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Chapter 6 Review

For each type of question, the achievement level is indicated. Showing work is an important strategy in communicating your knowledge and ideas so please be thorough.

Learning Goal 6.1	Using identities to reduce complexity in expressions and solve equations.

Developing		
1. Find the values of the following expressions without the use of a calculator.		
a. $\cos\left(\frac{\pi}{2}+x\right)+\sin x$ $= 0$	b. $\sin\left(\frac{3\pi}{4}\right)$ $\sin\left(\pi-\frac{\pi}{4}\right)=\frac{\sqrt{2}}{2}$	c. $\cos\left(\frac{5\pi}{3}\right)$ $\cos\left(2\pi-\frac{\pi}{3}\right)=\frac{1}{2}$
d. $\sin\left(\frac{5\pi}{6}\right)$ $\sin\left(\frac{\pi}{2}+\frac{\pi}{3}\right)=\frac{1}{2}$	e. $\cos\left(\frac{11\pi}{6}\right)$ $\cos\left(\frac{3\pi}{2}+\frac{\pi}{3}\right)=\frac{\sqrt{3}}{2}$	f. $\sin\left(\frac{9\pi}{4}\right)$ $\sin\left(2\pi+\frac{\pi}{4}\right)=\frac{\sqrt{2}}{2}$

Proficient
2. Determine the exact value of $\sec x$ if $\sin\left(\frac{\pi}{2}-x\right)=\frac{3}{4}$ if x is in QI. $\sec x=\frac{4}{3}$
3. Determine the exact value of $\cos x$ if $\cos\left(\frac{3\pi}{2}+x\right)=\frac{2}{3}$ if x is in QII. $\cos x=\frac{-\sqrt{5}}{3}$
4. Determine the exact value of $\cot x$ if $\cos(\pi+x)=\frac{1}{4}$ if x is in QIII. $\cot x=\frac{\sqrt{15}}{15}$
5. Determine the exact value of $\csc x$ if $\sin\left(\frac{3\pi}{2}-x\right)=\frac{5}{9}$ if x is in QII. $\csc x=\frac{9\sqrt{14}}{28}$
6. Determine the exact value of $\sin 2x$ if $\sin x=\frac{2}{7}$ if x is in QII. $\sin 2x=-\frac{12\sqrt{5}}{7}$

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7. Determine the exact value of $\cos 2x$ if $\tan x = -\frac{5}{3}$ if x is in QII.

$$\cos 2x = -\frac{8}{17}$$

8. Determine the exact value of $\sin 2x$ if $\sec x = -\frac{5}{3}$ if x is in QIII.

$$\sin 2x = \frac{24}{25}$$

Proficient

9. Prove the identity.

When in doubt, break everything down to sine and cosine.

a. $\tan^2 x - \sin^2 x = \tan^2 x \sin^2 x$

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

b. $\frac{\sec x - \cos x}{\tan x} = \sin x$

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

c. $\frac{\cos x + \sin x \tan x}{\sin x \sec x} = \csc x$

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

d. $\frac{\csc x}{\tan x + \cot x} = \cos x$

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

e. $\sin x + \cos x \cot x = \csc x$

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

f. $\csc^2 x + \sec^2 x = \csc^2 x \sec^2 x$

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

Extending

g. $\frac{\cot x}{\csc x - 1} = \frac{\csc x + 1}{\cot x}$

multiply by the conjugate $\csc x + 1$.

h. $\frac{\sin 2x}{2 - 2\cos^2 x} = \cot x$

$\sin 2x = 2 \sin x \cos x$

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

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

multiply by the conjugate $1 - \cos x$.

j. $\frac{\sin 2x}{\cos x} + \frac{\cos 2x}{\sin x} = \csc x$

$\sin 2x = 2 \sin x \cos x$

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

k. $\frac{1}{\sec x + \tan x} = \frac{1 - \sin x}{\cos x}$

multiply by the conjugate $1 - \sin x$.

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

multiply by the conjugate $1 - \cos x$.

m. $\frac{\cos 2x}{\sin x} = \frac{\cot^2 x - 1}{\csc x}$

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

n. $\frac{\cot x - 1}{1 - \tan x} = \frac{\csc x}{\sec x}$

o. $(1 - \sin x)(\sec x + \tan x) = \frac{1}{\sec x}$

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

p. $\sin 2x\,(\tan x + \cot x) = 2$

$\sin 2x = 2 \sin x \cos x$

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

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q. $\frac{\cot x}{\sin x \csc x} = -\sec x$ $\sin^2 x - 1 = -\cos^2 x$	r. $\frac{\sin 2x}{1+\cos 2x} = \frac{\sec^2 x - 1}{\tan x}$ $\sin 2x = 2\sin x \cos x$ $\cos 2x = 2\cos^2 x - 1$
s. $\frac{2\cos x + 2\cos^2 x}{\sin 2x} = \frac{\sin x}{1-\cos x}$ multiply by the conjugate $1+\cos x$. $\sin 2x = 2\sin x \cos x$	t. $\frac{1}{1+\sin x} = \sec^2 x - \frac{\tan x}{\cos x}$ multiply by the conjugate $1-\sin x$.
u. $\frac{\sin x + \tan x}{1+\cos x} = \frac{\sin 2x}{2\cos^2 x}$ multiply by the conjugate $1-\cos x$.	

Extending	
10. Solve each equation algebraically over the domain $0 \le x < 2\pi$.	
a. $2\cos^2 x - \cos x - 1 = 0$ $x = \frac{2\pi}{3}, \frac{4\pi}{3}, 0$	b. $2\sin^2 x - 7\sin x + 3 = 0$ $x = \frac{\pi}{6}, \frac{5\pi}{6}$
c. $2\sin x = 3 + 2\csc x$ $x = \frac{7\pi}{6}, \frac{11\pi}{6}$	d. $4\tan x + \cot x = 5$ $x = \frac{\pi}{4}, \frac{5\pi}{4}$ $x \approx 0.24, 3.39$
e. $\sin 2x + 2\sin^2 x = 0$ $x = 0, \pi, \frac{3\pi}{4}, \frac{7\pi}{4}$	f. $\sin x = \cos 2x$ $x = \frac{3\pi}{2}, \frac{\pi}{6}, \frac{5\pi}{6}$
g. $2\sin 2x = 3\cos x$ $x = \frac{\pi}{2}, \frac{3\pi}{2}$ $x \approx 0.85, 2.29$	