Ashley Tignor
Math 1010-042
project 1

Ashleytignor Math1010project1.pdf

MODELING UTAH POPULATION DATA

Math 1010 Intermediate Algebra 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	1980	1988	1993	2000	2004	2009
x	0	8	13	20	24	29
Population, y	14.6	16.9	19	22.4	24.4	27.8

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.

x_1 y_1 x_2 y_2 (0, 14.6) (24, 24.4) (0, 14.6), (24, 24.4)

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

$\frac{24.4 - 14.6}{24 - 0} = \frac{9.8}{24}$ slope

(0, 14.6) y intercept

$f(x) = \frac{9.8}{24}x + 14.6$

slope, y-intercept

$f(13) = \frac{9.8}{24}(13) + 14.6$

$13 \times 9.8 = 127.4$

$\frac{127.4}{24} = 5.30833$

$5.30833 + 14.6 = 19.90833$

$f(13) = 19.90833$

$f(x) = \frac{9.8}{24}x + 14.6$

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4. What is the slope of your line? $m = \frac{9.8}{24}$ x
Interpret its meaning. Does it make sense in the context of this situation? Please use complete sentences to respond to these questions.

It makes sense to the content in this situation because in the span of 24 years there is an increase in Utah's estimated resident population in the amount of 9.8 (in 100,000s) so our slope should rise 9.8 (in 100,000s) and run 24 years to best fit the function of my linear line.

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

$f(45) = \frac{9.8}{24}(45) + 14.6$

$\frac{9.8}{24} \cdot \frac{45}{1} = \frac{441}{24} = 18.375$

18.375
+14.6
32.975

$f(45) = 32.975$

$f(45) = \underline{32.975}$

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

In the year 2025 Utah's estimated resident population will be approximately 32,985 (in 100,000's).

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

$f(x) = \frac{9.8}{24}x + 14.6$

$20 = \frac{9.8}{24}x + 14.5$
$-14.5 \quad -14.5$

$5.5 = \frac{9.8}{24}x$

$\frac{\frac{9.8}{24}}{1} \cdot \frac{24}{9.8}$

$\frac{5.5}{1} \cdot \frac{24}{9.8} = \frac{132}{9.8} = 13.46938$

$X = 13.47$

Approximately between the year 1993 (13) and 1994 (14) the residential population of Utah reached 2,000,000.

1993 - 1994

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

Comparison function: $f(x) =$ 9/23 x +14.4

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

If they are different, explain why.

The function is similar to mine but is not exactly the same. My guess for this difference would be that a "best fit" line is open to some interpretation and is affected by the two coordinates that are best fitting to the line. Also, the y labels may be different which may make the "best fit" line different.

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.

A false conclusion may be that the growth rate is constant, and not relative, which would be a straight line instead of the actual curved line. Linear models are accurate in short amounts of time because the change in population may not be that great over the short amount of time but there may be a large change in population size if over a long amount of time, which is why an exponential model would be a better fit for longer periods of time.

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Project 1 modeling Utah population