NAME: _____Key_____ _____

MATH 1470 Fall 2005 Tintera

TEST 1: Basic Models. Covers Chapters 0-3

You may use calculators and one 8.5 b 11 inch page of notes. Please show all work on this test booklet. Partial credit is awarded only for work hown. Each problem is worth as indicated. Good luck!

In questions 1 – 5, select the best answ r by circling the letter marking it. (5 points each)

1. In a linear model $y = mt + b$, what d es the parameter m represent?

(a) the average rate of change
b) the residual
c) the starting value
d) the correlation

2. A modeler starts with a table of data with one column for t (= years since 1990) and one column for y (= number of cattle stolen in Texas). She wants to decide if an exponential model is appropriate for the data. What would she do?

a) Calculate the ratios $\Delta y / y$ for each pair of successive years.
b) Calculate the slopes $\Delta y / \Delta t$ for each air of successive years.
c) Calculate the RMSR for a rough-rea y linear model
d) Sketch a bar chart of the data.

3. Why is the exponential regression m del the "best" exponential model?

a) It has the smallest RMSR of any line ir model.
b) It has a formula.
c) Excel can find it with a mouse click.
d) It has the smallest r^2 of any linear m del.

4. Which makes a better model?

a) Smaller RMSR and r^2 closer to 100%
b) Bigger RMSR and smaller r^2.
c) Bigger RMSR and r^2 closer to 100%
d) Smaller RMSR and smaller r^2.

5. Which of the ways below is NOT a way of describing a model?

a) Verbally.
b) Willfully.
c) Numerically. = Tabularly.
d) Graphically

Possible Score on this page /25

In questions 6 through 8, identify each scenario below as appropriate for a linear or exponential model or neither. Be sure to justify your selection. If a linear model or exponential model is appropriate, write it in a formula with a complete definition of the variables. (25 points)

6. Researchers have found that the Arctic Ice Pack was about 2.69 million square miles in 2000 and has shrunk by about 6% per year since then.

Model type, with justification: exponential - constant % decrease

Model formula

$$K = 2.69 \text{ sq mi}$$
$$a = 1 - 6\% = .94$$

$$y = 2.69 \cdot .94^t$$
$$y = \text{area Arctic Ice Pack} (mi^2)$$
$$t = yrs \text{ since } 2000$$

7. In recent years, flash memory has decreased in cost by about $25 each year.

Model type, with justification: linear - constant change in amount

Model formula:

$$y = -.5t + b$$

$$y = \text{cost of memory}$$
$$b = \text{unknown starting cost}$$
$$t = yrs \text{ since start}$$

8. A New York Times article yesterday stated that legal immigration into the US peaked in 2000 at 650,000 people per year.

Model type, with justification: Neither. The peak indicates the # immigrants both rose & fell.

Model formula:

9. A spreadsheet is built to model data reported in an article on expensive homes. For the cells with ? marks, write formulas in the space provided as they would appear in Excel. Assume that you have all the data. Where appropriate, a formula should be written in such a way that it can be copied to other cells. (5 points each)

	A	B		C	D	E
1		m				
2		b		?		
3	2000 = 0	(million homes)	Predicted			
4	Yr	# Mil. $ Homes	# Mil. $ Homes	Residuals	Residuals^2	
5	0	.4				
6	1	.48	?			
7	2	.6		?		
8	3	.75			?	
9	4	1.05				
10					RMSR	?

C2 (where the Rough and ready method is used to generate a linear model)

$$= \text{BS.}$$

C6 (with linear predictions)

$$= C\$1 * A6 + C\$2$$

D7:

$$= C7 - B7 \qquad \text{or} \qquad = B7 - C7$$

(no need to write both)

E8:

$$= D8 \wedge 2$$

E10:

$$= \text{Sqrt}(\text{average}(E5:E9))$$

10. The following data was from a Corpus Christi Caller-Times article on increasing real estate prices. The variable t is the years since 2000 and y is the number of million-dollar homes in millions of homes.

t	Y	$\Delta y / \Delta t$
0	0.40	$(.48 - .40)/(1-0) = .08$ X
1	0.48	
2	0.60	.12
3	0.75	.15
4	1.05	.30

X

Median
$\longrightarrow$ = average $(.12, .15)$
$= \frac{.12 + .15}{2}$
$= .135$

a) (8 points) For the data above, decide if a <u>linear model</u> is appropriate. Justify your answer.
↳ Calculate $\Delta y / \Delta t$

No, a linear model would not be appropriate since the slopes, $\Delta y / \Delta t$ are clearly increasing as time passes.

b) (7 points) Estimate the rough and ready linear model for the data set above. Be sure to identify the variables.
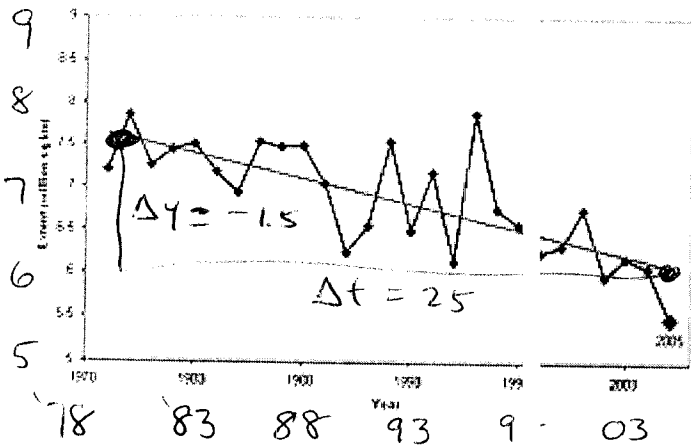
M = median slope = .135
b = start value = .40

So y = .135 t + .40

when y = # million $ homes (millions) & t = yrs since 2000.

11. (10 points) The graph below shows the extent of the Artic Sea Ice in millions of square kilometers from 1978 to 2005 with a linear trendline superimposed. From the graph, estimate the linear model. Be sure to define the variables used.

$\Delta y = -1.5$
$\Delta t = 25$

'18 '83 '88 '93 9· 03

↳ use y = m t + b
$m = \frac{\Delta y}{\Delta t} = \frac{-1.5}{25} = -.06$

b = start value ≈ 7.7

So y = -.06 t + 7.7

where y = area of Arctic Ice Pack
(millions of km²)
t = yrs since 1978.