2) b) eq. of motion $-K(x-x_{eq}) = m\frac{d^2x}{dt^2}$

$$x(t) = x_{eq} + \frac{1}{2}\left[\underline{A}\, e^{i\omega_0 t} + \underline{A}^* e^{-i\omega_0 t}\right]$$

$$\ddot{x}(t) = \frac{1}{2}\left[(i\omega_0)^2 \underline{A} e^{i\omega_0 t} + \underline{A}^* (i\omega_0)^2 e^{-i\omega_0 t}\right]$$

$$-K\left(x_{eq} + \tfrac{1}{2}\left[\underline{A} e^{i\omega_0 t} + \underline{A}^* e^{-i\omega_0 t}\right] - x_{eq}\right) \stackrel{?}{=} m\left(\tfrac{1}{2}\right)\left[(-\omega_0^2)\underline{A} e^{i\omega_0 t} + \underline{A}^*(-\omega_0^2) e^{-i\omega_0 t}\right]$$

$$\frac{-K}{2}\left[\underline{A} e^{i\omega_0 t} + \underline{A}^* e^{-i\omega_0 t}\right] \stackrel{?}{=} \frac{m}{2}(-\omega_0^2)\left[\underline{A} e^{i\omega_0 t} + \underline{A}^* e^{-i\omega_0 t}\right]$$

$$\frac{-K}{2} \stackrel{?}{=} \frac{m}{2}(-\omega_0^2) \qquad \text{remember } \omega_0 = \sqrt{\frac{K}{m}}$$

$$\frac{K}{m} = \frac{K}{m}$$

c) $\underline{A} = A_R + iA_I$ $\qquad A_R = x_0 - x_{eq}$

$$A_I = -v_0/\omega_0$$

$$\therefore \boxed{\underline{A} = (x_0 - x_{eq}) + i\left(\frac{-v_0}{\omega_0}\right)}$$

and $\boxed{\underline{A}^* = (x_0 - x_{eq}) + i\left(\frac{v_0}{\omega_0}\right)}$