If the right-hand side of the equation

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

can be written in the form

$$f(x, y) = g(x) \cdot h(y),$$

then the differential equation is called *separable*.

In theory, separable equations can be solved by separating the variables and integrating:

$$\frac{dy}{dx} = g(x) \cdot h(y)$$

$$\frac{1}{h(y)}\, dy = g(x)\, dx$$

$$\int \frac{1}{h(y)}\, dy = \int g(x)\, dx$$

Numerical approximations for solutions

Just as there are numerical approximation methods for solving equations, evaluating definite integrals, etc, there are numerical methods for solving differential equations.

Later in the semester we will discuss:

- Euler's method
- The improved Euler method
- Runge-Kutta methods

For now, just think about these methods as "black boxes" that we can use without necessarily understanding.