A. A cylinder is hung from a spring which is attached to a frame (see figure). The cylinder is pulled downward a distance y_{pull} and released. At the instant the cylinder passes its equilibrium position (as defined in the tutorial), a clock is started (t = 0).

Consider **two** coordinate systems to describe the motion of the cylinder. The first coordinate system is chosen with an origin ($y_b = 0$) at the base of the frame, and the upward direction is considered positive. The cylinder is shown at rest at its equilibrium position, y_0. The second coordinate system measures displacement from the cylinder's equilibrium position ($y_e = 0$).
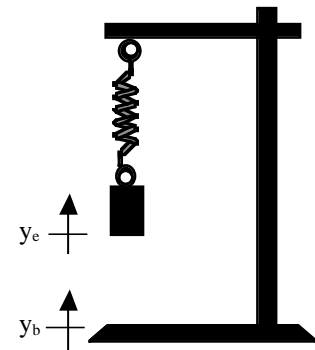
1. On the axes below, sketch graphs of y_b vs. t and y_e vs. t.
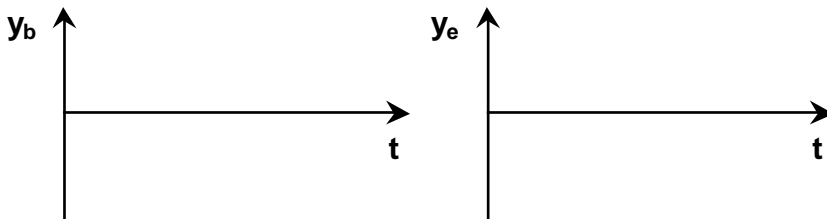
Account for any differences between the two graphs.

2. Write the general equation that gives y_e as a function of time for the y_e vs. t graph you sketched above.

3. Write the equation that gives y_b as a function of time.
    Explain how you arrived at your answer.

4. In the box at right, sketch a free-body diagram for the instant in time when the cylinder is located at $y_e = 0$. Label all forces like in tutorial. Are the forces the same in both coordinate systems?

5. Use your equations above to show that Newton's Second Law is the same in both coordinate systems. Show all work.