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Math - 1010

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 (years)	1	9	13	19	25	28
Population, y	15.2	17.1	19	22	25	27.4
	1,520,000	1,710,000	1,900,000	2,200,000	2,500,000	2,740,000

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.

   (8 , 16), (22 , 24)

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

$$\frac{24-16}{22-8} = \frac{4}{7} \qquad \text{Slope} = \frac{4}{7}$$

$$f(x) = \frac{4}{7}x + \frac{23}{2}$$

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 represents the amount of population (400,000) & the denominator represents the time lapse in years (7 years).

The population increases about 400,000 over 7 years.

For every seven years the population increases by 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.

Slope = $\frac{4}{7}$

$x = 45$

$y = \frac{23}{2}$

$f(45) = \frac{4}{7} \cdot 45 + \frac{23}{2}$

$= \frac{180}{7} + \frac{23}{2} = \frac{360}{14} + \frac{161}{14} = \frac{521}{14}$

$= 37\frac{3}{14}$

$f(45) = 37\frac{3}{14}$

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

By 2045 the population of UT would increase up to $37\frac{3}{14}$ (3.7 million)

6. Use your function from part 3 to approximate in what year the residential population of Utah reached 2,000,000. Show your work. 1995

$f(x) = \frac{4}{7}x + \frac{23}{2}$

$20 = \frac{4}{7}x + \frac{23}{2}$

$\frac{7}{4}\left(20 - \frac{23}{2}\right) = x$

$\frac{7}{4}\left(\frac{17}{2}\right) = x$

$\frac{119}{8} = x$

$14\frac{7}{8} = x$

$14\frac{7}{8}$ years (almost 15 yrs. later)

approximately 1995.

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

N/A

Comparison function: $f(x) =$ _____

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

N/A

If they are different, explain why.

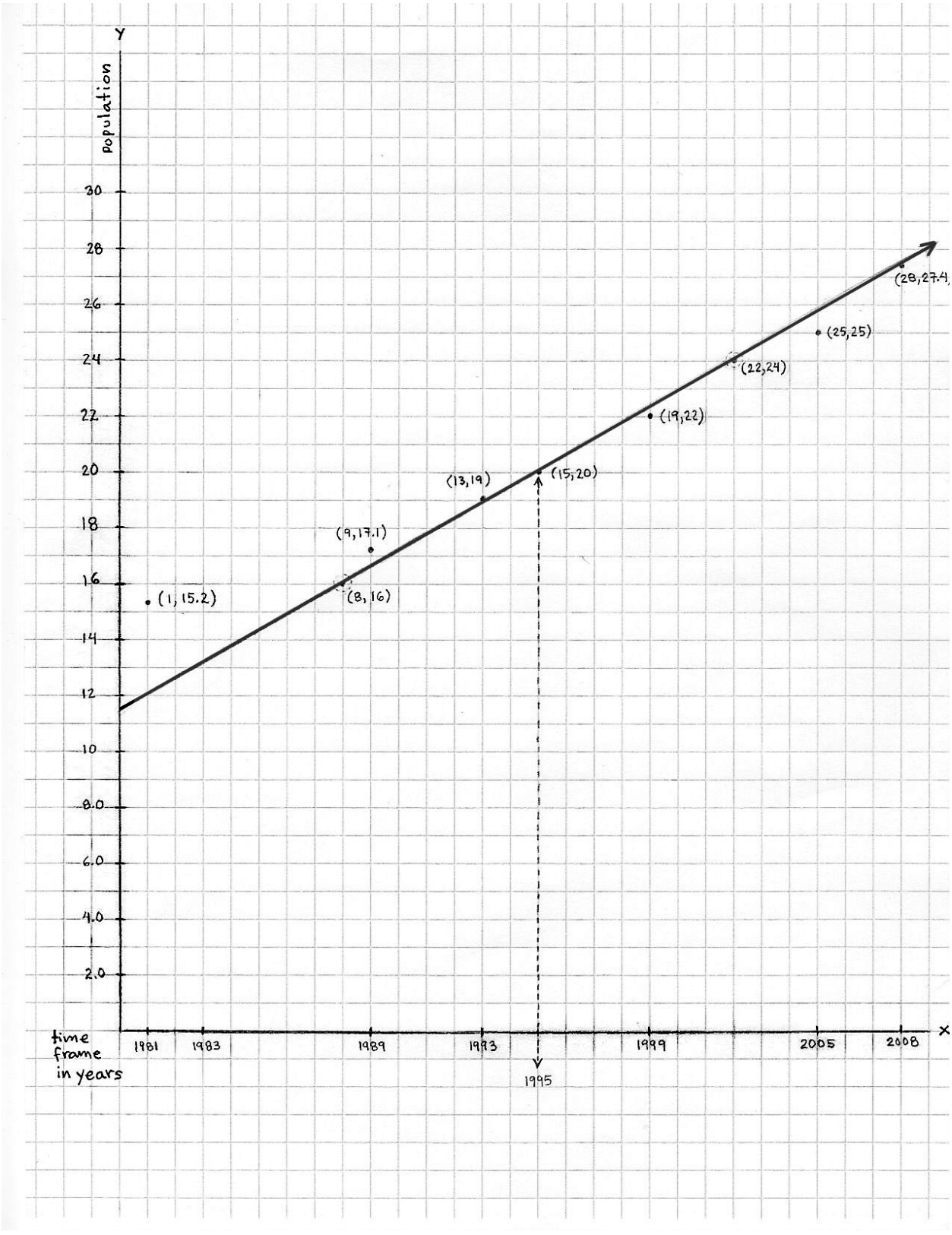
N/A

If they are the same, explain why.

N/A

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.

The growth of population is never constant so it cannot depend on a slope. It varies do to the variables that can affect it and it can even stop, therefore trying to represent its growth with a linear graphic for a longer time frame would be an inaqurate representation.


Y
population
30
28
26
24
22
20
18
16
14
12
10
8.0
6.0
4.0
2.0
(1, 15.2)
(8, 16)
(9, 17.1)
(13, 19)
(15, 20)
(19, 22)
(22, 24)
(25, 25)
(28, 27.4)
time frame in years
1981
1983
1989
1993
1995
1999
2005
2008
X