Math 107

Review for test #1

The following table shows the number of customer complaints at a Target store somewhere in the United States during the given months. Use this table to answer questions 1-4 below

Year	Jan	Feb	March	May	July
Number of complaints	9466	7452	8325	10648	16508

1) Calculate the percentage change from Feb to May and the percentage change from Jan to July.
(10648-7452)/7452=42.9% (16508-9466)/9466=74.4%

2) Find the average rate of growth from Feb to May and the average rate of growth from Jan to July.
(10648-7452)/(5-2)=1065.33 complaints/year (16508-9466)/(7-1)=1173.57 complaints/year

3) Use interpolation to estimate the number of complaints in June.
Find average rate of growth from May to July (16508-10648)/(7-5)=2930. 10,648 +2930=13,578

4) Use extrapolation to estimate the number of complaints in September
16508+2930*2=22,368 complaints

The following table shows total expenditures for Verizon Wireless in millions of dollars.

Year	1998	2000	2004	2006	2010
Expenditures	21043	56914	134656	236784	461000

5) Calculate the percentage change from 1998 to 2004 and the percentage change from 1998 to 2010
(134656-21043)/21043 *100=539.9% (46,1000-21043)/21403 * 100=2090.8%

6) Find the average rate of growth from 1998 to 2000 and from 2000 to 2010
(56914-21043)/2=17935.5 million $/year (461000-56914)/10 = 40408.6 million $/year

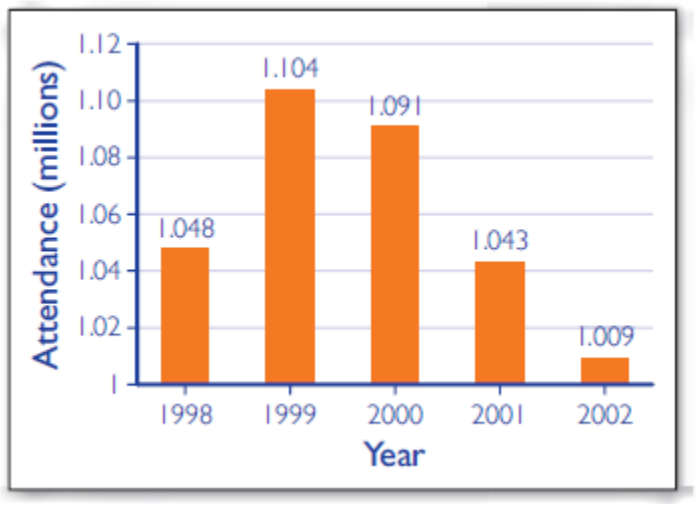
7) Use interpolation to estimate the total expenditures in 2005
From 2004-2006 (236784-134656)/2=51064 so 134646+51064 = 185,720 million dollars

8) Use extrapolation to estimate the total expenditures in 1996. Do you trust this number? Why or why not? *From 1998-2000 (56914-21043)/2 = 17935.5 So 21043-2(17935.5) = -14828 million dollars. This is not reasonable*.

9) The following graph shows expenses for a small business from 2005 to 2010

Calculate the average growth rate from 2005 to 2008 and from 2008 to 2012.
(10-16)/3=-2 thousand $/year (13-10)/4=0.75 thousand $ per year

10) The bar graph below appeared in a report of the Tulsa County Public Facilities Authority. The graph shows Tulsa State Fair attendance in millions from 1998 through 2002.



What is the percentage growth from 1998 to 1999, from 2001 to 2002? Do you think this graph is deceptive?
(1.104-1.048)/1.048 *100=5.3% (1.009-1.043)/1.043=-3.3% The graph seems deceptive in that it appears the changes are much bigger than a couple of percentage points.

11) The height of a young flower is increasing in a linear fashion. Its height t weeks after the first of this month is given by $H = 2.1t + 6$ millimeters. Identify the initial value and growth rate, and explain in

practical terms their meaning. *The height at the beginning of the month was 6 mm and it is growing at a rate of 2.1 mm per month.*

In problems 12-15, use the following table showing the total number of patients diagnosed with the flu in terms of the time in days since the outbreak started

Time in days	0	5	10	15	20	25
Number of flu patients	35	41	47	53	59	65

12) Show that the function giving the number of diagnosed flu cases in terms of time is linear. *The rate of change is constant 6 patients every 5 days.*

13) Find the slope of this function and explain in practical terms the meaning of the slope. *6 patients every 5 days*

14) Find a formula for the linear function in this case. *N=35+6/5 d*

15) How many flu cases would you expect after 18 days? *56 or 57*

The following table shows the average life expectancy of a child born in a given year

Year	2003	2004	2005	2006	2007	2008
Life Expectancy	77.1	77,5	77.4	77.7	77.9	78

If t denotes the time in years SINCE 2003 and E is the life expectancy in years, then it turns out the trend line for these data is given by

E= 0.17t + 77.17

16) What is the slope and explain it's meaning in practical terms for this problem*? Every year life expectancy is increasing by 0.17 years of life.*

17) Use this to predict the life expectancy for a child born in 2010? 78+2*.17= 78.34 years

18) If the linear trend continued through 2030, what would the life expectancy of child born in 2030? Does this seem reasonable? 78+22*0.17=81.74. This seems reasonable but hard to say what is going to happen 27 years from now.

In problem 21-27, use your unit conversion chart to solve these problems

19) Convert 25000 inches to miles. $25000\text{ in} \times \frac{1\text{ ft}}{12\text{ in}} \times \frac{1\text{ mi}}{5280\text{ ft}} = .395\text{ mi}$

$2.8\,L \times \frac{1.057\,qt}{1\,L} \times \frac{2\,pints}{1\,qt} \approx 5.9192\ pints$

20) Convert 2.8 liters to pints.

$\frac{55\ Km}{1\ hr} \times \frac{1\ mi}{1.6093\ Km} \approx 34.2\ mi/hr$

21) Convert 55 km per hour to miles per hour.

$\frac{300\,ft}{1\,sec} \times \frac{1\,mi}{5280\,ft} \times \frac{1\,Km}{.6214\,mi} \times \frac{60\,sec}{1\,min} \times \frac{60\,min}{1\,hr}$

$= \frac{329.2\ Km}{1\ hr}$

22) Convert 300 feet per second to km per hour.

23) Gas costs $1.65 euro per liter in a certain European Country, what is the cost in dollars per gallon.

$\frac{1.65\,€}{1\,L} \times \frac{1.32\,\$}{1\,€} \times \frac{1\,L}{.2642\,gal} \approx \$8.24/gal$

24) Carpet at a British home supply store, costs 16 pounds per square meter. What is the price in dollars per square yard?

$\frac{16\ pounds}{1\ m^2} \times \frac{1.624\,\$}{1\ pound} \times \frac{1\ m^2}{(1.094)^2\ yd^2} = \$21.71\ per\ yd^2$

25) There are approximately 3,000,000 births per year in the United States. Find the birth rate in births per minute.

$\frac{3{,}000{,}000\ births}{1\ year} \times \frac{1\ yr}{365\ day} \times \frac{1\ day}{24\ hr} \times \frac{1\ hr}{60\ min}$

$\approx 5.7\ births/min$

26) The distance travelled from one city to another is 2042 km. Your car gets 24 miles per gallon of gas.

a. How much gas will you need for the trip (round UP to the next gallon)
b. If Gas in Europe averages 1.61 Euro per liter and the exchange rate for Euro to Dollars is 1 Euro = 1.29 dollars, How much does gas cost in Dollars per gallon?
c. How much in U.S. Dollars will you spend on this trip?

a) $2042\ Km \times \frac{.6214\ mi}{1\ Km} \times \frac{1\ gal}{24\ mi} = 52.87 \text{ or } 53\ gal$

b) $\frac{1.61 €}{1\ L} \times \frac{1.29\ \$}{1 €} \times \frac{1\ L}{.2642\ gal} = \$7.86/gal$

c) $53\ gal \times \$7.86/gal = \$416.58$

27) In pouring a new sidewalk you need concrete for a space that is 100 feet long, 14 feet wide and 8 inches deep. How many cubic yards of concrete will you need for this job?

$14 \times 100 \times \frac{2}{3} = 933.33\ ft^3$

$\frac{933.33\ ft^3}{27\ ft^3/1\ yd^3} = 34.6\ yd^3$

28) Your utility company charges 13 cents per kilowatt-hour of electricity. What is the daily cost of keeping a 75 watt light bulb lit for 12 hours each day? How much will you save in a year if you replace the light bulb with an LED bulb that provides the same amount of light for 15 watts of power?

$75\ watt = 75\ \frac{J}{sec} \times \frac{60\ sec}{1\ min} \times \frac{60\ min}{1\ hr} \times 12\ hr = 3240000\ J$

$3240000\ J \times \frac{1\ kwh}{3600000\ J} = .9\ kwh \times .13 \approx \$.117/day$

so $\$.117/day \times \frac{365\ day}{1\ yr} = \$42.71$ per year

If replaced:

$15\ watt = 15\ \frac{J}{sec} \times \frac{60\ sec}{1\ min} \times \frac{60\ min}{1\ hr} \times 12\ hr = 648000\ J$

$648000\ J \times \frac{1\ kwh}{3600000\ J} = .18\ kwh \times \$.13/kwh = \$.0234/day$

$\$.0234/day \times \frac{365\ day}{1\ yr} = \$8.54$ per year

so a savings of $34.17

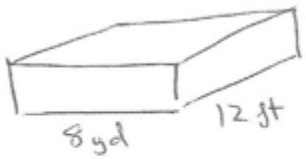
29) Modern Wind energy farms use large wind turbines that generate electricity from the wind. At a typical installation, a single modern turbine can produce an average power of about 200 kilowatts. How much energy, in kilowatt hours, can such a turbine generate in one year? Given that the average household uses about 10000 Kilowatt hours of energy each year how many households can be powered by a single wind turbine?

200 Kilowatts = $\frac{200{,}000\,J}{sec} \times \frac{60\,sec}{1\,min} \times \frac{60\,min}{1\,hr} \times \frac{24\,hr}{1\,day} \times \frac{365\,day}{1\,yr} \times \frac{1\,kwh}{3600000\,J}$

$= 1{,}752{,}000\ \frac{kwh}{year} \times \frac{1\ home}{10000\ kwh}$

$\approx$ 175 homes

30) If there are 7.5 gallons in one cubic foot, then how much water will be in the rectangular pool that is 8 yards long, by 12 feet wide by 2 feet deep?



or $8 \times 3 = 24$ ft

so $24 \times 12 \times 2 = 576\ ft^3$

$576\ ft^3 \times \frac{7.5\,gal}{1\,ft^3} = 4320\ gal$

31) The surface area of Lake Michigan is 22,300 square miles according to Wikipedia. If 50 cubic miles of water was added on top of the lake (and to simplify calculations assume it doesn't overflow onto land), how many feet would the lake rise?
50/22,300=0.002234 miles or 11.8 feet

32) How many cubic kilometers is 5000 cubic miles?
5000 mile* mile*mile*1.61 km/mile *1.61 mile/km *1.61 km/mile= 20,866 km^3

33) Suppose a website goes viral! The views quadruple every day, what percentage increase is this? If initially the website had 200 views per day, write an explicit and recursive equation that models the number of views the website in a given day.
*Quadruple means to multiply by 4. For example going from 100 to 400, this is an increase of (400-100)/100*100=300%.*
A direct formula is $V=200*4^d$ *. A recursive formula is* $V_1=200$, $V_d=4*V_{d-1}$

34) A population of penguins is growing at a rate of 5.5% per year. If 1450 penguins are in the population now, how many will be in the population in 5 years? In 8 years? When will the population double (approximately). Use an Excel chart to answer the last question.
$P = 1450 * 1.055^y$ in 5 years $1450 * 1.055^5 = 1895$ in 8 years $1450 * 1.055^8 = 2225$

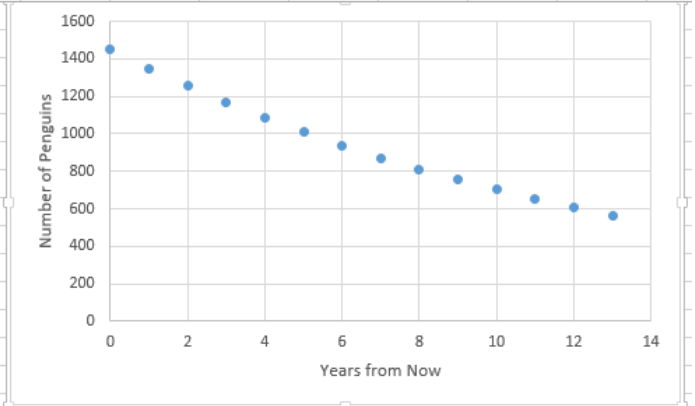
Around the 13th year, the population will have doubled from 1450 to 2900.

	A	B
1	0	1450
2	1	1529.75
3	2	1613.886
4	3	1702.65
5	4	1796.296
6	5	1895.092
7	6	1999.322
8	7	2109.285
9	8	2225.295
10	9	2347.687
11	10	2476.809
12	11	2613.034
13	12	2756.751
14	13	2908.372

35) A population of penguins is declining at rate of 7% per year. If 1450 penguins are present now, Write a function for the population, P, in terms of the number of years t. Use this function to determine the population 10 years from now. Now write a recursive formula. Suppose this type of Penguin will be listed as threatened if the population goes below 800. Use an Excel chart to see when this will occur. Use Excel to draw a graph of the population of penguins with respect to time.

$P = 1450 * 0.93^{y}$ in 10 years there will be about 702 penguins.
There will be 800 penguins somewhere around 8 years from now.

	A	B
1	0	1450
2	1	1348.5
3	2	1254.105
4	3	1166.318
5	4	1084.675
6	5	1008.748
7	6	938.1358
8	7	872.4663
9	8	811.3936
10	9	754.5961
11	10	701.7743
12	11	652.6501
13	12	606.9646
14	13	564.4771



A recursive formula is $P_0 = 1450$ and $P_n = P_{n-1} * 0.93$

36) Cesium-137 is a particularly dangerous by-product of nuclear reactors. It has a half-life of 30 years. It can be readily absorbed into the food chain and is one of the materials that would be stored in the proposed waste site at Yucca Mountain. Suppose we place 4000 grams of cesium-137 in a nuclear waste site.

a. How much Cesium-137 will be present after 30 years?
b. How much will be present after 90 years?
c. Determine the amount present after 22 years?

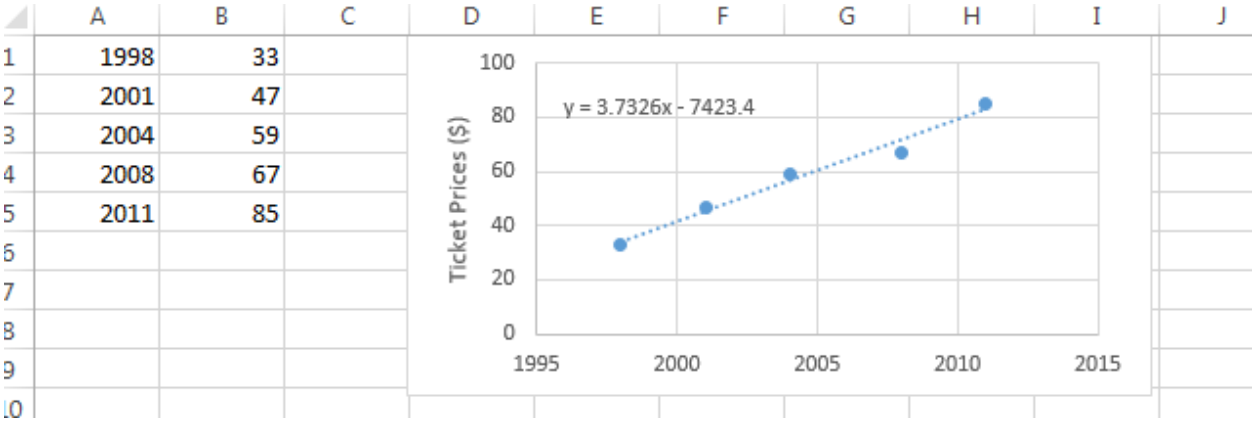
In 30 years there will be half of 4000 grams which is 2000 grams. In 60 years it will half again so 1000grams and then at 90 years it will have halved again so 500 grams.
To find out how much is left after 30 years, we can guess and check with Excel or we can think that $b^{30} = 1/2$ *so* $b = (1/2)^{30} = .97716$ *so the equation is* $A = 4000 * .97716^{22} = 2406$ *grams*

37) The population of Twin Peaks, WA increased at a rate of 2.3% per year for 10 years. The local Newspaper reports that represents at 23% increase in population. Is this claim correct? If not what if the actual increase in population?
If we start with 100 people then in 10 years we should have $100 * 1.023^{10} = 126$ *this gives a percent change of (126-100)/100*100=26%*

38) Below is a table of Concert Tours ticket Prices

Year	Average Ticket Prices
1998	$33
2001	$47
2004	$59
2008	$67
2011	$85

Use Excel to
a) Make a Scatterplot. Be sure to label your axes. Add a linear trend line and display the equation on your scatterplot.
b) Use your trendline to predict when tickets might reach $130.
c) Use your trend line to estimate ticket prices in 2006.
d) What is the rate of change and what does it mean?



b) Solve $130 = 3.7326x - 7423.4$ *so somewhere between 2023 and 2024 ticket prices will cost $130 if the trend continues (a big "if")*
c) In 2006 ticket prices were around $64.20
d) The rate of change is 3.73 $/year, meaning ticket prices have been rising $3.73 a year on average.