

P4820 Assignment II

Due, February 15, 2019

- 1) [10] Show that

$$\phi_n(x) = \frac{1 - \cos nx}{n\pi x^2}$$

is a delta sequence.

- 2) [5] Use delta sequences to show that the limit:

$$\frac{\lim}{l \rightarrow 0} = \left[\frac{\delta(x) - \delta(x-l)}{l} \right]$$

exhibits the sifting property of $\delta'(x)$.

- 3) [5] A disk of radius α and mass M lies in the $x-y$ plane. Express the density in terms of delta functions in Cartesian coordinates, cylindrical coordinates, and spherical coordinates.
- 4) [10] A disk of charge with radius a and surface charge density $\sigma(r) = \sigma_0 r/a$ lies in the $x-y$ plane with the center at the origin. Find the volume charge density in a) cylindrical coordinates and b) spherical coordinates.
- 5) [10] A string of length L , with tension T and mass per unit length μ is hit simultaneously at $t = 0$ at the two points $x = L/3$ and $x = 2L/3$. The impulse delivered at each point is I . Find the equation that describes the subsequent displacement of the string. Plot the string position for times of $t = v * t/L = 1/10$ and $1/100$. Compare plots when you use the first 20 terms versus when you use the first 200 terms.