Problems 1 and 2 are due Friday, February 19.

Question 1
Show the following:

(a) \[ \int_{0}^{2\pi} \sin(nx) \sin(mx) \, dx = \pi \delta_{m,n} \]

(b) \[ \int_{0}^{2\pi} \cos(nx) \sin(mx) \, dx = 0. \]

Question 2
French: Vibrations and Waves Chapter 6, problem 14 (a) and (b).

Problems 3 and 4 are due Monday, February 22.

Problem 3
Consider a string which is fixed at both ends. The string is initially at rest and its initial displacement is given by

\[ y(x) = \begin{cases} 
1/L & \text{for } 0 \leq x \leq L \\
0 & \text{for } x < 0 \text{ and } x > L.
\end{cases} \]

Determine the Fourier series for \( y(x) \) over the interval \([0,2L]\).

Question 4
Define your favourite (i.e., interesting and not too simple) function \( f(x) \) over the interval \([-4,4]\) and determine its Fourier components. Use Mathematica to help you determine the coefficients and plot the first few terms of your Fourier series together with your original function. Also, plot the difference between \( f(x) \) and your Fourier series and investigate the “goodness of approximation” as you increase the number of terms in your series.