MODELING UTAH POPULATION DATA

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	1995	1999	2005	2008
X	1	9	13	15	19	25	28
POPULATION, Y	15.2	17.1	19	20	22	25	27.4

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. (The grid is large enough to use a 1 to 1 scale)

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 and the line will NOT touch all the points you have plotted. One way to draw this line is to connect 2 data points. Another approach is to have your line not touch any points, but be close to most of them.

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

$x_1 \quad y_1 \qquad x_2 \quad y_2$

(1993, 19), (2005, 25)

(13) (25)

$$\frac{25-19}{2005-1993} = \frac{6}{12} = \frac{1}{2}$$

Use these points to find a linear function *f(x)* for the line. Show your work!

Remember the 3 steps to finding the equation of the line:
1. Determine Slope
2. Use Point Slope Form
3. Write in Slope Intercept Form

$$y - 19 = \frac{1}{2}(x - 13)$$

$$y - 19 = \tfrac{1}{2}x - 13\tfrac{1}{2} \leftrightarrow -6.5$$

$$+19$$

$$\begin{array}{r} -6.5 \\ 19.0 \\ \hline 12.5 \end{array}$$

f(x) = $\tfrac{1}{2}x + 12\tfrac{1}{2}$ $\left(\frac{25}{2}\right)$

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

Comparison function: $f(x) =$ $1/2x + \frac{25}{2}$

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

yes

If they are different, explain why. If they are the same, explain why.

one is a fraction reduced

5. What is the slope of **your** line? $m =$ $1/2$

Interpret its meaning as it relates to population and years. Does it make sense in the context of this situation? (This sentence should be written something like "For every 1 years, the population increases/decreases by ___") 50,000

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

$y = .5(45) + 12.5$

$22.5 + 12.5$

$y = 35$

$f(45) =$ 35

Write a sentence interpreting the meaning of $f(45)$ in the context of years and population.

In 45 years the population will be 3.5 million

7. Use your function from part 3 to approximate in what year the residential population of Utah reached 2,000,000. Show your work. (Note: 2,000,000 is 20 * 100,000 so you will find the value of x that gives a population of 20.)

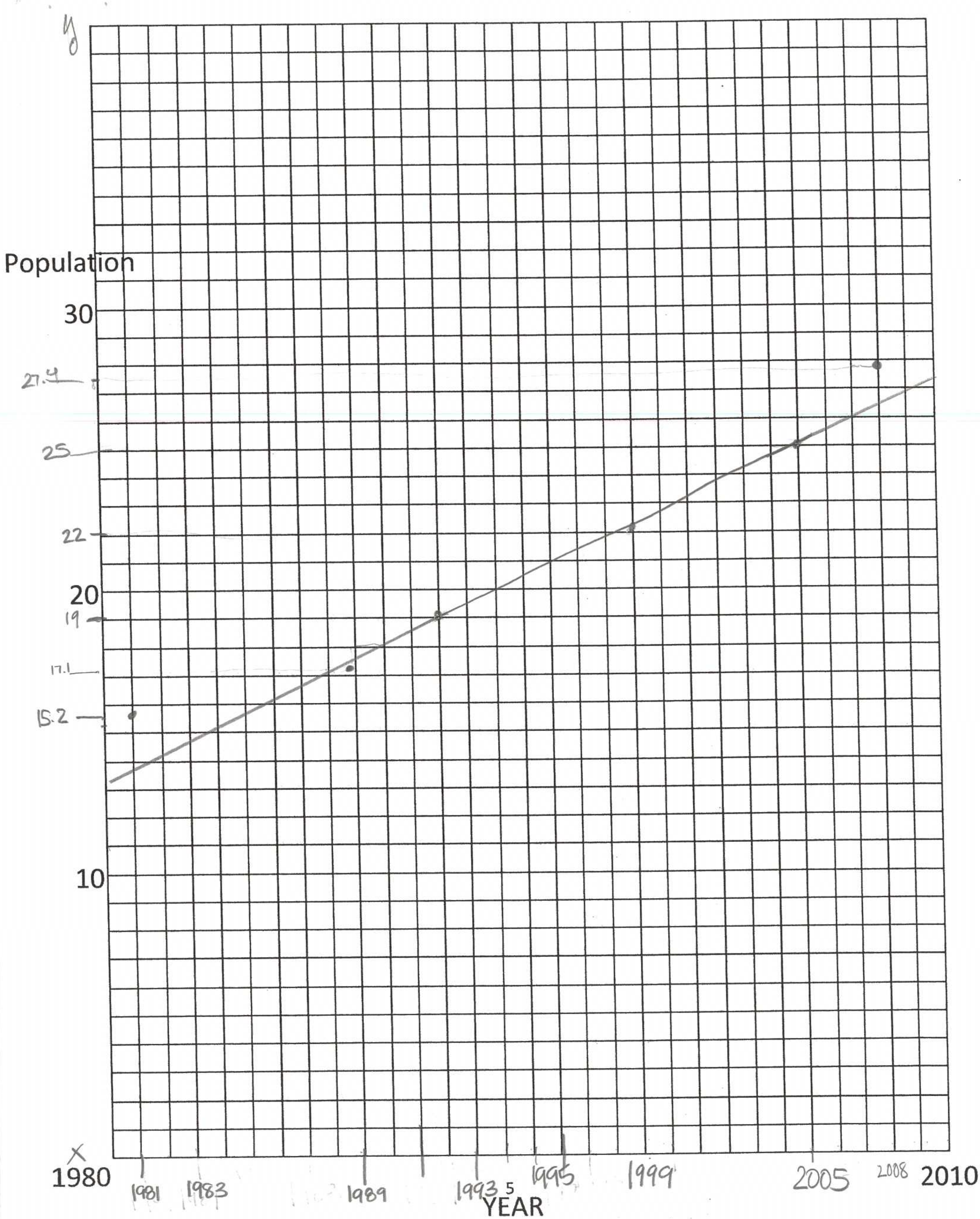
$$20 = .5x + 12.5$$
$$-12.5$$
$$\frac{7.5}{.5} = .5x$$
$$x = 15 \qquad (15, 20)$$

8. Compare your answer to part 7 to the chart given on page 1. Does the value you found in part 7 fit in with this data? yes

9. If your answer to part 8 is NO, it is because 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 (such as extending out to 2020 or going back in time to 1950). Even if your answer for #8 is yes, please still answer this question.

The growth of a linear model is not based on a realistic rate of growth therefor it would estimate the growth far below the actual growth.

10. Reflective Writing.
Did this project change the way you think about how math can be applied to the real world? Write **one paragraph** (at least 5 sentences!) stating what ideas changed and why. If this project did not change the way you think, write how this project gave further evidence to support your existing opinion about applying math. Be specific. (Note: a paragraph is at least 5 sentences!!!) **Each person** in your group should turn in their OWN reflections attached to the back of this packet.


y
Population
30
27.4
25
22
20
19
17.1
15.2
10
x
1980
1981
1983
1989
1993
1995
1999
2005
2008
2010
YEAR

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Reflective Writing

yes it taught me That using math provides a more accurate picture of growth. Using a linear model does not give us an actual real world picture of growth. If you did not use math & only estimated growth @ what it was say 40 years ago your data would be substantially less because it does not take into account many other factors in population growth