Mathematics B (Ordinary differential equations) Example problems

Find the general solutions of the following ordinary differential equations.

1. $\frac{d^2y}{dx^2} - y = xe^{2x} + e^x$

2. $\frac{d^2y}{dx^2} + y = \frac{1}{\cos x}$

3. $x^2\left(\frac{dy}{dx}\right)^2 + 3xy\frac{dy}{dx} + 2y^2 = 0$

4. $(x + y + 1)\frac{dy}{dx} - 3x + y + 5 = 0$

5. $\{y - 2xy\,tan(2x)\}\,dx + x\,dy = 0$

6. $y\frac{d^2y}{dx^2} + \left(\frac{dy}{dx}\right)^2 + 1 = 0$

7. $x\frac{d^2y}{dx^2} + \frac{dy}{dx} = 0$

8. $y = x\frac{dy}{dx} - \log_e\left(\frac{dy}{dx}\right)$