Math 2280 HOMEWORK #6 Name:

Due 2/16/2024, 9:30 A.M.

Solve the following problems and staple your solutions to this cover sheet. (Computer outputs must be put in the appropriate place in the solution, not attached as an appendix. You may physically cut and paste the output in the problem or allow appropriate space in the printout to add your hand written work.)

1. Sec 3.4 #2 Hint: The term $e^{-0.8t}$ in the equation for the time the object hits the ground can be ignored! Why? However, you may solve the equation for the time the object hits ground, using Mathematica. See below.

2. Sec 3.4 #3 Must start with appropriate ODE's and solve them. Hint: To solve the equation for the time the object hits the ground, use Mathematica. See below.

3. Sec 3.4 #13 Hints: With the up direction being the positive direction, $3\,\frac{dv}{dt} = -0.1v^2 - 29.43$, $v(0) = 500$. At the maximum height, $v = 0$. You can also find the maximum height without finding the height $x(t)$ as a function of t, by thinking of v as a function of x, $v = v(x)$, using the chain rule $\frac{dv}{dt} = \frac{dv}{dx}\,\frac{dx}{dt}$, and then solving $-\frac{0.1}{3}v^2 - 9.81 = \frac{dv}{dx}\,v$, with the initial condition at $x = 0$, $v(0) = 500$.

4. Sec 4.1 #2
   Hint: Plug in $f(t) = cy(t)$ and $f(t) = y_1(t) + y_2(t)$ in the left side of the ODE and simplify to get the right side, or 0.

5. Sec 4.1 #3
   Hint: L'Hospital's rule!

6. Sec 4.1 #8
   Hint: Plug $y(t) = A\cos 5t + B\sin 5t$ into the ODE and match the coefficients of sines and cosines.

7. Sec 4.2 #7

8. Sec 4.2 #13

9. Free points!

10. Free points!

Mathematica Commands

See your HW 2 for Mathematica commands. Below are just reminders of some useful commands for this homework.

To solve the equation $f(x) = g(x)$ numerically, do the following.

`NSolve[`$f(x)$`==`$g(x)$`]`

The `NSolve` may not work well. To apply the Newton's method to solve the equation $f(x) = g(x)$ with the starting x-value x_1, do the following.

`FindRoot[`$f(x)$`==`$g(x)$`,{x,`x_1`}]`