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$$① \frac{dy}{dx} = 7xy$$

$$dy = -7xy dx$$

$$\frac{dy}{y} = -7x dx$$

$$\int \frac{dy}{y} = \int -7x dx$$

$$\ln y = -\frac{7x^2}{2} + c_1$$

$$Y = e^{-\frac{7x^2}{2} + c_1}$$

$$Y = e^{-\frac{7x^2}{2}} \cdot e^{c_1}$$

$$Y = C e^{-\frac{7x^2}{2}}$$

$$② \frac{dy}{dx} = 7x$$

$$dy = 7x dx$$

$$\int dy = \int 7x dx$$

$$y = -\frac{7x^2}{2} + c$$

$$Y = -\frac{7x^2}{2} + c$$

$$③ Y' = e^{3x-y}$$

$$Y' = e^{3x-y}$$

$$\frac{dy}{dx} = \frac{e^{3x}}{e^y}$$

$$e^y dy = e^{3x} dx$$

$$\int e^y dy = \int e^{3x} dx$$

$$\int e^y dy = \int e^u \frac{du}{3}$$

$$\int e^y dy = \frac{1}{3} \int e^u du$$

$$e^y = \frac{1}{3} e^{3x} + c_1$$

$$\ln e^y = \ln\left(\frac{1}{3} e^{3x} + c_1\right)$$

$$Y = \ln\left(\frac{1}{3} e^{3x} + c_1\right)$$

$$④ \frac{dy}{dx} + e^{x+y} = 0$$

$$\frac{dy}{dx} = -e^{x+y}$$

$$\frac{dy}{dx} = -e^x \cdot e^y$$

$$\frac{dy}{e^y} = -e^x dx$$

$$\int e^{-y} dy = \int -e^x dx$$

$$e^{-y} = -e^x + c_1$$

$$\ln e^{-y} = \ln(-e^x + c_1)$$

$$y = \frac{\ln(-e^x + c_1)}{-1}$$

$$⑤ 3 + e^{-3x} y' = 0 \quad Y(0) = 2$$

$$3 + e^{-3x} \frac{dy}{dx} = 0$$

$$e^{-3x} \frac{dy}{dx} = -3$$

$$e^{-3x} dy = -3 dx$$

$$dy = \frac{-3 dx}{e^{-3x}} = -3 e^{3x} dx$$

$$dy = -3 \left[ \frac{1}{e^{-3x}} \right] dx$$

$$dy = -3 e^{3x} dx$$

$$\int dy = \int -3 e^{3x} dx$$

$$Y + c_1 = -3 \int e^{3x} dx$$

$$Y + c_1 = -\frac{3}{1} \left[ \frac{1}{3} e^{3x} + c_2 \right]$$

$$Y = -\frac{3e^{3x}}{3} + c$$

$$2 = -\frac{3e^{3(0)}}{3} + c$$

$$2 = \frac{-3(1)}{3} + c$$

$$2 = \frac{-3}{3} + c$$

$$\frac{2}{1} + \frac{3}{3} = c$$

$$c = \frac{9}{3}$$

$$c = 3$$

$$⑥ 2 + e^{6x} y' = 0$$

$$2 + e^{6x} \frac{dy}{dx} = 0$$

$$e^{6x} \frac{dy}{dx} = -2$$

$$e^{6x} dy = -2 dx$$

$$dy = \frac{-2 dx}{e^{6x}} = -2 \left[ \frac{1}{e^{6x}} \right] dx$$

$$\int dy = \int -2 e^{-6x} dx$$

$$\int dy = -2 \int e^{-6x} dx$$

$$Y = \int e^u \left[ \frac{du}{-6} \right] = -\frac{1}{6} \int e^u du = -\frac{1}{6} e^{-6x} + c$$

$$Y = -\frac{2}{1} \left[ -\frac{1}{6} \frac{e^{-6x}}{1} + c \right]$$

$$Y = \frac{2e^{-6x}}{-6} + c$$

$$2 = \frac{2e^{-6(0)}}{-6} + c$$

$$2 = \frac{2(1)}{-6} + c$$

$$2 = \frac{4}{-6} + c$$

$$\frac{2}{1} + \frac{4}{6} = c$$

$$c = \frac{12+4}{6}$$

$$\frac{16}{6} = c$$