ELECENG 4035 - COMMUNICATIONS IV
Tutorial 1

1 Exercise 2.10 from Proakis and Salehi

This question is intended to help you practise finding Fourier transforms for the sort of signals we will encounter in this course. Make sure you have the handout showing Fourier transforms and theorems in front of you.

It is also intended to help you become familiar with some of the special functions we use, in particular rect, sinc and Δ.

Determine the Fourier transform of each of the following signals (α is positive).

1. $x(t) = \frac{1}{1+t^2}$
2. $x(t) = \mathrm{rect}(t-3) + \mathrm{rect}(t+3)$
3. $x(t) = \Delta(2t+3) + \Delta(3t-2)$
4. $x(t) = \mathrm{sinc}^3(t)$
5. $x(t) = t\mathrm{sinc}(t)$
6. $x(t) = t\cos(2\pi f_o t)$
7. $x(t) = \exp(-\alpha t)\cos(\beta t)$
8. $x(t) = t\exp(-\alpha t)\cos(\beta t)$

2 Exercise 2.56 from Proakis and Salehi

This question is intended to help you understand why we might use analytic signals.

The bandpass signal $x(t) = \mathrm{sinc}(t)\cos(2\pi f_o t)$ is passed through a bandpass filter with impulse response $h(t) = \mathrm{sinc}^2(t)\sin(2\pi f_o t)$. Using the lowpass equivalents of both the input and the impulse response, find the lowpass equivalent of the output and from it the output $y(t)$.