

**Problem Definition**

Problem 5. Decide whether the variables in the differential equation can be separated.

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

**Solution Step 1:**

This is mostly algebraic manipulation. We start by rewriting the equation by multiplying by the  $dx$  infinitesimal.

$$x \frac{dy}{dx} dx = (x - y) dx$$

This can be rewritten as

$$x dy = (x - y) dx$$

Since the  $x$  and  $y$  variables can not be solved for, this equation is not separable. The real problem is the product of  $x$  and  $y'$  on the left hand side of the differential equation and the difference of  $x$  and  $y$  on the right hand side of the differential equation.