MA103: Mathematical Modeling
Linear Functions II **DD Month YYYY**

1. Define SSE and understand how minimizing it leads to an optimal solution for the parameters of a linear model
2. Understand the connection between SSE and R^2 as measurements of the fit of a model
3. Think through ethical considerations for using a linear model to make predictions

Review:

1. Write the First Principles model we developed for the transit problem from last class.

2. Redefine the variables.

3. What is the predicted cost of a ticket for 6 stops? What is the predicted cost of a ticket for 17 stops?

4. Which prediction are you most confident in?

Interpolation vs. Extrapolation

SSE and R^2

Stops	Price ($)	$\hat{y}_i$	$\hat{y}_i - y_i$	$(\hat{y}_i - y_i)^2$
2	5.40			
3	6.75			
5	9.15			
7	12.80			
11	18.25			
			SSE	

Practice Problems

For each of the problems that you modeled last class, calculate the SSE for the First Principles and Empirical models. Determine which has the highest R^2. Which model would you use? Why?

1. CDT Knight is testing a new compact oven and is curious about how fast it heats food. He places a slice of frozen pizza in the oven and uses a food thermometer to record the internal temperature every few minutes. However, because the pizza is not uniformly thick and the thermometer is hand-held, some slight variation occurs.

The data below shows the temperature readings (in °C) over time. Despite the noise, the temperature seems to be increasing steadily.

Time (minutes)	Temperature (°C)
1	3.1
4	26.3
7	49.0
10	70.8
13	91.4

2. A wildlife research team is monitoring the digging habits of Mr. Mole using a collar with depth sensors. Mr. Mole was released at the surface and dug steadily downward toward his burrow. The sensors take readings every few minutes, but the surrounding soil density and tunnel angles introduce slight inconsistencies in the reported altitudes.

The following table shows the reported depth (in meters below ground level) over time.

Time (minutes)	Depth (m)
5	-18.7
6.5	-21.8
8	-24.9
9.5	-28.8
11	-33.5

3. During a mechanical test, engineers monitored how an engine's surface temperature changed as they increased its rotation speed. Although the engine was running in a controlled environment, airflow variations and friction levels created slight inconsistencies in the temperature readings. The measurements below were recorded during a single warm-up run.

The table shows the engine's rotation speed (in cycles per second) and the corresponding recorded temperature (in °C).

Rotation Speed (cps)	Temperature (°C)
11	24.1
12	24.9
13	25.7
14	26.4
15	27.2