

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.

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

$$y = \frac{4}{3}x^3 + \frac{5}{3}$$

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

$$x = \frac{1}{30}t^6 + 2t^2 + t$$

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

$$y = 10e^{-4 \cos(t)}$$

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

$$y = \frac{1}{2}([\cos(t) + \sin(t)]e^t - 1)$$