GSE PreCalculus Unit 5: Trig Identities
Worksheet 5.3

Name _____
Date _____ Day ____

Even/Odd Identities - Verify

1. $\csc(-x)\tan(-x) = \sec x$

$(-\csc x)(-\tan x) = \sec x$

$\left(-\frac{1}{\sin x}\right)\left(-\frac{\sin x}{\cos x}\right) = \sec x$

$\frac{1}{\cos x} = \sec x$

$\sec x = \sec x$

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

$\cos\theta\left(\frac{1}{\cos\theta}\right) - \cos^2\theta = \sin^2\theta$

$1 - \cos^2\theta = \sin^2\theta$

$\sin^2\theta = \sin^2\theta$

3. $\frac{\csc(-x)}{\sin(-x)} + \frac{\cot(-x)}{\tan x} = 1$

$\frac{-\csc x}{-\sin x} + \frac{-\cot x}{\tan x} = 1$

$\frac{-\frac{1}{\sin x}}{-\frac{\sin x}{1}} + \frac{-\frac{\cos x}{\sin x}}{\frac{\sin x}{\cos x}} = 1$

$-\frac{1}{\sin x}\cdot -\frac{1}{\sin x} + -\frac{\cos x}{\sin x}\cdot\frac{\cos x}{\sin x} = 1$

$+\frac{1}{\sin^2 x} - \frac{\cos^2 x}{\sin^2 x} = 1$

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

$\frac{\sin^2 x}{\sin^2 x} = 1$

$1 = 1$

4. $\frac{\csc(-x)}{\sec(-x)} = \cot(-x)$

$\frac{-\csc x}{\sec x} = -\cot x$

$-\frac{\frac{1}{\sin x}}{\frac{1}{\cos x}} = -\cot x$

$-\frac{1}{\sin x}\cdot\frac{\cos x}{1} = -\cot x$

$-\frac{\cos x}{\sin x} = -\cot x$

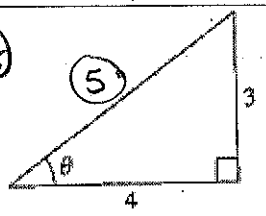
$-\cot x = -\cot x$

Double Angles

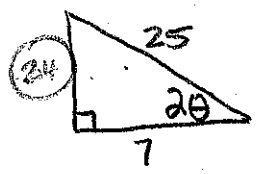
Use the figure to find the exact value of the trig function.

1. $\cos 2\theta = \cos^2\theta - \sin^2\theta = (4/5)^2 - (3/5)^2 = 7/25$
2. $\tan 2\theta = 24/7$
3. $\csc 2\theta = 25/24$

$\sin 2\theta = 24/25$



$\cos 2\theta = 7/25$



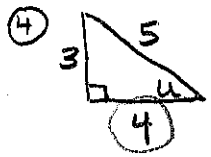
$a^2 + 7^2 = 25^2$

$a^2 = 576$

$a = 24$

Find the exact value of sin 2u, cos 2u, and tan 2u using the double angle formulas.

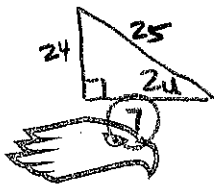
4. $\sin u = \frac{3}{5}, \quad 0 < u < \frac{\pi}{2}$ Q1 $\begin{matrix}x+\\y+\end{matrix}$
5. $\cos u = -\frac{2}{7}, \quad \frac{\pi}{2} < u < \pi$ Q2 $\begin{matrix}x-\\y+\end{matrix}$



$\sin 2u = 2\sin u\cos u$

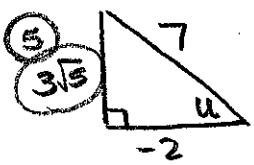
$= 2(3/5)(4/5)$

$= 24/25$



$\cos 2u = 7/25$

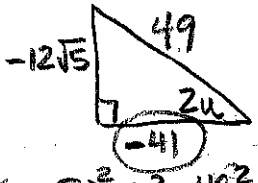
$\tan 2u = 24/7$



$\sin 2u = 2\sin u\cos u$

$= 2(3\sqrt{5}/7)(-2/7)$

$= \frac{-12\sqrt{5}}{49}$



$(-12\sqrt{5})^2 + b^2 = 49^2$

$720 + b^2 = 2401$

$b^2 = 1681$

$b = 41$

$\cos 2u = -41/49$

$\tan 2u = \frac{+12\sqrt{5}}{+41}$

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Verifying Identities Practice:

1. $\cos^4 x - \sin^4 x = \cos 2x$

$(\cos^2 x - \sin^2 x)(\cos^2 x + \sin^2 x) = \cos 2x$

$(\cos^2 x - \sin^2 x)(1) = \cos 2x$

$\cos 2x = \cos 2x$

2. $(\sin x + \cos x)^2 = 1 + \sin 2x$

$\sin^2 x + \sin x\cos x + \sin x\cos x + \cos^2 x = 1 + \sin 2x$

$1 + 2\sin x\cos x = 1 + \sin 2x$

$1 + \sin 2x = 1 + \sin 2x$

3. $\cos\theta \csc\theta \tan\theta = 1$

$\cos\theta\left(\frac{1}{\sin\theta}\right)\left(\frac{\sin\theta}{\cos\theta}\right) = 1$

$1 = 1$

4. $\sec^4 x \tan x - \sec^2 x \tan x = \sec^2 x \tan^3 x$

$\sec^2 x \tan x(\sec^2 x - 1) = \sec^2 x \tan^3 x$

$\sec^2 x \tan x(1 + \tan^2 x - 1) = \sec^2 x \tan^3 x$

$\sec^2 x \tan^3 x = \sec^2 x \tan^3 x$

5. $\dfrac{\tan x + \cot y}{\tan x \cot y} = \tan y + \cot x$

$\dfrac{\tan x}{\tan x \cot y} + \dfrac{\cot y}{\tan x \cot y} = \tan y + \cot x$

$\dfrac{1}{\cot y} + \dfrac{1}{\tan x} = \tan y + \cot x$

$\tan y + \cot x = \tan y + \cot x$

6. $\dfrac{\csc x - \sin x}{\cot x} = \cos x$

$\dfrac{\frac{1}{\sin x} - \frac{\sin x \sin x}{1 \sin x}}{\frac{\cos x}{\sin x}} = \cos x$

$\dfrac{\frac{1 - \sin^2 x}{\sin x}}{\frac{\cos x}{\sin x}} = \cos x$

$\dfrac{\cos^2 x}{\sin x} \cdot \dfrac{\sin x}{\cos x} = \cos x$

$\cos x = \cos x$

7. $1 - 2\cos^2 x + \cos^4 x = \sin^4 x$

$(1 - \cos^2 x)(1 - \cos^2 x) = \sin^4 x$

$(\sin^2 x)(\sin^2 x) = \sin^4 x$

$\sin^4 x = \sin^4 x$

8. $\cos x(1 - 2\sin^2 x + \sin^4 x) = \cos^5 x$

$\cos x(1 - \sin^2 x)(1 - \sin^2 x) = \cos^5 x$

$\cos x(\cos^2 x)(\cos^2 x) = \cos^5 x$

$\cos^5 x = \cos^5 x$

9. $(\cos x - \sin x)^2 + (\cos x + \sin x)^2 = 2$

$\cos^2 x - 2\cos x\sin x + \sin^2 x + \cos^2 x + 2\cos x\sin x + \sin^2 x = 2$

$(\cos^2 x + \sin^2 x) + (\cos^2 x + \sin^2 x) = 2$

$1 + 1 = 2$

$2 = 2$

10. $\dfrac{2\cos^2 x + 3\cos x + 1}{\cos^2 x - 1} = \dfrac{2\cos x + 1}{\cos x - 1}$

$\dfrac{(2\cos x + 1)(\cos x + 1)}{(\cos x + 1)(\cos x - 1)} = \dfrac{2\cos x + 1}{\cos x - 1}$

$\dfrac{2\cos x + 1}{\cos x - 1} = \dfrac{2\cos x + 1}{\cos x - 1}$