Exercise 11

Differentiate both sides of the following equations:

$$2x^2 + 3x^3 = \int_0^x (6 + 5x - 5t)u(t)\,dt$$

Solution

Differentiating both sides of the equation with respect to x gives us

$$4x + 9x^2 = 6u(x) - (6 + 5x)u(0) \cdot 0 + \int_0^x \frac{\partial}{\partial x}(6 + 5x - 5t)u(t)\,dt,$$

where we used the Leibnitz rule to differentiate the integral. Therefore,

$$x(4 + 9x) = 6u(x) + 5\int_0^x u(t)\,dt.$$