Exam 2
Chapter 2.2-2.5 and 3

Name:_____

Do not write your name on any other page. Answer the following questions. *Answers without proper evidence of knowledge will not be given credit.* Make sure to make reasonable simplifications. Do not approximate answers. Give exact answers. **Only scientific calculators are allowed on this exam.**

Show your work!

1. (10 points) Draw the phase diagram for the autonomous differential equation

$$\frac{dx}{dt} = x^2 - 5x + 4$$

and determine which critical points are stable and unstable.

2. (10 points) Consider a body that moves horizontally through a medium whose resistance is proportional to the square of velocity so that

$$\frac{dv}{dt} = -2v^2.$$

Assuming that $v(0) = 1$ and $x(0) = 1$, find the position $x(t)$ as a function of t.

3. (10 points) Find the general form of the complementary solution of the differential equation

$$6y^{(4)} + 5y^{(3)} + 25y'' + 20y' + 4 = 0$$

which has characteristic function

$$(r^2 + 4)(6r^2 + 5r + 1) = 0.$$

4. (10 points) Find the particular solution to the differential equation

$$y'' + 2y' + 2y = 3x^2 - 1.$$

5. (10 points) Consider an RLC circuit with $R = 40$ ohms, $L = 10$ henries, $C = 0.02$ farads and $E(t) = 50 \sin 2t$ volts at time t. This information gives the differential equation

$$10I'' + 40I' + 50I = 100 \cos 2t$$

for the current $I(t)$ (in amperes). Find the general complementary solution and the particular solution for this circuit.