1. $e^{i\pi} + 1 = \cos\pi + i\sin\pi + 1 = -1 + 1 = 0$

2. (a) $\phi_X(t) = pe^{it} + (1-p)$

(b) $\phi_Y(t) = \left[pe^{it} + (1-p)\right]^n$

(c) $\phi_Z(t) = E\left[e^{itZ}\right] = E\left[e^{it\left(\frac{1}{n}Y - p\right)}\right] = e^{-itp}E\left[e^{itY/n}\right] = e^{-itp}\phi_Y(t/n)$

$= \left[pe^{it/n} + (1-p)\right]^n e^{-itp}$