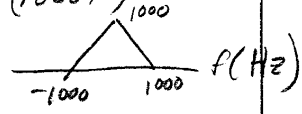
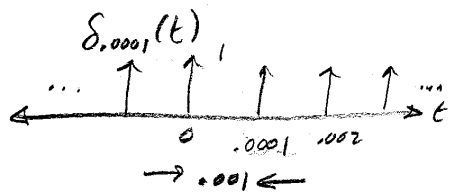
(1)

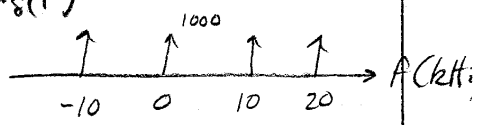
$x(t) = \text{sinc}\left(\frac{t}{1000}\right) \longleftrightarrow X(f) = 1000\,\text{tri}(1000f)$



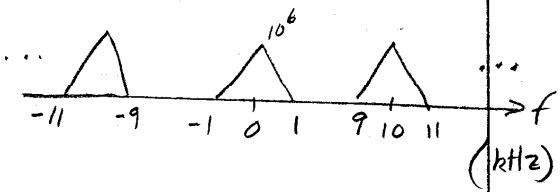


$T_s = 0.0001$

$\longleftrightarrow$

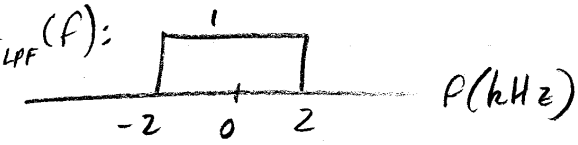


$x(t)\cdot\delta_{.0001}(t) \longleftrightarrow$



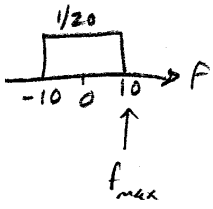
To recover original signal $x(t)$, use a Lowpass filter with cutoff frequency somewhere between 1 kHz and 9 kHz. Example:

$H_{LPF}(f)$:



(2) Text, 14-7a, d, e

(a) $x(t) = \text{sinc}(20t) \longleftrightarrow X(f) = \frac{1}{20}\,\text{rect}\left(\frac{f}{20}\right)$



Nyquist rate $= 2 f_{max} = 20$ Hz

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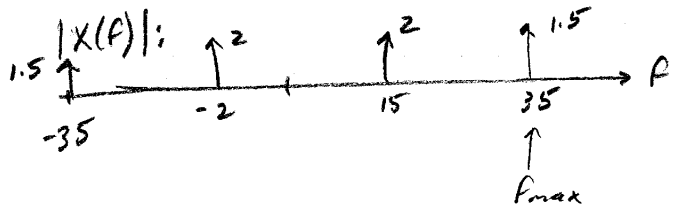
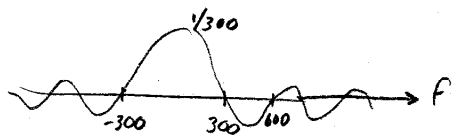
14 (d) $\overset{x(t)}{4\sin 2\pi 15 t + 3\cos 2\pi 35 t}$



Nyquist rate $= 2 \times f_{max} = 70\,\text{Hz}$

14 (e) $x(t) = \text{rect}(300t) \longleftrightarrow \frac{1}{300}\,\text{sinc}\left(\frac{f}{300}\right)$

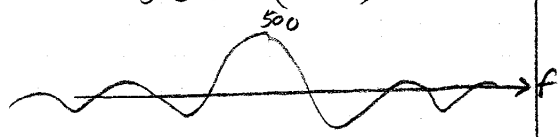


$f_{max} = \infty$

Nyquist rate $= 2 f_{max} = \infty$

(3) Text 14-8(a)

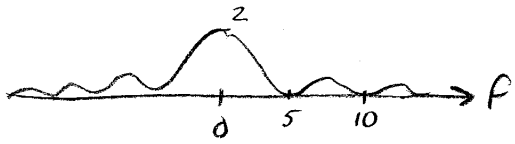
$x(t) = 5\,\text{rect}\left(\frac{t}{100}\right) \longleftrightarrow 500\,\text{sinc}(100f)$



sinc does not go to 0 and stay there as $f \to \infty$

so $x(t)$ is <u>not</u> band limited.

(b) $x(t) = 10\,\text{tri}(5t) \longleftrightarrow 2\,\text{sinc}^2\left(\frac{f}{5}\right)$



sinc^2 does not go to zero and stay there as $f \to \infty$

so $x(t)$ is <u>NOT</u> band limited.

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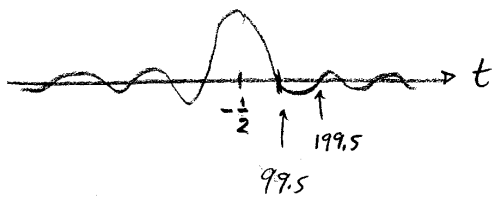
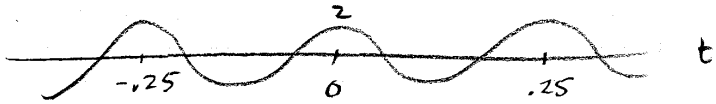
(3) Text 14-9 b, c

(b) $X(f) = \mathrm{tri}(100f)e^{j\pi f} \longleftrightarrow \frac{1}{100}\,\mathrm{sinc}^2\left(\frac{t+\frac{1}{2}}{100}\right)$



sinc^2 is not time limited.

(c) $X(f) = \delta(f-4) + \delta(f+4) \longleftrightarrow 2\cos 2\pi 4t$



cosine is not time limited.