Modeling Real-World Data

Exponential, Logarithmic, and Logistic Growth Model

Project Overview:

You will model real-world scenarios using exponential, logarithmic, or logistic growth models. This will be 3 grades, one grade for each scenario. You have one week to complete this.

Standards:

MAFS.K12.MP.5.1 Use appropriate tools strategically. MAFS.K12.MP.4.1 Model with mathematics. MAFS.912.F-BF.1.1 Write a function that describes a relationship between two quantities.

Objectives:

- Create an exponential model of a savings account
- Create a model to represent a country's population growth or decay
- Create an exponential model of a pharmaceutical drug's decay

Display:

- Sway (Microsoft Office app)
- PowerPoint/Prezi
- Share with ldelavega@dadeschools.net through Microsoft OneDrive. DO NOT EMAIL TO ME.

Tasks:

1. Create an exponential model of a savings account $A = P\left(1+\frac{r}{n}\right)^{nt}$
    - Identify the bank and include a picture of the offer (screenshot of website)
    - Convert APY to APR
    - Assume monthly interest (unless stated otherwise)
    - Graph the exponential model (Label axes)
    - Choose a year and predict the accumulated amount using your model (Show point on graph). Explain how much money was accumulated and the difference from your initial balance. Is this the amount you expected? Explain.

2. Create a model to represent a country's population growth or decay
    - Identify the country name along with a *world* map of that country's location
    - Create a data table showing 10 data entries from 1968 to 2018
        - Years should be years after 1968 (t = 0 for 1968)
        - Population should be in terms of thousands or millions (3,485,294 ≈ 3.49 million) – LABEL the units
    - Use exponential, logarithmic, or logistic growth to model a country's population. Explain why you chose said model and why the other models are not appropriate.
    - Two options for coming up with a model:
        - By hand, solve for k using the exponential model with e and the initial and final data points (1968 and 2018) $A = A_0e^{kt}$
        - A TI-84 calculator or desmos, using the regression capability (GC: instructions, desmos: instructions)

          $y = a \cdot b^x$ (or $y = a \cdot e^{kx}$) or $y = a + b\ln x$ or $y = \frac{c}{1+ae^{-bx}}$
    - Graph the model along with the 10 data points to show similarities and differences. (label axes)
    - Predict what the population will be in 2030 using your model. (Show point on graph and work that leads to your answer)

3. Create an exponential model of a pharmaceutical drug's decay $A = A_0e^{kt}$
    - Identify the drug's generic name, brand name(s), and what it is mainly prescribed for
    - State the half-life and determine the decay rate (specify hours or days)
    - Graph the model (initial dose in mg as A_0) (label axes)
    - Using your model, identify how long it takes for the drug to decay to less than 1mg. Show how you found your answer. (This is more simplistic than the actual process of decay and body absorption)