

**Problem P3:**

In class we showed that the motion  $x(t)$  for an arbitrary force  $F(t)$  applied to a damped harmonic oscillator can be found by evaluating the integral

$$x(t) = \frac{1}{m\omega_1} \int_{-\infty}^t F(t') \sin \omega_1(t - t') e^{-\beta(t-t')} dt'.$$

- a) Find  $x(t)$  for a step force,  $F(t) = 0$  for  $t < 0$  and  $F(t) = F_0$  for  $t > 0$ .
- b) Find  $x$  in the limit  $t \rightarrow \infty$  and explain why the result is what you would expect.