2.1

(15) \( ty' + 2y = t - t + 1 \quad t > 0 \quad y(1) = \frac{1}{2} \)

\[ y' + \frac{2}{t} y = t - 1 + \frac{1}{t} \]

\[ M(t) = e^{\int \frac{2}{t} dt} = \frac{e^{2\ln t}}{t^2} = e^t = t^2 \]

\[ t^2 y + 2ty = t - t + t \]

\[ (t^2 y)' = t - t + t \]

\[ t^2 y = \frac{1}{4} t^4 - \frac{1}{3} t^3 + \frac{1}{2} t^2 + C \]

\[ y = \frac{1}{4} t^2 - \frac{1}{3} t + \frac{1}{2} + C t^{-2} \]

\[ y(1) = \frac{1}{2} \quad \text{so} \]

\[ \frac{1}{2} = \frac{1}{4} - \frac{1}{3} + \frac{1}{2} + C \]

\[ \frac{1}{3} - \frac{1}{4} = C \quad \text{so} \quad C = \frac{1}{12} \]

\[ y = \frac{1}{4} t^2 - \frac{1}{3} t + \frac{1}{2} + \frac{1}{12} t^{-2} \]