Handout for MATH 1300 (Barsamian) Lect. L40 Mon Nov 16, 2026 Section 5.3

Recall the Angle Sum Formulas

$$\sin(a+b) = \sin a \cos b + \cos a \sin b$$
$$\cos(a+b) = \cos a \cos b - \sin a \sin b$$
$$\tan(a+b) = \frac{\tan a + \tan b}{1 - \tan a \tan b}$$

and the Double Angle Formulas

$$\sin(2a) = 2 \sin a \cos a$$
$$\cos(2a) = \cos^2 a - \sin^2 a = 2\cos^2 a - 1 = 1 - 2\sin^2 a$$
$$\tan(2a) = \frac{2 \tan a}{1 - \tan^2 a}$$

[1] Find $\sin 2x$, $\cos 2x$, and $\tan 2x$ if $\cos x = -\frac{3}{\sqrt{13}}$ and x terminates in quad II.

[2] Simplify by using a double angle formula

$(a) \dfrac{2\tan\frac{\theta}{2}}{1-\tan^2\frac{\theta}{2}} =$

$(b) \sin 5\theta \cos 5\theta =$

$(c) \cos^2 3\theta - \sin^2 3\theta =$

[3] (a) Find the exact value of $\tan\left(2\cos^{-1}\left(-\frac{12}{13}\right)\right)$.

(b) Find exact value of $\cos\left(2\tan^{-1}\left(-\frac{2}{5}\right)\right)$.

[4] Rewrite $\cos(2\tan^{-1}u)$ as an algebraic expression in u.

[5] Prove that $\frac{1+\tan^2 x}{2\tan x} = \csc 2x$

[6] Prove that $\cot x\,(1-\cos 2x) = \sin 2x$

Half Angle Formulas

$$\cos\frac{\theta}{2} = \pm\sqrt{\frac{1+\cos(\theta)}{2}}$$

$$\sin\frac{\theta}{2} = \pm\sqrt{\frac{1-\cos(\theta)}{2}}$$

$$\tan\frac{\theta}{2} = \pm\sqrt{\frac{1-\cos(\theta)}{1+\cos(\theta)}} = \frac{1-\cos\theta}{\sin\theta} = \frac{\sin\theta}{1+\cos\theta}$$

[7] If $\cot\theta = 2$ and $0° \le \theta \le 90°$ find exact value of $\cos\frac{\theta}{2}$ and $\tan\frac{\theta}{2}$.

[8] If $\sec\theta = -\frac{17}{18}$ and $\frac{\pi}{2} < \theta < \pi$ find exact value of $\cos\frac{\theta}{2}$ and $\tan\frac{\theta}{2}$.