Name: Perm number:

## $\mathbf{Midterm-in\text{-}class\ part}$

Time: 75 minutes

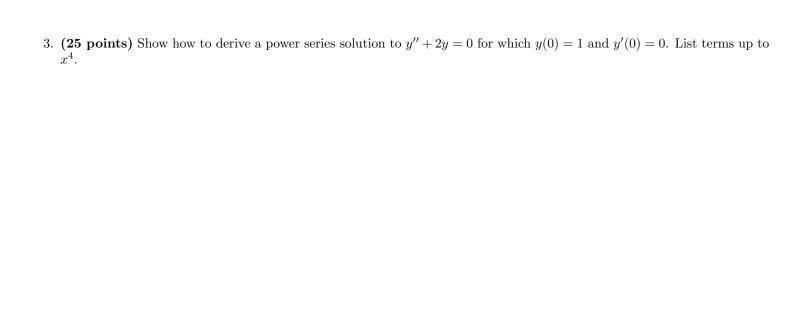
## 1. **(25 points)**

- Find all real solutions to  $y'' + y = x^2$ .
- Find all real solutions to  $y'' + y = x^2$  for which y(0) = 0 and y'(0) = 0.

## 2. (25 points) Consider the equation

$$y''' - y'' + y' - y = 0$$

- What are all of its real solutions?
- What are all of its real solutions for which y(0) = 0, y'(0) = 1, and y''(0) = 0?



## 4. (25 points) Suppose the second order linear ODE

$$y'' + p(x)y' + q(x)y = 0$$

has two solutions f(x) and g(x) and you know that the Wronskian

$$W(f(x), g(x)) > 0$$

for all x. Using f(x) and g(x) explain how to find a solution h(x) of

$$y'' + p(x)y' + q(x)y = 0$$

for which h(1) = 3 and h'(1) = 7.