Example: $\frac{dy}{dx} = f(x)$

We'll solve our first, very simple, example using the method of separation of variables. We start by multiplying both sides by $dx$:

$$dy = f(x) \, dx.$$ 

Then integrate both sides:

$$\int dy = \int f(x) \, dx$$

The antiderivative of $dy$ is just $y$, so we get:

$$y = \int f(x) \, dx,$$

as we did before.