Physics 132 Exam #1

- Partial credit will be awarded. However, you must show/explain your work. A correct answer without explanatory material will not receive full credit.
- Clearly indicate your final result with a box or circle.
- If you need more space go onto the back and indicate "OVER".

Equation sheet is separate.

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<th>problem</th>
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1. (15 pts) A block (mass \( m \)) is at rest on a frictionless tabletop attached to the end of a horizontal spring (constant \( k \)). An initial energy \( E \) is given by stretching the spring. The block is released and a graph of the motion is shown, displacement from equilibrium \( x \) vs. time \( t \).

![Graph of displacement vs. time](image)

a) The experiment is repeated exactly as before except with a larger mass \( (4m) \). On the graph below indicate with a dotted line the resulting \( x \) vs. \( t \) graph. Explain what has changed and why.

![Dotted graph for larger mass](image)

b) The experiment is repeated exactly as before except with a stiffer spring. On the graph below indicate with a dotted line the resulting \( x \) vs. \( t \) graph. Explain what has changed and why.

![Dotted graph for stiffer spring](image)
c) The experiment is repeated exactly as before except with less energy given in the initial stretch. On the graph below indicate with a dotted line the resulting $x$ vs. $t$ graph. Explain what has changed and why.

![Graph](image)

2. (20 pts) Standing waves on a 1.0 m string fixed at both ends are seen at successive frequencies of 24 Hz and 36 Hz.
   a) The fundamental frequency is _________ Hz. Explain your answer briefly.

   b) The speed of the wave on the string is _________ m/s. Explain your answer briefly.

   c) Draw the standing wave pattern (nodes and antinodes) for the string at 36 Hz.

   d) If one end of the string is cut so that it moves as a free end, give the first two standing wave frequencies, _____ Hz, _____ Hz. Explain briefly and assume the tension remains the same.
3. (15 pts) The pulses shown below at $t = 0.0$ s are moving to the right at a speed of 10 m/s on a string with both ends fixed as shown. On the corresponding diagrams carefully draw the shape of the string at $t = 0.2$ s, 0.4 s, 0.6 s, 0.8 s.
4. (20 pts) A small block (mass 5.0 kg) hangs from a spring ($k = 2 \times 10^3$ N/m). The block is displaced 50 cm downward from the equilibrium position and is given an initial velocity of 10 m/s back toward equilibrium.
   
a) Find the frequency of the motion.
   
b) Find the initial potential energy of the system.
   
c) Find the initial kinetic energy of the system.
   
d) Find the amplitude of oscillation.
5. (15 pts) A 50 cm long wire (mass 1 g) is stretched under tension of 440 N. It is stroked with a bow so it resonates at the fundamental frequency and generates sound. Then it is placed near the open end of a tube partially filled with water. The water in the tube is slowly lowered until the tube resonates. It is then lowered another 36 cm until the next resonance is detected. Find the speed of sound in air.