September 19,2003

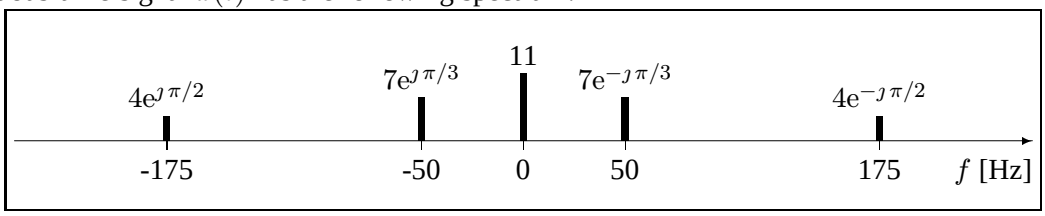
Homework #3, EECS 206, F03. Due **Fri. Sept. 26**

Notes

-
- Reading: "Part 3a" lecture notes (p.1-8 for now).
  Soon: Ch. 3 of text, 3.4.5 supplement (on web), Prof. Wakefield's Fourier series "quick primer" (on web)

Skill Problems

1. [25] Concept(s): ***spectra and effect of time shift/scale***
   A continuous-time signal $x(t)$ has the following spectrum.



   (a) [5] Determine an equation for $x(t)$ as a sum of sinusoidal signals in standard form.

   (b) [5] Is $x(t)$ a periodic signal? If so, find its period.

   (c) [0] Explain why "negative" frequencies are needed in the spectrum.

   (d) [5] Sketch the spectrum of the following signal: $y_1(t) = -2x(t)$. Hint: $-22 = 22e^{j\pi}$.

   (e) [5] Sketch the spectrum of the following signal: $y_2(t) = x(3t)$.
   [0] Describe how this time scaling affected the spectrum.

   (f) [5] Sketch the spectrum of the following signal: $y_3(t) = x(t - 1/4)$.
   [0] Describe how this time shift affected the spectrum.

2. [25] Concept(s): ***spectra from formula***
   Consider the signal $x(t) = 4 + \cos(2\pi 3t) + \sin^2(5\pi t)$.
   (a) [10] Express this $x(t)$ as a sum of complex exponential signals. (Use an inverse Euler identity.)

   (b) [5] Sketch the magnitude spectrum of this signal.

   (c) [5] Sketch the phase spectrum of this signal.

   (d) [5] Sketch the spectrum of $y(t) = 3x(2t - 1/4)$.