

Readings: Riley, Hobson and Bence - Chapter 16
Boccio - 03_ODEs, 04_ODEs and 05_ODEs

Problems:

16.01 Series Solution

EP-5 For the ODE

$$36x^2 \frac{d^2y}{dx^2} + (5 - 9x^2)y = 0$$

use the method of **Frobenius** to find both homogeneous solutions.

Determine the first four Chebyshev polynomial solutions.

EP-6 Solve the ODE for a general solution using the power-series method (non-singular equations).

(b) $(x^2 - 1)u'' - 4u = 0$

(c) $(4 - x^2)u'' + 2u = 0$, $u(0) = 0, u'(0) = 1$

EP-7 Solve the ODE for a general solution using the power-series method (singular equations).

(a) $2x(1 - x)u'' + u' - u = 0$

(c) $2x^2u'' + x^2u' + (4/9)u = 0$

EP-8 Roots Differing by an Integer - Series + Wronskian Method
Solve

$$xu'' + (1 - x)u' - u = 0$$

by finding the first solution using the series method and then finding the second solution using the Wronskian method.

EP-9 Bessel's Equation (use solutions in text)

Determine the general solution for

$$xu'' + u' + (x - 1/9x)u = 0$$

EP-10 Properties of Bessel Functions

Find an expression in terms of $J_1(x)$ and $J_0(x)$ for each integral below:

(a) $\int \frac{J_4(x)}{x} dx$ (b) $\int x^3 J_1(x) dx$