

# Suggested Problems

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All suggested problems are from the textbook of the course specified in the syllabus, i.e. *Elementary Differential Equations and Boundary Value Problems* by Boyce and DiPrima (10<sup>th</sup> edition: ISBN 978-0-470-45831-0).

This list is *not necessarily* comprehensive; however, it would give the student an idea of how well they are doing in this course: they are expected to be able to solve all these questions!

Although students are expected to be able to solve *all* questions in this list, *I as the instructor do not suggest them to sit down and solve all questions!* Depending on how well they are doing, on how much time they can spare for this course, and on how useful they find solving these questions are for them, they should themselves decide to choose which subset of these questions they would like to solve!

## 1 Linear equations with constant coefficients

**Characteristic equation, repeated roots, initial & boundary value problems:**

Section 3.3, Problems 1-22 (page 164)

Section 4.2, Problems 11-24, 37, 39 (page 235-236)

**Laplace transform:**

Section 6.1, Problems 1-23, 30, 31 (page 315-316)

Section 6.2, Problems 5-20 (page 325)

**Convolution and particular solution:**

Section 6.6, Problems 4-11, 13-15, 17-20 (page 355)

## 2 Linear equations with functional coefficients

### 2.1 Homogeneous Solution

**Reparemetrization, Euler equations:**

Section 3.3, Problems 34-46 (page 165-166)

Section 3.4, Problems 40-45 (page 175)

**Equations with dependent variable missing:**

Section 2.9, Problems 36, 37, 40 (page 135)

**Exact equations:**

Section 3.2, Problems 41-45 (page 157)

**Reduction of order:**

Section 3.4, Problems 23-30 (page 174)

**Wronskian:**

Section 3.3, Problem 27 (page 165)

Section 4.1, Problems 11-16 (page 226)

**Series expansion around an ordinary point:**

Section 5.1, Problems 9-28 (page 253-254)

Section 5.2, Problems 1-14 (page 263-264)

Section 5.3, Problems 1,22,27 (page 269-271)

**Series expansion around a singular point:**

Section 5.4, Problems 1-12, 17-34 (page 280)

Section 5.5, Problems 1-10 (page 286)

Section 5.6, Problems 1-12 (page 294)

## 2.2 Particular Solution

**Method of undetermined coefficients:**

Section 3.5, Problems 1-20 (page 184)

Section 3.6, Problems 1-4 (page 190)

**Method of variation of parameters:**

Section 3.6, Problems 5-18, 28-32 (page 190-192)

## 3 Systems of first order linear differential equations

**Solving general linear ordinary first order differential equations:**

Section 2.1, Problems 13-20 (page 40)

**Conversion between arbitrary linear ordinary differential equations and systems of first order linear differential equations:**

Section 7.1, Problems 1-12 (page 363-364)

**Basics of linear algebra:**

Section 7.2, Problems 1-26 (page 376-378)

Section 7.3, Problems 1-11, 16-25 (page 388-389)

**Analysis of coupled systems via matrix differential equations:**

Section 7.5, Problems 9-18, 32-33 (page 405-407)

Section 7.6, Problems 7-10, 25-26, 29 (page 417-420)

Section 7.9, Problems 1-12 (page 447-448)

## 4 Partial differential equations

**Method of separation of variables:**

Section 10.5, Problems 1-12, 20-23 (page 630-631)

**Wave equation:**

Section 10.7, Problems 12-14, 16-18 (page 653-654)