

We saw in class Thursday that dividing by y when performing separation of variables can lead to losing solutions. The following problems show some more examples of this. Begin by solving:

1. $\frac{dy}{dx} = -2y^2x$

using separation of variables. If you might have “lost” the solution $y = 0$ in the process, so

- Go back to the equation and check whether or not $y = 0$ is a solution.
- Is the solution $y = 0$ represented in your formula?
- What is a complete answer as to the solutions of this equation?

Some of you asked in class - will it always be the case that we are losing the solution $y = 0$? The examples below show that this is not always the case. For both problems **2** and **3** below, you are given a separable ODE.

2. $y' = x(y - 1)$

3. $y' = 2x(1 - y)^2$

When performing the separation of variables, you may be losing the solution $y = 1$. So, for each problem:

- Go back to the equation and check whether or not $y = 1$ is a solution.
- Is the solution $y = 1$ represented in your formula?
- What is a complete answer as to the solutions of this equation?

Now solve the initial value problem:

4. $\frac{dy}{dx} = y^2 - 4$; $y(0) = -2$.

Solve the ODE:

5. $x \frac{dy}{dx} = y^2 - y$

subject to each of the initial conditions:

- a). $y(0) = 1$;
- b). $y(1) = 1$;
- c). $y(1) = 0$.