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Math 1010-OLe1
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MODELING UTAH POPULATION DATA

Math 1010 Intermediate Algebra Group Project

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

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.

(6 , 16), (20 , 24)

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

Slope formula $\frac{y_2-y_1}{x_2-x_1} = \frac{24-16}{20-6} = \frac{8}{14}$ $\quad m=\frac{8}{14}=\frac{4}{7}$

point slope $y-y_1=m(x-x_1)$

$y-16=\frac{4}{7}(x-6)$ $\quad \frac{6}{1}\cdot\frac{4}{7}=\frac{24}{7}$

$y-16=\frac{4}{7}x-\frac{24}{7}+\frac{16(7)}{1(7)}$ $=-\frac{24}{7}+\frac{112}{7}$

+16

$y=\frac{4}{7}x+\frac{88}{7}$

$f(x) = \frac{4}{7}x + \frac{88}{7}$

4. What is the slope of your line? m = $\frac{4}{7}$

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

The numerator of the slope is the amount of increase in Utah's population (in 100,000). The denominator of the slope is the number of years it takes for the amount of population in the numerator to grow. Essentially, every ~~##~~ 7 years the population in Utah increased by approximately 400,000.

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

$$f(x) = \frac{4}{7}x + \frac{88}{7}$$

$$f(45) = \frac{4}{7}\left(\frac{45}{1}\right) + \frac{88}{7}$$

$$\frac{180}{7} + \frac{88}{7} = \frac{268}{7} = 38.29$$

$f(45) =$ $\frac{268}{7}$ (38.2857) round 38.29

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

Every 45 years [f(45)] Utah's population increases by 38.29(y), which is 3829,000.

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

$$\cancel{f(x)} = \frac{4}{7}x + \frac{88}{7}$$

population year

if population is in 100,000 then $\frac{2,000,000}{100,000} = 20$

$$20 = \frac{4}{7}x + \frac{88}{7}$$ (x = year)

$$-\frac{88}{7} \qquad -\frac{88}{7}$$

$$\frac{20}{1}\left(\frac{7}{7}\right) = \frac{140}{7} - \frac{88}{7} = \frac{4}{7}x$$

$$\frac{\cancel{7}}{4} \cdot \frac{\cancel{52}^{13}}{\cancel{7}} = \frac{7}{4} \cdot \frac{4}{7}x$$

X=13 in the year ~~2013~~ 1993 the residential population of UT reached 2,000,000

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

Comparison function: $f(x) =$ $y = \frac{1}{2}x + 13$ - from D.J.

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

no

If they are different, explain why.

DJ's y intercept is 13 & mine is ~12.5. His slope is $\frac{1}{2}$ & mine is $\frac{4}{7}$ ... so they are very close. But not exact. This may be because the line we drew was our best estimate that included all of the points given. (as close as possible)

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.

By using a wide range of time for our model, we assume that the population is going to continue to increase at its present rate. We fail to take into account those things that influence population growth such as a strong economy, affordable housing, cost of living (inflation!) & fuel cost (both inside UT and those factors outside of UT which may cause people to want to migrate to our state -or out of it- due to the strength or weakness of these factors.

Points Plotted (1,15.2),(9,17.1),(13,19),(19,22),(25,25),(28,27.4)