Worksheet 13, Math 1B
Damped Harmonic Motion and Series Solutions

Friday, April 20, 2012

1. A spring with a mass of 2 kg has a damping constant 14, and a force of 6 N is required to keep the spring stretched 0.5 m beyond its natural length. The spring is stretched 1 m beyond its natural length and then released with zero velocity. Find the position of the mass at any time t. Determine also what mass of weight would result in critical damping in this system.

2. Use power series to solve the initial value problem. For each series, determine the interval of convergence.

   (a) $y'' - y = 1$, $y(0) = 0$, $y'(0) = 0$

   (b) $y'' + xy = 0$, $y(0) = 0$, $y'(0) = 1$

   (c) $y'' + \dfrac{2y'}{x} = 0$, $y(1) = 1$, $y'(1) = -1$

   (d) $x^2 y'' + xy' + x^2 y = 0$, $y(0) = 1$, $y'(0) = 0$

   The solution to the last of these initial value problems is called a Bessel function of order 0.