1. Do some examples of separable equations:
   
   (a) \( y' = -y^2 - 1 \); (b) \( y' = y^2 \), (c) \( y' = e^{-y} \), (d) \( y' = y^{1/2} \)
   
   In some cases discuss where the solution is defined, existence and uniqueness (particularly for the last one).

2. Do one (or maybe 2) examples of integrating factor,
   
   (a) \( y' + t \cdot y = t^3 \), (b) \( y' + \frac{1}{t} y = 1 \).

3. What is the most general hypothesis on \( p(t), q(t) \) under which \( y' + p(t)y = q(t) \) has a solution? Maybe talk about “patching” solution for a piecewise cts. function: \( p(t) = \) constant,
   
   \[
   q(t) = \begin{cases} 
   0, & t < t_0 \text{ Find solutions for } t < t_0 \text{ & } t > t_0 \text{ separately, and then match the limiting values of } y(t). \\
   1, & t \geq t_0
   \end{cases}
   \]

4. How does the order of diff. of \( p(t), q(t) \) effect the order of diff. of \( y \) ? (in the last example, for instance).

5. Warm-up for lecture: Define Lipschitz and prove a cts. function on a closed, bdd interval is Lipschitz.