1. Consider the following differential equation:

\[ y'' + x^2 y = 0. \]

(a) Are there any singular points of the differential equation? If so, are they regular singular points? Why or why not?

(b) Write the recursive relation for coefficients in a series solution about the point \( x = 0 \).

2. Let \( \lambda \) be a constant complex number. Consider the following differential equation.

\[(x - x^2)y'' + (1 - x)y' + \lambda y = 0.\]

(a) Are there any singular points of the differential equation? If so, are they regular singular points? Why or why not?

(b) Find a general series solution about the point \( x = 0 \).

(c) In general, what is the radius of convergence of this solution?

(d) For which values of \( \lambda \) is the solution a polynomial?

(e) Write three examples of polynomials satisfying the differential equation as well as the initial condition \( y(0) = 1 \), together with their required values of \( \lambda \).