Homework 5

Due Sunday, March 10th at 6pm

Read Boas Ch. 7, §§1-10.

1. (**a**) Boas 7.2.17 and (**b**) Write the equation for a sinusoidal wave of wavelength 1.2 meters, amplitude 0.5 meters, and speed 0.4 meters/second. If this wave represents the shape of a long rope which is being shaken back and forth at one end, find the velocity $\partial y/\partial t$ of a segment of the rope at position x_o. Is this velocity the same as the wave speed? Explain why or why not.

2. (**a**) Boas 7.4.1 and (**b**) Boas 7.4.2

3. (**a**) Use a trigonometric identity to reexpress the product $\sin(nx)\sin(mx)$ as sum of two trigonometric functions with new arguments.

   (**b**) Use this identity to evaluate the indefinite integral

   $$\int \sin(nx)\sin(mx)dx.$$

   Does your result hold for all m and n? If not, for what values of m and n does it fail?

   (**c**) Use your result from (**b**) to evaluate the definite integral

   $$\int_0^{2\pi} \sin(nx)\sin(mx)dx.$$

   If you found any cases in which your result from (**b**) failed evaluate this definite integral separately for those cases. [Hint: You may find that your result from Boas 7.4.2 is useful here.]

4. Boas 7.5.8

5. Boas 7.5.9

6. (**a**) Boas 7.5.11. (**b**) Use Dirichlet's theorem to find the value to which the Fourier series converges at $x = 0, \pm\pi/2, \pm\pi, \pm 2\pi$. (**c**) Boas 7.6.15.

7. Boas 7.9.14