A New Family That Multiplies

Lines add the same amount every step; exponentials multiply by the same number every step. Subtract for a constant difference, divide for a constant ratio. Exponents write the multiplying.

Name _____ Date _____

Words we use

say the math word, then the plain English

WORD	PLAIN ENGLISH	WHAT YOU DO
Exponent	How many times the base is multiplied. In 2^5, the 5.	Count the copies of the base.
Base	The number being multiplied over and over. In 2^5, the 2.	It is the number you multiply by each step.
Power	The whole thing, like 2^5: read two to the fifth.	Work it out by multiplying the base by itself.
Constant difference	The same amount added each step: the line pattern.	Subtract each output from the next to check.
Constant ratio	The same number multiplied each step: the exponential pattern.	Divide each output by the one before to check.
Exponential function	A function that multiplies by the same number every step.	The second family of graphs. Lines add, exponentials multiply.

Part A Build both tables

Start both at 1. The left column adds 3 each step; the right column multiplies by 3. Fill in, then write the difference and the ratio between rows.

STEP	ADDS 3	DIFFERENCE	MULTIPLIES BY 3	RATIO
0	1		1	
1				
2				
3				
4				

Part B Read the powers

Write the multiplying out, then the value. Name the base and the exponent for the first two.

POWER	WRITTEN OUT	VALUE
2^4		

3^3

10^3

3^x

6^1

Part C Walk it backward

Fill in the powers of 3 by dividing as you go left.

X	3	2	1	0	−1	−2
3^x	27					

Why is 3^0 equal to 1? Use the words divide and do-nothing.

Part D Adds or multiplies?

Subtract, then divide if needed. Write linear, exponential, or neither.

TABLE (X = 0, 1, 2, 3)	DIFFERENCES	RATIOS	FAMILY
y: 4, 12, 36, 108			
y: 5, 8, 11, 14			
y: 80, 40, 20, 10			
y: 1, 4, 9, 16			

Part E In your own words

1. Say the one idea that separates lines from exponentials.

2. What is the difference between 2^3 and 2×3?

3. A plant grows 2 inches a week; a rumor doubles every day. Which adds and which multiplies?

Part F Exit ticket

1. 3^4 = ? Base and exponent?

2. Why is $5^0 = 1$?

3. y: 2, 6, 18, 54 (x = 0 to 3): which family?

Answer key

Part A. Adds: 1, 4, 7, 10, 13 (difference 3). Multiplies: 1, 3, 9, 27, 81 (ratio 3).

Part B. $2 \times 2 \times 2 \times 2 = 16$ (base 2, exponent 4). $3 \times 3 \times 3 = 27$ (base 3, exponent 3). 25. 1,000. 6.

Part C. 27, 9, 3, 1, 1/3, 1/9. Each step left divides by 3; from 3 one step left is 1, the do-nothing number.

Part D. Exponential (ratio 3). Linear (difference 3). Exponential (ratio 1/2). Neither.

Part E. 1. Lines add the same amount; exponentials multiply by the same number. 2. 8 versus 6: the exponent counts copies. 3. Plant adds (linear); rumor multiplies (exponential).

Part F. 1. 81; base 3, exponent 4. 2. One step left from 5 divides by 5: 1. 3. Exponential, ratio 3.