DEPARTMENT OF MATHEMATICS

MATHS 260 **Tutorial Week 12 - Notes**

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1. (a) See lecture notes for explanation of model.
   (b) See lecture notes
   (c) i. Equilibrium is a centre. The mass oscillates for ever.
   ii. Equilibrium is a spiral sink. The mass oscillates with decreasing amplitude and approaches rest. It is underdamped.
   iii. Equilibrium is a sink. The mass approaches rest without oscillation. It is overdamped.
   iv. Equilibrium is a sink. The mass approaches rest without oscillation. It is critically damped.

2. $y = c_1 e^{2t} + c_2 e^{-3t}$.
   (a) $y = \frac{3}{5}e^{2t} + \frac{2}{5}e^{-3t}$. Tends to infinity.
   (b) $y = e^{-3t}$. Tends to zero.

3. (a) When $p = 3, q = 2, w = 1$,
   i. $y = c_1 e^{-2t} + c_2 e^{-t}$.
   ii. Substitute into DE to check.
   iii. $y = c_1 e^{-2t} + c_2 e^{-t} + 0.1\cos t + 0.3\sin t$. Long term behaviour is periodic for ever.
   (b) Oscillates for ever with a mixture of frequencies.
   (c) When $q = w^2$.