PHYS 452 Homework
Chapter 2

Name:

Problem 1 _______________

Problem 2 _______________

Problem 3 _______________

Problem 4 _______________

Problem 5 _______________

Problem 6 _______________

Total _______________

Directions: Work as many of the problems as you can and return the problem set when you are finished Remember, you are to work *independently* on these problems.

You are encouraged to either type your work directly into this form, or to print the form, write your answers on the printed copy, scan and attach to a return email. Either way works for me.

If, however, you are a luddite or (some other form of technophobe) you may just drop it by my office in Pocatello, hand it to me in class, or snail mail it. Any method of delivery that gets it in my hands by the due date is fine.

Best of luck!

Problem 1. Give a mathematical representation for a one-dimensional harmonic traveling wave moving in the –*x* direction which has the following characteristics: λ = 10 cm, *f* = 200 Hz, *A* = 5 cm, subject to the initial condition that $\psi(x = +2\text{cm}, t = 0) = 2.5\text{cm}$.

Problem 2. If the following represents a traveling wave, determine its velocity where distances are in meters.

$$y = \frac{100e^{x^2 - 20xt + 100t^2}}{x - 10t}$$

Problem 3. A harmonic traveling wave is moving in the –z direction with an amplitude of 2, a wavelength of 5 meters, and a period of 3 seconds. At $t = 0$ displacement is zero at the origin. Write wave equations for this wave in the following terms:

- wavelength and period
- propagation constant and velocity
- complex form

Problem 4. A harmonic wave traveling in the $+x$ direction has, at $t = 0$, a displacement of 13 units at $x = 0$ and a displacement of -7.5 units at $x = 3\lambda/4$. Write the equation for the wave at $t = 0$.

Problem 5. Prove that $\boldsymbol{E} = \boldsymbol{E}_0 \sin(kx - \omega t)$ and $\boldsymbol{B} = \boldsymbol{B}_0 \sin(kx - \omega t)$ are solutions to the wave equations:

$$\frac{\partial \vec{E}}{\partial x} = -\frac{\partial \vec{B}}{\partial t} \text{ and } \frac{\partial \vec{B}}{\partial x} = -\mu_0 \varepsilon_0 \frac{\partial \vec{E}}{\partial t}$$

Problem 6. Show that if $\tilde{z}$ is a complex number,

- Re $(\tilde{z}) = \frac{(\tilde{z} + \tilde{z}^*)}{2}$
- Im $(\tilde{z}) = \frac{(\tilde{z} - \tilde{z}^*)}{2i}$
- $\cos\theta = \frac{(e^{i\theta} + e^{-i\theta})}{2}$
- $\sin\theta = \frac{(e^{i\theta} - e^{-i\theta})}{2i}$