Exam 2 review:

To solve a single differential equation, for exam 2, use Ch 5 methods:

A.) If you have an Euler equation, $x^2y'' + \alpha xy' + \beta y = 0$ where α, β are constants, use simple 5.4 method (guess $y = |x|^r$, breaks into standard 3 cases, see 5.4 handouts).

B.) Suppose you are interested in the solution near $x = x_0$, then we can find

(1.) exact solution solution by solving for the series solution (ex: see 5.2 handout)

(2.) An approximate solution by determining the first few terms in the series solution (ex: see 5.5 part 2 handout)

Determine if x_0 is an ordinary point, regular singular value, or irregular singular value.

If x_0 is an ordinary point, solution near x_0 is $\Sigma_{n=0}^{\infty} a_n(x - x_0)^n$.

If x_0 is a regular singular point, solution near x_0 is $\Sigma_{n=0}^{\infty} a_n(x - x_0)^{n+r}$.

When (and where) do you know when solution exists?

What are the subparts of these problems?

Look at theory including existence, uniqueness, domain of solution, linearity.

To solve a system of differential equations use Ch 7 methods:

Linear: find eigenvalues, eigenvectors, breaks into standard 3 cases (plus a subcase) – see last 7.5 handout

When do you know a solution exists? uniqueness? Linearity properties?

Be able to translate an nth order linear differential equation into a system of n linear differential equations and write in matrix form.

Understand and be able to identify different types of critical points (equilibrium solutions = constant solutions) for both linear and non-linear systems.

* asymptotically stable, stable, unstable
* sink, center, source
* spiral, node, saddle

Be able to graph phase portrait of a linear system of DE (trajectories in x_1, x_2-plane). Also be able to graph x_i versus t for simple cases.

Completely understand Fig 9.1.9.

Look at theory including existence, uniqueness, domain of solution, linearity.