**Trigonometry Lesson 10: The Double and Half Angle Formulas**
*textbook section 8.3*

**Introduction:** though the double angle formulas are really just special cases of the addition formulas as we saw in Lesson 9 (and may seem unnecessary for this reason), they are helpful because they can help us figure out how to take the sine, cosine, and tangent of *half* of a given angle (for example, 22.5 degrees). How might this be useful? Are there any angles that such a formula could help us find trigonometric values for?

**1:** Using any identities that we have proven to this point, prove that another valid formula for $\cos 2\theta$ is $2\cos^2\theta - 1$. Use this formula to find $\cos\frac{\pi}{8}$.

**2:** Use a method similar to how you found $\cos\frac{\pi}{8}$ to find a general formula for $\cos\frac{\theta}{2}$.

**3:** From the above formula for $\cos\frac{\theta}{2}$, find a formula for $\sin\frac{\theta}{2}$. (Hint: think of an identity that we regularly use to "switch" between sine and cosine.)

**4:** Evaluate the following (using the half-angle formulas):

$\cos 112.5°$

$\sin \frac{\pi}{8}$

$\tan \frac{\pi}{8}$

$\csc \frac{5\pi}{8}$

$\sec \frac{11\pi}{12}$

**5:** Given that $\sin\theta = -\frac{4}{5}$ and $\frac{3\pi}{2} \leq \theta < 2\pi$, find $\sin\frac{\theta}{2}$, $\cos\frac{\theta}{2}$, $\tan\frac{\theta}{2}$.

**6:** Since we have accumulated so many additional formulas in the past few lessons, draw a "concept map" that explains the train of thought we used to find them and prove that they are true. (Hint: it all started with $\cos(\alpha - \beta)$.)

**Section 8.3 Homework:** 13-23 odd