You are living in an apocalyptic wasteland. Food is scarce. Radiation is plentiful. People's most prized possessions are now their Nickelback CD collections. Humanity is on its last legs. Nevertheless, you continue with your chemical engineering training. Your next lesson is on determining the order of a reaction for the synthesis of some unknown substance, which you hope is not toxic. You take a container labeled "reagents" off the shelf and pour it into an isothermal, isobaric batch reactor and monitor the concentration over time. You suspect the reaction has the chemical equation A → P and is irreversible.

time (min)	0	1	2	3	4	5	6	7	8	9	10
C_A (mol/L)	0.953	0.686	0.424	0.290	0.176	0.136	0.077	0.056	0.039	0.036	0.014

a. Using the Integral Method, find the order of the reaction. Create a plot with the kinetic data and your fitted line with the appropriate axes for the order of the reaction. Be sure to label the axes (with units, if applicable) and give it a legend.

b. From your fit in part a, what is the reaction rate constant for this process?

c. After reading the container of "reagents" more carefully, you realize that the chemical equation for the reaction was actually A + B → P all along and the reaction follows an elementary rate law. It also says that the reaction rate constant is 0.02 $L\ mol^{-1}\ min^{-1}$. Given this new information, what was the concentration of B if it was held constant when the tabulated data was gathered.

3) Kinetic rate data (which can be found on Canvas) is given for a chemical reaction A → B, but the order of the reaction is not known. The reaction occurred in an isothermal, isobaric batch reactor. The units of the concentration data are in mol/L and time is in minutes.

a. Use the Differential Method to determine the order of the reaction given the kinetic rate data. You may round to the nearest whole number. It would be best to perform these calculations in Python (`np.diff()` is very helpful here).

b. Calculate the rate constant of the reaction as well with the proper units.

c. Include the plot of your fitted line to the provided data with appropriately labeled axes