5.1 Using Fundamental Identities

Reciprocal and Quotient Identities
Pythagorean Identities
Simplifying Trigonometric Expressions
Using Factoring and Foiling to Simplify

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Reciprocal Identities

$$\sin\theta = \frac{1}{\csc\theta} \qquad \cos\theta = \frac{1}{\sec\theta} \qquad \tan\theta = \frac{1}{\cot\theta}$$

$$\csc\theta = \frac{1}{\sin\theta} \qquad \sec\theta = \frac{1}{\cos\theta} \qquad \cot\theta = \frac{1}{\tan\theta}$$

Quotient Identities

$$\tan\theta = \frac{\sin\theta}{\cos\theta} \qquad \cot\theta = \frac{\cos\theta}{\sin\theta}$$

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Pythagorean Identities

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

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

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

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

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

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

$1 + \cot^2 x = \csc^2 x$

$\tan^2 x + 1 = \sec^2 x$

$\tan^2 x = \sec^2 x - 1$

$\tan^2 x - \sec^2 x = -1$

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

$\tan^2 x + 1 = \sec^2 x$

$1 + \cot^2 x = \csc^2 x$

$1 = \csc^2 x - \cot^2 x$

$1 - \csc^2 x = -\cot^2 x$

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Simplifying Trig Expressions

Rules/Suggestions/Look fors

reciprocal functions
quotient functions
rewrite w/ sine/cosine

1. $\tan x \csc x$

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

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

2. $\cos^2 x(1 - \sec^2 x)$

$\cos^2 x(-\tan^2 x)$

$\cos^2 x\left(-\frac{\sin^2 x}{\cos^2 x}\right)$

$-\sin^2 x$

$\cos^2 x - 1$

$-\sin^2 x$

Pythagorean Identities
reciprocal pairs to multiply

$\cos^2 x \cdot 1 - \sec^2 x \cdot \cos^2 x$

3. $(1 + \cot^2 x)\sin x$

$\csc^2 x \cdot \sin x$

$\csc x \cdot \csc x \cdot \sin x$

$\csc x$

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

$\frac{1}{\sin x} = \csc x$

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Factoring and Foiling to Simplify

4. $\dfrac{\sin^2\beta - 1}{\sin\beta - 1}$

$x = \sin^2\beta$ $\quad x^2 - 1 \rightarrow (x+1)(x-1)$

$\dfrac{(\sin\beta + 1)(\sin\beta - 1)}{\sin\beta - 1}$ $\quad \sin\beta + 1$

5. $\sec^4 x - \tan^4 x$

$(\sec^2 x - \tan^2 x)(\sec^2 x + \tan^2 x)$

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(by P.I.)

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6. $(5 - 5\sin x)(5 + 5\sin x)$

$25 + 25\sin x - 25\sin x - 25\sin^2 x$

$25 - 25\sin^2 x$ factor out 25

$25(1 - \sin^2 x)$ (P.I.)

$25\cos^2 x$

7. $\dfrac{1}{\sec x - 1} - \dfrac{1}{\sec x + 1}$

$\dfrac{(\sec x + 1) - (\sec x - 1)}{(\sec x - 1)(\sec x + 1)}$ common denom

$\dfrac{\sec x + 1 - \sec x + 1}{\sec^2 x + \sec x - \sec x - 1}$

$\dfrac{2}{\sec^2 x - 1}$ P.I.

$\dfrac{2}{\tan^2 x}$

$2\cot^2 x$ reciprocals

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HOMEWORK

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11-17 odd, 21, 23, 27-33 odd, 51-67 odd

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