Mathematical Methods II
Weekly problem set 5

(1) Solve the following differential equation

$$y'' - y = x,$$

using the Wronskian method.

(2) Consider the following equation

$$(1 - x^2)y'' - 2xy' + 30y = 0. \tag{1}$$

(a) Identify the type of this equation, stating its general form.

(b) Find the expression for the Legendre polynomial solution of this equation by applying the Rodrigues formula.
Hint: the Rodrigues formula for Legendre polynomials is given by

$$P_l(x) = \frac{1}{2^l l!} \frac{d^l}{dx^l}(x^2 - 1)^l.$$