Question 1

a) For the doublet pulse given below

(i) Show that the Fourier transform is given as

\[ X(f) \leftrightarrow 2jAT\text{sinc}(Tf)\sin(\pi Tf) \]  

[3 marks]

(ii) Based on the result in (i) show that the Fourier Transform of a triangular pulse is given as

\[ \text{tri}\left(\frac{t}{T}\right) \leftrightarrow T\text{sinc}^2(Tf) \]  

[3 marks]

b) For the following system

\[ x(t) = 8\text{tri}\left(\frac{t}{4}\right) \quad \rightarrow \quad y(t) = x(t)c(t) \]

\[ c(t) = \cos(2\pi 10^6 t) \]

Find the expression for the Fourier transform of the output signal \( y(t) \).  

[5 marks]

c) For a rectangular pulse given below

\[ \text{rect}\left(\frac{t}{T}\right) \]

\[ -\frac{T}{2} \quad \frac{T}{2} \]  

\[ t \]
Show that the Fourier transform is given as [4 marks]

\[ \text{rect}\left(\frac{t}{T}\right) \Leftrightarrow T\text{sinc}(Tf) \]

d) For the following signal in time domain

\[ g(t) = \text{rect}\left(\frac{t}{16}\right)\text{rect}\left(\frac{t-4}{8}\right) \]

(i) Plot \( g(t) \). [4 marks]

(ii) Find the expression for the Fourier transform of \( g(t) \). [6 marks]