

Solve the following differential equations. Note: all of them can be separated into left and right hand sides each of which has only one variable. They can then be integrated directly.

1.

$$\frac{dy}{dx} = 4x^2 \quad \text{given } y = 3 \text{ when } x = 1$$

2. $\frac{d^3x}{dt^3} = 4t^3$ given $x=0$, $\frac{dx}{dt} = 1$, and $\frac{d^2x}{dt^2} = 4$, all when $t=0$.

3. $\frac{dy}{dt} = 4y \sin(t)$ given $y=10$ when $t = \frac{\pi}{2}$

4. $e^{-t} \frac{dy}{dt} = \cos(t)$ given $y = 0$ when $t = 0$. Hint: think complex numbers.