

Instructions: Complete each of the following on separate, stapled sheets of paper.

1. Compute the singular points of each ODE below, and classify as a regular singular point or an irregular singular point.

(a) $x(x+3)^2y'' - y = 0$

(b) $y'' - \frac{1}{x}y' + \frac{1}{(x-1)^3}y = 0$

(c) $(x^2 + x - 6)y'' + (x + 3)y' + (x - 2)y = 0$

(d) $x(x^2 + 1)y'' + y = 0$

(e) $(x^3 - 2x^2 + 3x)^2y'' + x(x - 3)^2y' - (x + 1)y = 0$

2. Compute solutions to the ODEs below near the singular point $x_0 = 0$.

(a) $2xy'' - y' + 2y = 0$

(b) $2x^2y'' - xy' + (x^2 + 1)y = 0$

(c) $9x^2y'' + 9x^2 + 2y = 0$

(d) $8xy'' + y' + y = 0$

(e) $xy'' - xy' + y = 0$