I. Introduction - Distribution of Syllabus. Brief "tour" of web page.

II. Diff. Eqns come from our desire to model and hence predict. We need to learn:

A. How to construct a DE.
B. "" solve a DE (resulting in a model).
C. "" use the model.

III. \[ \frac{d}{dx} \left[ x \sin(x) \right] - 3y = \sin(x) \] is a differential equation.

This is an ordinary differential equation (ODE).

The ""B"" job in this class will be to find a function or collection of functions, \( y = f(x) \), such that \( x \cdot \frac{dy}{dx} - 3y = \sin(x) \).

Such a function(s) is (are) called solutions to the ODE.

IV. 1st SKILL. Verifying Solutions.

A. \[ y' - 5y = 0 \] is an ODE. My claim is that \( y = e^{5x} \) is a sol to (8)

Verification:
1. \( y = e^{5x} \), \( \therefore y' = 5e^{5x} \)

2. Plugging \( y \) into LHS of (*):
\[ y' - 5y = (5e^{5x}) - 5(e^{5x}) = 0 \]

3. \( \frac{d}{dx} \left[ x \ln x \right] \) is a sol to \[ y' = \frac{1}{x} y = 1 \] (as)

Verification:
\[ y = x \ln x \Rightarrow y' = x \cdot \frac{1}{x} + \ln x \]
\[ y' = 1 + \ln x \]

2. Rewrite (as):
\[ y' - \frac{1}{x} y = 1 - 0 \]

3. Pic: \( 1 + \ln x - \frac{1}{x} (x \ln x) - 1 = 1 + \ln x - \ln x - 1 = 0 \) \( \checkmark \)

4. \( y = x \ln x \) is a solution of (*).