

Chapter 1:

- Solve a first order differential equation using separation of variables.
- Solve a first order differential equation using the integrating factor technique.
- Use the initial condition to solve for the unknown constant in the general solution

Chapter 2:

- Find the critical points of a first order differential equation and determine their stability.

Chapter 3:

- Write a linear system as an augmented matrix system
- Use Gaussian elimination to convert an augmented matrix to reduced echelon form.
- Use the reduced echelon form of a matrix to identify free variables and express all possible solutions to the system (or explain why no solutions exist)
- Calculate the determinant of a matrix

Chapter 4:

- Determine whether a set of vectors is linearly independent or linearly dependent.
- Determine whether or not a finite set of vectors is a basis of a give vector space.
- Determine the solution space of a linear system.
- Determine whether two functions are linearly independent.

Chapter 5:

- Find the general solution for a homogeneous linear differential equation with constant coefficients when the roots of the characteristic equation are:
 - Distinct
 - Duplicated
 - Complex
- Find the specific solution to a homogenous linear differential equation with constant coefficients given a set of initial conditions.

Chapter 10:

- Using the table on the front cover of your book, know how to find the Laplace Transform of any of the following types of functions:
 - Polynomial
 - Trigonometric
 - Exponential
 - Basic piece-wise
- Using the table on the front cover of your book, know how to find the Inverse Laplace Transform of any of the following types of functions:
 - Rational
 - Exponential
- Use the Laplace Transform Method to solve an initial value problem.

Chapter 6:

- Find all eigenvalues and eigenvectors of a matrix.
- Find the eigenspace of a given eigenvalue.
- Determine whether a given eigenvalue is complete or defective.

Chapter 7:

- Rewrite an n th order differential equation as a system of n first order differential equations.
- Use the eigenvalue method to find the general solution a system of n first order linear differential equations in all of the following cases:
 - Real distinct eigenvalues
 - Complex eigenvalues
 - Duplicated eigenvalues
 - Defective eigenvalues
- Find the general solution of a system of second order linear differential equations.

Chapter 9:

- Find all of the critical points of a system of two first order non-linear differential equations.
- Linearize a system of two first order non-linear differential equations about each of its critical points and determine the type of equilibrium point from among the following options:
 - Stable Node
 - Unstable Node
 - Spiral Sink
 - Spiral Source
 - Saddle Point
 - Spiral Center

- Understand the difference between a stable, unstable and asymptotically stable equilibrium point.
- Qualitatively sketch the phase portrait corresponding to a non-linear system of two first order differential equations given the following information:
 - Location of critical points
 - Type of each critical point
 - Slope field
 - Form of solution trajectories on phase plane.

Practice Problems:

Note: I would suggest trying out at least one of each type of problem. If you need the additional practice then work through additional examples of the same problem type. Problem types are separated by commas.

Section 1.4: 1 - 18, 19 - 28, 45 - 50

Section 1.5: 1 - 25

Section 2.2: 1 - 12

Section 3.3: 1 - 20

Section 3.4: 17 - 22

Section 3.6: 1 - 6

Section 4.1: 15 - 18, 19 - 24

Section 4.2: 15 - 18, 19 - 22

Section 4.3: 9 - 16, 17 - 22

Section 4.4: 1 - 8, 15 - 26

Section 4.7: 13 - 18

Section 5.1: 1 - 16, 20 - 26

Section 5.2: 7 - 12

Section 5.3: 1 - 20, 21 - 26

Section 10.1: 1 - 10, 11 - 22, 23 - 32

Section 10.2: 1 - 16, 17 - 24

Section 10.3: 5 - 10, 11 - 22

Section 10.4: 1 - 6, 7 - 14

Section 10.5: 1 - 10

Section 6.1: 1 - 26, 27 - 32

Section 7.1: 1 - 10

Section 7.3: 1 - 16, 17 - 25

Section 7.4: 1 - 7

Section 7.5: 1 - 22, 23 - 32

Section 9.1: 1 - 8, 9 - 12

Section 9.2: 1 - 10, 11 - 18, 19 - 28, 29 - 32

Section 9.4: 1 - 4, 5 - 8, 9 - 11, 12 - 16