NAME: _____ PERIOD: _____ DATE: _____

Homework Problem Set

1. From 2000 to 2013, the value of the U.S. dollar was shrinking. The value of the U.S. dollar over time ($v(t)$) can be modeled by the following formula:

   $v(t) = 1.36(0.9758)^t$, where t is the number of years since 2000

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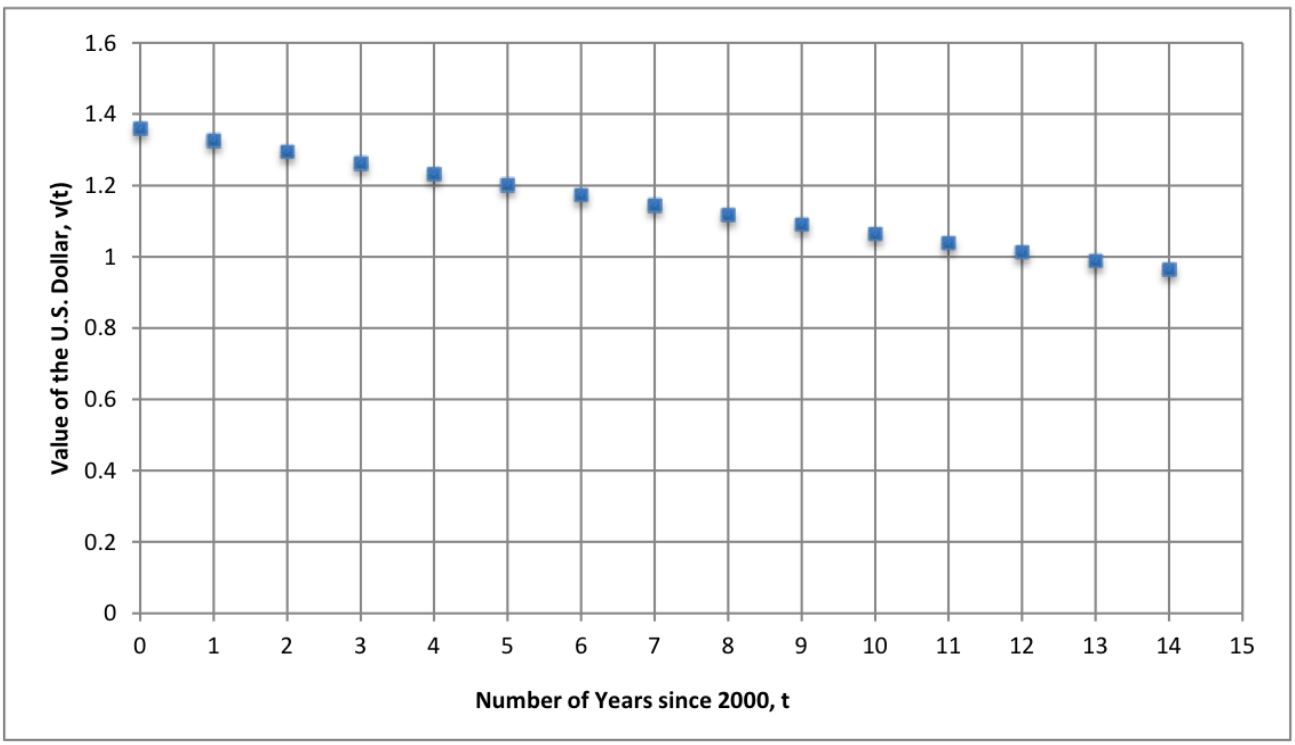
   A. How much was a dollar worth in the year 2005?

$V(5) = 1.36(0.9758)^5 = \$1.20$

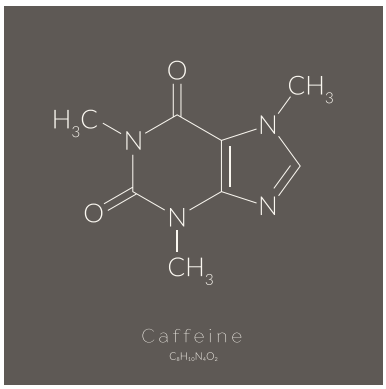
   B. Graph the points $(t, v(t))$ for integer values of $0 \leq t \leq 14$.



   C. Estimate the year in which the value of the dollar fell below $1.00.

2013

2. Doug drank a soda with 130 mg of caffeine. Each hour, the caffeine in the body diminishes by about 12%.



   A. Write a formula to model the amount of caffeine remaining in Doug's system each hour.

$100\% - 12\% = 88\% = 0.88$

$C(t) = 130(0.88)^t$

t = # of hours after Doug drinks beverage.

   B. How much caffeine remains in Doug's system after 2 hours?

$C(2) = 130(0.88)^2$

$C(2) \approx 101\text{mg}$

   C. How long will it take for the level of caffeine in Doug's system to drop below 50 mg?

8 hours

$C(7) = 130(0.88)^7$

53mg

$C(8) = 130(0.88)^8$

47mg

3. A local college has increased its number of graduates by a factor of 1.045 over the previous year for every year since 1999. In 1999, 924 students graduated. What explicit formula models this situation? Approximately how many students will graduate in 2014?

$f(t) = 924(1.045)^t$

$f(15) = 1788$

* 1788 students are expected to graduate in 2014

4. The population growth rate of New York City has fluctuated tremendously in the last 200 years, the highest rate estimated at 126.8% in 1900. In 2001, the population of the city was 8,008,288, up 2.1% from 2000. If we assume that the annual population growth rate stayed at 2.1% from the year 2000 onward, in what year would we expect the population of New York City to have exceeded ten million people? Be sure to include the explicit formula you use to arrive at your answer.

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$f(t) = 8{,}008{,}288(1.021)^t$

The population will exceed 10 million in 2012.

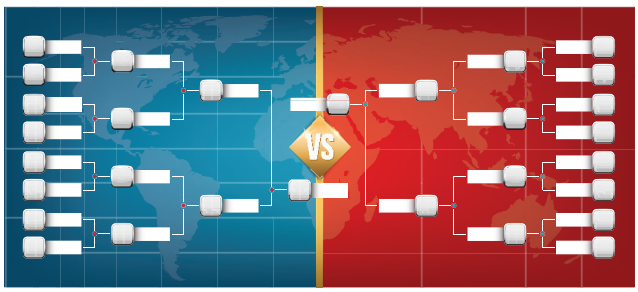
* use guess & check to solve *

2010 → $f(9) = 9{,}655{,}424$ people

2011 → $f(10) = 9{,}858{,}188$ people

2012 → $f(11) = 10{,}065{,}210$ people *

5. 64 teams participate in a softball tournament in which half the teams are eliminated after each round of play.



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   A. Write a formula to model the number of teams remaining after any given round of play.

$t(n) = 64(0.5)^n$

   B. How many teams remain in play after 3 rounds?

$t(3) = 64(0.5)^3$

$t(3) = 8$ teams

   C. How many rounds of play will it take to determine which team wins the tournament?

* Use Guess & Check

5 rounds = $t(5) = 2$ teams

* 6 rounds = $t(6) = 1$ team

* It will take 6 rounds to determine winner

6. If a person takes a given dosage d of a particular medication, then the formula $f(t) = d\,(0.8)^t$ represents the concentration of the medication in the bloodstream t hours later. If Charlotte takes 200 mg of the medication at 6:00 a.m., how much remains in her bloodstream at 10:00 a.m.? How long does it take for the concentration to drop below 1 mg?

$f(t) = d(0.8)^t$

$f(4) = 81.92$ mg

* At 10:00am 81.92 mg remains in bloodstream

24 hrs

$f(24) = 0.94$ mg

After 24 hours the concentration will be < 1 mg.

use guess & check.

7. Kelli's mom takes a 400 mg dose of aspirin. Each hour, the amount of aspirin in a person's system decreases by about 29%. How much aspirin is left in her system after 6 hours?

$f(a) = 400(0.71)^t$

$f(6) = 51.24$ mg

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8. The average cost of a new home has risen dramatically over the last 80 years.

Average Cost of New Home	
1930	3845
1940	3920
1950	8450
1960	12700
1970	23450
1980	68700
1990	123000
2008	238000
2013	289500

Source: http://www.thepeoplehistory.com/70yearsofpricechange.html

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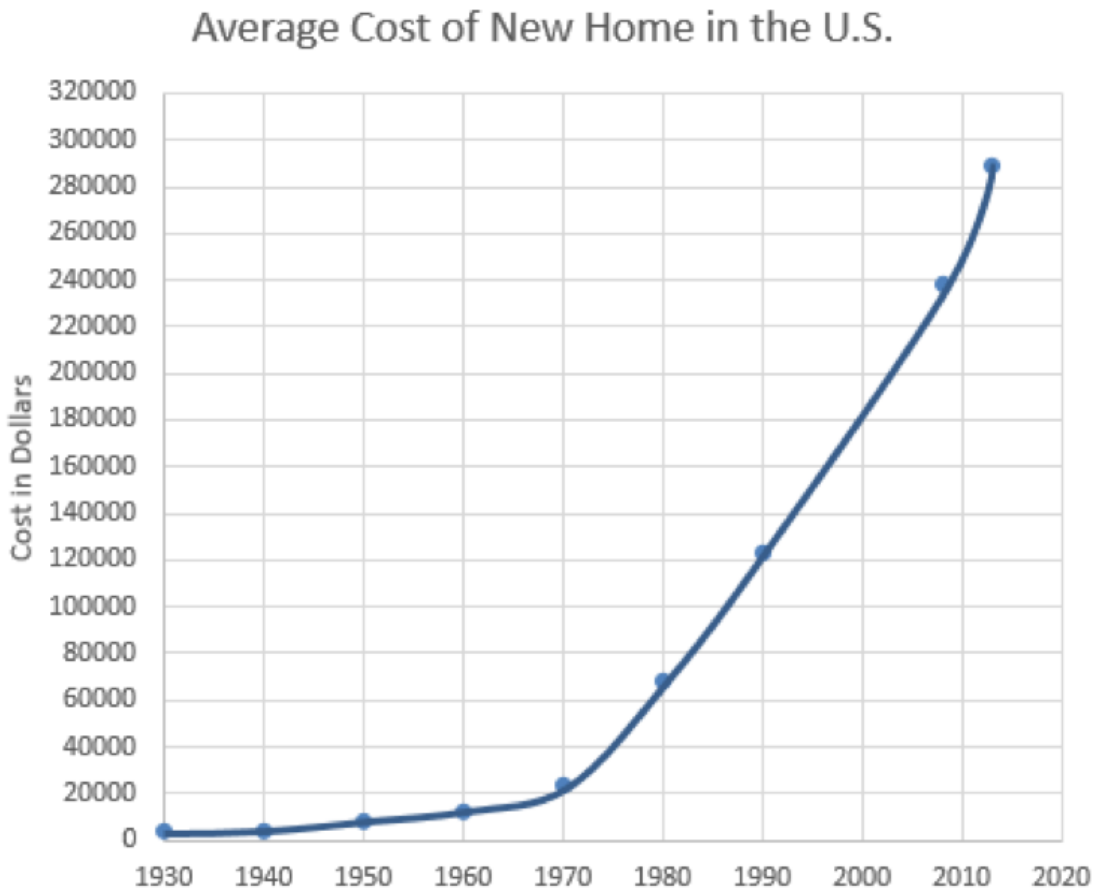
A. Graph the data.



B. Does it make sense to connect the data points?

Yes, because time & money is continuous data.

C. Estimate the average cost of a new home in 2000. Explain how you made your estimate.

You can use the graph to make an estimate.

A new home in 2000 is about $180,000.

D. What type of model would best fit this data? Why?

Data looks exponential, but it could also be piecewise

E. The U.S. census, states that the average cost of a house in 1963 was $19,300. Does this make sense with the data you already have? Explain. Source: https://www.census.gov/const/uspriceann.pdf

Yes, based on the graph, the cost of a new home was between $12,700 and $23,450.