19. (a) Eq. 16-8 leads to

$$a = -\omega^2 x \implies \omega = \sqrt{\frac{-a}{x}} = \sqrt{\frac{123}{0.100}}$$

which yields $\omega = 35.07$ rad/s. Therefore, $f = \omega/2\pi = 5.58$ Hz.

(b) Eq. 16-12 provides a relation between ω (found in the previous part) and the mass:

$$\omega = \sqrt{\frac{k}{m}} \implies m = \frac{400}{35.07^2} = 0.325 \text{ kg} .$$

(c) By energy conservation, $\frac{1}{2}kx_m^2$ (the energy of the system at a turning point) is equal to the sum of kinetic and potential energies at the time t described in the problem.

$$\frac{1}{2}kx_m^2 = \frac{1}{2}mv^2 + \frac{1}{2}kx^2 \implies x_m = \frac{m}{k}v^2 + x^2 .$$

Consequently, $x_m = \sqrt{(0.325/400)(13.6)^2 + 0.1^2} = 0.400$ m.