----- 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 \( x = 0.13 \text{ m} \) and its velocity is \( v_x = -3.4 \text{ m/s} \).

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