

# Homework #6: Phys 3320: Prof. Olness Fall 2019

*Due XX November 2019..*

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## ONE DIMENSIONAL WAVE EQUATION:

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1) By hand, solve the 1-dimensional wave equation: (I recommend you use Sin terms):

$$\partial_t^2 f(x,t) = c^2 \partial_x^2 f(x,t)$$

Assume  $f(x,t)=0$  for  $x=0$  and  $x=\pi$ .

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2) Using Mathematica: (*I'll give you sample notebooks*)

- Plot solution for  $t=0$  for the first 5 modes :
- Animate the solution as a function of time.  
(Set it up so you can choose the mode “k” and start the animation.)

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3) Write down Maxwell's equations in the presence of charge and current.

Now simplify for the case of empty space (no charges or currents).

Now use these to find the EM wave equation for both E and B, and find the speed of light c in terms of  $\mu_0$  and  $\epsilon_0$ . Compute numerically

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## TWO DIMENSIONAL WAVE EQUATION:

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4) By hand, solve the 2-dimensional wave equation: (I recommend you use Sin terms):

$$\partial_t^2 f(x,y,t) = c^2 \partial_x^2 f(x,y,t) + c^2 \partial_y^2 f(x,y,t)$$

Assume  $f(x,y,t)=0$  for  $x=0$  and  $x=\pi$ , and for  $y=0$  and  $y=\pi$ ,

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5) Using Mathematica: (*I'll give you sample notebooks*)

- Plot solution for  $t=0$  for the first few modes :
- Animate the solution as a function of time.  
(Set it up so you can choose the mode “ $k_x$ ” and “ $k_y$ ” and start the animation.)