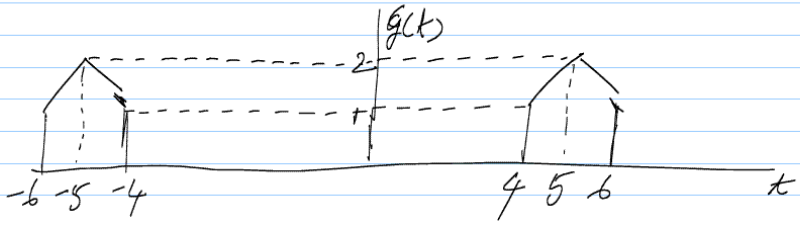
WEDNESDAY QUIZ 1

Note Title 2/11/2008

FIND THE FOURIER TRANSFORM OF THE FOLLOWING SIGNAL



$\text{RECT}(t) \rightleftharpoons \text{SINC}(f)$

$\text{RECT}(t) = 1$ IF $|t| < \frac{1}{2}$

$= 0$ OTHERWISE

~~$\text{RECT}(t) * \text{RECT}(t)$~~ 1

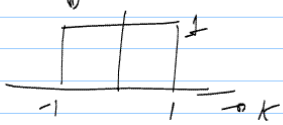
$\text{RECT}(t) * \text{RECT}(t) = \text{TRIANG}(t)$

$\text{TRIANG}(t) = 1 - |t|$ FOR $|t| < 1$

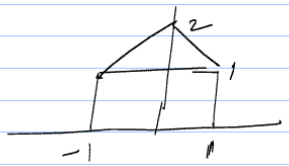
$= 0$ OTHERWISE

CONSIDER $\text{RECT}(t/2) = 1$ IF $|t| < 2/2$

$= 0$ OTHERWISE



LET $\quad house(t) = rect(t/2) + triang(t)$



$rect(t) \rightleftharpoons sinc(f)$

SCALING $\quad rect(t/2) \rightleftharpoons 2\,sinc(2f) \longrightarrow (1)$

$rect(t) * rect(t) = triang(t)$

CONVOLUTION $\quad rect(t) * rect(t) \rightleftharpoons sinc^2(f)$

$\therefore \; triang(t) \rightleftharpoons sinc^2(t) \longrightarrow (2)$

COMBINING (1) & (2),

$house(t) \rightleftharpoons HOUSE(f) = 2\,sinc(2f) + sinc^2(f)$

TIME SHIFTING $\quad house(t-5) \rightleftharpoons HOUSE(f)\,exp(-j2\pi f5)$

$\quad house(t+5) \rightleftharpoons HOUSE(f)\,exp(j2\pi f5)$

$\therefore \; house(t-5) + house(t+5) \rightleftharpoons HOUSE(f)\,2\cos(10\pi f)$

$= [2\,sinc(2f) + sinc^2(f)]\,2\cos(10\pi f)$