

Physics 422 – Fall 2012

Homework #11, due at beginning of class Friday Dec 7.

1. [8 pts] A uniform continuous string of length a is pulled away from its equilibrium position by a small distance h at $x = \frac{3a}{8}$ and simultaneously by distance $-h$ at $x = \frac{5a}{8}$. Hence at $t = 0$, the string shape consists of three straight line segments connecting the (x, y) points $(0, 0)$, $(3a/8, h)$, $(5a/8, -h)$, $(a, 0)$.
The string is released from rest, so $\partial y(x, t)/\partial t = 0$ at $t = 0$.
Use normal modes to find the subsequent motion of the string.
2. [8 pts] A thin flexible string of length a has a linearly varying mass density: $\rho(x) = bx$ where $0 < x < a$ and b is a positive constant.
 - (a) Find the equation for its normal mode frequencies.
 - (b) Find the frequency of its lowest mode of vibration.
 - (c) Find the frequency of its second-lowest mode of vibration.

Hints: You will probably have to use some numerical methods to solve this problem. You will probably find it convenient to choose units in which some constants can be replaced by 1.