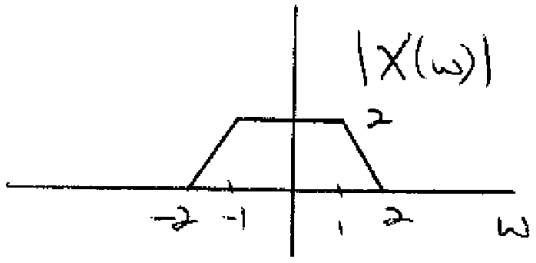
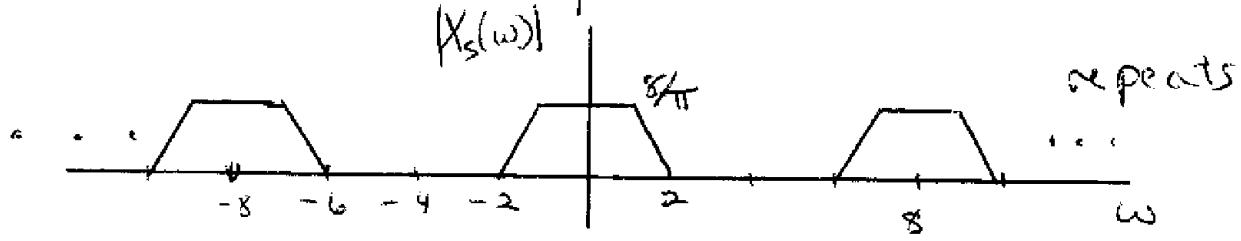
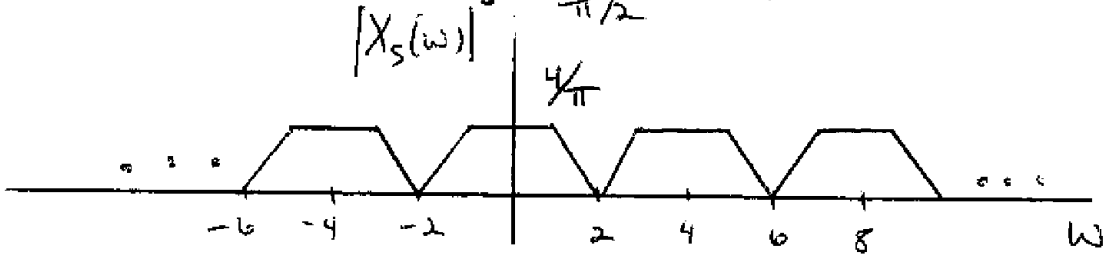
1



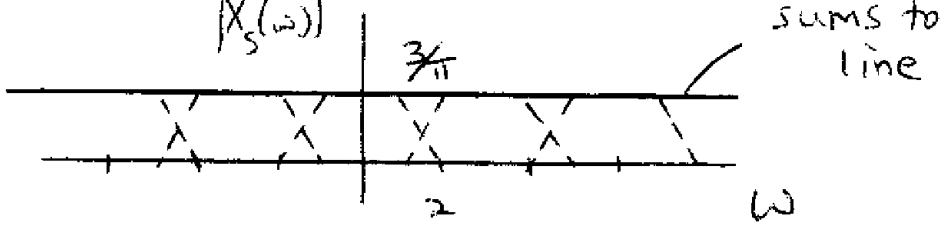
a) $T = \pi/4$ so $\omega_s = \frac{2\pi}{T} = 8$



b) $T = \pi/2$ so $\omega_s = \frac{2\pi}{\pi/2} = 4$

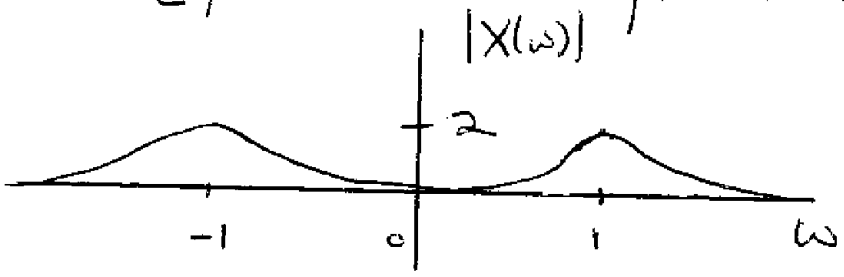


c) $T = \frac{2\pi}{3}$ so $\omega_s = \frac{2\pi}{2\pi} 3 = 3$

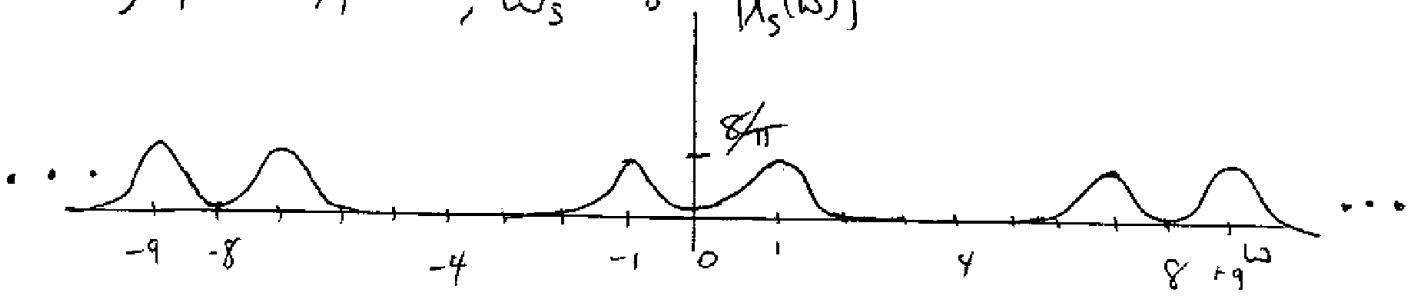


2. $x(t) = e^{-t/4}\cos(t)u(t)$

$$X(\omega) = \frac{1}{2}\left[\frac{1}{j(1-\omega)+0.25} + \frac{1}{j(1+\omega)+0.25}\right]$$

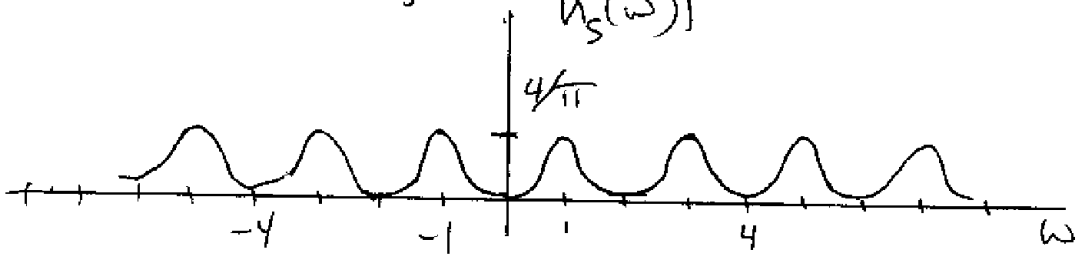


a) $T = \pi/4$, $\omega_s = 8$ $|X_s(\omega)|$



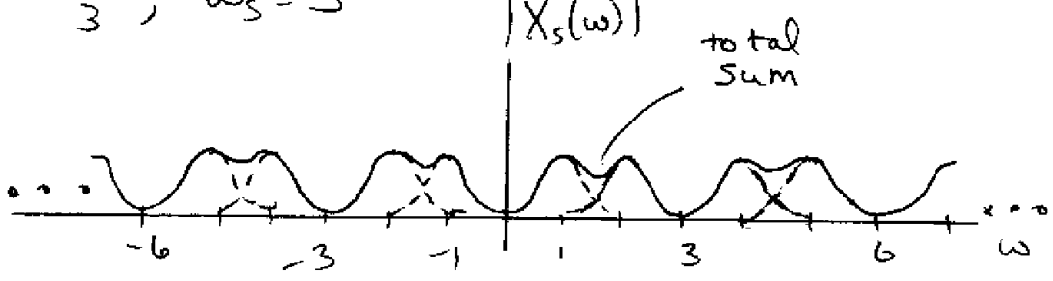
very little overlap

b) $T = \pi/2$ so $\omega_s = 4$ $|X_s(\omega)|$



some aliasing

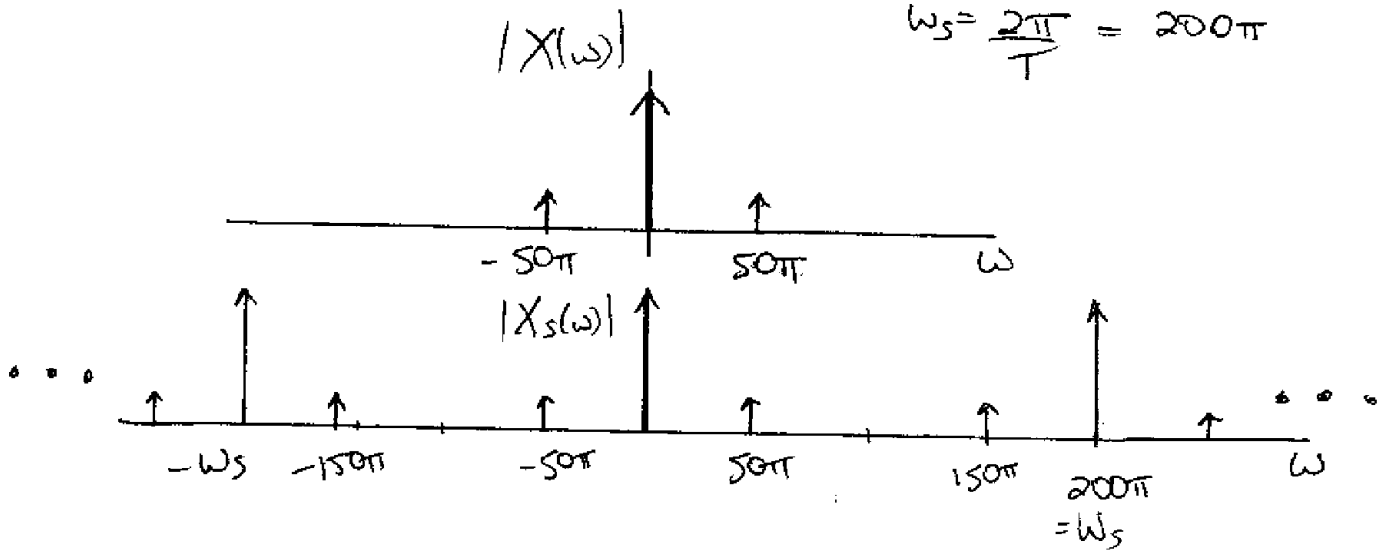
c) $T = \frac{2\pi}{3}$, $\omega_s = 3$ $|X_s(\omega)|$



a lot of aliasing

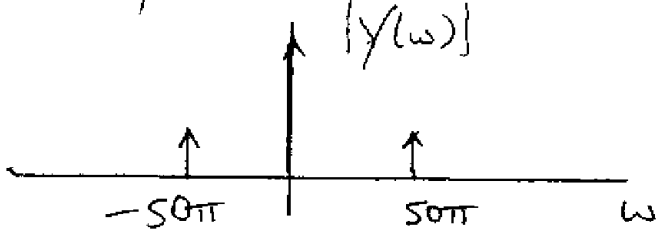
3a) $x(t) = 2 + \cos(50\pi t)$, $T = 0.01$ sec

$\omega_s = \frac{2\pi}{T} = 200\pi$



no aliasing

b) after filtering (i.e., reconstruction)



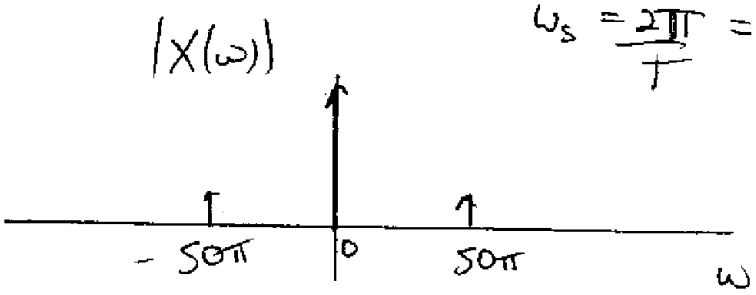
$y(t) = 2 + \cos(50\pi t)$

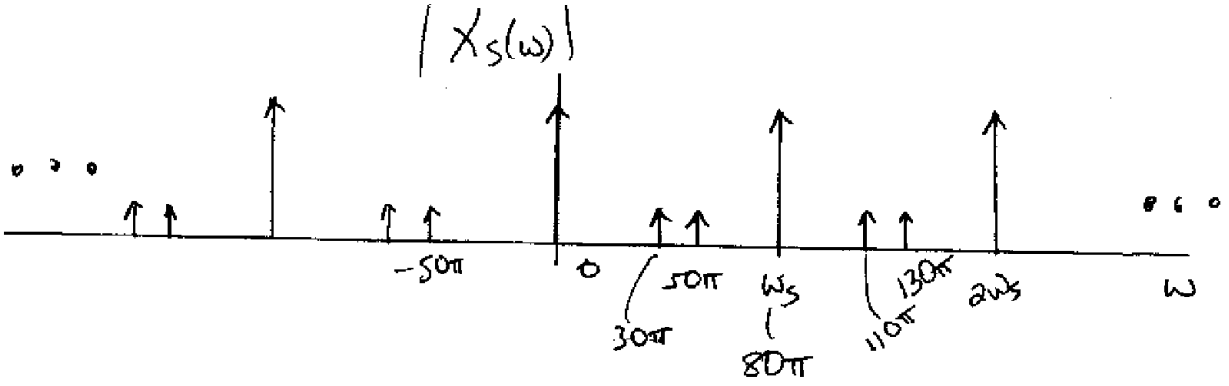
c) $x[n] = 2 + \cos(50\pi n(.01))$

$x[n] = 2 + \cos(0.5\pi n)$

4 a) $x(t) = 2 + \cos(50\pi t)$, $T = 0.025$ sec

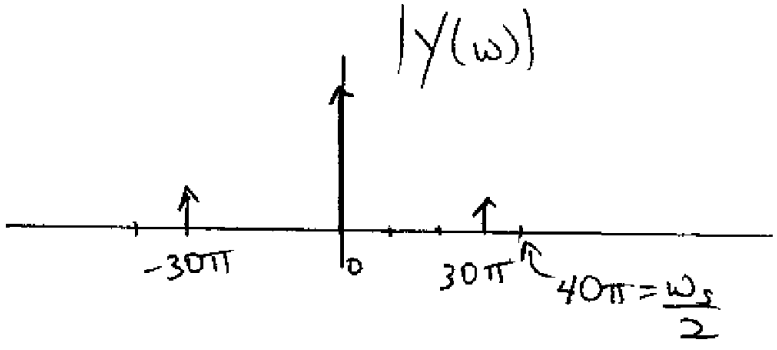
$\omega_s = \frac{2\pi}{T} = 80\pi$





aliasing, term at $\omega = 30\pi$ came from aliasing

b) after filtering (reconstruction)



$y(t) = 2 + \cos(30\pi t)$

c) $x[n] = 2 + \cos(50\pi(.025)n) = 2 + \cos(1.25\pi n)$

note that $\cos(1.25\pi n) = \cos((2\pi - 1.25\pi)n) = \cos(0.75\pi n)$

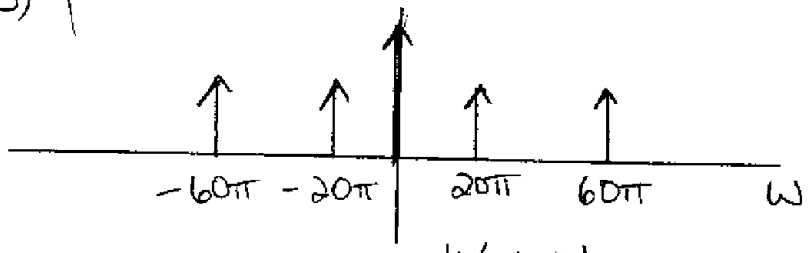
$\Rightarrow x[n] = 2 + \cos(0.75\pi n)$

Same as $y[n] = y(nT)$

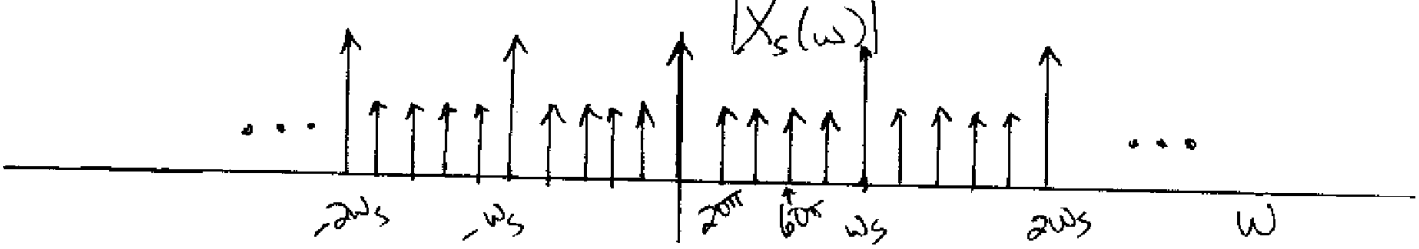
5 a) $x(t) = 1 + \cos(20\pi t) + \cos(60\pi t)$, $T = 0.02$ sec

$\omega_s = \frac{2\pi}{T} = 100\pi$

$|X(\omega)|$



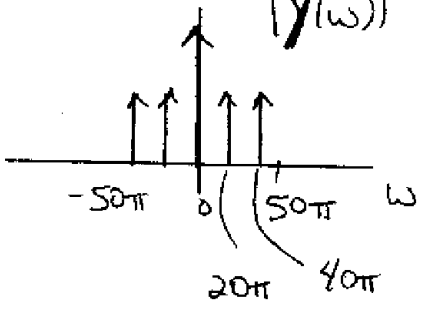
$|X_s(\omega)|$



aliasing occurs at $\omega = 40\pi$

b) after reconstruction

$|Y(\omega)|$



$$y(t) = 1 + \cos(20\pi t) + \cos(40\pi t)$$

c) $x[n] = 1 + \cos(20\pi(.02)n) + \cos(60\pi(.02)n)$

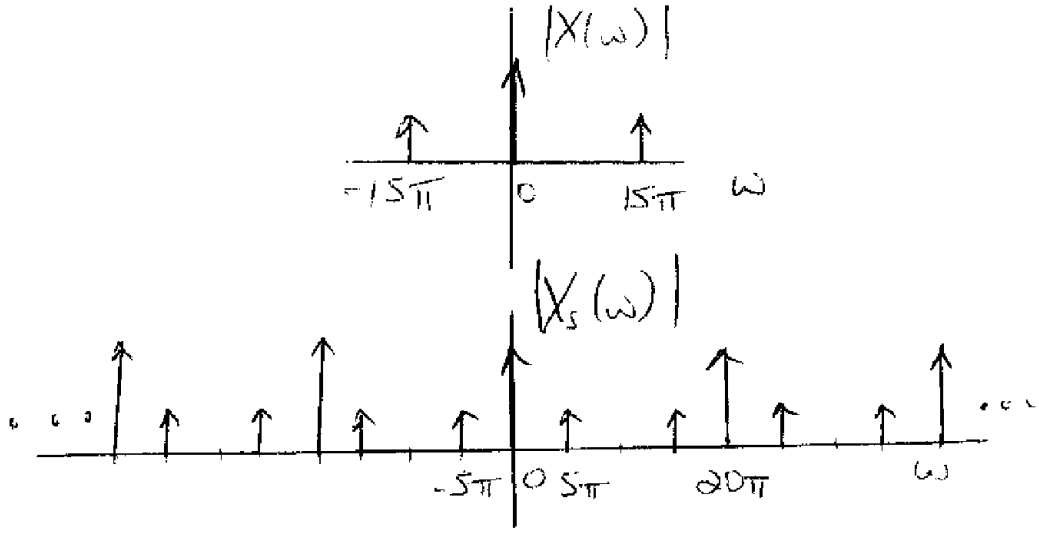
$= 1 + \cos(0.4\pi n) + \cos(1.2\pi n)$

note that $\cos(1.2\pi n) = \cos((2\pi - 1.2\pi)n) = \cos(0.8\pi n)$

$x[n] = 1 + \cos(0.4\pi n) + \cos(0.8\pi n)$

same as $y[n] = y(nT)$

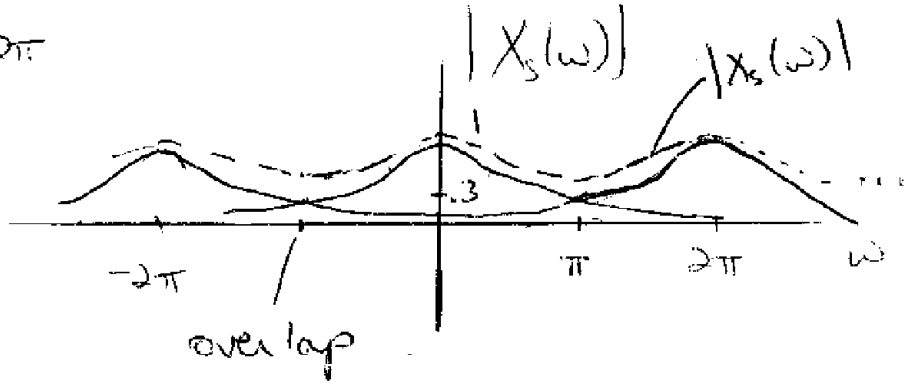
a)



$\omega_s = \frac{2\pi}{.1} = 20\pi$

$y(t) = 1 + \cos(5\pi t)$

b) $\omega_s = 2\pi$



Signal is not band limited so there will be aliasing no matter how large the value of ω_s