MAT 239 (Differential Equations), Prof. Swift
Worksheet 6 on Linear 1st Order ODEs

In this worksheet you will find the general solution to $xy' + 3y = 5x^2$.

0. Is $y(x) = 0$ a solution? yes/no   Is $y(x) = k$ a solution for any constant k? yes/no

1. Put the ODE $xy' + 3y = 5x^2$ into standard form and identify $p(x)$ and $g(x)$. What is the x value where p and/or g are not continuous?

2. Compute *and simplify* the "magic" integrating factor $\mu(x)$.

3. Multiply both sides of the *standard form* of the ODE by $\mu(x)$.

4. Compute $\frac{d}{dx}[\mu(x)y]$ leaving y as an unknown function of x. This should be the Left Hand Side (LHS) of that ODE you wrote in part 3. Magic! Rewrite the ODE as

$$\frac{d}{dx}[\mu(x)y] = \mu(x)g(x).$$

5. Integrate to find $\mu(x)y$ (don't forget the "$+C$") and then solve for y. This is the general solution!