1. Arfken, Chapter 8, pages 387, problems 8.2.1, 8.2.3, 8.2.5.

2. Arfken, Chapter 8, page 394: problems 8.3.2.

3. Show that the linear operator $L = -d^2/dx^2$ on $L^2([0, 2\pi])$ is hermitian on the functions that satify periodic boundary conditions: $y(0) = y(2\pi)$ and $y'(0) = y'(2\pi)$, and that are twice differentiable. That is, for any two such functions
$$\int_0^{2\pi} \overline{f}(x)(Lg)(x) \ dx = \int_0^{2\pi} \overline{Lf}(x)g(x) \ dx.$$

Find the normalized eigenfunctions of L, that is, functions satisfying $Lf = \lambda f$, with these properties, and the corresponding eigenfunctions. check that the eigenfunctions are orthogonal.