

$$\frac{dy}{dx} = -2y$$

Separate variables:

$$-\frac{1}{2y} dy = dx$$

Integrate:

$$\int -\frac{1}{2y} dy = \int dx$$

$$-\frac{1}{2} \ln|y| = x + C$$

$$\ln|y| = -2x + C_0$$

$$|y| = e^{(-2x + C_0)}$$

since RHS > 0:

$$y = C e^{-2x}$$