For EACH of the part of this problem:

- You need only plot the magnitude of the DTFT over $-\pi < \omega < \pi$, but it is very important to keep in mind that a DTFT is always periodic with period $2\pi$.

- You must clearly label the DTFT magnitude plot requested and show as much detail as possible, clearly pointing out regions over $-\pi < \omega < \pi$ for which the DTFT is zero.

- You MUST show all work and explain how you got your answer concisely but with sufficient detail to receive full credit.

- The unit of $T_s$ is seconds for all parts.
(a) \( x_1(t) = \cos(4t) \). Plot the magnitude of the DTFT of \( x_1[n] = x_1(nT_s) \) for \( T_s = \frac{2\pi}{6} \).

(b) \( x_2(t) = \frac{\sin(4t)}{\pi t} \). Plot the magnitude of the DTFT of \( x_2[n] = x_2(nT_s) \) for \( T_s = \frac{2\pi}{16} \).

(c) \( x_3(t) = \frac{\sin(4t)}{\pi t} \). Plot the magnitude of the DTFT of \( x_3[n] = x_3(nT_s) \) for \( T_s = \frac{2\pi}{12} \).

(d) \( x_4(t) = \frac{\sin(4t)}{\pi t} \). Plot the magnitude of the DTFT of \( x_4[n] = x_4(nT_s) \) for \( T_s = \frac{2\pi}{9} \).

(e) \( x_5(t) = \frac{\sin(4t)}{\pi t} \). Plot the magnitude of the DTFT of \( x_5[n] = x_5(nT_s) \) for \( T_s = \frac{2\pi}{6} \).

(f) \( x_6(t) = \frac{d}{dt} \left\{ \frac{\sin(4t)}{\pi t} \right\} \). Plot the magnitude of the DTFT of \( x_6[n] = x_6(nT_s) \) for \( T_s = \frac{2\pi}{12} \).

(g) \( x_7(t) = \frac{d}{dt} \left\{ \frac{\sin(4t)}{\pi t} \right\} \) Plot the magnitude of the DTFT of \( x_7[n] = x_7(nT_s) \) for \( T_s = \frac{2\pi}{8} \).

(h) \( x_8(t) = \left( \frac{\sin(4t)}{\pi t} \right)^2 \). Plot the magnitude of the DTFT of \( x_8[n] = x_8(nT_s) \) for \( T_s = \frac{2\pi}{16} \).

(i) \( x_9(t) = \left( \frac{\sin(4t)}{\pi t} \right)^2 \). Plot magnitude of the DTFT of \( x_9[n] = x_9(nT_s) \) for \( T_s = \frac{2\pi}{12} \).

(j) \( x_{10}(t) = t \left( \frac{\sin(4t)}{\pi t} \right)^2 \). Plot magnitude of the DTFT of \( x_{10}[n] = x_{10}(nT_s) \) for \( T_s = \frac{2\pi}{24} \).

(k) \( x_{11}(t) = t \left( \frac{\sin(4t)}{\pi t} \right)^2 \). Plot magnitude of the DTFT of \( x_{11}[n] = x_{11}(nT_s) \) for \( T_s = \frac{2\pi}{16} \).

(\ell) \( x_{12}(t) = \left( \frac{\sin(4t)}{\pi t} \right)^2 \cos(6t) \). Plot magnitude of DTFT of \( x_{12}[n] = x_{12}(nT_s) \) for \( T_s = \frac{2\pi}{24} \).

(m) \( x_{13}(t) = \left( \frac{\sin(4t)}{\pi t} \right)^2 \cos(6t) \). Plot magnitude of DTFT of \( x_{13}[n] = x_{13}(nT_s) \) for \( T_s = \frac{2\pi}{16} \).

(n) \( x_{14}(t) = \left\{ \frac{\sin(2t)}{\pi t} \right\} \left\{ \frac{\sin(4t)}{\pi t} \right\} \). Plot the magnitude of the DTFT of \( x_{14}[n] = x_{14}(nT_s) \) for \( T_s = \frac{2\pi}{18} \).

(o) \( x_{15}(t) = \left\{ \frac{\sin(2t)}{\pi t} \right\} \ast \left\{ \frac{\sin(4t)}{\pi t} \right\} \), where \( \ast \) denotes convolution. Plot the magnitude of the DTFT of \( x_{15}[n] = x_{15}(nT_s) \) for \( T_s = \frac{2\pi}{8} \).