$x(t)$ has amplitude A, period T, and $\omega_0 = \frac{2\pi}{T}$,

3) A) $C_0 = \frac{1}{T}\int_{-T/2}^{T/2} x(t)\, e^{-jk\omega_0 t}\, dt = \frac{1}{T}\int_{-T/2}^{T/2} A\, dt = \frac{A}{T}\left(\frac{T}{2} - \left(-\frac{T}{2}\right)\right) = \frac{A}{T}(T) = A$

$C_k = \frac{1}{T}\int_{-T/2}^{T/2} x(t)\, e^{-jk\omega_0 t}\, dt = \frac{1}{T}\int_{-T/2}^{T/2} A e^{-jk\omega_0 t}\, dt = \frac{A}{T}\left(\frac{1}{-jk\omega_0}\right) e^{-jk\omega_0 t}\Big|_{-T/2}^{T/2} =$

$= \frac{A}{T}\left(\frac{1}{-jk\omega_0}\right)\left[e^{-jk\omega_0 \frac{T}{2}} - e^{-jk\omega_0 \left(-\frac{T}{2}\right)}\right] = \frac{A}{jk2\pi}\left(e^{jk\pi} - e^{-jk\pi}\right) =$

$= \frac{A}{jk2\pi}\left(e^{jk\pi} - e^{-jk\pi}\right) = \frac{A}{k\pi}\left(\frac{1}{2j}e^{jk\pi} - \frac{1}{2j}e^{-jk\pi}\right) =$ lets say $\theta = k\pi$. Then,

$= \frac{A}{k\pi}\sin(\theta) = A\left(\frac{\sin(k\pi)}{k\pi}\right) = A\,\mathrm{sinc}(k)$ ∴

$C_k = A\,\mathrm{Sinc}(k)$ ∴ Series $= C_0 + C_1 + C_2 \ldots$

However this is only for odds:

$C_{1,3,5,\ldots} = A\,\mathrm{Sinc}\,k$

$C_{2,4,6,\ldots} = 0$

B) See Attached Graphs:

C) The value overshoots 1 before coming back down to 1. This is due to the inability of the series to represent discontinuitys. (10) is the notes only works for signals that are continuous.

4) A) $C_{ky} = \frac{1}{T}\int_{-T/2 - T_1}^{T/2 - T_1} x(t - T_1)\, e^{-j\frac{2\pi}{T}kt}\, dt$ Lets say $u = t - T_1$: $t = u + T_1$

$= \frac{1}{T}\int_{-T/2 + (u-t)}^{T/2 + (u-t)} x(u)\, e^{-j\frac{2\pi}{T}k(u + T_1)}\, du$

$= \left(e^{-j\frac{2\pi}{T}kT_1}\right)\frac{1}{T}\int_{-T/2 + (u-t)}^{T/2 + (u-t)} x(u)\, e^{-j\frac{2\pi}{T}k(u)}\, du = e^{-j\frac{2\pi}{T}kT_1}\left(C_{kx}\right)$

$\boxed{C_{ky} = e^{-j\frac{2\pi}{T}kT_1} C_{kx}}$