CHAPTER 2 MODELING ASSESSMENT ACTIVITY

Answer each scenario thoroughly. Use the **TI-Nspire Student Software** to generate your graphs, spreadsheets and other necessary work. Include screen shots in your write up. A copy of these guidelines is available on the Chapter 2 section of my homework website site if you wish to use it to complete your write up.

Format: [10 points]

1) Proper MLA formatting throughout!!
2) Make sure header is proper format: lastname-lastname-page#
3) All figures/tables should be labeled and anchored. Figures should be only 2"-3" in height.
4) Complete sentence answers that use appropriate mathematical vocabulary. Write in the third person. Outside resources, in proper MLA format, should be included in a Bibliography page.
5) Organize your answers as they appear below. Answer so that someone **without this instruction sheet** would understand what question you are answering. In other words, repeat part of the question in your answer.
6) Be sure that each scenario has a short introduction.

Scenario 1: Chemistry [35 points]

In class, we conducted a virtual experiment about solubility of certain chemicals at different temperatures. That lab can be found at the following link:
http://www.glencoe.com/sites/common_assets/science/virtual_labs/PS15/PS15.html

Water solubility is an important physical property in chemistry and is often expressed as the mass of solute that dissolves in 100 g of water at a certain temperature. The data below was gathered in an experiment where different quantities of potassium nitrate, KNO_3, were completely dissolved at different temperatures. Each data pair consists of a solubility value (g of solute per 100 g H_2O) and corresponding temperature. Your task is to find the best mathematical model for this situation.

Trial	1	2	3	4	5	6	7	8
Solubility (g per 100 H_2O)	40	47	65	79	93	120	139	160
Temperature °C	25.5	30.1	42.0	47.2	53.2	64.0	70.0	76.4

a) Identify the independent and dependent variables. Make a scatterplot. [2 pts.]

b) Determine a linear model for the data and show it on a scatterplot. Identify the equation separately as well (formatting as a figure) with four decimal place accuracy, and interpret the slope in the context of the problem. On a spreadsheet determine the residuals and then find the sum of the squared residual using the spreadsheet (format as a **table**). You may wish to show the SSR on a scatterplot as well. For this model, identify and explain the formulas you used in your spreadsheet to determine the SSR. (Formulas as centered and each variable is identified in the accompanying sentences. Calculate the correlation coefficient for the linear model. Explain what this value means. Graph the residual plot, include a screenshot, and describe briefly. Do NOT make any conclusions yet.

c) Determine an exponential model for the data and show it on a scatterplot. Identify the equation separately as well (formatting as a figure) with four decimal place accuracy. On a spreadsheet determine the residuals and then find the sum of the squared residual using the spreadsheet (format as a **table**). Graph the residual plot, include a screenshot, and describe briefly. Do NOT make any conclusions yet.

d) Determine a quadratic model for the data and show it on a scatterplot. Identify the equation separately as well (formatting as a figure) with four decimal place accuracy. On a spreadsheet determine the residuals and then find the sum of the squared residual using the spreadsheet (format as a **table**). Graph the residual plot, include a screenshot, and describe briefly. Do NOT make any conclusions yet.

e) Identify and explain your choice of best fit model thoroughly [i.e. in a paragraph or two]. Focus on the mathematical reasoning behind your decision based on what the information gained completing parts a – d. You may want to create a scatterplot that shows all three models to use as evidence. You are **interpreting** the data analyzed above. *Be careful not to compare results prior to this section of the project*. [10 pts.]

f) According to the model chosen in part e, how many grams of potassium nitrate would you expect to dissolve at a temperature of 50°C? Show/explain how the answer was determined (format as a figure). Explain why you feel this prediction is/is not reliable. [3 pts.]

Part II: Physics – Light Intensity [10 points]

The intensity of light I (measured in candles – yes, really) was measured at different distances of a projector from a movie screen and recorded below.

Distance from screen (ft)	1.5	2	3	4	5	6
Light intensity (candles)	14.0	9.2	3.5	1.8	1.6	1.1

a) Identify the independent and dependent variables. Make a scatterplot of this data. [2 pts.]

b) From scientific theory, we know the relationship between the intensity of light striking an object is inversely proportional to the square of the distance from the source of the light. Using this information, you will need to find k the proportionality constant and write a model for this situation. Find a non-regression model for this situation. Justify the reasoning behind choosing this particular equation over other options. [3 pts.]

c) Plot your function/model on a separate scatterplot and discuss the fit. [3 pts.]

d) Predict the intensity of light at 4.5 ft and 10 ft. and identify each prediction as an interpolation or extrapolation. Show how the answered were determined. [2 pts.]

CHAPTER 2 MODELING PROJECT Rubric

_____ **Format [10 pts.]** Proper MLA formatting throughout, proper heading, **figures/tables labeled & anchored**, **complete sentence answers with mathematical language**, understood without instructions sheet, calculator, lists & spreadsheets, data & statistics pages shown, Equation Editor used when needed, and intro to each scenario.

Part 1: Chemistry [35 pts.]

_____ a) [2 pts.] Independent/dependent variables identified; Scatterplot included

_____b) [8 pts.] Linear model. **All** components included as described. Meaning and value of slope in words. Value and interpretation of correction coefficient in words. SSR computed correctly. Residual plot present and is briefly described, including relevant information about scale and pattern. Answers in complete sentences. Does NOT compare to other models. Formulas for spreadsheet included separately & explained.

_____c) [6 pts.] Exponential model. **All** components included as described. SSR computed correctly. Residual plot present and is briefly described, including relevant information about scale and pattern. Answers in complete sentences. Does NOT compare to other models

_____d) [6 pts.] Exponential model. **All** components included as described. SSR computed correctly. Residual plot present and is briefly described, including relevant information about scale and pattern. Answers in complete sentences. Does NOT compare to other models

_____e) [10 pts.] Choice of best fit indicated and fully justified; interpret your analysis!
Mathematical reasoning clearly present and supported
Well written, thorough and appropriate mathematical terminology used

_____ f) [3 pts.] Correct prediction. Prediction's reliability explained with correct terminology

Part II: Physics [10 pts.]

_____ a) [2 pts.] Independent/dependent variables correctly identified. Scatterplot correct.

_____ b) [3 pts.] Correct model with work shown. Point chosen to create model reasonable and reasoning for choosing this equation explained.

_____ c) [3 pts.] Model plotted on separately included scatterplot. Fit of model discussed.

_____ d) [3 pts.] Predictions correct based on model and properly identified as interpolation or extrapolation.

_____ **TOTAL** (out of 55 points)