Challenge Problems

1. Be sure to attach a hand - sketch for this problem.

   (a) First draw $-\mathbf{245}°$ in standard position.

   (b) Now draw the reference angle of $-\mathbf{245}°$ in the same diagram. Do not find the value, just draw it.

   Remember the definition: The reference angle of a given angle is the POSITIVE ACUTE angle formed by the terminal side of the angle and the NEAREST x – axis.

   (c) Use the drawing in part (b) to find the value of the reference angle.

2. Find the exact value of the following expression which basically stands for the sum of $\cos 1°$, $\cos 2°$, $\cos 3°$ all the way up to $\cos 179°$. Do not use a calculator.

   $$\cos 1° + \cos 2° + \cos 3° + \cdots\cdots\cdots + \cos 178° + \cos 179°$$

   Hints: See the hints below.

   i. Start by establishing a relationship between the last term $\cos 179°$ and the first term $\cos 1°$. To establish the relationship, first draw $179°$ in standard position and find its reference angle. Then use the reference angle and the quadrant in which $179°$ lies to rewrite $\cos 179°$ in terms of $\cos 1°$. This will help you evaluate $\cos 1° + \cos 179°$.
   ii. Follow the above method to evaluate the intermediate sums $\cos 2° + \cos 178°$, $\cos 3° + \cos 177°$ and so on.

3. A person's blood pressure follows a sine wave corresponding to the beats of the heart. A particular individual's blood pressure at time t (measured in minutes) is
   $P(t) = 20 \sin(160\pi t) + 110$.

   What does this tell us about the person's (a) heart rate, (b) systolic and diastolic blood pressure?

4. Determine the amplitude, period, and phase shift for the function $y = \pi \cos(\frac{1}{\pi}x - \frac{1}{3})$. Then graph one period of the function using a graphing utility such as Graphmatica, Desmos or something of your choice. Hand sketches will not be accepted.

Note: Some graphing tips can be found in the "Math Calculator and Graphing Resources" page under the "Course Specific Information" module.