Good Morning!

I am not available for help day Tuesday as I won't be here.

I will pass back your exams and go through them.

I am not available Thursday as I have a meeting. I teach the HSA review session Wednesday (You can come do test corrections/take the quiz)

Schedule Update:
• Today: Double-Half Angle Formulas
• Next Class: Law of Sines (new info)
• Following Class: Quiz 6 Review (Sum & Difference, Double-Half)
• Quiz 6

Objective: Students will be able to use the double and half angle identities to find the exact value of a trigonometric function.
**Why are we doing this?**

Given \( \sin(x) \), we can find \( \cos(x) \) and \( \tan(x) \).

Now we'll be able to find \( \cos(2x) \) or \( \cos((1/2)x) \).

We can solve \( \sin(2x) = 0 \).

Now we'll be able to solve \( 2\cos(x) + \sin(2x) = 0 \).

**Real-Life Applications:**
- Optics Fields in Physics and Biochemistry
- When you take Calculus in College or next year to solve integrals
- Architecture (bridges)
- Engineering
- Surveyors

**Double-Angle Formulas:**

\[
\begin{align*}
\sin(A + B) &= \sin A \cos B + \cos A \sin B \\
\sin(A - B) &= \sin A \cos B - \cos A \sin B \\
\cos(A + B) &= \cos A \cos B - \sin A \sin B \\
\cos(A - B) &= \cos A \cos B + \sin A \sin B
\end{align*}
\]

*Let's derive these formulas using the sum and difference formulas:

\[
\begin{align*}
\sin 2x &= \sin(x + x) = \sin x \cos x + \cos x \sin x \\
\cos 2x &= \cos(x + x) = \cos^2 x - \sin^2 x
\end{align*}
\]
Steps to Find Exact Values of Trig. Functions using Double and Half Angle Identities

1. Draw a triangle in the correct quadrant using given information

2. Find the missing side using P.Thm.

3. Use the appropriate identity to find the angle

4. Simplify

Example #1:
If \( \sin \alpha = -\frac{12}{13} \) and \( 180^\circ < \alpha < 270^\circ \), find \( \cos 2\alpha \)
**Example #2:**
If \( \tan \alpha = -\frac{5}{12} \) and \( 270^\circ < \alpha < 360^\circ \), find \( \sin 2\alpha \)

\[
\sin 2\alpha = 2 \sin \alpha \cos \alpha
\]
\[
= 2 \left( -\frac{5}{13} \right) \left( \frac{12}{13} \right)
\]
\[
= -\frac{120}{169}
\]

**Half-Angle Identities:**

\[
\sin \frac{1}{2}x = \pm \sqrt{\frac{1 - \cos x}{2}}
\]

\[
\cos \frac{1}{2}x = \pm \sqrt{\frac{1 + \cos x}{2}}
\]

**The quadrant location determines the sign!**
Example #3:
If \( \sin \alpha = -\frac{12}{13} \) and \( 180^\circ < \alpha < 270^\circ \), find \( \cos \frac{1}{2} \alpha \)

Example #4:
If \( \tan \alpha = -\frac{5}{12} \) and \( 270^\circ < \alpha < 360^\circ \), find \( \sin \frac{1}{2} \alpha \)
Why can't we solve this like we used to?

What do we have to do instead?

\[ \sin 2x + \cos x = 0 \]

After applying the double angle formula, the process for solving is the same as before!