1) b) find A + φ_0

$$\underline{A} = -10\text{ cm} + i\,2\text{cm}$$

$$A = \sqrt{(A_r)^2 + (A_i)^2} = \sqrt{(-10\text{cm})^2 + (2\text{cm})^2} = \boxed{\sqrt{104}\text{ cm}}$$

$$\varphi_0 = \tan^{-1}\left(\frac{A_I}{A_R}\right) = \tan^{-1}\left(\frac{2\text{cm}}{10\text{cm}}\right) = \boxed{-11.3^\circ \text{ or } -.197\text{ rad}}$$

2) a) start with $x(t) = x_{eq} + A\cos(\omega_0 t + \varphi_0)$

given Euler's Identity $e^{i\theta} = \cos\theta + i\sin\theta$

$$x(t) = x_{eq} + \text{Re}\left[Ae^{i(\omega_0 t + \varphi_0)}\right]$$

substitute $\underline{A}$ in for $Ae^{i\varphi_0}$

$$x(t) = x_{eq} + \text{Re}\left[\underline{A}\,e^{i\omega_0 t}\right]$$

Given that any complex number $\underline{B}$ can be written as $B_R + iB_I$ and has a complex conjugate $\underline{B}^* = B_R - iB_I$ It is true that

$$\underline{B} + \underline{B}^* = B_R + iB_I + B_R - iB_I = 2B_r$$

$$\text{or } \tfrac{1}{2}\left[\underline{B} + \underline{B}^*\right] = \text{Re}\left[\underline{B}\right]$$

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