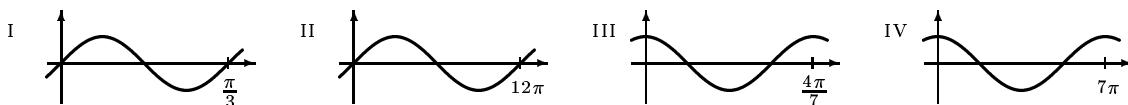# Sine and Cosine Function Problems
Math 130 *Kovitz*

1. Find: $\sin\frac{\pi}{6}$ $\sin(-\frac{4\pi}{3})$ $\cos\frac{\pi}{4}$ $\cos(-\frac{11\pi}{6})$ $\cos(\frac{5\pi}{3})$ $\sin(\frac{5\pi}{4})$

2. Carefully graph $\cos x$ for x between 0 and 6.283185307. Label all the points that are multiples of $\frac{\pi}{6}$ or $\frac{\pi}{4}$ and two additional points that are not.

   Do not use the letter π in your graph, either for labeling the x-axis or for labeling points. Instead use the fact that $\pi = 3.141592654$ (approximately, to nine decimal places). For example, $\cos(\frac{\pi}{3}) = \frac{1}{2}$ becomes $\cos(\frac{3.141592654}{3}) = \cos 1.047197551 = .5$. The point on the graph is $(1.047197551, .5)$. Also do not use radical notation. Instead write approximate decimal equivalents for all square roots. For example, $\sqrt{3}/2$ becomes $1.732050808/2 = .866025404$.

3. (a) Graph $\sin x$ and $-\cos x$, for x between 0 and 2π, on the same axes. Where do they intersect? Label the two points.
   (b) Using the unit circle $(u, v) = (\cos s, \sin s)$, find the points where $\sin s = -\cos s$, for $0 \le s \le 2\pi$. Label them.
   (c) Show that the answers in parts (a) and (b) are exactly the same. Explain briefly.

4. By using a graph of the unit circle draw the points that have the property that $\sin s = \frac{1}{2}$.
   (a) By looking at the graph, roughly estimate s for each such point. (Is there more than one answer to this question for each point?)
   (b) By looking at the graph, roughly estimate the value of $\cos s$ for each such point.
   (c) By using a graph of $\sin x$, locate some points which have the property that $\sin x = \frac{1}{2}$. By looking at the graph, roughly estimate x for at least four of those points.

5. (a) Sketch a graph of $\cos x$.
   (b) Roughly label the points on the graph of $\cos x$ for which
       i. $x = \frac{\pi}{6}$
       ii. $x = \frac{5\pi}{4}$
       iii. $x = 4.71238898$
       iv. $x = 2$
   (c) By translating, sketch the graph of $y = \cos(x + \frac{\pi}{2})$.
   (d) By reflecting the graph of $\sin x$, sketch the graph of $y = -\sin x$.
   (e) How do the graphs in parts (c) and (d) compare?

6. (a) Graph $y = 2 + \cos x$.
   (b) Graph $y = 3\cos 6x$ for $0 \le x \le \frac{\pi}{2}$. What is the period?

7. (a) Find the period
       i. $\cos(16x)$
       ii. $\sin(\frac{x}{7})$
       iii. $\cos(6\pi x)$
   (b) Match to the correct graph
       i. $\cos(\frac{2x}{7})$
       ii. $\sin(6x)$

8. By translation, graph $y = \sin(x - \frac{\pi}{3})$ for $0 \le x \le 2\pi$. Label all intercepts and the peak and the valley.