

### Problem 3

In each of Problems 1 through 4, transform the given equation into a system of first order equations.

$$t^2 u'' + tu' + (t^2 - 0.25)u = 0$$

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#### Solution

Let  $u = x_1$ .

$$t^2 x_1'' + tx_1' + (t^2 - 0.25)x_1 = 0$$

Finally, let  $x_2 = x_1'$ .

$$t^2 x_2' + tx_2 + (t^2 - 0.25)x_1 = 0$$

By making these substitutions, the original second-order ODE has become a system of first-order ODEs.

$$\begin{cases} x_1' = x_2 \\ x_2' = -(1 - 0.25t^{-2})x_1 - t^{-1}x_2 \end{cases}$$