

2. Neither

4. linear

6. linear

8. $\frac{dy}{dx} - \frac{1}{x}y = 2x+1$

$$\begin{aligned} \mu(x) &= e^{\int -\frac{1}{x} dx} = e^{-\ln|x|} \\ &= e^{\ln \frac{1}{|x|}} = \frac{1}{|x|} = \pm \frac{1}{x} \end{aligned}$$

choose $\mu(x) = \frac{1}{x}$

$$\begin{aligned} \therefore \frac{d}{dx} \left[\frac{1}{x} y \right] &= \frac{1}{x} (2x+1) \\ &= 2 + \frac{1}{x} \end{aligned}$$

$$\begin{aligned} \therefore \frac{1}{x} y &= \int \left(2 + \frac{1}{x} \right) dx \\ &= 2x + \ln|x| + C \end{aligned}$$

$$\therefore \underline{y = 2x^2 + x \ln|x| + Cx}$$

17. $\frac{dy}{dx} - \frac{1}{x}y = xe^x$

$$\begin{aligned} \mu(x) &= e^{\int -\frac{1}{x} dx} = e^{-\ln|x|} \\ &= \frac{1}{|x|} = \pm \frac{1}{x} \end{aligned}$$

choose $\mu(x) = \frac{1}{x}$

$$\begin{aligned} \therefore \frac{d}{dx} \left[\frac{1}{x} y \right] &= \frac{1}{x} (xe^x) \\ &= e^x \end{aligned}$$

$$\frac{1}{x} y = e^x + C$$

$$\therefore y = xe^x + Cx$$

$$y(1) = e-1 \rightarrow e-1 = e + C$$

$$\therefore C = -1$$

$$\therefore \underline{y = xe^x - x}$$

$$(\text{for } x \in (0, \infty))$$