PY212

**Discussion Worksheet 10**

Please work with your partners on the following exercises.

1. An ac power supply supplies a voltage to a circuit consisting of a resistor *R* and capacitor C in series.
2. Draw a circuit diagram.
3. A phasor diagram is shown here for this circuit. The largest vector is *V*, the amplitude (maximum value) of the voltage across the power supply. Identify the two other voltage phasors and explain how they relate to *V* and to each other.

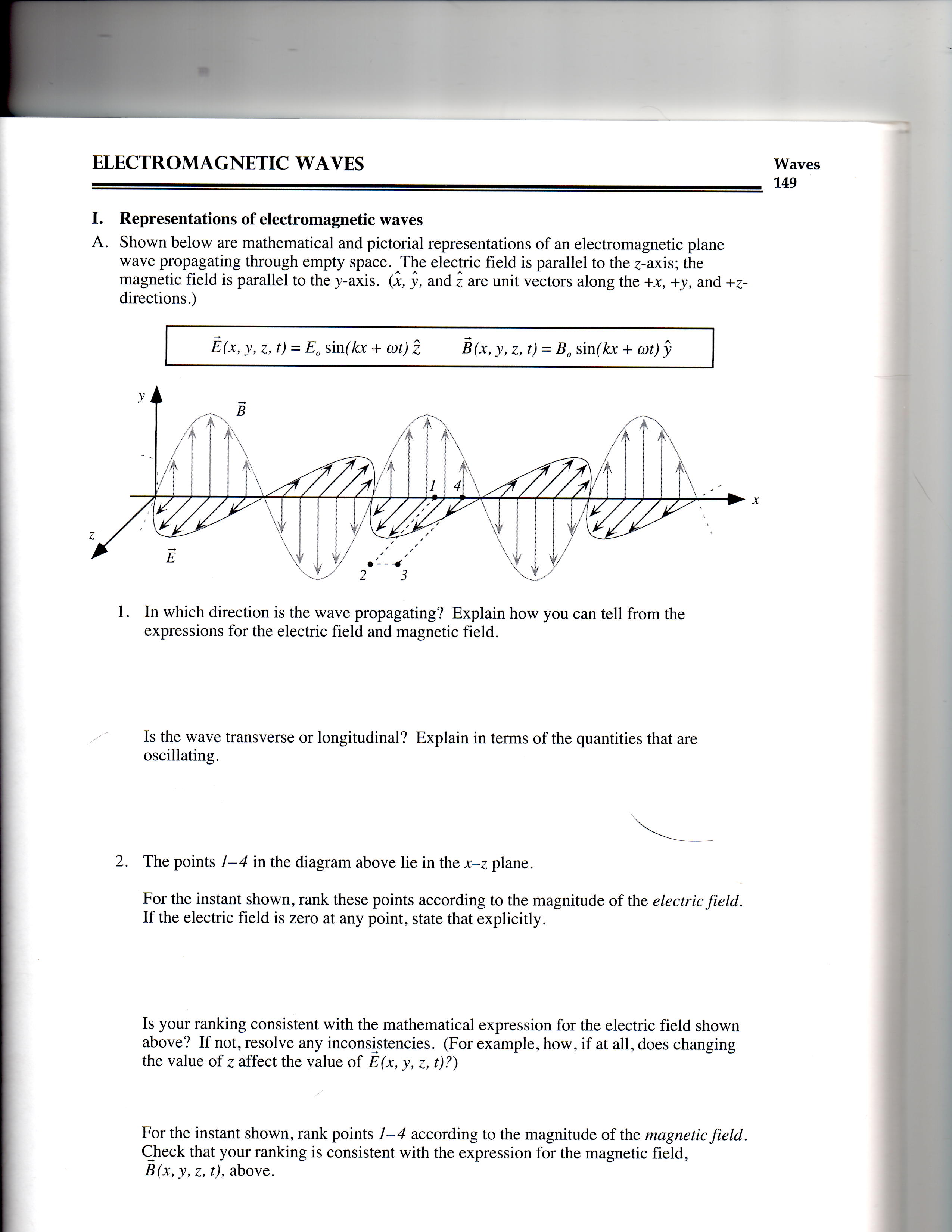
**ω**



1. Do any of the circuit elements have a *reactance*? Please identify and calculate.
2. Answer the following about the circuit if the frequency is doubled from ω to 2ω:
   1. Does the maximum voltage across the resistor *increase, decrease,* or *stay the same*? Explain.
   2. Does the maximum voltage across the capacitor *increase, decrease,* or *stay the same*? Explain.
   3. Does the maximum voltage across the power supply *increase, decrease,* or *stay the same*? Explain.
3. Shown below are the mathematical and pictorial representations of an electromagnetic plane wave propagating through empty space. The electric field is parallel to the z-axis; the magnetic field is parallel to the y-axis. (, , and are unit vectors along the +x, +y, and +z – directions.)





1. In which direction is the wave propagating? Explain how you can tell from the mathematical expressions for the electric field and magnetic field.

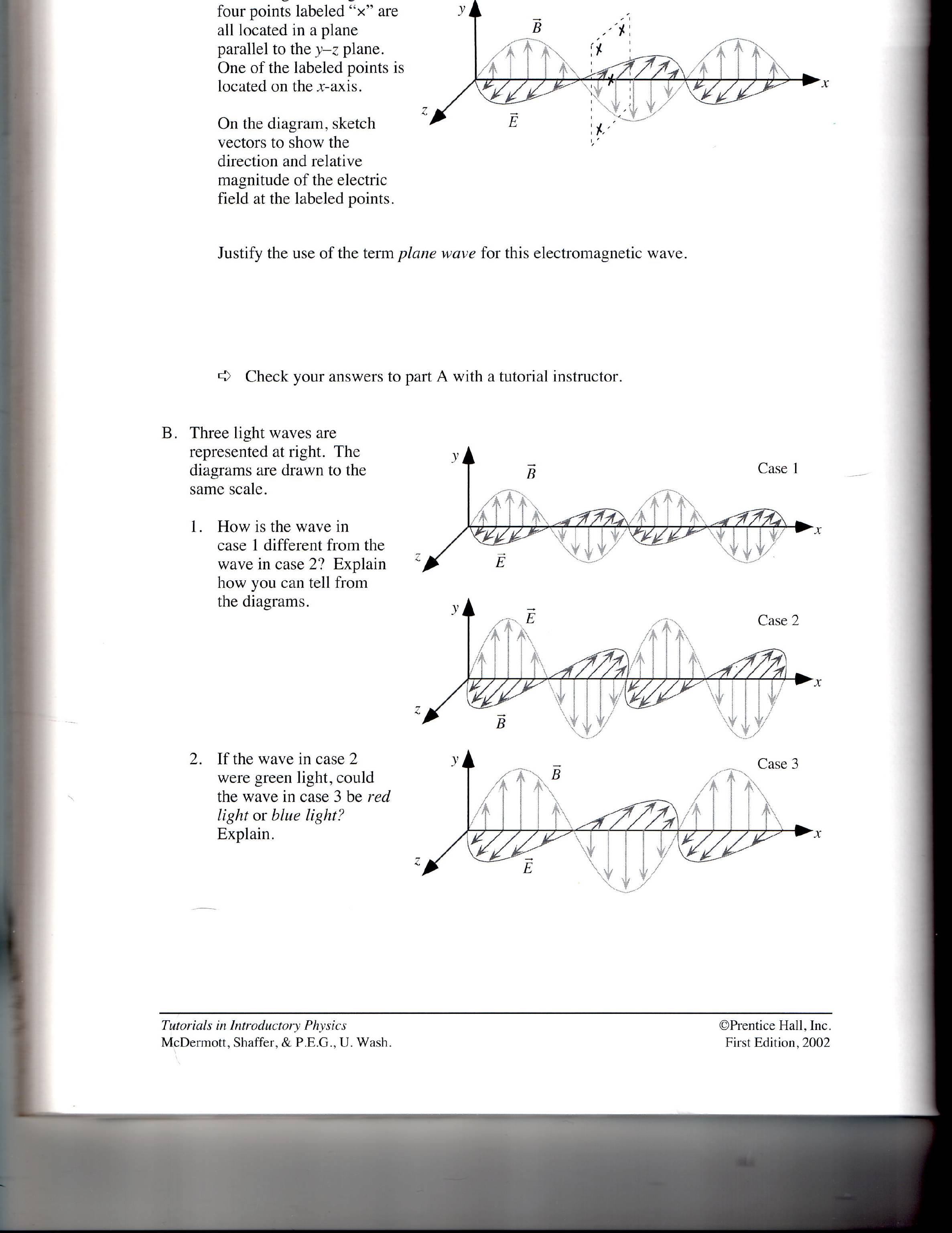
1. The points *1 – 4* in the diagram above lie in the *x-z* plane.

For the instant shown, rank these points according to the magnitude of the electric field. If the electric field is zero at any points, state that explicitly.

Is your ranking consistent with the mathematical expression for the *electric field* shown above? If not, resolve any inconsistencies. (For example, how, if at all, does changing the *z* affect the value of?

For the instant shown, rank points *1 – 4* according to the magnitude of the *magnetic field*. Check that your ranking is consistent with the expression for the magnetic field, above.

1. Two light waves are represented at right. The diagrams are drawn to the same scale.



How is the wave in case 1 different from the wave in case 2? Explain how you can tell from the diagrams.

What direction is the wave propagating in each case? Explain how you can tell from the diagrams.

**Additional Problems**

1. An ac power supply supplies a voltage to a circuit consisting of a resistor *R* and inductor *L* in series.
2. Draw a circuit diagram.
3. Construct a phasor diagram showing the amplitudes (maximum values) of the:

* current *I*
* voltage *V*R across the resistor
* voltage *V*L across the capacitor
* voltage *V* across the power supply

1. How do and  relate to *I* (mathematically)?
2. Using your previous answer (c.) and how , and  relate in the phasor diagram, show (mathematically) how *V* relates to *I*.
3. Answer the following about the circuit if the frequency is doubled from ω to 2ω.
   1. Does the amplitude of the voltage across the inductor *increase, decrease,* or *stay the same*? Explain.
   2. Does the amplitude of the voltage across the power supply *increase, decrease,* or *stay the same*? Explain.
4. The electric field in a plane wave is described by the equation

. Answer the following questions about the wave.

* 1. What direction is the wave traveling in? Explain how you can tell from the equation for the electric field.
  2. What is the magnitude of the magnetic field of the wave? Explain.
  3. In what direction is the magnetic field pointing? Explain.
  4. Below are three equations for a magnetic field. Which is the correct form for this wave?

For each, explain why it does or does not describe the correct magnetic field. Please articulate all the reasons.

A. 

B. 

C. 

D. 