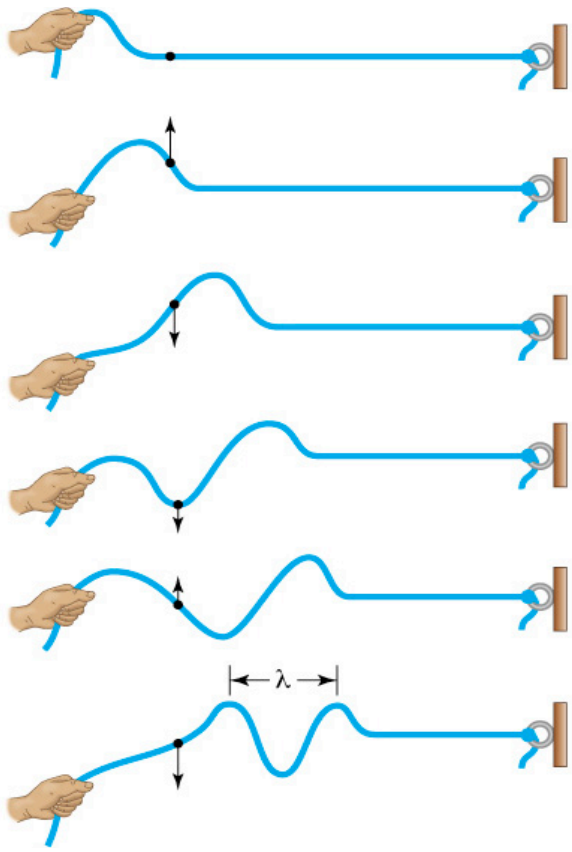
UCA Department of Physics and Astronomy

PHYS 3345: OPTICS



A classical traveling wave is a self–sustaining disturbance of a medium, which moves through space transporting energy and momentum.
Hecht, page 10

Assignment 01: Chapter 02
DUE: January 18, 2008

Spring 2008

Work each problem neatly and completely. Unless otherwise noted, each problem is worth **5 points**. You should solve on green engineering paper or blank unruled paper. You must include sufficient demonstration of your problem solving process. If a problem is to be solved by inspection, state this. If graphs or plots are required, you should use an appropriate tool for their construction (there are several options available on the computers in LSC 114).

Most of these initial problems are pretty easy; you should expect the level of mathematical rigor to increase sharply, and in short order. I would also take this opportunity to scoop up as many points as possible before it actually gets hard.

1. (3 points) Hecht, problem 2.2
2. (3 points) Hecht, problem 2.5
3. A one-dimensional wave is specified by:

$$y = 15\sin 2\pi\left(4t - 5x + \frac{2}{3}\right)$$

All units are mks. Determine this wave's
a) amplitude
b) wavelength
c) frequency
d) phase speed
e) initial phase

See Hecht 2.16 and 2.17 for help.

4. Show that the one-dimensional pulse

$$\psi(x,t) = Ae^{-4\left(x-\frac{3t}{2}\right)^2}$$

satisfies the one-dimensional wave equation.

5. Hecht, problem 2.22

For problems 2.31 and 2.32, it is not sufficient to assert that a function does or does not represent a traveling wave. You must demonstrate *why* the function is or is not a wave.

6. (6 points) Hecht, problem 2.31
7. (8 points) Hecht, problem 2.32

The *Schaum's Outline: Optics* supplement has many solved problems to assist you. In particular, you will find the following problems useful: 1.8, 1.9, 1.10, 1.12. Supplementary Problems have answers (not solutions, though). You will find 1.31, 1.32, 1.39, 1.41 useful and relevant.