

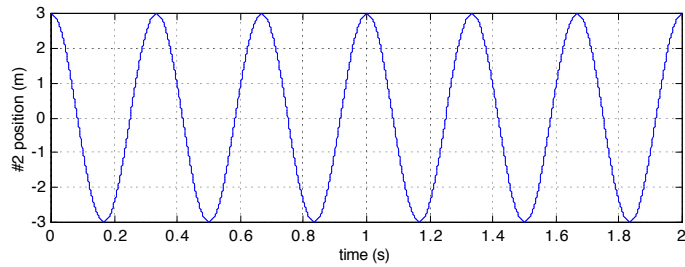
**Phys 122 Midterm 2**

Speed of sound in air at  $20^{\circ}\text{C}$  is 343 m/s

**Q2 (a)** Sketch a position vs time graph of a system undergoing damped oscillations. Be sure to label your axes.

**(b)** Sketch a response curve (amplitude vs driving frequency) for an oscillator that is being driven by an external force. Be sure to label your axes.

**Q3** The graph below shows a position versus time graph for a vertical mass-spring system.



**(a)** What is the period of the oscillation?

**(b)** Write down the equation for the position as a function of time, i.e.  $y(t) = ?\cos(?t)$ .  
Replace each ?

**(c)** Calculate the velocity of the hanging mass at  $t=0.36$ s.

**Q4** While you are standing outside lab your lab partners set a vertical mass-spring system oscillating. The mass is 0.40 kg and the spring constant is 10 N/m. Upon rejoining your lab group, the mass is 20 cm below its equilibrium position and is moving upwards with a speed of 100cm/s.

**(a)** Calculate the energy of the system.

**(b)** Calculate the amplitude of the oscillation.

**Q5 (a)** The displacement  $y(x, t)$  of a sinusoidal wave on a string is given by:

$$y(x, t) = (0.035\text{m})\cos(2.7x / \text{m} - 92t / \text{s})$$

Find the amplitude, wavelength, frequency and wave speed. What direction is the wave traveling in?

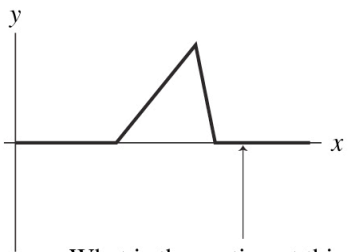
**(b) (5 pts)** The string is replaced with one of the same length but that is twice as heavy. The string is kept at the same tension. It is then wiggled with the same frequency and amplitude as before and a new sinusoidal wave is generated. Find the new wave speed.

**Q6** A large solar panel on a spaceship in orbit around the earth is rectangular with sides 60cm and 80cm. The intensity of light from the sun is  $1,400 \text{ W/m}^2$ .

(a) (5pts) How many joules of solar energy fall on the solar panel in one hour?

(b) (5pts) How much solar energy would fall on the solar panel in one hour if the spaceship were in orbit around Mars, which is 1.5 times further from the sun than Earth?

**Q7 (a) (5 pts)** Below is a snapshot of a wave pulse on a string. The wave pulse is traveling to the right. Next to the figure, sketch the history graph for the point on the string indicated by the arrow.



What is the motion at this point?

(b) (5 pts) Below are a history graph and a snapshot graph for the same wave pulse on a string. The wave is travelling to the right. Calculate the speed of the wave.

