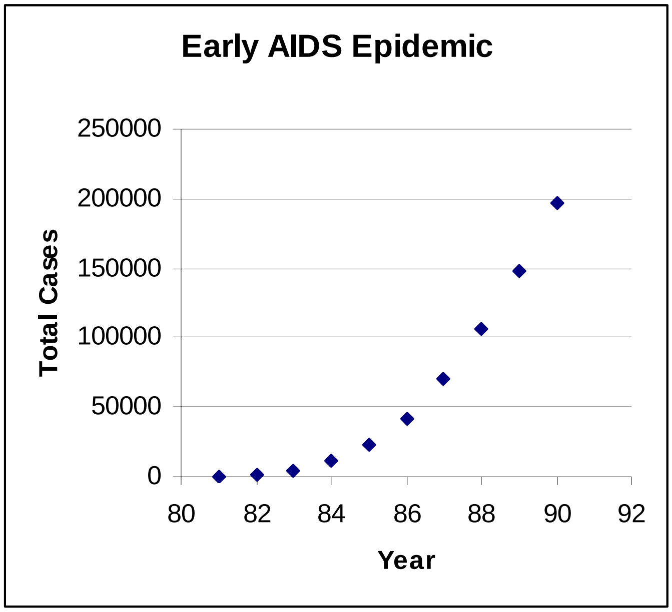
Math 126 Calculus I Class Example Week 2 Block 3

We continue using calculus to try and better understand the spread of AIDS in the United States. We began this effort on the first quiz and continued earlier this week. We continue today.

Recall that the total number of cases grew dramatically during the first 10 years of the epidemic. These represent AIDS cases as defined by the Centers for Disease Control and, thus, do not include all people with HIV infection. Our goal is to model this epidemic using calculus.

Year	Total Cases
81	321
82	1489
83	4564
84	10807
85	22590
86	41630
87	70216
88	105697
89	148441
90	197138



Instructions: Work in the same groups of two or three. Briefly discuss each of the following questions. After jointly agreeing on an answer, have a member with neat handwriting record your responses. Turn in only one solution, but be sure to put all your names on the paper.

I. Recall that the function $y = f(x)$ describing the AIDS epidemic is given numerically and then graphically. We cannot the derivative as a limit: $\lim_{h \to 0} \frac{f(x+h) - f(x)}{h}$, since with numerically defined functions, we cannot let h $\to$ 0.

A. You have begun studying $f''(x)$, the second derivative of *y* with respect to *x*. Numerically approximate $f''(86)$, the second derivative with respect to *x* of the AIDS function. In doing so, do not forget how you approximated the derivative last time and do not forget that, in general, $f''(x) = \frac{d}{dx}\left(f'(x)\right)$. (Hint: since you are approximating the "derivative of the derivative", you will need some values of $f'(x)$ in order to approximate $f''(x)$.

B. Interpret *f* ''*(86)* for the layperson who might be interested AIDS epidemic.

C. Bernoulli's theories suggest that during the early part of the AIDS epidemic, the correct modelling function should be exponential. This means that $Cases \approx ae^{b \cdot Year}$ where *a* and *b* are positive constants. Thus, if this is so, then $ln(Cases) \approx ln\left(ae^{b \cdot Year}\right) = ln(a) + b \cdot Year$. Thus, if we were to plot *ln(Cases)* versus *Year*, we should see an approximate linear function. Try this. What do you think? Explain your answer.

Year	Total Cases	ln(Total Cases)
81	321	
82	1489	
83	4564	
84	10807	
85	22590	
86	41630	
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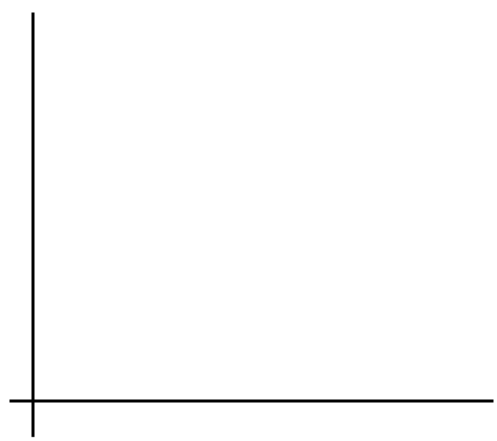
90	197138	



D. Is at least one member of your group familiar with Excel or some other spreadsheet?