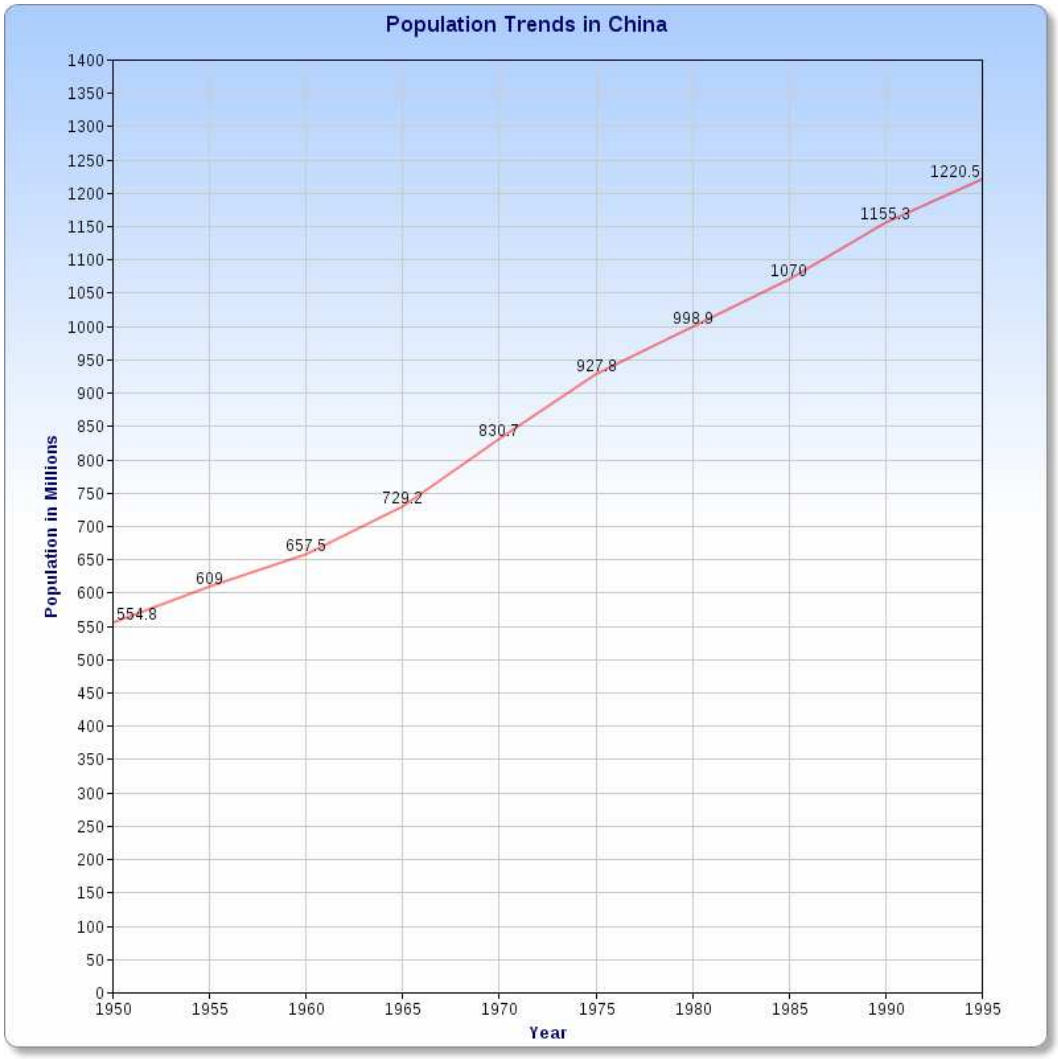
Math IA

Year	Population in Millions
1950	554.8
1955	609.0
1960	657.5
1965	729.2
1970	830.7
1975	927.8
1980	998.9
1985	1070.0
1990	1155.3
1995	1220.5



In this set of data, the x axis is the year that the population was measured. The Y axis is the population in millions of China.

In this set of data the population before the year 1950 is not listed so that does not mean that the data before 1950 does not exist it just means that for the purposes of this investigation they are irrelevant. The time period or range of the data is only from the years 1950 to 1995, this limits the amount of data points we have, and restricts the overall trend of the graph that we can see. Instead of seeing the data from year 0, we only see it from 1950 to 1995. When you view this specific section of data, it will have a different function that fits it than would the entire data set.

This graph looks to be almost linear. The data looks to be almost arranged in a straight linear graph. This data looks to have almost the same slope or close to the same slope for all the data points. It is of course not perfectly linear because the growth of a population would not be perfectly linear. This data is close to linear but it is not perfectly linear. A linear function is plausible.

This is a graph with the data points on it as well as a linear function:

y = 15.496x - 29690.2501

The function of the parent linear function is

$y = mx + b$

If in the TI-84 calculator you do a linear regression. You first need to put all the data from the years 1950 to 1995 into L1 and the corresponding population data into L2. After you have put the data in the L1 and L2 lists. After the data has been entered into the lists. Press the 2nd button then the Y= button. Scroll down so that the 1: is highlighted. Press enter. Scroll to where it says "ON" and hit enter. Scroll down and select the line graph from the list of possible graph types. Make sure that the field labeled X List : is filled out with L1. Make sure that the field labeled Y List: is filled out with L2, press enter.
Hit Zoom, scroll down to 0:ZoomFit press enter. This will format your window so that you can view the data on the graph.

This graph is a graph of the data from the table.

To perform a linear regression hit the STAT button, scroll over to the field labeled CALC. Scroll down to the field labeled 4:LinReg(ax+b), press enter. Hit the 2nd key, then hit the 1 key. This should make a L1 appear behind the LinReg(ax+b). After you have the L1 behind the LinReg(ax+b), hit the comma button (,). Then hit the 2nd button again and then the 2 button. This will make your screen look like this:

LinReg(ax+b) L1 , L2

Hit the comma (,) button again. Then your screen will look like this:

LinReg(ax+b) L1 , L2 ,

Next hit the VARS button. Scroll over to the field labeled Y-VARS. Scroll down to where it says Function. Hit enter. After you have hit enter, then you need to scroll down to where the field labeled Y1 is. Once you have selected this, hit enter. After doing this your screen will look like this:

LinReg(ax+b) L1 , L2, Y1

Hit enter.

You will see a screen that looks like this:

LinReg

y= ax+b

a= 15.49587879
b= -29690.25091
r^2= .9946591286
r= .9973259891

This is the Linear regression or line of best fit for your data. The linear regression function gives you the "a" value which is equal to the slope of the line of best fit of your data. It gives you the y intercept value which in this case is -29690.25091.

Knowing this information, the formula that I am using to model this data will be

y = 15.496x - 29690.2501
Because this function has r^2= .9946591286, we know that this function is very accurate when determining the next data point in the pattern.

The linear function line is very close to being almost perfect at plotting out the points. My model fits the data extremely well. My model has a r^2 value of .995 when rounded to three significant figures. This is a very good number to have. the closer the r^2 value is to 1.0 the more accurate the function is at determining the location of more data points. The point which seems to be the farthest from my function line is at the year 1965, this data

point looks to be the farthest from my function line. This function would not be perfect at predicting the amount of people in China in the year 2000 because the function does not have a perfect 1.0 for its r^2 value. This function is accurate to determine the population of China.

The researchers function of

P(t) = (K)/((1+(Le)^(-Mt))) where K, L, and M are parameters

This is a basic logistic function. The basic logistic function is:

$$P(t) = \frac{1}{1 + e^{-t}}$$

In order to find the function that the researchers suggested I will run a Logistic Regression on the TI 84 plus calculator. You first need to put all the data from the years 1950 to 1995 into L1 and the corresponding population data into L2.

After you have put the data in the L1 and L2 lists. After the data has been entered into the lists. Press the 2nd button then the Y= button. Scroll down so that the 1: is highlighted. Press enter. Scroll to where it says "ON" and hit enter. Scroll down and select the line graph from the list of possible graph types. Make sure that the field labeled X List : is filled out with L1. Make sure that the field labeled Y List: is filled out with L2, press enter.

Hit Zoom, scroll down to 0:ZoomFit press enter. This will format your window so that you can view the data on the graph.

This graph is a graph of the data from the table.

To perform a linear regression hit the STAT button, scroll over to the field labeled CALC. Scroll down to the field labeled LOGISTIC, hit enter.

You will come up with a screen that looks like this:

Logistic
y= c/(1+ae^(-bx))
a= 4.3365552E28
b = .0333213657
c = 1946.183708

When you plug these values you found in the logistic regression, the researchers equation will look like this:

$$P(t) = \frac{1946.18}{4.33656 \times 10^{28}\, e^{-0.0333214\, x} + 1}$$

This is the function for the logistical regression of the data.

When you plug in the values for K,L, and M, I found that the function that the function suggested by the researcher is much more accurate for describing the data than my linear function was.

This function is more accurate than the linear function at modeling these data points.

If the population follows the linear function then population of China will steadily increase, which would cause world wide problems. The linear function is not scientifically accurate because of the nature of the growth of populations. If this happens then we can expect to see the chinese population reach 1400 million people by the end of 2010.

If the population of China follows the logistic function then in a few years China and its people will reach their breaking point, and the environment will begin to reach the carrying capacity. Also because of the natural way that populations grow, the logistic equation makes more logical since than my original interpretations of Westchester. With the logistic function I am better able to predict the population of China for the rest of many years.

Both the linear function and the logistic function fit the data points from the data collected and reported. The linear function fits really accurately and does a good job of predicting the future data.

My formula with the linear equation still is probably the most valuable source in determining the population for China. The linear function has a straight line that is very close to the data points. Other functions are also good at describing where the data points lie, such as the logistic equation that the researchers suggested. I would not modify my original linear equation because it works to predict the population of china. My function was very good at being able to predict the population of China.

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