Linear, Quadratic, & Exponential Functions Tables

Linear Functions	Quadratic Functions	Exponential Functions
$y = mx + b$ $y = (slope)x + y\text{-}intercept$ slope = # you add/sub each time y-intercept: starting amount or y-value when x = 0 b	**$y = a(x - h)^2 + k$** $y = opens(x - x\text{-}value)^2 + y\text{-}value$ *(h, k) is vertex* **$y = a(x - p)(x - q)$** $y = opens(x - zero)(x - zero)$ *You then have to multiply your equation out to get to standard form.*	**$y = ab^x$** $y = y\text{-}intercept(constant\ ratio)^x$ y-intercept: starting amount or y-value when x = 0 constant ratio = # you multiply by each time b = base

Review Identifying Types of Functions from an Equation

Classify each equation as linear, quadratic, or exponential:

a. $f(x) = 3x + 2$

linear

b. $y = 5^x$

exponent

c. $f(x) = 2$

$y = 0x + 2$

Linear

d. $f(x) = 4(2)^x + 1$

exponent

e. $y = 7(.25)^{3x}$

e

f. $y = 4x^2 + 2x - 1$

q

Identifying Types of Functions from a Table

Remember with linear functions, they have **constant** (same) **first differences** (add same number over and over).

Quadratic Functions have **constant second differences**.

Exponential functions have **constant ratios** (multiply by same number over and over).

Linear Function

x	y	
2	4	
5	3	−1
8	2	−1
11	1	−1

(x: +3, +3, +3)

Quadratic Function

x	y		
0	3		
1	2	−1	
2	3	+1	+2
3	6	+3	+2
4	11	+5	+2

Exponential Function

x	$f(x) = 2(3)^x$	
1	6	
2	18	×3
3	54	×3
4	162	×3

(x: +1, +1, +1)

Algebra 1 Unit 11: Comparing Linear, Quadratic, and Exponential Functions Notes

Determine if the following tables represent linear, quadratic, exponential, or neither and explain why.

a.

x	y
−2	7
−1	4
0	1
1	−2
2	−5

-3 -3 -3 -3

Linear

b.

x	y
−1	1.5
0	3
1	6
2	12

·2 ·2 ·2

expon.

c.

x	y
−1	−9
1	9
3	27
5	45

+18 +18 +18

linear

d.

x	y
−2	6
−1	3
0	2
1	3
2	6

-3 -1 +1 +3

+2 +2 +2

quad.

e.

Volleyball Tournament	
Round	Teams Left
1	16
2	8
3	4
4	2

f.

x	$f(x) = 2(3)^x$
1	6
2	18
3	54
4	162

g.

x	−3	−2	−1	0	1	2	3
y	0	5	8	9	8	5	0

h.

x	−3	−2	−1	0	1	2	3
y	−16	−13	−10	−7	−4	−1	2

i.

x	−3	−2	−1	0	1	2	3
y	−14	−9	−4	1	6	11	16

+5 +5 +5 linear

j.

x	−3	−2	−1	0	1	2	3
y	4	8	16	32	64	128	256

·2 ·2 ·2 ·2

exponent.

k.

x	−3	−2	−1	0	1	2	3
y	3	0	−1	0	3	8	15

l.

x	0	1	2	3	4	5
y	$\frac{1}{16}$	$\frac{1}{4}$	1	4	16	64

Quadratic and Exponential Regression Models

To calculate a quadratic or exponential regression model, you will follow the same procedures as calculating a linear regression model on your calculators except you will select 5:QuadReg or 0:ExpReg.

Scenario 1:
A pumpkin tossing contest is held each year in Morton, IL, where people compete to see whose catapult will send pumpkins the farthest. One catapult launches pumpkins from 25 feet above the ground at a speed of 125 feet per second. The table show the horizontal distances (in feet) the pumpkins travel when launched at different angles. Use a graphing calculator to find the best fitting quadratic model for the data.

Angle (degrees)	20	30	40	50	60	70
Distance (feet)	372	462	509	501	437	323

Model for the Data: $y = Ax^2 + Bx + C$

a: $-.3$

b: 23

c: 23

$y = -.3x^2 + 23x + 23$

How does the regression model compared the parabola created in your scatterplot?

$r^2 = .999$ great fit

Scenario 2:
A study compared the speed, x, in miles per hour and the average fuel economy y (in miles per gallon) for cars. The results are shown in the table. Find a **quadratic** model in standard form for the data.

Speed x	15	20	25	30	35	40	45	50	55	60	65	70
Fuel Economy y	22.3	25.5	27.5	29	28.8	30	29.9	30.2	30.4	28.8	27.4	25.3

A. Model for the Data:

a:

b:

c:

$y_1 \sim ax_1^2 + bx_1 + C$

B. Find the speed that maximizes the fuel economy.

C. Using your model, predict the fuel economy if you were going:

a. 42 mph

b. 19 mph

Scenario 3:
The table below shows the number of new stores a coffee shop chain opened from 1986 to 1994. Using x = 1 to represent the year 1986 and y to represent the number of new stores, write an **exponential** regression model for the data. Round all values to the nearest hundredth.

$y = ab^x$

Year (x)	Number of New Stores (y)
1 [illegible]	14
2 [illegible]	27
3 [illegible]	48
4 [illegible]	80
5 [illegible]	110
6 [illegible]	153
7 [illegible]	261
8 [illegible]	403
9 [illegible]	681

·1.6 ·1.6 1.6

a. Write a model to describe the data:

a: 9.5

b: 1.6

$y = 9.5(1.6)^x$

b. Interpret what the "a" value represents:

a = start pt (y-int)

c. Interpret what the "b" value represents:

b = constant ratio

Scenario 4:
A box containing 1,000 coins is shaken, and the coins are emptied onto a table. Only the coins that land heads up are returned to the box, and then the process is repeated. The accompanying table shows the number of trials and the number of coins returned to the box after each trial.

Trial (x)	0	1	3	4	6
Coins Returned (y)	1000	610	220	132	45

$y_1 \sim ab^{x_1}$

a. Write an **exponential** regression model, rounding the calculated values to the nearest thousandth.

b. Interpret what the "a" value represents:

c. Interpret what the "b" value represents:

d. Using your model, predict how many coins would be returned after the eighth trial?