

DATE: _____

Even though the study of differential equations is complex, we are only required to know and understand the easiest method for solving them – **separation of variables**.

1. What makes the equation $\frac{dy}{dx} = \frac{x}{y^2}$ a differential equation?
2. Your goal is going to be to find an equation (in the form $y = f(x)$) whose derivative is $\frac{x}{y^2}$. Why can't you just simply integrate right away? Think about what makes this differential equation different from $\frac{dy}{dx} = \frac{4}{x^2}$, which you can just simply integrate right away.
3. Before you can integrate $\frac{dy}{dx} = \frac{x}{y^2}$, you must separate the variables (put the y 's on one side and the x 's on the other). How can you accomplish this? Show your work in separating the variables.
4. Once the variables are separated, you can integrate both sides. Write the general solution to the differential equation.

Example 1:

Let $y = f(x)$ be the particular solution to the given differential equation $\frac{dy}{dx} = 2xy + 2x$ with the initial condition $f(1) = 2$. Find $y = f(x)$.

Example 2:

Find the particular solution to the differential equation $\frac{dy}{dx} = e^{x-2y}$ that passes through the origin.