SEPARABLE ODEs

First, a little bit more from Section 1.2:

Recall: You showed in the last example from last class that for any constants $c_1$ and $c_2$, the function

$$
\phi(x) = c_1 e^x + c_2 e^{-2x}
$$

is a solution to the ODE

$$
y'' + y' - 2y = 0.
$$

We call $\phi$ the general solution to the above ODE because . . .

Ex 1: Find a solution to the Initial Value Problem (IVP)

$$
y'' + y' - 2y = 0, \quad y(0) = 2, y'(0) = 1.
$$

Ok, now we can move on to the stuff on Separable ODEs!

Def: A first order ode is called separable if . . .

Practical Def: A differential equation is called separable if . . .
Ex 2: Are the following ODEs separable?

(a) $r^2 + 3s' = 0$

(b) $\frac{dy}{dx} = \ln(xy)$

Solving Separable Differential Equations:

1.

2.

WARNING!!!

3.

4.
Ex 3: Solve each differential equation. That is, find the general solution to each differential equation.

(a) \( r^2 + 3s' = 0 \)

(b) \( (x^2 + 4) \frac{dy}{dx} = x(y + 3) \)  

There’s more room on the next page for the soln to this one!
WARNING!!!

Recall from Algebra:

Avoid Missing Solutions:

Ex 4: Check for missing solutions to the ode in Example 3(b). If you missed some, then state the complete general solution here.
Ex 5: Solve the IVP $xy \, dx + e^{-x^2}(y^2 - 1) \, dy = 0$, $y(0) = 1$.

Note:

- This ODE is in what is called “differential form” since the $\frac{dy}{dx}$ is already separated.
- You will not be able to express your solution explicitly. So leave it in implicit form.