TCSS – Advanced Mathematical Decision Making
Unit 5

Content Map: Using Functions in Models and Decision Making

Teacher Materials: Using Functions in Models & Decision Making Teacher Materials (The Charles A. Dana Center)

CCGPS Unit Standards or Troup County Version (TCV):

- MAMDMD4 Students will use functions to model problem situations in both discrete and continuous relationships
  - a. Determine whether a problem situation involving two quantities is best modeled by a discrete (pattern identification, population growth, compound interest) or continuous (medication dosage, climate change, bone decay) relationship
  - b. Use linear, exponential, logistic, piecewise and sine functions to construct a model
- MAMDMG1. Students will create and use two- and three-dimensional representations of authentic situations
- MAMDMG2. Students will solve geometric problems involving inaccessible distances using basic trigonometric principles, including the Law of Sines and the Law of Cosines

Prerequisites: As identified by the CCGPS Frameworks
- applying linear functions
- using exponential functions
- making a scatterplot of data with or without technology
- determining the rate of change from a table of data
- making a scatterplot with or without technology
- analyzing regression models
- understanding characteristics of linear functions
- using recursion and other graphing calculator skills
- understanding how to graph functions
- identifying and using linear functions

Unit Length: 20 days
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Concept 1: Regression in Linear and Non-Linear Functions (MAMDMD4 a and b)

Essential Questions:
- How can students make connections between an exponential function rule that models a data set and the recursive rule for the data?
- How can students compare and contrast recursive and explicit function models using regression?
- How can students analyze data to develop a concept of a functional relationship where the rate of change demonstrates logistical growth?

Resources:
5A Student Activity Sheet 1: Analyzing Linear Regression Equations
5A Teacher Activity Sheet 1: Analyzing Linear Regression Equations
5A Student Activity Sheet 2: Comparing Linear and Exponential Functions
5A Teacher Activity Sheet 2: Comparing Linear and Exponential Functions
5A Student Activity Sheet 3: Growth Model
5A Teacher Activity Sheet 3: Growth Model

Concept 2: Cyclical Functions (MAMDMD4 a-b; MAMDMG1; MAMDMG2)

Essential Questions:
- How can students model real-world data using cyclical or sinusoidal models?
- How can students interpret cyclical models in the context of a situation?
- How can students use cyclical models to make predictions and draw conclusions?
- How can students discuss various types of limitations that occur in models? (including problems with extrapolating outside the data with models that fit the data but do not adhere to known principles or natural laws)

Resources:
5B Student Activity Sheet 4: Length of Daylight
5B Teacher Activity Sheet 4: Length of Daylight
5B Student Activity Sheet 5: Crossing the Equator
5B Teacher Activity Sheet 5: Crossing the Equator
5B Student Activity Sheet 6: Making Decisions from Cyclical Functions in Finance
5B Teacher Activity Sheet 6: Making Decisions from Cyclical Functions in Finance
5B Student Activity Sheet 7: Making Decisions from Cyclical Functions in Science and Economics
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5B Teacher Activity Sheet 7: Making Decisions from Cyclical Functions in Science and Economics  
4D Student Activity Sheet 7: Modeling the Singapore Flyer  
4D Teacher Activity Sheet 7: Modeling the Singapore Flyer

**Concept 3: Step and Piecewise Functions (MAMDMD4.a-b; MAMDMG1-G2)**

**Essential Questions:**
- How can students model real-world data using step functions?
- How can students develop and apply the notion of piecewise functions?
- How can students use step functions to model concentrations of medicine in the bloodstream over time?

**Resources:**
- 5C Student Activity Sheet 8: Introducing Step and Piecewise Functions  
- 5C Teacher Activity Sheet 8: Introducing Step and Piecewise Functions  
- 5C Student Activity Sheet 9: Another Piecewise Function  
- 5C Teacher Activity Sheet 9: Another Piecewise Function  
- 5C Student Activity Sheet 10: Concentrations of Medicine  
- 5C Teacher Activity Sheet 10: Concentrations of Medicine  
- 5C Student Activity Sheet 11: Making Decisions from Step and Piecewise Models  
- 5C Teacher Activity Sheet 11: Making Decisions from Step and Piecewise Models