	t	# cases	$\Delta\#/\Delta t$	$\Delta\#/\#$
1989	0	23.4	21.1−23.4	
	1	21.1	−2.3	$-2.3/23.4 = -9.8\%$
	2	18.0	−3.1	$= -14.7\%$
	3	16.1	−1.9	$= -10.6\%$
	4	13.4	−2.7	$= -16.8\%$
	5	12.5	−.9	$= -6.7\%$
	6	10.8	−1.7	$= -15.7\%$

Is a linear model reasonable?

- Slopes constant?
  - No, jumpy
  - Yes, $m \approx -2$
- graph linear?
  - Yes if line - kindof
  - No if curve
- Make sense?
  - No b/c negative # in ~ 6 yrs

Is an exponential model reasonable?

- Method 1 - Are % changes ~ constant?
  - No % change not constant
  - Yes % change varies but ~ −10%

9-14-05

What is an exponential model?

$$y = k \cdot a^t$$

k = starting value

23.4

a = growth factor

= 1 + growth rate

→ older %

$-\cancel{16.8}, -\cancel{15.7}, \underbrace{-14.7, -10.6}, -\cancel{9.8}, -\cancel{6.7}$

$-.1265 = -12.65\%$ growth rate

$a = 1 + (-.1265) = .8735$

$a < 1 \leftrightarrow$ decay

$a > 1 \leftrightarrow$ growth

$$y = 23.4 \cdot 0.8735^t$$

y = # new cases Hep B

t = yrs since 1989

Exponential Models (growth) have constant <u>doubling times</u>

DT = doubling time

Starting value for $y = \underline{\underline{K}}$

Doubled value for $y = 2K$

At DT

$$\frac{2\cancel{K}}{K} = \frac{\cancel{K}\cdot a^{DT}}{K}$$

Solve $\quad 2 = a^{DT}$ for DT

$$\log(2) = \log\left(a^{DT}\right)$$

$$\log(2) = DT \cdot \log(a)$$

$$\frac{\log(2)}{\log(a)} = DT$$

Knowing "a" we can find DT

Example A $r = 4\% = .04$

$a = 1 + .04 = 1.04$

$$DT = \frac{\log 2}{\log(1.04)}$$

$$= 17.67 \text{ yrs}$$

B US Pop $r \approx 1\%$

$a = 1 + .01 = 1.01$

$$DT = \frac{\log 2}{\log(1.01)} = 69.7 \text{ yrs}$$

$$2 = a^{DT}$$

$$a = 2^{1/DT} \qquad a = 2^{(1/5)} = 1.149$$

How ~~long would it tal~~

What interest rate doubles \$ in 5 yrs? 14.9 %