3. (30 pts.) A 3 kg block on a horizontal frictionless surface is attached to a horizontal spring. The block is pulled a distance of 0.03m away from equilibrium and released from rest. It reaches the equilibrium point 0.145 seconds later.

a. (10 pts.) What is the spring constant?

b. (10 pts.) What will be the speed of the block as it passes through the equilibrium point?

c. (10 pts.) Now suppose that the block was initially pulled 0.07 m away instead. (All the other numbers are unchanged.) How would this affect your answers to a and b? You don't have to do any calculations—just explain in words whether your answers to a and b would be larger, smaller, or stay the same. Justify your answer clearly.

3. (30 pts.) A 3 kg block on a horizontal frictionless surface is attached to a horizontal spring. The block is pulled a distance of 0.03m away from equilibrium and released from rest. It reaches the equilibrium point 0.145 seconds later.

a. (10 pts.) What is the spring constant?

$$T = 4(0.145\,s) = 0.580\,s$$

$$T = 2\pi\sqrt{\frac{m}{k}} \Rightarrow \frac{T^2}{4\pi^2} = \frac{m}{k}$$

$$k = \frac{4\pi^2 m}{T^2} = \frac{4\pi^2(3)}{(0.580)^2} = \boxed{352\,N/m}$$

[Note: can not use constant acceleration formulas since $a \neq$ constant.]

b. (10 pts.) What will be the speed of the block as it passes through the equilibrium point?

$$E = \frac{1}{2}kA^2 = \frac{1}{2}mv_{max}^2$$

$$v_{max}^2 = \frac{k}{m}A^2$$

$$v_{max} = \sqrt{\frac{k}{m}}A = \sqrt{\frac{352}{3}}(0.03)$$

$$\boxed{v_{max} = 0.325\,m/s}$$

c. (10 pts.) Now suppose that the block was initially pulled 0.07 m away instead. How would this affect your answers to a and b? You don't have to do any calculations—just explain in words whether your answers to a and b would be larger, smaller, or stay the same. Justify your answer clearly.

(a) Since the period is independent of amplitude, T wouldn't change. ∴ (a): No change.

(b) v_{max} would increase.