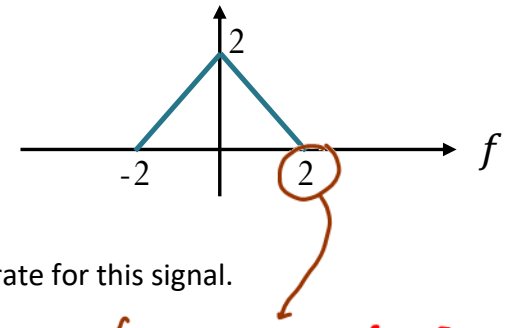
ECS 332: In-Class Exercise # 18_1

Instructions

1. Separate into groups of no more than three persons. **The group cannot be the same as any of your former groups after the midterm.**
2. Write down all the steps that you have done to obtain your answers. You may not get full credit even when your answer is correct without showing how you get your answer.
3. **Do not panic.**

Date: 16 / 11 / 2018			
Name	ID (last 3 digits)		
Prapun	**5**	**5**	**5**

Consider a continuous-time signal $g(t)$ whose **Fourier transform** is plotted below.



(a) Find the Nyquist sampling rate for this signal.

Nyquist sampling rate $= 2 \times f_{max} = 2 \times 2 = 4$ [Sa/s]

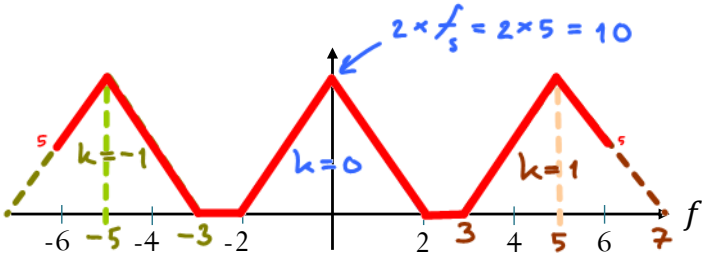
Note that f_{max} is NOT the freq. at which the spectrum is maximum.

Mathematically, $f_{max} = \max\{f : G(f) \neq 0\}$.

(b) The ideal sampled signal $g_\delta(t)$ is defined by $g_\delta(t) = \sum_{n=-\infty}^{\infty} g[n]\,\delta(t - nT_s)$ where T_s is the sampling interval.

Plot the **Fourier transform** of $g_\delta(t)$ from $f = -6$ to $f = 6$.

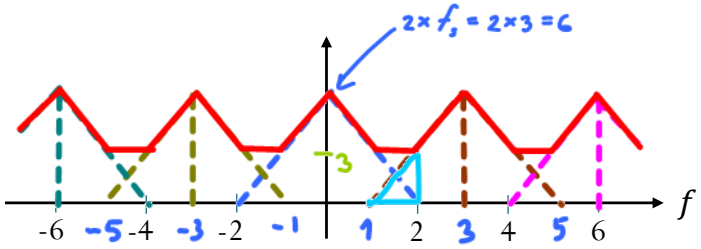
a. when $T_s = 0.2$ $\Rightarrow f_s = \frac{1}{T_s} = \frac{1}{0.2} = \frac{10}{2} = 5$



$G_s(f) = \sum_{k=-\infty}^{\infty} f_s\, G(f - kf_s)$

Only $f_s G(f - kf_s)$ for $k = -1, 0, 1$ are shown here. The contributions from other k values are outside of this region.

b. when $T_s = 1/3$ $\Rightarrow f_s = \frac{1}{T_s} = 3$



Note: The sum of two straight lines is also a straight line.

$((a_1 f + b_1) + (a_2 f + b_2)) = (a_1 + a_2) f + (b_1 + b_2)$

So it is sufficient to simply look at their sums at the two boundaries and connect them using straight line.

Using similar triangle,

$\frac{1}{2} = \frac{h}{6} \Rightarrow h = \frac{1}{2} \times 6 = 3$