MthSc 208 (Spring 2011) Worksheet 3c

MthSc 208: Differential Equations (Spring 2011) In-class Worksheet 3c: Harmonic motion

NAME:
When a 2 kg mass is hung from a spring, the spring is displaced by 0.5 m. Now, suppose that the mass
is displaced an additional 0.12 m downward from this equilibrium, and then released. We will set up and
solve an initial value problem that models this.

(a) Sketch this mass-spring system, before and after the mass is place on the spring. (Let x = 0 be the height of the spring without the mass).

(b) At equilibrium, the spring force kx_0 equals the gravitational force, mg, in magnitude. Use this to solve for the spring constant k.

(c) Newton's 2^{nd} law tells us that F = mx'', which is equal to the sum of the forces (gravitational and spring). Write down a second-order differential equation that models this. Include both initial conditions, x(0) and x'(0).

Written by M. Macauley

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(d)	Find the g	general	solution	to this	ODE.	Is there	a steady-state	solution?	If so,	describe it.
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(e) Solve the initial value problem. (*Hint*: Use the "simplest" initial condition first).

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