Algebra RH

Essential Question: How can you identify if a function is Linear, Exponential or Quadratic?

Do Now:

Three cars start traveling at the same time. The distance traveled in *t* minutes is *y* miles. Complete each table and sketch all three graphs in the same coordinate plane.

Window Setting
Xmin = 0
Xmax = 1
Xscl = 0.025
Ymin = 0
Ymax = 1
Yscl = 0.025

t	$y = t$
0	
0.2	
0.4	
0.6	
0.8	
1.0	

t	$y = 2^t - 1$
0	
0.2	
0.4	
0.6	
0.8	
1.0	

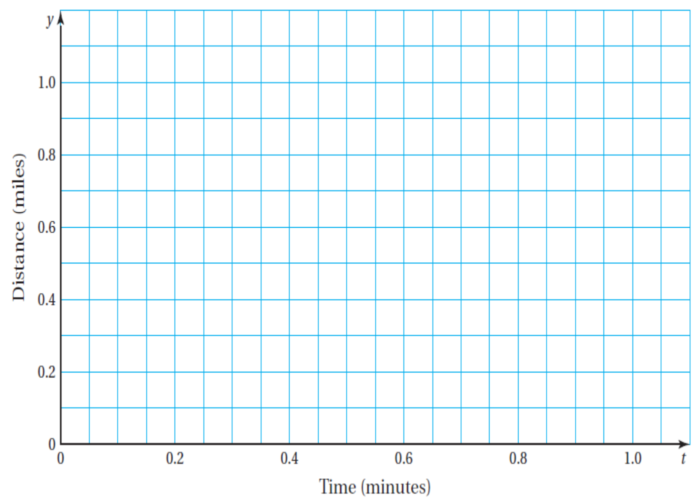
t	$y = t^2$
0	
0.2	
0.4	
0.6	
0.8	
1.0	

Compare the speeds of the three cars.

a) Which car has a constant speed?

b) Which car is accelerating the most?

Explain your reasoning.



In this course you have learned about three types of functions: **linear**, **exponential**, and **quadratic**.

Finding the function is an important part of solving problems. ***What methods can be used to identify which function describes the relationship between the dependent and independent variables in a problem?***

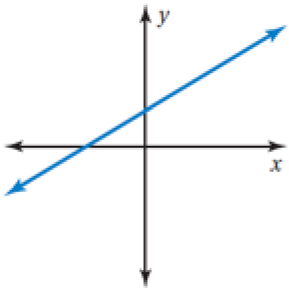
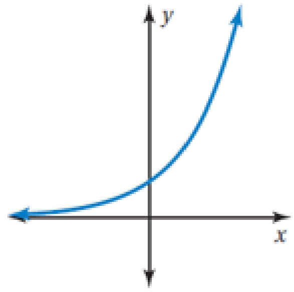
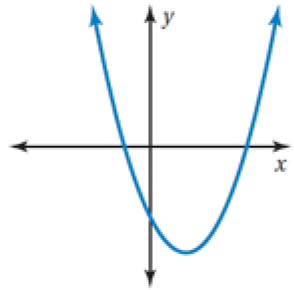
1. Identify functions from their **<u>equations.</u>**

Linear	Exponential	Quadratic
$y = mx + b$ Degree of the function is 1	$y = ab^x$ Exponent is the unknown	$y = ax^2 + bx + c$ Degree of the function is 2

Identify each function as *linear, exponential* or *quadratic*

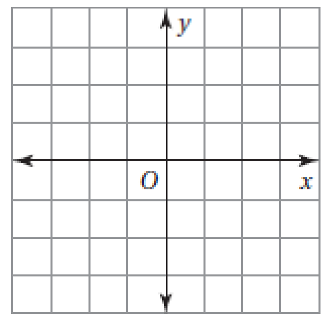
a. $y = \frac{1}{4}(3)^{2x}$ **b.** $y - 4 = -2(x + 1)$ **c.** $y = 3(x + 1)^2 - 2$

2. Identify functions from their **<u>graphs.</u>**

Linear Function	Exponential Function	Quadratic Function
		
LINE	CURVE	PARABOLA

Plot the points. State whether the points represent a linear, an exponential, or a quadratic function.

(0, −1), (1, 2), (2, 3), (3, 2), (4, −1)



3. Identifying Functions Using **<u>Differences</u>** or **<u>Ratios.</u>**

If the ***difference*** between values of the dependent variable is the same each time we change the independent variable by the same amount, then the function is **<u>linear</u>**.

+1 +1 +1 +1

x	−2	−1	0	1	2
y	1	3	5	7	9

+2 +2 +2 +2

The *y*-values have a common *difference* of 2.

If the ***ratio*** between values of the dependent variable is the same each time we change the independent variable by the same amount, then the function is **<u>exponential</u>**.

+1 +1 +1 +1

x	−2	−1	0	1	2
y	1	2	4	8	16

×2 ×2 ×2 ×2

The *y*-values have a common *ratio* of 2.

Differences can also be used to identify **<u>quadratic</u>** functions. For a quadratic function, when we increase the *x* values by the same amount, the difference between *y* values will *not* be the same. However, <u>the difference of the differences</u> of the *y* values will be the same.

+1 +1 +1 +1

x	−2	−1	0	1	2
y	−1	−2	−1	2	7

−1 +1 +3 +5 ← First differences

+2 +2 +2 ← Second differences

State whether the table of values represents a linear, an exponential, or a quadratic function.

1.

x	−2	−1	0	1	2
y	0	0.5	1	1.5	2

2.

x	−1	0	1	2	3
y	0.2	1	5	25	125

3.

x	−2	−1	0	1	2
y	0.75	1.5	3	6	12

4.

x	2	3	4	5	6
y	2	4.5	8	12.5	18

APPLICATIONS:

1. Match the function to the situation.

A. $p(x) = -16x^2 + 30x + 160$ B. $f(x) = 10x$ C. $q(x) = 2^x$

_______The population of bacteria doubled every month, and the total population vs. time was recorded.

_______A ball was launched upward from the top of a building, and the vertical distance of the ball from the ground vs. time was recorded.

_______Melvin saves the same amount of money every month. The total amount saved after each month was recorded.

2. The table shows the shipping cost *c* (in dollars) by weight *w* (in pounds) for items from an online store.

Weight, *w*	1	2	3	4
Cost, *c*	8.5	11	13.5	16

Does a linear, an exponential, or a quadratic function represent this situation?

3. Analyze each table and match it to the correct equation to the right.
Use the equations to fill in the missing numbers for each table.

Table A

x	y
0	6
1	10
2	14
3	
4	22
5	

Table B

x	y
0	6
1	15
2	18
3	15
4	
5	

Table C

x	y
-1	$\frac{1}{6}$
0	1
1	
2	36
3	
4	1296

Table D

x	y
-1	
0	6
1	8
2	6
3	0
4	
5	-24

Equations:

$f(x) = 6^x$

$h(x) = -3(x-2)^2 + 18$

$g(x) = -2(x+1)(x-3)$

$r(x) = 4x + 6$

TAKE AWAY!

How can I tell the difference between linear, exponential and quadratic functions from a table of values?

A **common difference** can be calculated if the function is ______________________________.

A **common ratio** can be calculated if the function is ______________________________.

A **common second difference** can be calculated if the function is _________________________.