

This is a closed book exam held under the auspices of the Hamilton Honor Code. Useful bits of information are included in the problems and on the Handy Relations page. Please do not hesitate to ask questions!

Problems: 5

(1) (10 pts.) Equations!

- (a) Write down the equation of motion for a simple harmonic oscillator
- (b) Circle the angular frequency in the equation.
- (c) Write down the wave equation.
- (d) Circle the phase velocity of the wave.

$$\frac{d^2 x}{dt^2} + \omega_0^2 x = 0$$

$$\frac{\partial^2 y}{\partial x^2} = \frac{1}{v^2} \frac{\partial^2 y}{\partial t^2}$$

(2) (5 pts.) A 30 g bird lands on a bird feeder (310 g) suspended by a spring. If after landing the bird and feeder bounce up and down at frequency of 2 Hz, what is the effective spring constant?

$$\omega = \sqrt{\frac{k}{m_b + m_f}} = 2\pi f \quad f = \frac{\omega}{2\pi}$$

$$\Rightarrow k = (m_b + m_f) 4\pi^2 f^2 = (0.34)(4\pi^2)(4) = 53.7 \approx 50 \text{ N/m}$$

