NAME: _____

MATH 1470 Fall 2005 Tintera

TEST 1: Basic Models. Covers Chapte s 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 by circling the letter marking it. (5 points each)

1. In a linear model y = mt + b, what d es the parameter b 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 ants to decide if a linear model is appropriate for the data. What would she do?

a) Calculate the ratios $\Delta y/y$ for each pa 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 linear regression model t e "best" linear model?

a) It has the smallest RMSR of any line r 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 smaller r^2.
b) Bigger RMSR and smaller r^2.
c) Bigger RMSR and r^2 closer to 100%
d) Smaller RMSR and r^2 closer to 100%

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

a) Verbally.
b) Algebraically.
c) Numerically.
d) Mechanically.

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 .1 million square miles in the years since then.

Model type, with justification:

10 — 5

Linear, ~constant decrease in amount

5

Model formula $y = 2.69 - .1t$ ($y = 2.69 - \frac{.1}{5}t$ is also ok)

y = Area of Arctic Ice Pack (mi^2)

t = yrs since 2000

7. In recent years, flash memory has decreased in cost by about 40% each year.

Model type, with justification:

10 — 5

Exponential. There is a constant % decrease each year.

Model formula:

5

$y = K \cdot (1-.40)^t$ or $y = K \cdot (.6^t)$

where y = cost of flash Memory ($)

t = time in yrs

K = original cost

8. A New York Times article yesterday stated that immigration into the US peaked in 2000 at 1.2 million people per year.

5

Model type, with justification: Neither. A peak suggests a steady increase followed by a steady decrease. Neither model can follow this trend.

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)

= B5

C6 (with linear predictions)

= C$1 * A6 + C$2

D7:

= C7 - B7 or = B7 - C7

(no need to write both).

E8:

= D8 ^ 2

E10:

= Sqrt (average (E5 : E9))

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

t	Y	$\Delta y/y$	
0	0.40		
1	0.48	.08/.40	= .2 X
2	0.60	.12/.48	= .25
3	0.75	.15/.60	= .25
4	1.05	.30/.75	= .40 X

Median → average of .25 & .25

a) (8 points) For the data above, decid if an exponential model is appropriate. Justify your answer.

↳ look at $\Delta y/y$

Either No, an exponential model is not appropriate because there s an increasing trend to the ratios $\Delta y/y$.

Or Yes, an exponential model is appropriate b/c the ratios $\Delta y/y$ are all approximately 0.25.

b) (7 points) Estimate the rough and re dy exponential model for the data set above. Be sure to identify the variables.

K = starting value = .4

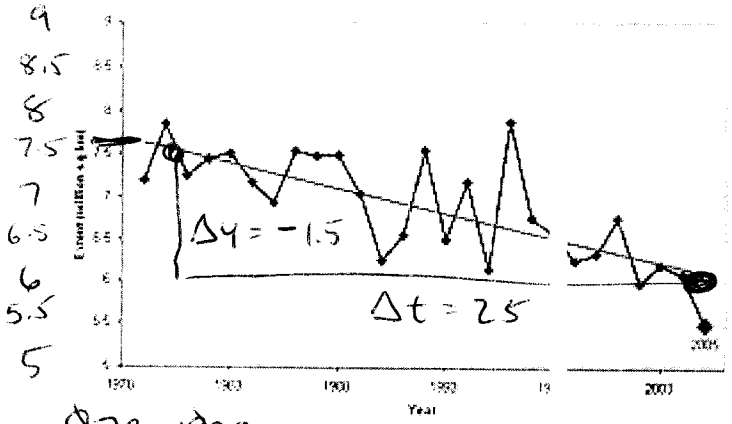
a = 1 + growth rate, growth rate = median $\Delta y/y$

= 1.25

So $y = .4(1.25^t)$ where y = # million \$ homes (millions)

t = yrs since 2000.

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



1978 1983 2003

$y = mt + b$

$m = \frac{\Delta y}{\Delta t} = \frac{-1.5}{25} = -.06$

b = starting value 7.7

So $y = -.06t + 7.7$

where y = extent of Arctic Sea Ice (millions Km^2)

t = yrs since 1978.