Take Home 4_(Due July 15th, before class)

- You may get assistance from tutors.
- **Late work will not be accepted.**
- **All answers and work must be on seperate sheets of paper.**
- **Keep work organized.** Answer that are hard to find illegible work will be awarded no points.
- Answers without justification will be awarded no points.
- You may verify your answers with a calculator, but **all calculations must be done by hand.**
- Answers that look similar to another students work will be judged harshly.

1. Solve the initial value problem.

$$(3x - 1)y'' - (3x + 2)y' - (6x - 8)y = 0, \quad y(0) = 2, \quad y'(0) = 3; \quad y_1 = e^{2x}$$

where $y_1 = e^{2x}$ is an element of the fundamental set (solution to the homogenous equation). Use the table of values to estimate $y(0.5)$.

2. My Tesla model Y performance. Now that we have seen the application of the least-squares regression line in action, lets put it to the test. Here are more data (data is plural).

May 6th	May 8th	May 13th	May 15th	May 17th	May 20th
(0,51)	(0,32)	(0,12)	(0,36)	(0,30)	(0,?)
(12,70)	(7,50)	(6,33)	(7,51)	(6,46)	(7,?)
(20,81)	(15,66)	(13, 52)	(18,72)	(11,58)	(15, ?)
(28,90)	(20,75)	(18,62)	(31,90)	(17,70)	(20,?)
	(30,88)	(29,78)		(23,80)	(25,?)
	(32,90)	(35,85)		(32,?)	
		(40,90)			

Yes, the 2nd component of the ordered pair for May 20th is missing, but we will fill in the details using the least-squares regression line. Models generally will follow an exponential model, a least-squares regression line can be turned into a linear model if the y's are 'straightened out'. From the previous takehome we found that methods of a linear equation could be used by first applying a logarithm to the dependent variable, so to create our exponential model, take the dependent second component and apply a logarithm (natural base). Use all the data points from May 6th to May 20th and **create an exponential model**. You are allowed to use some tye of technology. Calculators are do not counts as technology. Please include documentation of your work.

$$\begin{cases} nb + (\sum x)m = \sum y \\ (\sum x)b + (\sum x^2)m = \sum xy \end{cases}$$

To add a bit of description and context, use $B(t)$ to represent the percent of the battery full (dependent variable) given some time t (independent variable), where t is measured in minutes after the Tesla has started charging. Using the function fill in the missing values of May 20th. Describe the strenghts and weakness of your model (least-squares regression line exponential model).