9-13-05

All HW Exercises are now due in lecture on Thursdays

- Only one paper per group

Lab B Practice Table p 288

Δprice / Δtime

C12: = (B12 - B11) / (A12 - A11)

D11: = y = mx + b

= d$6 * A11 + d$7

E13: (Actual - predicted)^2

(B$13 - D13) ^ 2

Root Mean Square Resid

D8:

= sqrt(average(E11:E50)

from book

#4 p63 Hep. B

	t	#	Δ#/Δt	Δ#/#
1989 ⟷	0	23.4		
	1	21.1	-2.3	-2.3/23.4 = -0.098 = -9.8%
	2	18.0	-3.1	-3.1/21.1 = -.147 = -14.7%
	3	16.1	-1.9	-1.9/18. = -10.6%
	4	13.4	-2.7	= -16.8%
	5	12.5	-0.9	= -6.7%
	6	10.8	-1.7	= -13.6%

1. Is a linear model reasonable? - Look at slopes to decide. Either they're close & ~ -2. or Not b/c ~~lot~~ lot of variation in slopes. Also say a linear model is ~~not~~ w/ slope = -2 is not reasonable since it predicts a -# in 6-7 yrs.

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2 Is an exponential model appropriate? Since $\Delta t = 1$ - constant, check % growth (decline)

3 Find an exponential model regardless

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

K = initial value
= 23.4

a = growth factor
= 1 + growth rate = .879

choose median of % growth

-9.8%		~~-16.8%~~	average
-14.7%	order	~~-14.7%~~	
-10.6%	$\longrightarrow$	-13.6%	-12.1%
-16.8%		-10.6%	$a = 1 + {}^{-}.121$
-6.7%		~~-9.8%~~	$= .879$
-13.6%		~~-6.7%~~	

$$y = 23.4(.879)^t$$

y = # cases Hep B (thous)

t = yrs since 1989

The # of cases of Hep B was 23.4 thousand in 1989 and has been decreasing at a rate of 12.1% per year since

$(12.1\% = \cancel{.89}\ .879 - 1)$

If $y = K \cdot a^t$

Doubling time = value of t where $y = 2K$

(y starts at K when $t = 0$, is doubled at $2K$

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

$$2 = a^t$$

$$\log(2) = \log(a^t)$$

$$= t \cdot \log a$$

$$\boxed{\frac{\log 2}{\log a} = t = \text{doubling time}}$$

4% Bank example

$$a = 1 + 4\% = 1.04$$

$$\text{doubling time} = \frac{\log 2}{\log 1.04} = 17.7 \text{ yrs}$$

$$\left(\log\left(\frac{a}{b}\right) = \log a - \log b \right)$$

Rule of 70: $\text{growth rate} = \frac{70}{\text{D.T.}}$

$$\text{Doubling Time} \approx \frac{70}{\underset{\text{as \#}}{\text{growth rate}}}$$

$$20 \approx \frac{70}{\text{growth rate}}$$

e.g. 4% $\quad DT \approx \frac{70}{4} = 17.5$ ~~%~~ yrs

US Pop
1% $\quad DT \approx \frac{70}{1} = 70$ yrs

MexicoPop

2% $\quad DT \approx \frac{70}{2} = 35$ yrs

3% $\quad DT \approx \frac{70}{2} \approx 23$

$a = 2^{\frac{1}{DT}}$

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

growth factor

$a = 1 + r$

$r = a - 1$

$$\begin{tikzcd}
 & a \arrow[dl, leftrightarrow] \arrow[dr, leftrightarrow] & \\
DT \arrow[rr, leftrightarrow, "\text{Rule of 70}"'] & & r
\end{tikzcd}$$

doubling time

growth rate

$a = 2^{\frac{1}{DT}}$ Example:

We want to double money in 20 yrs. What is a?

$$a = 2^{1/20} = 2 \wedge (1 \div 20)$$

$=$

$= 20 \ \boxed{1/x}$ ~~sto~~ M

$* \ 2 \ \boxed{x^y}$ RM $=$