Worksheet 19: Simple Harmonic Motion

1. Sketch the position-time graph you would expect from a mass bobbing at the end of a spring. More precisely, sketch the position-time graph you would expect from a moving object acted on by a Hooke's law force $F = -kx$.

2. Sketch velocity-time and acceleration-time graphs corresponding to the motion from the previous problem.

3. We have made an ansatz (guess) of the equation of motion for a Hooke's law mass, which we hope is the solution to the differential equation of Hooke's law, $md^2x/dt^2 = -kx$.

   a. Write down the proposed formula for the position as a function of time.

   b. To test if the ansatz satisfies the differential equation, we will need to know the acceleration d^2x/dt^2. From our ansatz for $x(t)$, find:

      i. The first derivative dx/dt.

      ii. The second derivative d^2x/dt^2.

4. Substitute the ansatz $x(t)$ and its second derivative d^2x/dt^2 (t) into the Hooke's law differential equation to see if it works.