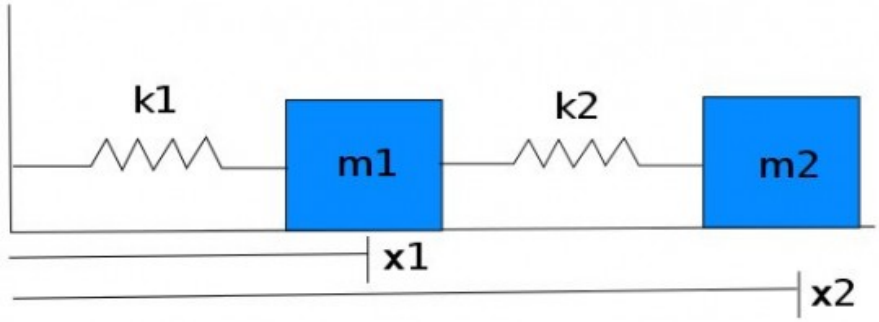
WEEK 8 SECTION PROBLEMS

If not otherwise specified, solve the following problems. If initial conditions are given, solve for all constants of integration. It is okay to leave answers in implicit form or with unsolved integrals.

1. For the following, give the natural frequency ω_0. State whether or not there is resonance or beats, and give a reason for why.
   a) $y'' + 4y = sin(2t)$
   b) $y'' + 5y' + 2y = cos(2t)$
   c) $y'' + y' + 2y = 3$
   d) $y'' + 4y = sin(2.05t)$

2. For the system described by the image below, derive the system of ODEs governing the mass-spring system. Treat the masses as point masses and assume no damping or friction.



3. Perform the following integrals:
   a) $\int_0^\infty e^{-sx} dx$
   b) $\int_0^\infty sin(x) e^{-sx} dx$
   c) $\int_0^\infty u(x-2) sin(x-2) e^{-sx} dx$

4. Solve the following using a Laplace transform:

$$y'' - 2y' + y = 2\,; \qquad y(0) = 0 \qquad y'(0) = 0$$