Homework Assignment 1: Due at the beginning of class 2/6/02

In this homework assignment, you will be investigating the patterns of heroin (and other drug) use among high school seniors in the United States. Often the phrase "number of heroin users" or "number of heroin addicts" will be used. What is meant by these phrases is this:

> Suppose you took a random sample of 100,000 high school seniors from across the United States. The "number of heroin users" is the number of students from this group of 100,000 who used heroin during the previous 30 days.

1. In 1975, the number of high school seniors using heroin was 400. Table 1[1] shows the rate of change from 1975-1995. Use the information in Table 1 to estimate the number of high school seniors who were using heroin in the year 2000.

Year	Number of heroin users	Rate of change	Amount that number of users will change by in 5 years	New number of heroin users
1975	400	−40		
1980		20		
1985		−20		
1990		80		
1995		−33.3		

Table 1

NOTE: You should hand in a completed version of Table 1 as part of your homework assignment.

[1] Source: US Department of Health and Human Services, National Institute on Drug Abuse, Monitoring the Future Study, 1998.

2. In 1990[2], the number of heroin users among high school seniors was about 200. Table 2[3] (below) shows the rate of change from 1990 to 1991. Use the information in Table 2 to estimate the number of high school seniors who were using heroin in the year 2000.

Year	Number of heroin users	Rate of change	Amount that number of users will change by in 1 year	New number of heroin users
1990	200	0		
1991		100		
1992		−100		
1993		100		
1994		300		
1995		−100		
1996		0		
1997		0		
1998		0		
1999		200		

Table 2

NOTE: You should hand in a completed version of Table 2 as part of your homework assignment.

3. Which of these two estimates would you expect to be the most accurate? (That is, closest to the "true" number of high school seniors who were using heroin in the year 2000?) In a paragraph, explain why you hold this opinion.

[2] Source: US Department of Health and Human Services, National Institute on Drug Abuse, Monitoring the Future Study, 1998.

[3] Source: US Department of Health and Human Services, National Institute on Drug Abuse, Monitoring the Future Study, 2001. Available on-line from: http://monitoringthefuture.org

4. In 1991, the number of high school seniors who had used any kind of illicit drug[4] was about 29,400[5]. If we let T represent the number of years since 1990 and $N(T)$ represent the number of high school seniors who have used some illicit drug, then the derivative is given by the equation[6]:

$$N'(T) = -0.65 \cdot \big(N(T) - 43{,}200\big).$$

Use this equation along with Table 3 (below) to estimate the number of high school seniors who will have tried illicit drugs in the year 2003.

Year	Number of illicit drug users	Rate of change	Amount that number of users will change by in 2 years	New number of illicit drug users
1991	29,400			
1993				
1995				
1997				
1999				
2001				
2003				

Table 3

NOTE: You should hand in a completed version of Table 2 as part of your homework assignment.

5. Do you think that the estimate that you obtained in Question 4 will be an over-estimate or an under-estimate of the "true" number of high school seniors who used illicit drugs in 2003? Give the details of a calculation and a sentence or two of explanation to back up your conclusion.

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[4] This includes marijuana/hashish, inhalants, nitrites, LSD, hallucinogens other than LSD, PCP, Ecstasy, Cocaine (powder and crack), heroin, amphetamines, barbituates, tranquilizers, rohypnol, GHB, ketamine, but **excludes** alcohol, tobacco and steroids.

[5] Source: US Department of Health and Human Services, National Institute on Drug Abuse, Monitoring the Future Study, 2001.

[6] The equation for the derivative is obtained from data recorded in the Monitoring the Future Study, 2001.