






Activity 9


The World Population: Linear and Exponential Models

The population of the world has grown rapidly over the last century. In this activity, several models for the growth of the world's population will be developed. The validity of each in predicting past, current, and future populations will then be explored.

Exploration


1. Open a new TI InterActive! document. Title this report **World Population Growth**. Be sure to put your name and date at the top of the report.
2. Click on List  to open the Data Editor. Double-click on the name **L1** and change the name to **Years**. Click OK. Double-click on the name **L2** and change the name to **Population**. Click OK.
3. Click on the Web Browser icon  to open TI InterActive!'s Internet Browser. Click on the Data Sites icon . Under the **Activity Book Links** category, click *TI InterActive! Math for High School*. Choose **Activity 9: World Population**.
4. Once the page has loaded in the browser, click on **Select**, then **Extract** to download the data into the Data Editor.
5. Highlight and copy the numerical data for the Years and Population from 1950 to 1990. Click into cell 1 of the **Years** column and paste the copied data.
6. Double-click on **L3**. Change the name from L3 to **Time**. Enter the formula **Years -1900** to look at the years since 1900. Click on Save to Document .

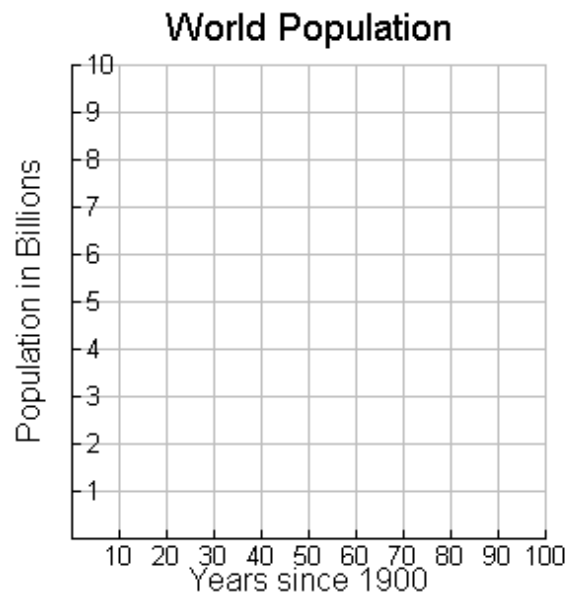
7. Select Graph . Click on the Stat Plots tab. Enter **Time** in the first field and **Population** in the second field. Click in the check box at the left to select this plot.

8. Click on Format . Set up the window with x: [0, 100], Xscale = 10, and y: [0, 10], Yscale = 1. Click on Apply.

9. Click on the Labels tab in the Format window. Title this graph **World Population**. Label the X-axis **Years since 1900** and the Y-axis **Population in Billions**.

10. Click on OK and then Save to

Document . Record your graph on the grid provided.



Analysis

Record the answers to the following questions in the report. Be sure to write in complete sentences when answering these questions.

1. What type of equation(s) could model this data?

2. Double-click on the graph. Define $y_1(x) = x$. Adjust the slope, m , and y -intercept, b , of the line, $y = mx + b$, until you have a good linear fit for this data. Record the equation.

3. State the slope of this line. Interpret the meaning of the slope including the units.

4. State the y -intercept of this line. Interpret the meaning of the y -intercept including the units.

5. Based upon the y -intercept, is this model appropriate for the domain 1900 to 2000? Explain.

6. Double-click on the graph. Define $y_2(x) = 2^x$. Adjust the initial population, a , and the growth factor, b , of the function, $y = ab^x$, until you have a good exponential fit for this data. Close the Graph window. Record the function.

7. Interpret the meaning of a in your function $y = ab^x$ including the units.

8. Interpret the meaning of b in your function $y = ab^x$.



9. Could this model be appropriate for the domain 1900 to 2000? Explain.

10. Double-click on the data. Highlight and copy the original numerical data for the years and population from 1900 through 1990. Click in cell 1 of **Years** and paste the copied data. Close the Data Editor.

11. How well does the linear model fit this data set? Explain.

12. How well does the exponential model fit this data set? Explain.

13. Double-click on the graph. In $y_3(x)$, adjust a , b , and d of the function $y = ab^x + d$ to find a better fit of this data. Close the Graph window. Record the function.

14. Double-click on the graph. Click on Table . Click on Table Setup . Change the Independent Mode to Ask. Click on OK.

15. Use these functions to predict the population in the years 1850, 1916, this year, and 2050 by entering the years since 1900 in the X column. Click on

Save to Document .

16. How well do your functions predict the population in each of the years in the table above compared to the data from the United Nations? Explain.

17. Save this document as **worldpop_linear.tii**. Print a copy of this document.