

Solutions Problem Set #2

Phy 214

1) a) Find Ause general solution: $x(t) = x_{eq} + \text{Re}[A e^{i\omega_0 t}]$ where $A = A e^{i\phi_0}$

apply Initial conditions

$$x_0 = x(t=0) = x_{eq} + \text{Re}[A e^{i\omega_0(0)}] = x_{eq} + \text{Re}[A]$$

$$x_{eq} - 10 \text{ cm} = x_{eq} + \text{Re } A$$

$$\text{Re } A = -10 \text{ cm}$$

$$v_0 = \dot{x}(t=0) = 0 + \left. \frac{d}{dt} \text{Re}[A e^{i\omega_0 t}] \right|_{t=0}$$

$$-40 = \text{Re} \left[\left. \frac{d}{dt} A e^{i\omega_0 t} \right|_{t=0} \right] = \text{Re} [A (i\omega_0) e^{i\omega_0 t}] \Big|_{t=0}$$

$$-40 = \text{Re} [A i\omega_0] = \text{Re} [(A_r + iA_i) i\omega_0] = \text{Re} [A_r(i\omega_0) + -\omega_0 A_i]$$

$$-40 = -\omega_0 A_i$$

$$\text{Im } A = \frac{40}{\omega_0} \frac{\text{cm}}{\text{s}}$$

$$A = A_r + iA_i = -10 \text{ cm} + \frac{40}{\omega_0} \frac{\text{cm}}{\text{s}} \quad \omega_0 = \sqrt{\frac{k}{m}} = \sqrt{\frac{160}{.4}} = 20 \text{ rad/s}$$

$$\boxed{A = -10 \text{ cm} + i2 \text{ cm}}$$