

Growth Modeling and Prediction Writing Task

In this assignment, you will analyze real-world data, develop growth models, and use those models to make predictions. You'll apply the modeling concepts we've explored in this module to demonstrate your understanding of linear and exponential growth patterns.

The Assignment

You will analyze two different datasets representing real-world growth scenarios and determine which type of growth model (linear or exponential) best fits each situation.

Part 1: College Tuition Analysis

The table below shows the average annual tuition and fees (in dollars) at public four-year colleges over a 10-year period.

Year	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Tuition	8,312	8,543	8,778	9,036	9,349	9,682	10,025	10,388	10,740	11,097

1. Create a scatterplot of this data with years since 2013 as the input variable and tuition as the output variable.
2. Determine whether this data is better modeled with linear or exponential growth by:
 - Calculating the annual change in tuition for several consecutive years
 - Creating both linear and exponential models for the data
 - Comparing the coefficient of determination (R^2) for both models
3. Write the best-fitting model in both recursive and explicit forms, clearly identifying all parameters.
4. Use your model to predict the average tuition in 2025.
5. Discuss any potential limitations of your model and when it might break down.

Part 2: Social Media Growth

The following table shows the number of active users (in millions) for a growing social media platform during its first few years.

Year	2018	2019	2020	2021	2022
Users	25	58	126	285	624

1. Create a scatterplot of this data with years since 2018 as the input variable and number of users as the output variable.
2. Determine whether this data is better modeled with linear or exponential growth, showing your work and reasoning.
3. Write the best-fitting model in both recursive and explicit forms, clearly identifying all parameters.
4. Use your model to predict the number of users in 2024.
5. If the trend continues, when will the platform reach 2 billion users?
6. Discuss the limitations of your model. What factors might cause the actual growth to deviate from your prediction?

Part 3: Comparison and Reflection

1. Compare the growth patterns of the two scenarios. Why is one scenario better modeled by one type of growth while the other is better modeled by a different type?
2. Explain how understanding the type of growth model helps with making more accurate predictions.
3. Discuss a real-world situation from your own life or field of interest where understanding growth patterns would be valuable. What type of growth would you expect it to follow and why?

Your submission should include:

- Clearly labeled scatterplots for both data sets
- Step-by-step calculations for determining the appropriate growth models
- Complete mathematical work for all predictions
- Thoughtful discussion of model limitations and applications
- Proper use of mathematical terminology throughout

This assignment is worth 20 points. Your work will be assessed on mathematical accuracy, clarity of explanations, quality of visual representations, and your ability to interpret the results in real-world contexts.

Rubric:

Criteria	Proficient	Developing	Not Evident	Points
Data Analysis and Visualization	Accurately creates well-labeled scatterplots for both datasets. Clear evidence of thorough analysis to determine appropriate growth models with detailed comparisons of R^2 values or growth patterns.	Creates basic scatterplots with minor labeling issues. Some analysis present but may lack depth or contain minor errors in growth pattern recognition.	Scatterplots missing or significantly flawed. Little or no evidence of analysis to determine appropriate growth models.	___/5
Model Development	Correctly develops both linear and exponential models for each dataset. Models are accurately expressed in both recursive and explicit forms with all parameters clearly identified. Calculations are accurate and well-documented.	Models are mostly correct with minor errors in calculations or parameter identification. Some confusion between recursive and explicit forms may be present.	Significant errors in model development or missing models. Confusion about basic differences between linear and exponential models.	___/5
Predictions and Applications	Accurately makes all requested predictions using appropriate models. Shows all mathematical work and clearly explains reasoning. Thoughtfully discusses model limitations with specific examples.	Makes most predictions with minor calculation errors. Explanation of reasoning may lack some clarity. Basic discussion of model limitations present.	Predictions contain major errors or are missing. Little or no explanation of reasoning. Minimal or no discussion of model limitations.	___/5

Comparison and Reflection	Provides insightful comparison of growth patterns with clear explanation of why different models are appropriate for different scenarios. Thoroughly connects mathematical concepts to real-world applications with specific examples.	Comparison of growth patterns present but may lack depth. Some connection between mathematical concepts and real-world applications but examples may be general.	Minimal or superficial comparison of growth patterns. Little or no connection made between mathematical concepts and real-world applications.	___/5
Total				___/20