

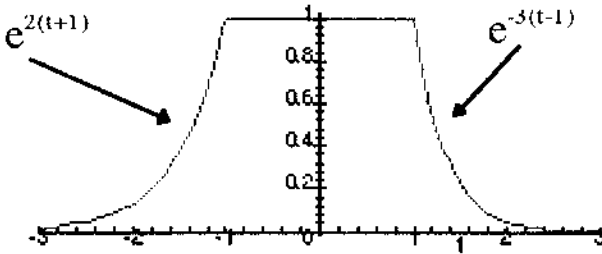
**Rose-Hulman Institute of Technology**  
**Electrical and Computer Engineering**

EC 300 - Exam No. 3

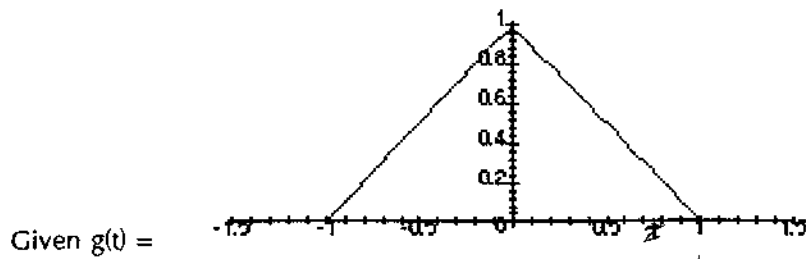
Thursday, February 13, 1997

**CLOSED BOOK.** Work each problem in the space provided on its sheet. Be sure the work you present is clear so the grader can understand what you have done. One 3" x 5" card and a calculator/computer are allowed. No other aids, animate or inanimate, are permitted. All problems have the same weight. Please do your own work. State answers in engineering form. **Box your answer, please, and don't forget units!**

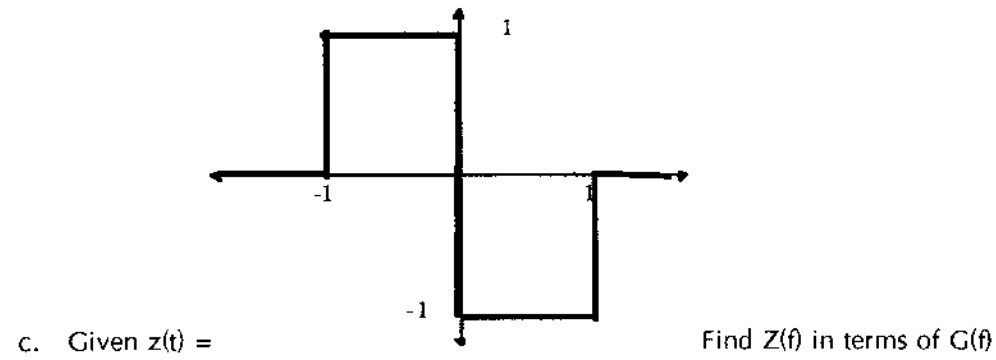
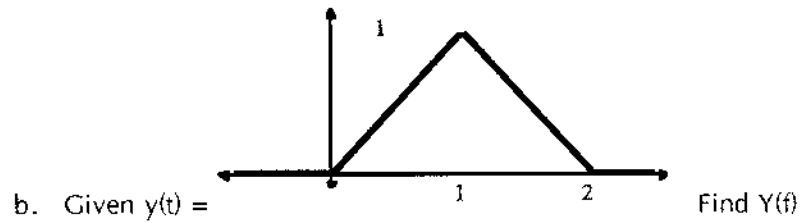
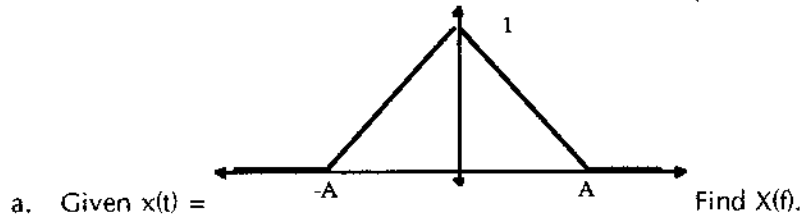
**Problem 1** – Write the integral needed to find Fourier transform of the signal below. **Do not simplify.**



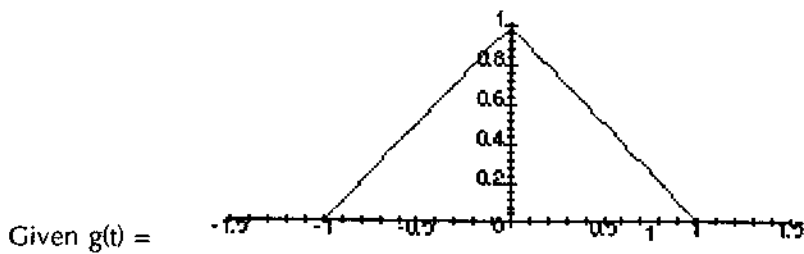
**Problem 2 – Short answer -**



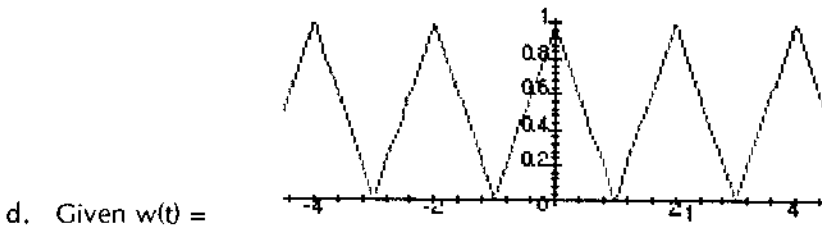
the table says  $G(f) = \text{sinc}^2(f)$



**Problem 3 – Short answer (continued)**



the table says  $G(f) = \text{sinc}^2(f)$

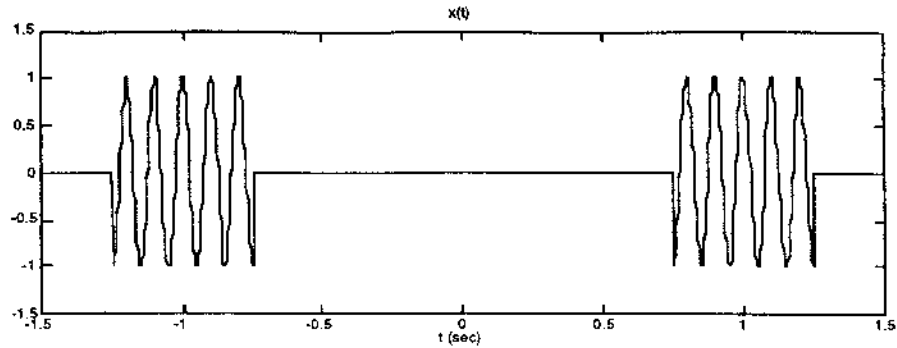


that is  $w(t)$  is a periodic version of  $g(t)$ . Find the Fourier Series coefficients,  $c_k$ , of  $w(t)$  in terms of  $G(f)$ .

e. What is  $\int_{-\infty}^{\infty} g(\alpha) \delta\left(\alpha - \frac{1}{2}\right) d\alpha$

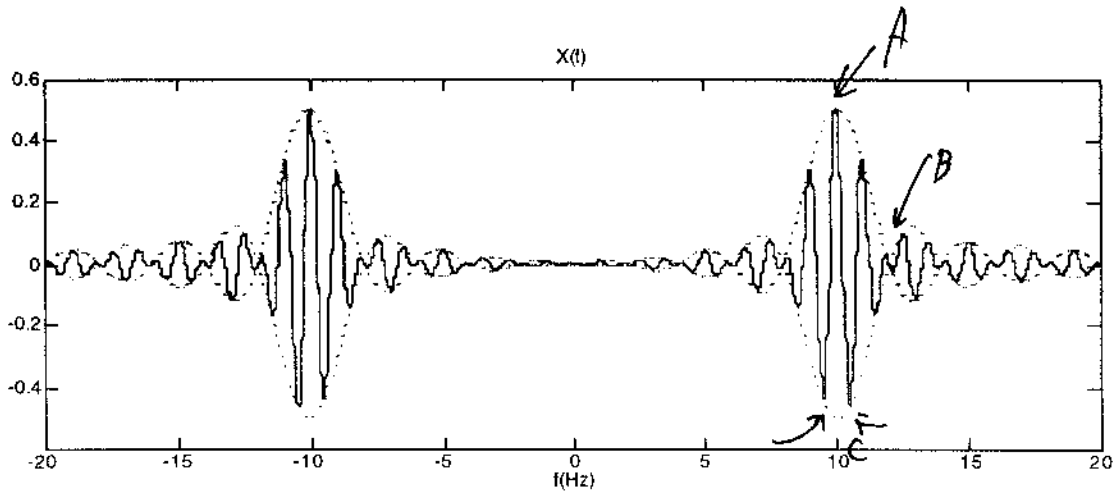
**Problem 4** - A plot of the signal  $x(t) = \text{rect}\left(\frac{t}{T}\right) \cos(2\pi f_0 t) * [\delta(f - t_0) + \delta(f + t_0)]$  is shown below.

- a. Mark on the plot of  $x(t)$  the parameters  $T$ ,  $f_0$ , and  $t_0$ .



The Fourier Transform,  $X(f)$ , of  $x(t)$  is shown.

- b. What is the equation for  $X(f)$ ?



- c. Which of the parameters controls the position of the peak labeled A? (Circle one)

$T$       $f_0$       $t_0$

- d. Which way does the peak move if you increase this parameter?

To the left                      To the right

- e. Which of the parameters controls the position of the null labeled B?

$T$       $f_0$       $t_0$

- f. If it is increased which way does the null move relative to the peak A?

Toward A                      Away from A

- g. Which of the parameters controls the frequency spacing between the peaks labeled C?

$T$       $f_0$       $t_0$

- h. If the parameter is increased will the frequency spacing increase or decrease?

**Problem 5** - Given,  $x(t)$ , a pulsed cosine shown below, write the time-domain expression. Express it in a form that is easy to find the Fourier transform, but don't find the transform. The pulses go on forever.

