

EXAMPLE (SECTION 4.1)

A mass weighing 2 lb stretches a spring 6 in.

The mass is pulled down an additional 3 in and at time $t=0$ it is released at a velocity of 1 ft/s in the upward direction.

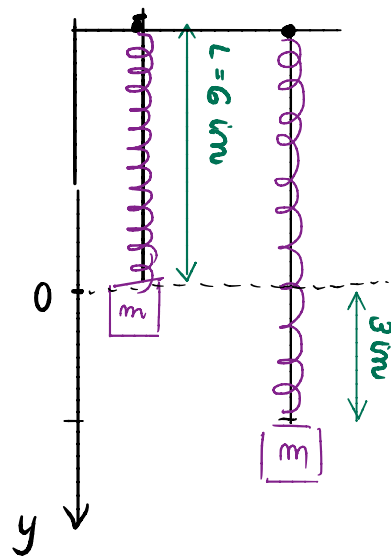
Assume there is no damping.

Write down an appropriate IVP.

SOLUTION

We are using the engineering system of units, so inches must be converted into feet:

$$6 \text{ in} = \frac{1}{2} \text{ ft}; \quad 3 \text{ in} = \frac{1}{4} \text{ ft}$$



• Determine the spring constant k from: $W = mg = kL$
where $W = 2 \text{ lb}$, $L = 6 \text{ in} = \frac{1}{2} \text{ ft}$. So $k = \frac{W}{L} = 4 \text{ lb/ft}$

• $g = 32 \text{ ft/s}^2$, so $m = \frac{W}{g} = \frac{2}{32} = \frac{1}{16} \frac{\text{lb}}{\text{ft}} \text{ s}^2$

• Unforced, undamped oscillator: $my''(t) + ky(t) = 0$

with initial conditions: $y(0) = 3$, $y'(0) = -1$ (because upward direction)