Review Prove 5

$$\sec\theta\cot\theta - \sin\theta = \frac{\cos^2\theta}{\sin\theta}$$

$$\sec\theta\cot\theta - \sin\theta = \frac{1}{\cos\theta}\frac{\cos\theta}{\sin\theta} - \sin\theta$$

$$= \frac{1}{\sin\theta} - \sin\theta$$

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

$$= \frac{\cos^2\theta}{\sin\theta} \checkmark$$

$$\frac{1+\cot^3 t}{1+\cot t} = \csc^2 t - \cot t$$

$$\frac{1+\cot^3 t}{1+\cot t} = \frac{(1+\cot t)(1-\cot t+\cot^2 t)}{1+\cot t}$$

$$= 1 - \cot t + \cot^2 t.$$

$$= 1 - \cot t + \csc^2 t - 1$$

$$= \csc^2 t - \cot t \checkmark$$

$$\frac{\cos\alpha}{1+\sin\alpha} = \sec\alpha - \tan\alpha$$

$$\frac{\cos\alpha}{1+\sin\alpha} = \frac{\cos\alpha}{1+\sin\alpha}\,\frac{1-\sin\alpha}{1-\sin\alpha}$$

$$= \frac{\cos\alpha\,(1-\sin\alpha)}{1-\sin^2\alpha}$$

$$= \frac{\cos\alpha\,(1-\sin\alpha)}{\cos^2\alpha}$$

$$= \frac{1-\sin\alpha}{\cos\alpha}$$

$$= \frac{1}{\cos\alpha} - \frac{\sin\alpha}{\cos\alpha}$$

$$= \sec\alpha - \tan\alpha \quad \checkmark$$

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

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

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

$$= \tan^2 x \quad \checkmark$$

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

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

$$= \sec^2 x - \cos^2 x - \sin^2 x \quad \checkmark$$

$$10\csc^2 x - 6\cot^2 x = 4\csc^2 x + 6$$

$$10\csc^2 x - 6\cot^2 x = 10\csc^2 x - 6(\csc^2 x - 1)$$

$$= 10\csc^2 x - 6\csc^2 x + 6$$

$$= 4\csc^2 x + 6 \quad \checkmark$$

$$\frac{\csc x - 1}{\csc x + 1} = \frac{\cot^2 x}{\csc^2 x + 2\csc x + 1}$$

$$\frac{\csc x - 1}{\csc x + 1} = \frac{\csc x - 1}{\csc x + 1} \cdot \frac{\csc x + 1}{\csc x + 1}$$

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

$$= \frac{\cot^2 x}{\csc^2 x + 2\csc x + 1} \quad \checkmark$$

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

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

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

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

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

$$= 2\sec x \quad \checkmark$$

$$\frac{\cos(x+y)}{\cos(x-y)} \qquad \frac{\cot y - \tan x}{\cot y + \tan x}$$

$$\frac{\cos(x+y)}{\cos(x-y)} = \frac{\frac{\cos x \cos y}{\cos x \sin y} - \frac{\sin x \sin y}{\cos x \sin y}}{\frac{\cos x \cos y}{\cos x \sin y} + \frac{\sin x \sin y}{\cos x \sin y}}$$

$$= \frac{\cot y - \tan x}{\cot y + \tan x}$$ ✓

$$\frac{\sin(x-y)}{\sin x \sin y} = \cot y - \cot x$$

$$\frac{\sin(x-y)}{\sin x \sin y} = \frac{\sin x \cos y - \cos x \sin y}{\sin x \sin y}$$

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

$$= \cot y - \cot x$$ ✓

$$\csc(x-y) = \frac{\sin x\cos y + \cos x \sin y}{\sin^2 x - \sin^2 y}$$

$$\csc(x-y) = \frac{1}{\sin(x-y)} \quad \frac{\sin(x+y)}{\sin(x+y)}$$

$$= \frac{\sin(x+y)}{(\sin x\cos y - \cos x \sin y)(\sin x\cos y + \cos x \sin y)}$$

$$= \frac{\sin(x+y)}{\sin^2 x\cos^2 y - \cos^2 x \sin^2 y}$$

$$= \frac{\sin(x+y)}{\sin^2 x(1-\sin^2 y) - (1-\sin^2 x)\sin^2 y}$$

$$= \frac{\sin(x+y)}{\sin^2 x - \sin^2 x \sin^2 y - \sin^2 y + \sin^2 x \sin^2 y}$$

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

$\cos 3x = \cos^3 x - 3\cos x \sin^2 x$

$\cos 3x = \cos(2x + x)$

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

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

$= \cos^3 x - \sin^2 x \cos x - 2\sin^2 x \cos x$

$= \cos^3 x - 3\cos x \sin^2 x$ ✓

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

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

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

$= 4 \sin x \cos x (2\cos^2 x - 1)$ ✓

$$\cos 4x = \cos^4 x - 6\sin^2 x \cos^2 x + \sin^4 x$$

$$\begin{aligned}
\cos 4x &= \cos 2(2x) \\
&= \cos^2 2x - \sin^2 2x \\
&= (\cos^2 x - \sin^2 x)^2 - (2\sin x \cos x)^2 \\
&= \cos^4 x - 2\cos^2 x \sin^2 x + \sin^4 x \\
&\qquad - 4\sin^2 x \cos^2 x \\
&= \cos^4 x - 6\cos^2 x \sin^2 x + \sin^4 x \checkmark
\end{aligned}$$

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

$$\begin{aligned}
\frac{\cos 2x}{\sin^2 x} &= \frac{2\cos^2 x - 1}{\sin^2 x} \\
&= 2\frac{\cos^2 x}{\sin^2 x} - \frac{1}{\sin^2 x} \\
&= 2\cot^2 x - \csc^2 x \checkmark
\end{aligned}$$

$$\sin^2\frac{x}{2}\cos^2\frac{x}{2} = \frac{\sin^2 x}{4}$$

$\sin 2x$

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

$$= \left(\frac{1}{2}\sin x\right)^2$$

$$= \frac{1}{4}\sin^2 x \quad \checkmark$$

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

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

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

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

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

$$\tan^2\frac{x}{2} = \frac{\sec x + \cos x - 2}{\sec x - \cos x}$$

$$\frac{1}{\cos x} - \cos x$$

$$\tan^2\frac{x}{2} = \frac{\sin^2\frac{x}{2}}{\cos^2\frac{x}{2}}$$

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

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

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

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

$$= \frac{\sec x - 2 + \cos x}{\sec x - \cos x} \quad \checkmark$$

$$\frac{1}{4}\sin 4t = \cos^3 t \sin t - \sin^3 t \cos t$$

$$\frac{1}{4}\sin 4t = \frac{1}{4}\sin 2(2t)$$

$$= \frac{1}{4}\, 2\sin 2t \cos 2t$$

$$= \frac{1}{2}(2\sin t \cos t)(\cos^2 t - \sin^2 t)$$

$$= \cos^3 t \sin t - \sin^3 t \cos t \quad \checkmark$$

About Exam 12/9

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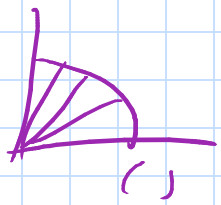

$\cos(A+B) = \cos\cos - \sin\sin$ (−, +)

$\sin(A+B) = \sin\cos + \cos\sin$ (−, −)

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