Ian Baker

MODELING UTAH POPULATION DATA

Math 1010 Intermediate Algebra Group Project

100A+

According to data from the U.S. Census Bureau, Population Division, the population of Utah appears to have increased linearly over the years from 1980 to 2008. The following table shows the population in 100,000's living in Utah according to year. In this project, you will use the data in the table to find a linear function $f(x)$ that represents the data, reflecting the change in population in Utah.

Estimates of Utah Resident Population, in 100,000's

Year	1981	1989	1993	1999	2005	2008
x	1	9	13	19	25	28
Population, y	15.2	17.1	19	22	25	27.4

2004 - 2044
24 64

Source: U.S. Census Bureau, Population Division

1. Using the graph paper on the last page, plot the data given in the table as ordered pairs. Label the x and y axes with words to indicate what the variables represent.

2. Use a straight edge to draw on your graph what appears to be the line that "best fits" the data you plotted. You will only have one line drawn, rather than several pieces of lines

3. Estimate the coordinates of two points that fall on your best-fitting line. Write these points below.

   (2 , 14), (28 , 27)

   Use the points that you wrote down to find a linear function $f(x)$ for the line. Show your work!

   $(27-14) = m(28-2)$

   $13 = 26m \quad m = \frac{1}{2}$

$f(x) = \frac{1}{2}x + 13$

4. What is the slope of your line? $m = \frac{1}{2}$

Interpret its meaning. Does it make sense in the context of this situation? Please use complete sentences to respond to these questions.

A slope of $\frac{1}{2}$ means that the population of Utah grows by 100,000 every 2 years, or 50,000 every year.

Find the year that $x = 45$

5. Find the value of $f(45)$ using your function from part 3. Show your work, then write your result in the blank below.

$45 = \frac{1}{2}x + 13$

$\frac{2}{1} \cdot 32 = \frac{1}{2}x$

$64 = x$

$f(45) =$ 64

Write a sentence interpreting the meaning of $f(45)$ in the context of this project.

Utah's population will reach 4.5 million in the year 2044.

Set $y = 2{,}000{,}000$

6. Use your function from part 3 to approximate in what year the residential population of Utah reached 2,000,000. Show your work.

$20 = \frac{1}{2}x + 13$

$\frac{2}{1} \cdot 7 = \frac{1}{2}x \quad x = 14$

The population will reach 2,000,000 in the year 1994, approximately.

7. Compare your linear function with that of another student or group.

Comparison function: $f(x) =$ $\frac{1}{2}x + 12$

Is the comparison function the same as the function you wrote down for part 3?

No, The two functions are different.

If they are different, explain why.

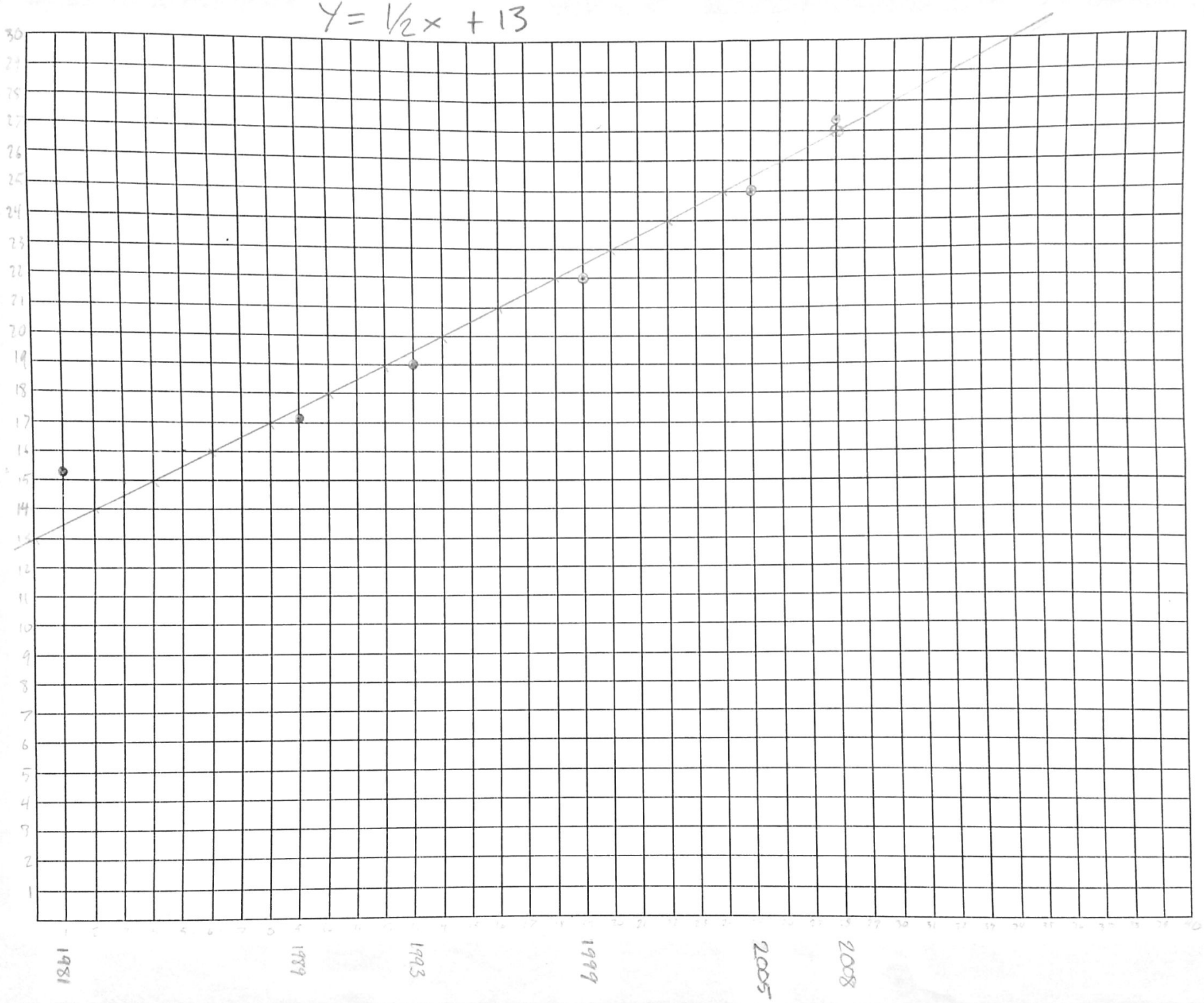
The slope is the same but the y intercepts are different. This could be due to human error as the trend line that "best fits" our two graphs may have been perceived to fit the data better for Emma the way that she drew hers than for me and mine.

If they are the same, explain why.

8. In actuality, using a linear growth model for population is not common. Most models are exponential models, due to the fact that most populations experience relative growth, i.e. 2% growth per year. Linear models for nonlinear relationships like population work only within a small time frame valid close to the time of the data modeled. Discuss some of the false conclusions you might reach if you use your linear model for times far from 1980-2008.

Our linear model may work to give a general view of the way populations change within a few years of given data but because populations change exponentially our linear model will give a misleading representation of where a population will be many years in the future. One using a linear model may estimate a given population based on past trends but this will not account for the upward exponential curve the population growth will exhibit. One using a linear model will estimate a population to be much lower if looking many years into the future than what it is more likely to be because the model fails to take into account the yearly added 2% population.

$Y = 1/2x + 13$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