

Double Angle Identities Examples * use scientific calculator!

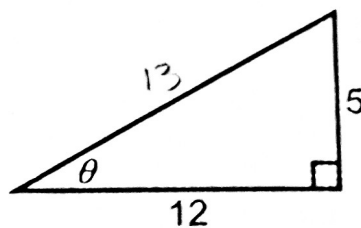
Double Angle Identities

$$\sin 2\theta = 2 \sin \theta \cos \theta$$

$$\begin{aligned} \cos 2\theta &= \cos^2 \theta - \sin^2 \theta \\ &= 1 - 2 \sin^2 \theta \\ &= 2 \cos^2 \theta - 1 \end{aligned}$$

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

Example 1:



$$\begin{aligned} \sin \theta &= \frac{5}{13} \\ \cos \theta &= \frac{12}{13} \\ \tan \theta &= \frac{5}{12} \end{aligned}$$

Find:

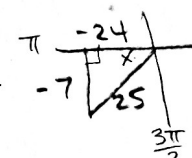
$$\begin{aligned} 1) \sin 2\theta &= 2 \sin \theta \cos \theta \\ &= 2 \cdot \frac{5}{13} \cdot \frac{12}{13} = \boxed{\frac{120}{169}} \end{aligned}$$

$$\begin{aligned} 2) \cos 2\theta &= 2 \cos^2 \theta - 1 \\ &= 2 \left(\frac{12}{13}\right)^2 - 1 \\ &= \boxed{\frac{119}{169}} \end{aligned}$$

$$\begin{aligned} 3) \tan 2\theta &= \frac{2 \tan \theta}{1 - \tan^2 \theta} = \frac{2 \cdot \frac{5}{12}}{1 - \left(\frac{5}{12}\right)^2} = \frac{\frac{5}{6}}{\frac{119}{144}} = \frac{5}{6} \cdot \frac{144}{119} = \boxed{\frac{120}{119}} \end{aligned}$$

Example 2:

Given $\sin x = -\frac{7}{25}$ when $\pi < x < \frac{3\pi}{2}$



Find:

$$\begin{aligned} 1) \sin 2x &= 2 \sin x \cos x \\ &= 2 \left(-\frac{7}{25}\right) \left(-\frac{24}{25}\right) = \boxed{\frac{336}{625}} \end{aligned}$$

* use any of the 3 formulas

$$\begin{aligned} 2) \cos 2x &= \cos^2 x - \sin^2 x \\ &= \left(-\frac{24}{25}\right)^2 - \left(-\frac{7}{25}\right)^2 = \frac{576}{625} - \frac{49}{625} = \boxed{\frac{527}{625}} \end{aligned}$$

$$\begin{aligned} 3) \tan 2x &= \frac{2 \tan x}{1 - \tan^2 x} = \frac{2 \left(-\frac{7}{24}\right)}{1 - \left(-\frac{7}{24}\right)^2} = \frac{\frac{7}{12}}{\frac{527}{576}} = \boxed{\frac{336}{527}} \end{aligned}$$