

Exponential Models

$$y = ab^x$$

initial value (when $x = 0$)

rate of increase or decrease

Fit an exponential curve to the data.

X	1	3	4	5
y	3.00	6.75	10.13	15.19

$$y \approx 1.9998 (1.5001)^x$$

50% rate of increase

1. The average price of an adult ticket to the movies in the United States has increased,

a. Use the movie price data to plot y versus year x. Represent the years 1948, 1958, ... as $x = 0, 10,$

b. linear or exponential?

$\ln r \approx 0.4562$

$r \approx 0.9996$

c. write the equation.

\$ 9.81 d. price of a movie ticket in 2000?

\$ 16.22 e. price of a movie ticket in 2010?

L1 L2

X = year	Y = price
1948	\$0.36
1958	\$0.68
1967	\$1.22
1978	\$2.34
1988	\$4.11

** when you want to plug in values for x, use vars, y-vars then type in x value in parentheses

* when you want to find x -values put the given y value in y= usually for y2 might need to press ZOOM 9 or change window manually for y max

2. A study of nutrition in developing counties collected data from the Egyptian village of Nahya. Here are the mean weights for 170 infants in Nahya who were weighed each month during their first year of life.

Age (in months)	1	2	3	4	5	6	7	8	9	10	11	12
Mean Wt. (kg)	4.3	5.1	5.7	6.3	6.8	7.1	7.2	7.2	7.2	7.2	7.5	7.8

- a. Find the correlation coefficient for each type of equation. (linear, exponential) round to 4 places

0.9066, 0.8804
linear

- b. Which equation best fits the data?

3. Brian wanted to determine the relationship that might exist between speed and miles per gallon of an automobile. Let x be the average speed of a car on the highway measured in miles per hour and let Y represent the miles per gallon of the automobile. The following data are collected.

X	50	55	55	60	60	62	65	65
Y	28	26	25	22	20	20	17	15

$$y \approx -0.8265x + 70.3903$$

- a) Plot the data. Find the regression equation and correlation coefficient (r). $r \approx -0.9715$
- b) Interpret what the slope means. every 1 mph increase, lose .8265 miles/gal
- c) Predict the miles per gallon of a car traveling 61 miles per hour. $y(61) = 19.9719$ miles/gal
- d) Predict the speed of a car that gets 24 miles per gallon.

$$y = 24$$

$$x \approx 56.1265 \text{ mph}$$

$$m = \frac{-0.8265}{1}$$

4. A doctor wished to determine whether a relationship exists between the height of a female and weight. She obtained the heights and weights of 10 females aged 18-24. Let height be the independent variable, measured in inches, and weight be the dependent variable, Y , measured in pounds.

X	60	61	62	62	64	65	65	67	68	68
y	105	110	115	120	120	125	130	135	135	145

$$y = 14.4484(1.0340)^x$$

- a) Plot the data. Find the regression equation and correlation coefficient (r). $r \approx 0.9638$
- b) Interpret what the ~~slope~~^{base} means. Every inch increase 3.4% increase in weight
- c) Predict the weight of a female aged 18 to 24 whose height is 66 inches. $y(66) \approx 131.0912$ lb
- d) Predict the height of a female whose weight is 122 pounds.

$$y = 122$$

$$x \approx 63.8490 \text{ inches}$$

5. Suppose you are studying frogs that live in a nearby wetland area. The data below was collected by a local conservation organization. They indicate the number of frogs estimated to be living in the wetland area over a 5-year period.

Year	Estimated Population
2006	120
2007	101
2008	86
2009	72
2010	60

a. Write the exponential equation to model this data.

$$y \approx 120.3648(0.8416)^x$$

b. What will the population be in 8 years?

$$y(8) \approx 30.2578$$

c. What will be the population in 2020?

$$y(14) \approx 10.7606 \text{ frogs}$$

Frog population decreases at a rate of about 16% per year

$$1 - 0.8416 \approx 0.1584 \approx 16\%$$

STAT CALC ALPHA A

AFM Unit 9 Day 3 notes

PwrReg
 $y = a * x^b$

x	y
2.0	4.0
3.0	13.5
5.0	62.5
6.0	108.0

1. Find the power curve that fits the data.

$$y = .5x^3$$

$$y = 2.2439x^{0.8340}$$

Write a power function
 Write a power function $y = ax^b$
 whose graph passes through (2, 4) and (6, 10)

Handwritten notes: $\sqrt[4]{2}$, $\sqrt[10]{4}$

3. The following information is on the growth of AIDS in the US.

$$y = 222.0518(x)^{2.8788}$$

a) Write the power model for the data.

$$6,147,096.624$$

b) Predict how many cases of AIDS by 2015.

x is the number of years since 1980

$$x = 35$$

$$y(35)$$

Year	Cumulative cases of AIDS in the US
1980	0
1981	295
1982	1374
1983	4239
1984	10211
1985	21278
1986	39353
1987	66290
1988	98910
1989	135614
1990	170851

**POWER FUNCTIONS
 CAN NOT HAVE ZERO
 IN THE DATA FOR X**

Choosing the Best Model

After reading a problem, you are unsure as to which regression would be best, calculate all 3 on your calculator, then use the r-value to determine which equation is the best one.

4. Write the best model for the data. Then predict the unknown y-value.

a.

Exponential

x	y
0.3	8.011
1.5	1.591
2	0.8112
5	0.01426
1.4	? <i>1.8204</i>

$$y \approx 12.0000 (-0.2600)^x$$

74% rate of decrease

b.

lin r ≈ 0.8958
exp r ≈ .9145
PWR r ≈ .9999...

x	y
0.5	0.02031
2	7.879
2.5	20.57
4	155.2
7	1722
3	? <i>45.0506</i>

y(3)

$$y = .4000(x)^{4.3000}$$

5. The table shows the average salaries (in thousands of dollars) of major league baseball players for selected years from 1967-1989.

year	1967	1976	1979	1982	1984	1986	1989
salary (in thousands)	19.0	51.5	114	242	329	413	497

- a. What is the correlation coefficient for a linear model for this data? 0.9218
- b. What is the correlation coefficient for a exponential model for this data? 0.9841
- c. What is the correlation coefficient for a power model for this data? 0.8963
- d. Which model best fits the data? exponential
- e. What is the best model equation? $y \approx 14.4754(1.1767)^x$
- f. Estimate the average salary in 1970.

$$x = 4$$

$$y \approx 27.7505$$

$$\boxed{\$ 27,750.47}$$

17.67% rate of increase in salary per year

x = years since 1966