$$e^{i\theta} = \cos(\theta) + i\sin(\theta)$$

$$C = a + ib$$

$$C = p + iq$$

$$C^* = a - ib$$

$$C^* = p - iq$$

$$C + C^* = (a + ib) + (a - ib) = 2a$$

$$C + C^* = (p + iq) + (p - iq) = 2p$$

$$A_0 + \sum_{n=1}^{\infty}\left[A_n\cos(n\omega_1 t) + B_n\sin(n\omega_1 t)\right]$$

$$A_0 + \sum_{n=1}^{\infty}\left[A_n\cos(n\omega_1 t) + B_n\sin(n\omega_1 t)\right] = C_0 + \sum_{n=1}^{\infty}\left[C_n e^{in\omega_1 t} + C_n^* e^{-in\omega_1 t}\right]$$

$$A_0 = C_0$$

$$A_1\cos(\omega_1 t) + B_1\sin(\omega_1 t) = C_1 e^{i\omega_1 t} + C_1^* e^{-i\omega_1 t}$$

$$C_1 = p + iq \qquad C_1^* = p - iq$$

$$A_1\cos(\omega_1 t) + B_1\sin(\omega_1 t) = (p + iq)e^{i\omega_1 t} + (p - iq)e^{-i\omega_1 t}$$

$$\begin{aligned} A_1\cos(\omega_1 t) + B_1\sin(\omega_1 t) = {} & (p + iq)\left[\cos(\omega_1 t) + i\sin(\omega_1 t)\right] + \\ & (p - iq)\left[\cos(\omega_1 t) - i\sin(\omega_1 t)\right] \end{aligned}$$

$$\begin{aligned} A_1\cos(\omega_1 t) + B_1\sin(\omega_1 t) = {} & p\cos(\omega_1 t) + ip\sin(\omega_1 t) \\ & iq\cos(\omega_1 t) + i^2 q\sin(\omega_1 t) \\ & p\cos(\omega_1 t) - ip\sin(\omega_1 t) \\ & -iq\cos(\omega_1 t) - i^2 q\sin(\omega_1 t) \end{aligned}$$

$$A_1 \cos(\omega_1 t) \; + \; B_1 \sin(\omega_1 t) \quad = \quad 2p \cos(\omega_1 t) \; - \; 2q \sin(\omega_1 t)$$

$$p \quad = \quad \frac{1}{2} A_1 \qquad\qquad q \quad = \quad -\frac{1}{2} B_1$$

$$C_1 \quad = \quad \frac{1}{2} A_1 \; - \; i \frac{1}{2} B_1$$

$$C_1^* \quad = \quad \frac{1}{2} A_1 \; + \; i \frac{1}{2} B_1$$

Fred says $\qquad y(t) \quad = \quad (30\,\mathrm{cm}) \;\; \sin(\omega t)$

Jane says $\qquad y(t') \quad = \quad (30\,\mathrm{cm}) \;\; \cos(\omega t')$