



**Example:** Determine the singular points of the given differential equation. Classify each singular point as regular or irregular.

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

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**Theorem:** (Frobenius' Theorem) If  $x = x_0$  is a regular singular point of (\*), then there is at least one solution of the form

$$y = (x - x_0)^r \sum_{n=0}^{\infty} c_n (x - x_0)^n = \sum_{n=0}^{\infty} c_n (x - x_0)^{n+r},$$
 where the number  $r$  is a constant to be determined.

**Example:**  $x = 0$  is a regular singular point of the given differential equation. Show that the indicial roots of the singularity do not differ by an integer. Use the method of Frobenius to obtain two linearly independent solutions about  $x = 0$ . Form the general solution on  $(0, \infty)$ .

$$2xy'' + 5y' + xy = 0$$

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