

## Lab 1

Name \_\_\_\_\_

Name \_\_\_\_\_

Name \_\_\_\_\_

### Objectives

The purpose of this lab is;

- to use numerical, graphical and analytic methods to model US Exports and to use the model to predict the expenses for future years.
- to practice using basic features in the calculator GRAPH and STAT menus.

### Data

The following table from the U.S. Census Bureau lists the dollar value of exports from the United States. The export data are given in billions of dollars.

Year	Dollars (billions)
1987	250.208
1988	320.230
1989	359.916
1990	387.401
1991	414.083
1992	439.631
1993	456.943
1994	502.859
1995	575.204
1996	612.113
1997	678.366
1998	670.416
1999	683.965
2000	771.994
2001	718.712
2002	682.422
2003	713.415

Source: U.S. Census Bureau, U.S. trade in goods and services:  
<http://www.census.gov/foreign-trade/statistics/historical/gands.txt>

1. Do some research to learn how to determine if sets of data might be linear or exponential. Use only the data in the table to decide whether a linear model ( $y = ax + b$ ) or an exponential model ( $y = ab^x$ ) better fits the export data. Explain your conclusion in detail giving a supporting mathematical analysis.
2. Visualizing data is also a way to determine the behavior of data. Plot the data in the table using your TI-89 calculator.

3. Find an exponential model,  $y = ab^x$ , that passes thru the data points for the years 1989 and 2001. (Find the constants in  $y = ab^x$  using these two points.) Explain in detail how you found the model giving a supporting mathematical analysis.
4. Use your calculator to plot the exponential model of part 3 and all 17 data points on the same set of axis. Use GRAPH to enter the exponential model you found in the previous question as  $y1$ . Make an accurate plot of the calculator display on graph paper. You may copy the graph (carefully!) by hand or use GRAPHLINK to export the graph to a computer in order to print it by machine. Discuss any differences between the model and the actual data.
5. Explain how to determine what the exponential model of part 3 predicts for the US Exports in 1990 and in 2004. Find the predicted US Export value for 1990 and 2004. Compare the actual exports to the predicted exports for 1990. Explain any differences between the actual and the predicted values.
6. The “best” exponential model uses all 17 data points instead of two arbitrary ones (for example, the points 1985 and 1995) and a statistical technique called **regression**. Use your TI-89 to compute an exponential regression model of the form  $y = ab^x$ .
7. Is the model in part 3 or par 6 better? Explain your answer.
8. Find a parabolic model ( $y = ax^2 + bx + c$ ) for the data. Is a parabolic model appropriate for the US Exports? do you think it is better than your models from part 3 and 6? Explain your answers giving supporting mathematical analysis as necessary.

### Group Lab Report

Write a report containing your answers for parts 1-8. Write the report so that a person knowledgeable in math can understand what you have done without recourse to your group. Please use a Word Processor for writing your report. You do not have to use an equation editor if you do not want to. Instead you may write mathematical equations (such as  $y = 92.34x^2 - 17.38x + 1.234$ ) by hand. Graphs should be drawn on graph paper (or printed out using graphlink on your calculator). Submit one report from each group and use this sheet as a cover page for that report.