1. Given $\sec \theta = -7$, $\csc \theta < 0$ and $0 \leq \theta < 2\pi$, find the exact values of

(a) $\cos 2\theta$.

(b) $\sin 2\theta$.

(c) $\cos \left( \frac{\theta}{2} \right)$.

(d) $\sin \left( \frac{\theta}{2} \right)$. 

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2. Prove the identity: \[
\frac{\cot x}{\cot x + \tan x} = \cos^2 x.
\]

3. Use one of the trigonometric addition formulae to find the exact value of \[
\cos \frac{25\pi}{42} \cos \frac{\pi}{14} - \sin \frac{25\pi}{42} \sin \frac{\pi}{14}.
\]

4. Use the addition formulae for \(\sin(A \pm B)\) to simplify \[
\sin \left( x + \frac{\pi}{3} \right) + \sin \left( x - \frac{\pi}{3} \right)
\]
5. (a) Find all exact solutions to \( \frac{\sin 2x}{1 + \sin 2x} = \frac{1}{3} \)

(b) Use inverse trigonometric functions to find the exact solutions to \( \cot x = -5 \) in the range \( 0 \leq x < 2\pi \).

6. Graham looks up at an angle of 80° to the horizontal to see the top of a tall tree. Kent is 100 feet away, on the opposite side of the tree, and has to look up at an angle of 70°.
   How tall is the tree?
7. Solve the system *exactly*:

\[
\begin{align*}
4x - 5y - 6z &= 5 \\
2x - 3y + 3z &= 0 \\
x + 2y - 3z &= 5
\end{align*}
\]

8. Write the partial fraction expansion of \( \frac{2x^2 + x + 3}{(x - 1)(x - 2)(x + 1)} \)

15 points

10 points

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