Homework Answers:

Statistics Chapter 8: Linear and Exponential Patterns – KEY

Linear functions $(y = a + bx)$ start with an initial value (a) and change by repeated addition or subtraction of a constant (b). The repeated addition is represented by multiplication (bx).

Exponential functions $(y = a(b)^x)$ start with an initial value (a) and change by repeated multiplication or division by a constant (b). The repeated multiplication is represented by an exponent (b^x).

	Pattern	As a function	Value of y when $x = 8$
1.	$y = 43 + \underbrace{2 + 2 + 2 + 2 + \ldots + 2}_{\text{add 2 "x" times}}$	$y = 43 + 2x$	59
2.	$y = 43 \cdot \underbrace{2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 \cdot \ldots \cdot 2}_{\text{multiply by 2 "x" times}}$	$y = 43(2)^x$	11008
3.	$y = 0 - \underbrace{7 - 7 - 7 - 7 - 7 - \ldots - 7}_{\text{subtract 7 "x" times}}$	$y = 0 - 7x$	-56
4.	$y = -5\underbrace{\left(\frac{1}{2}\right)\left(\frac{1}{2}\right)\left(\frac{1}{2}\right)\left(\frac{1}{2}\right)\left(\frac{1}{2}\right)\left(\frac{1}{2}\right)\ldots\left(\frac{1}{2}\right)}_{\text{multiply by ½ "x" times}}$	$y = -5\left(\frac{1}{2}\right)^x$	$-\frac{5}{256}$
5.	$y = 3.2\underbrace{(1.9)(1.9)(1.9)(1.9)\ldots(1.9)}_{\text{multiply by 1.9 "x" times}}$	$y = 3.2(1.9)^x$	543.474
6.	$y = \underbrace{\frac{3}{4} + \frac{3}{4} + \frac{3}{4} + \frac{3}{4} + \frac{3}{4} + \frac{3}{4} + \ldots + \frac{3}{4}}_{\text{add ¾ "x" times}} - 6$	$y = \frac{3}{4}x - 6$	0
7.	$y = 6 + \underbrace{6 + 6 + 6 + 6 + 6 + \ldots + 6}_{\text{add 6 "x" times}} + 25$	$y = 6x + 25$	73
8.	$y = 1.27 \cdot \underbrace{1.27 \cdot 1.27 \cdot 1.27 \cdot 1.27 \cdot \ldots \cdot 1.27}_{\text{multiply by 1.27 "x" times}}$	$y = 1.27^x$	6.768
9.	$y = \underbrace{3 + 3 + 3 + 3 + 3 + 3 + 3 + 3 + \ldots + 3}_{\text{add 3 "x" times}}$	$y = 3x$	24
10.	$y = 100 \div \underbrace{3 \div 3 \div 3 \div 3 \div \ldots \div 3}_{\text{divide by 3 "x" times}}$	$y = 100\left(\frac{1}{3}\right)^x$ Hint: Think fractions!	$\frac{100}{6561}$
11.	$y = 3 \cdot \underbrace{3 \cdot 3 \cdot 3 \cdot 3 \cdot 3 \cdot 3 \cdot 3 \cdot \ldots \cdot 3}_{\text{multiply by 3 "x" times}}$	$y = 3^x$	6561
12.	$y = 3$	$y = 3$	3

*Name*_____ *Statistics Chapter 8: Linear/Exponential Models and Residuals*

For each set of data given below,

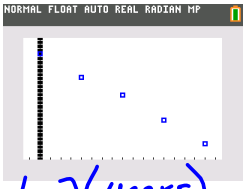
a) use your calculator to examine a scatterplot and residual plot and choose determine if a linear or exponential model better models the data, (Be prepared to defend your choice.)
b) make a prediction using your model for the value given,
c) find the residual for the value given.

1. The availability of leaded gasoline in New York State is decreasing, as shown in the accompanying table.

Number of years since 1984	0	4	8	12	16
Gallons Available (in thousands)	150	124	104	76	50

1988

L1 x
L2 y



a) Linear or exponential? Linear Model: gal = 150.4 − 6.2(years)

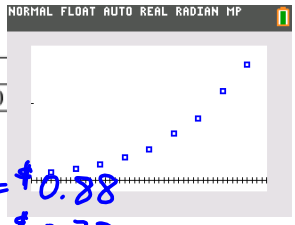
b) For the year 1990, the model predicts … sub in x=6
gal = 150.4 − 6.2(6) = 113.2 gal. 113,200 gal

c) For the year 1988, the residual for this model is…
gal = 150.4 − 6.2(4) = 125.6 gal 125,000 gal
Resid = actual − predicted
= 124 − 125.6
= −1.6 gal

2. The table below, created in 1996, shows a history of transit fares from 1955 to 1995.

Year since 1900	55	60	65	70	75	80	85	90	95
Fare ($)	0.10	0.15	0.20	0.30	0.40	0.60	0.80	1.15	1.50

L1 x
L2 y
Stat-Calc-0:ExpReg



a) Linear or exponential? Exponential Model: Fare = .002(1.07)^x

b) For the year 1990, the model predicts … sub in x=90
Fare = .002(1.07)^90 = $0.88

c) For the year 1975, the residual for this model is…
Fare = .002(1.07)^75 = $0.32
Resid = actual − predicted = 0.40 − .32 = $0.08

3. Since 1990, fireworks usage nationwide has grown, as shown in the accompanying table, where t represents the number of years since 1990, and p represents the fireworks usage per year, in millions of pounds.

Number of years since 1990	0	2	4	6	7	8	9	11
Fireworks usage per year (millions of pounds)	67.6	88.8	119.0	120.1	132.5	118.3	159.2	161.6

a) Linear or exponential? linear Model: usage = 72.8 + 8.19 year

b) For 1993, the model predicts… x=3
usage = 72.8 + 8.19(3) = 97.4 mill

c) For 1996, the residual for this model is… x=6
usage = 72.8 + 8.19(6) = 121.9 million pounds of fireworks
Resid = actual − predicted = 120.1 − 121.9 = −1.8 million

Homework:

Linear vs. Exponential Patterns

WS #8-9

Skip #3c, 4c