

Double Angle Formulas

$$\sin(2\theta) = 2 \sin\theta \cos\theta$$

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

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

$$\text{ex: } \sin 270^\circ = \sin(2 \cdot 135^\circ) = 2 \sin 135^\circ \cos 135^\circ$$

$$= 2 \cdot \frac{\sqrt{2}}{2} \cdot \frac{-\sqrt{2}}{2} = \frac{-4}{4} = \boxed{-1}$$

$$\text{ex: } \cos \frac{5\pi}{3} = \cos(2 \cdot \frac{5\pi}{6}) = \cos^2(\frac{5\pi}{6}) - \sin^2(\frac{5\pi}{6})$$

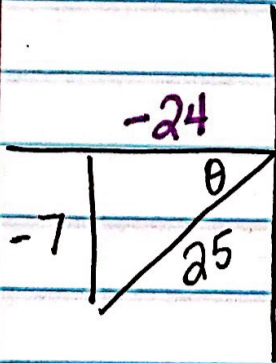
$$= \left(\frac{-\sqrt{3}}{2}\right)^2 - \left(\frac{1}{2}\right)^2 = \frac{3}{4} - \frac{1}{4} = \boxed{\frac{1}{2}}$$

$$\text{ex: } \tan \frac{2\pi}{3} = \tan(2 \cdot \frac{\pi}{3}) = \frac{2 \cdot \tan \frac{\pi}{3}}{1 - \tan^2 \frac{\pi}{3}}$$

$$= \frac{2 \cdot \sqrt{3}}{1 - (\sqrt{3})^2} = \frac{2\sqrt{3}}{-2} = \boxed{-\sqrt{3}}$$

ex: $\sin \theta = \frac{-7}{25}$, where θ is in the interval $(\pi, \frac{3\pi}{2})$

$$\text{Find } \sec 2\theta = \frac{1}{\cos^2 \theta - \sin^2 \theta} = \frac{1}{\left(\frac{-24}{25}\right)^2 - \left(\frac{-7}{25}\right)^2}$$

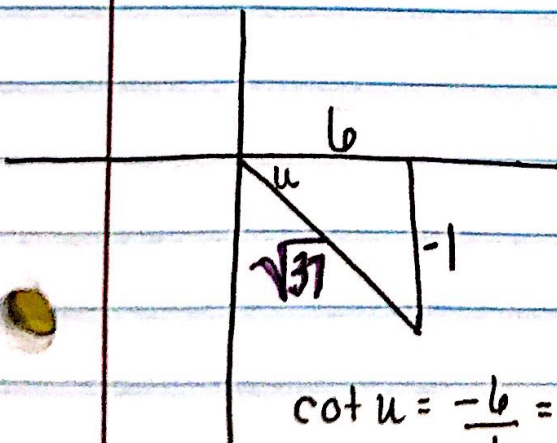


$$= \frac{1}{\frac{576}{625} - \frac{49}{625}} = \frac{1}{\frac{527}{625}} = \frac{625}{527}$$

ex: $\cot u = -6$, where $\frac{3\pi}{2} < \theta < 2\pi$

Find $\sin 2u$ and $\tan 2u$.

$$* \sin 2u = 2 \sin u \cos u = 2 \cdot \frac{-1}{\sqrt{37}} \cdot \frac{6}{\sqrt{37}} = \frac{-12}{37}$$



$$\cot u = \frac{-6}{1} = \frac{6}{-1} \text{ adj opp}$$

$$* \tan 2u = \frac{2 \tan u}{1 - \tan^2 u} = \frac{2 \cdot \frac{-1}{6}}{1 - \left(\frac{-1}{6}\right)^2}$$

$$= \frac{-\frac{1}{3}}{1 - \frac{1}{36}} = \frac{-\frac{1}{3}}{\frac{35}{36}} = \frac{-1}{3} \cdot \frac{36}{35} = \frac{-12}{35}$$