Precalculus
Homework Lecture 3

1. Use the known values of $\sin 30^\circ, \cos 30^\circ, \sin 45^\circ, \cos 45^\circ, \sin 60^\circ, \cos 60^\circ, \ldots$, the angle sum formulas and the cofunction identities to find an exact value (using radicals) for the trigonometric function.

   (a) The six trigonometric functions of $105^\circ = 45^\circ + 60^\circ$:
   - $\sin(105^\circ)$.
   - $\cos(105^\circ)$. Should your answer be a positive or a negative number?
   - $\tan(105^\circ)$.
   - $\cot(105^\circ)$.
   - $\sec(105^\circ)$.
   - $\csc(105^\circ)$.

   (b) The six trigonometric functions of $\frac{\pi}{12} = \frac{\pi}{3} - \frac{\pi}{4}$:
   - $\sin\left(\frac{\pi}{12}\right)$.
   - $\cos\left(\frac{\pi}{12}\right)$. Should $\sin\left(\frac{\pi}{12}\right)$ be larger or smaller than $\cos\left(\frac{\pi}{12}\right)$?
   - $\tan\left(\frac{\pi}{12}\right)$.
   - $\cot\left(\frac{\pi}{12}\right)$.
   - $\sec\left(\frac{\pi}{12}\right)$.
   - $\csc\left(\frac{\pi}{12}\right)$.

2. Simplify to a trigonometric function of the angle θ. The answer key has not been proofread, use with caution.

   (a) $\sin\left(\frac{\pi}{2} - \theta\right)$.
   (b) $\cos\left(\frac{13\pi}{2} - \theta\right)$.
   (c) $\tan(\pi - \theta)$
   (d) $\cot\left(\frac{3\pi}{2} - \theta\right)$
   (e) $\csc\left(\frac{3\pi}{2} + \theta\right)$

3. **Problems 3.c and 3.d are considered challenge problems and will not be tested/quizzed upon.** Using the power-reducing formulas, rewrite the expression in terms of first powers of the cosines and sines of multiples of the angle θ.

   (a) $\sin^4\theta$.
   (b) $\cos^4\theta$.
   (c) $\sin^6\theta$.
   (d) $\cos^6\theta$.

4. Use the sum-to-product formulas to find all solutions of the trigonometric equation in the interval $[0, 2\pi)$.

   Please note that typing a query such as "solve(sin(x)+sin (3x)=0)" at `www.wolframalpha.com` will provide you with a correct answer and a function plot.

   (a) $\sin(x) + \sin(3x) = 0$.
   (b) $\cos(x) + \cos(-3x) = 0$.
   (c) $\sin(x) - \sin(3x) = 0$.
   (d) $\cos(2x) - \cos(3x) = 0$.