Homework 8 (due 13th April)

1. A damped harmonic oscillator has a damping parameter β = 3 rad/s. k = 49 N/m, mass = 1 kg and is driven by a force of $F=A\cos(\omega t)$. Ignore transient effects.

Find:

a) The angular frequency ω_R it should be driven at to get maximum amplitude of displacement.
b) The Q value of the oscillator
c) The ratio of amplitude obtained with ω=5 rad/s compared with that obtained with ω_R.
d) The phase angle between the driving force and the resultant motion.
e) If the damping was changed so that it was critically damped, what would β be now?
f) Now that it is critically damped, what angular frequency would give the maximum amplitude of displacement?

2. A force F(t) has a period of $2\pi/\omega$ and is given by F(t)=A for $-\pi/2\omega < t < \pi/2\omega$ and F(t)=0 for the rest of the time in the range $-\pi/\omega < t < \pi/\omega$. Find the Fourier series for this function.