

Mock midterm #2.

1. Find all solutions to the equation

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

2. Solve the equation

$$xy'' + 2y = 0$$

using Frobenius' method.

3. Find a Fourier series for the ramp function

$$f(x) = \begin{cases} x & \text{for } 0 \leq x \leq 1 \\ 1 & \text{for } 1 \leq x \leq 2. \end{cases}$$

on the interval $[0, 2]$.

4. If f is represented by the series $f(x) = \sum c_n e^{inx}$ and g by the series $g(x) = \sum d_n e^{inx}$, prove the generalized Parseval theorem:

$$\frac{1}{2\pi} \int_0^{2\pi} f(x) \overline{g(x)} dx = \sum_{n=-\infty}^{\infty} c_n \overline{d_n}.$$