Unit 5: Exponential Assessment   Names________________________________

1) Record data in the table below and show work to calculate the constant multiplier.

Months past November **X:** (1918)	Cases of FLU **Y:** (thousands)	**Ratio (Constant Multiplier)**
0	794	
1	1167	1167/794 ≈ 1.470
2	1659	1659/1167 ≈ 1.422
3	2300	2300/1659 ≈ 1.386
4	3208	3208/2300 ≈ 1.395
5	4495	4495/3208 ≈ 1.401
6	6526	6526/4495 ≈ 1.452
7	9365	9365/6526 ≈ 1.435
8	13013	13013/9365 ≈ 1.390
9	17511	17511/13013 ≈ 1.346
10	20413	20413/17511 ≈ 1.166
11	32207	32207/20413 ≈ 1.578
12	41659	41659/32207 ≈ 1.293
13	52866	52866/41659 ≈ 1.269

2) Find the constant multiplier by averaging the ratios:

(1.470 + 1.422 + 1.386 + 1.395 + 1.401 + 1.452 + 1.435 + 1.390 + 1.346 + 1.166 + 1.578 + 1.293 + 1.269) / 13 ratios ≈ 1.385

3) Write the equation for your exponential data: $y = 794(1.385)^x$

4) Identify the parts of equation. $y = a(1 \pm r)^x$

Y: Influenza cases in thousands

x: Time in months after November 1918

a: Number of flu cases in November of 1918.

r: .385 = 38.5% growth rate of flu cases.

5) Verify your equation using data from your original data set.
(Is your equation an accurate model of the data? Why so?)

① January 1919: month 2, 1659 flu cases.

$y = 794(1.385)^2$

$y \approx 794(1.918)$ — 1523 is 136 less cases

$y \approx 1523$ cases. — of flu than actual data.

② November 1919: month 12, 41,659 flu cases.

$y = 794(1.385)^{12}$

$y \approx 794(49.82)$ — 39,556 is 2103 less cases

$y \approx 39,556$ — of flu than actual data.

Our equation is a moderately good fit for our data. Because there wasn't a consistant rate of increase between months, the constant multiplier was averaged. Since the ratio is averaged, the values shouldn't be exact, and 1523 cases in January and 39,556 cases in December is close enough to actual data.

6) Use your equation to make a prediction regarding your data.

① When will there be 90,000,000 (or 90,000 thousand) cases of flu?

$$\frac{90{,}000}{794} = \frac{794(1.385)^x}{794}$$

$$113.35 \approx 1.385^x$$

$$x = \log_{(1.385)}(113.35)$$

$x \approx 14.5$ months after November 1919.

(This means the world should expect about 90,000,000 flu cases to have been diagnosed by the middle of January 1920).

② If this strain of flu continues, how many cases will there be in the start of the flu season of 1920? October of 1920 is 23 months after November 1918.

$$y = 794(1.385)^{23}$$

$$y \approx 794(1792.03)$$

$y \approx 1,422,870$ thousand cases.

This amounts to 1,422,870,000 - over 1 billion cases of flu! Luckily we now have a vaccine!!

7) Graph your data on the graph below.