Algebra 2 Name:
Fitting Curves to Data Date: Period:

So far this chapter, we have found an exponential model to predict the US population two ways – from a rate & an initial value and from two points. Now you are going to look at a lot of data over 160 years.

Year	1815	1825	1835	1845	1855	1865	1875	1885	1895
Population (in millions)	8.3	11.0	14.7	19.7	26.7	35.2	44.4	55.9	68.9
Year	1905	1915	1925	1935	1945	1955	1965	1975	
Population (in millions)	83.2	98.8	114.2	127.1	140.1	164.0	190.0	214.3	

1) Using the data above, find the exponential model using a graphing calculator. Based on the graph of the curve and data points, is the model a good one (does it fit the points well)? Briefly explain.

2) Use that model to predict the population in 2015.

3) The population next year is expected to be 321 million. Is the prediction you just found a good prediction? Does this support or contradict your conclusion about whether the model is good? Explain.

There are countless situations that can be represented by an exponential model. Here are some of them…

Average NBA Salaries

Years (since 1980)	0	5	10	15	16	17	18
Annual salary (in thousands of dollars)	170	325	750	1900	2000	2200	2600

1) Using the data above, find the exponential model. Is the model a good one? How did can you tell?

2) Use that model to predict the average annual salary of NBA players in 2015.

3) If the average salary of current NBA players is about $5 million, is the prediction you just found a good prediction? Does this support or contradict your conclusion about whether the model is good? Explain.

Inflation

Inflation (rising prices) causes money to lose its buying power. In the United States, inflation is 1.1% annually. If a candy bar costs an average of $0.89 today, what will be the cost in 2030? Show your work including the exponential model you used.

Cell Phone Users in the US

Year	1985	1987	1990	1993	1995	2000	2005	2008	2010
Users	340,213	1,230,855	5,283,055	16,009,461	33,758,661	109,478,031	207,896,198	262,700,000	300,520,098

1) Using the data above, find the exponential model. Is the model a good one? How did can you tell?

2) Use that model to predict the number of cell phone users in 2015? Considering the population expected in 2015, does this prediction make sense? Why or why not?

Vinyl Record Sales

As cassette tapes and compact disks became more popular, the sales of vinyl singles declined, as shown in the following table.

Year	1988	1989	1992	1994	1996
Millions of units	65.6	36.6	19.8	11.7	101

1) Find the exponential model for the data. What is the decay rate in sales of vinyl singles?

2) Suppose that vinyl singles will be discontinued when their sales fall below 2 million. In what year will this occur?

Number of Females Practicing Medicine in the US

Year	1980	1985	1990	1993	1994	1995	1996
Number (in thousands)	48.7	74.8	96.1	117.2	124.9	140.1	148.3

1) Find the exponential model for the data. What is the growth rate of female MDs?

2) What is the approximate number of female MDs in 1988? 2014?

3) In what year will the number of female MDs exceed 300 thousand?

Heart Disease Death Rates per 100,000 people in 2001 for selected ages

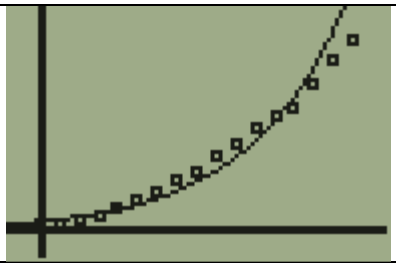
Age	30	40	50	60	70
Death Rate	8.0	29.6	92.9	246.9	635.1

1) Find the exponential model for the data.

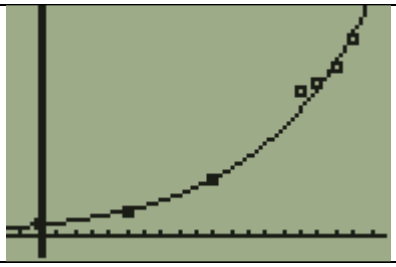
2) Estimate the heart disease death rate for people who are 80 years old and for people who are 18 years old.

Answers

US Population:

1) $y = 11.15(1.02)^x$ This model is ok for years before about 1965. After 1965, the model curves steeply upward while the data points tend to grow more slowly.	
2) 621.02 million	3) This is not a good prediction which supports my earlier statement about the model being bad after about 1965.

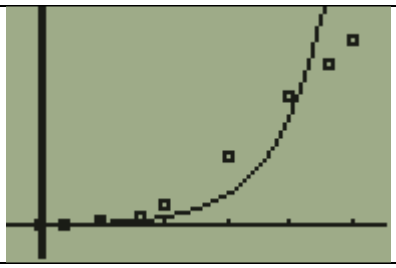
Average NBA Salaries:

1) $y = 161.43(1.169)^x$ This model appears to fit the data very well. The curve follows the all of the data points.	
2) $38,367,000	3) This prediction is not a good model after all. $38.4 million far exceeds the current average of $5 million. Although the model looks good for the years we have data, a lot of changes must have occurred between 1998 and 2014 for the model to be so far different than current values.

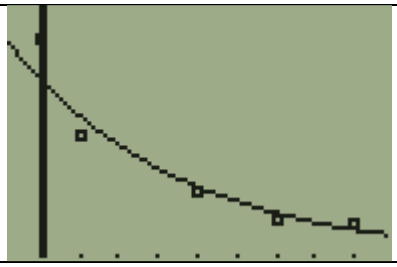
Inflation

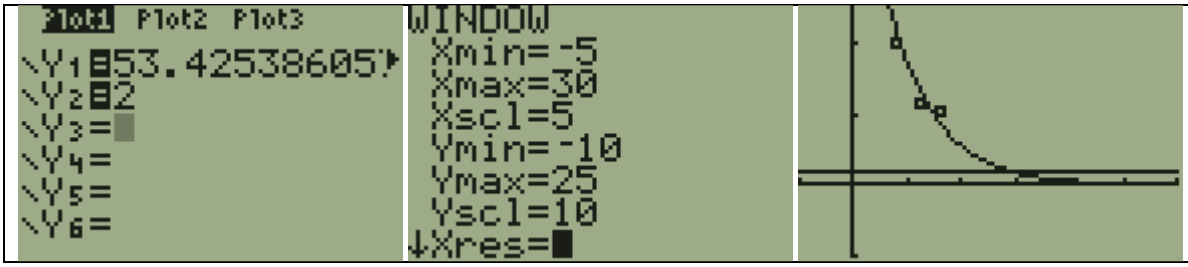
a) $y = 0.89(1.011)^x$ b) $y = 0.89(1.011)^{16} = \$1.06$

Cell Phone Users in the US:

1) $y = 1081652.15(1.292)^x$ The model doesn't seem to fit the data at all. At times the curve is far below the data and at other times far above the data points.	
2) 2368400980.47 cell phone users	3) Considering the population is expected to only be 321 million people in 2015, an estimate of over 2.3 billion is not reasonable.

Vinyl Record Sales

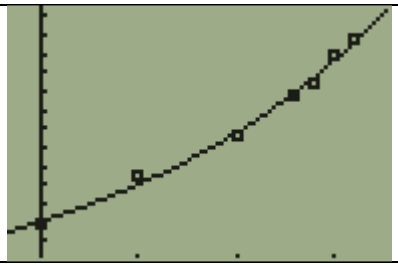
1) $y = 53.425(0.795)^x$ The decay rate is $1 - 0.795 \approx .205$ or a decrease of 20.5%	
2) Vinyl records should be discontinued about a third of the way through 2002. Below are some screen shots to help you figure out how to do this. Hint: 2ND CALC → Intersection You have to SEE the intersection on the screen or the calculator cannot locate it for you.	



Number of Females Practicing Medicine in the US:

1) $y = 50.22(1.069)^x$

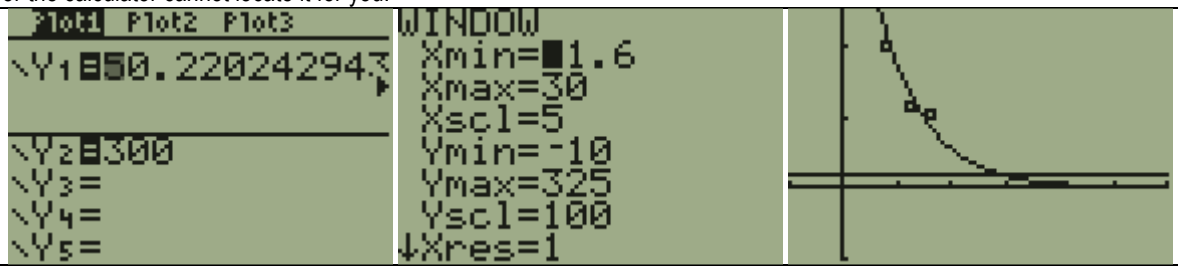
The growth rate is 1.069 - 1 = .069 or an increase of 6.9%



2) About 85,700 in 1988 and 249,570 in 2014.

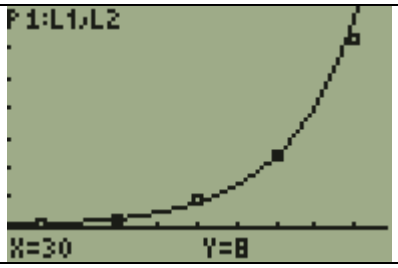
3) The number of female doctors should exceed 300 thousand about two-thirds of the way through 2006.

Below are some screen shots to help you figure out how to do this. Hint: 2ND CALC → Intersection You have to SEE the intersection on the screen or the calculator cannot locate it for you.



Heart Disease:

1) $y = 0.3525(1.115)^x$



2) Death rate is 2107.5 per 100,000 people who are 80 years old and 2.494 per 100,000 for 18-year-olds.