $\cos(\alpha + \beta)$

$$\cos \alpha \cos \beta - \sin \alpha \sin \beta$$

$$\left(\frac{12}{13}\right)\left(\frac{3}{5}\right) - \left(\frac{3}{13}\right)\left(-\frac{4}{5}\right)$$



$$\frac{36}{65} - \frac{-20}{65} = \boxed{\frac{56}{65}}$$

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