

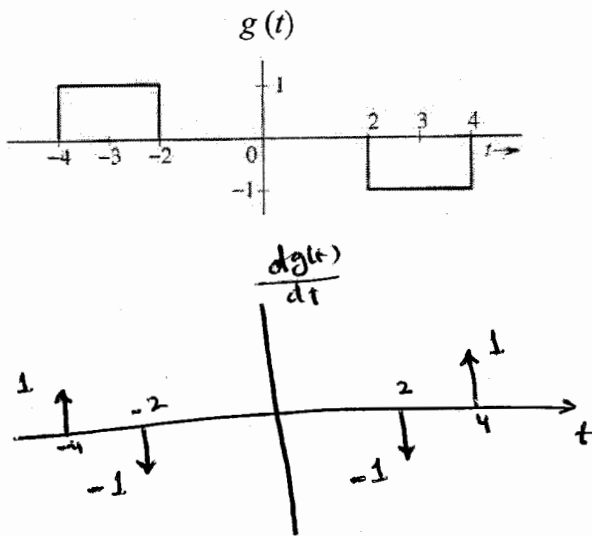
Name: **KEY**

ver. 1

We would like to find the Fourier transform of  $g(t)$  using the time differentiation property.

- 1) Sketch the  $\frac{dg(t)}{dt}$ . Show all important values. 3
- 2) Find the Fourier transform of  $\frac{dg(t)}{dt}$ . 4
- 3) Find and simplify the Fourier transform of  $g(t)$ . 3

Tables provided at the back of this page.



$$\frac{dg(t)}{dt} = \delta(t+4) - \delta(t+2) + \delta(t-2) - \delta(t-4)$$

$$\mathcal{F}\left[\frac{dg(t)}{dt}\right]$$

$$\mathcal{F}[\delta(t)] = 1$$

using the Time shift property

$$e^{-j\omega 4} - e^{-j\omega 2} + e^{j\omega 2} - e^{j\omega 4}$$

Using the differentiation property

$$\mathcal{F}\left[\frac{dg(t)}{dt}\right] = j\omega G(\omega)$$

$$\Rightarrow G(\omega) = \frac{1}{j\omega} \mathcal{F}\left[\frac{dg(t)}{dt}\right]$$

$$= \frac{1}{j\omega} \left[ e^{-j\omega 4} + e^{j\omega 4} - e^{-j\omega 2} - e^{j\omega 2} \right]$$

$$= \frac{1}{j\omega} \left[ 2 \cos 4\omega - 2 \cos 2\omega \right]$$

$$= \frac{2}{j\omega} \left[ \cos 4\omega - \cos 2\omega \right]$$