

7-6

Reteaching

Exponential Functions

Functions that can be modeled by an equation of the form $y = a \cdot b^x$ are exponential functions. These functions have properties that are different from the properties of linear and quadratic functions.

Consider the three function tables below.

x	y
0	3
1	9
2	27
3	81
4	243
5	729

x	y
0	3
1	6
2	12
3	24
4	48
5	96

x	y
0	2
1	10
2	50
3	250
4	1250
5	6250

Notice that in each table, the x -value increases by a constant amount. If these functions were linear, the y -values would also increase by a constant amount. You used these values to find the slope of linear equations.

This does not hold true for exponential functions. See if you can determine the property that holds true for all exponential functions by:

- Finding the sum of some random pairs of consecutive y -values in each table.
- Finding the difference between some random pairs of consecutive y -values in each table.
- Finding the product of some random pairs of consecutive y -values in each table.
- Finding the quotient of some random pairs of consecutive y -values in each table.

You should have noticed that, for each table, the quotients remain the same.

Exponential functions model an initial amount, a , that is repeatedly multiplied by the same positive number, b . The number of times the multiplication occurs is determined by the independent variable, x , which is the exponent in the power b^x .

1. For each of the tables on the previous page, extend them two units in each direction. Use the common difference in the x -values and the common ratio in the y -values to do the extension. The first table is done for you.

x	y
-2	$\frac{1}{3}$
-1	1
0	3
1	9
2	27
3	81
4	243
5	729
6	2187
7	6561

2. Plot the points in each of your extended tables on separate coordinate grids. Connect the points with a smooth curve. The domain of each function is all real numbers and that the range is all positive real numbers. Explain why there are negative values for x but not for y .
3. For each of the tables, identify the starting value a and the common ratio b . For the first table, a is 1 and b is 3. Next, write the exponential function that describes each table. The function for the first table is $f(x) = 1 \cdot 3^x$. Check if your function is correct by substituting in x -values and seeing if the function produces values for y that match the values in the table.