----- Problem 1 ----- A 2.3 kg mass oscillates back and forth from the end of a spring of spring constant 120 N/m. At $t = 0$, the position of the block is $x = 0.13$ m and its velocity is $v_x = -3.4$ m/s.

- (1) What is the angular frequency of the block?
- (2) What is the mechanical energy of this block-spring system?
- (3) What is the amplitude of the oscillation?
- (4) What is the maximum speed of the block and where is this experienced over the motion?
- (5) What is the phase constant? (Choose a cosine function to describe the motion.)
- (6) What is the position of block as a function of time?
- (7) What is the maximum acceleration of the block and where is this experienced over the motion?

Answers
1. (1) $\omega = 7.22135$ rad/s
(2) $E_{\text{mechanical}} = 14.308$ J
(3) $x_{\text{max}} = 0.48833$ m
(4) $v_{\text{max}} = 3.52728$ m/s
(5) $\phi = 1.30133$ rad
(6) $x = (0.48833 \text{ m})\cos[(7.22315 \text{ rad/s})t + (1.30133 \text{ rad})]$ (7) $a_{\text{max}} = 25.4781 \text{ m/s}^2$, at the turning points ($+$ or $- x_{\text{max}}$)