

Lesson 81 Objective: SWBAT solve for trigonometric double angles.

Kickoff- Solve the following:

$$-2 \csc \theta = -3 \csc^2 \theta + 2$$

Let  $x = \csc \theta$

$$-2x = -3x^2 + 2$$

$$3x^2 - 2x - 2 = 0$$

$$X = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} = \frac{-(-2) \pm \sqrt{(-2)^2 - 4(3)(-2)}}{2(3)}$$

$$\frac{2 \pm \sqrt{28}}{6}$$

$\frac{2 + \sqrt{28}}{6} = 1.215$   
 $\frac{2 - \sqrt{28}}{6} = -0.548$

$\csc \theta = 1.215$        $\csc \theta = -0.548$   
 $\sin \theta = .823$        $\sin \theta = -1.8284$   
 $\sin^{-1}(.823)$        ~~$\sin^{-1}(-1.8284)$~~   
 $m \approx 55$       ~~DNE~~

**$\theta = 55$      $\theta = 125$**

Double Angles

Try This:  
 If  $\sin x = \frac{2}{3}$  where x terminates in quadrant II and  $\cos y = \frac{3}{4}$  where y terminates in quadrant IV find  $\sin(x+y)$

$\sin^{-1}(\frac{2}{3})$        $\cos^{-1}(\frac{3}{4})$   
 $m \approx 42$        $m \approx 41$   
 $X = 138$        $Y = 319$   
 $\sin(138 + 319) = .993$

Double-angle identities

$\sin 2A = 2 \sin A \cos A$   
 $\cos 2A = \cos^2 A - \sin^2 A$   
 $\tan 2A = \frac{2 \tan A}{1 - \tan^2 A}$

Example: If  $\sin A = \frac{2}{5}$  and  $\cos A = \frac{3}{5}$  find  $\sin 2A$ ,  $\cos 2A$ , and  $\tan 2A$ .

$\sin 2A = 2(\frac{2}{5})(\frac{3}{5}) = \frac{12}{25}$   
 $\cos 2A = 2(\frac{3}{5})^2 - 1 = \frac{18}{25} - 1 = -\frac{7}{25}$   
 $\tan 2A = \frac{2(\frac{2}{3})}{1 - (\frac{2}{3})^2} = \frac{\frac{4}{3}}{1 - \frac{4}{9}} = \frac{\frac{4}{3}}{\frac{5}{9}} = \frac{12}{5}$

1) If  $\sin \theta = -\frac{3\sqrt{10}}{10}$  and  $0^\circ < \theta < 180^\circ$  find  $\tan 2\theta$ .

2) If  $\cos \theta = -\frac{3}{5}$  and  $0^\circ < \theta < 90^\circ$  find  $\cos 2\theta$ .

$\sin \theta = \frac{\sqrt{7}}{4}$        $0 < \theta < 90^\circ$        $\tan \theta = \frac{\sqrt{3}}{1}$

$\tan 2\theta = \frac{2 \tan \theta}{1 - \tan^2 \theta}$   
 $\frac{2(\frac{\sqrt{3}}{1})}{1 - (\frac{\sqrt{3}}{1})^2} = \frac{2\sqrt{3}}{1 - 3} = \frac{2\sqrt{3}}{-2} = -\sqrt{3}$

$\frac{\sqrt{7}}{4} \cdot \frac{\sqrt{3}}{2} = \frac{\sqrt{21}}{8}$