Algebra 1   7.5
Graph exponential functions
Identify behavior that displays exponential behavior
base
exponent
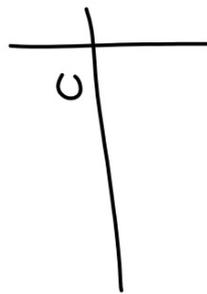y-intercept $y = b^x$
m = rate of change
linear
exponential growth
exponential decay
whiteboards

(handwritten top) (X X) ↑   (X)( ) ↓

KeyConcept Graphs of Exponential Functions

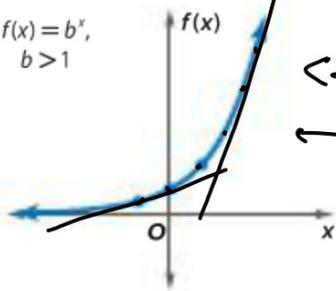### Exponential Growth Functions

Equation: $f(x) = ab^x$, $a > 0$, $b > 1$

Domain, Range: all reals; all positive reals

Intercepts: one y-intercept, no x-intercepts

End behavior: as x increases, $f(x)$ increases; as x decreases, $f(x)$ approaches 0

$f(x) = b^x$, $b > 1$

(handwritten) ← D : ARN →
← R y > 0 →
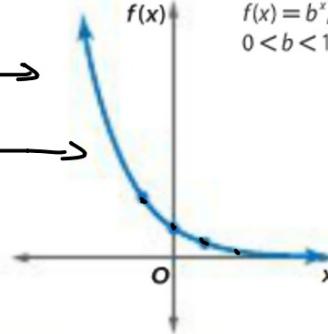
Exponential Decay Functions

Equation: $f(x) = ab^x$, $a > 0$, $0 < b < 1$

Domain, Range: all reals; all positive reals

Intercepts: one y-intercept, no x-intercepts

End behavior: as x increases, $f(x)$ approaches 0; as x decreases, $f(x)$ increases
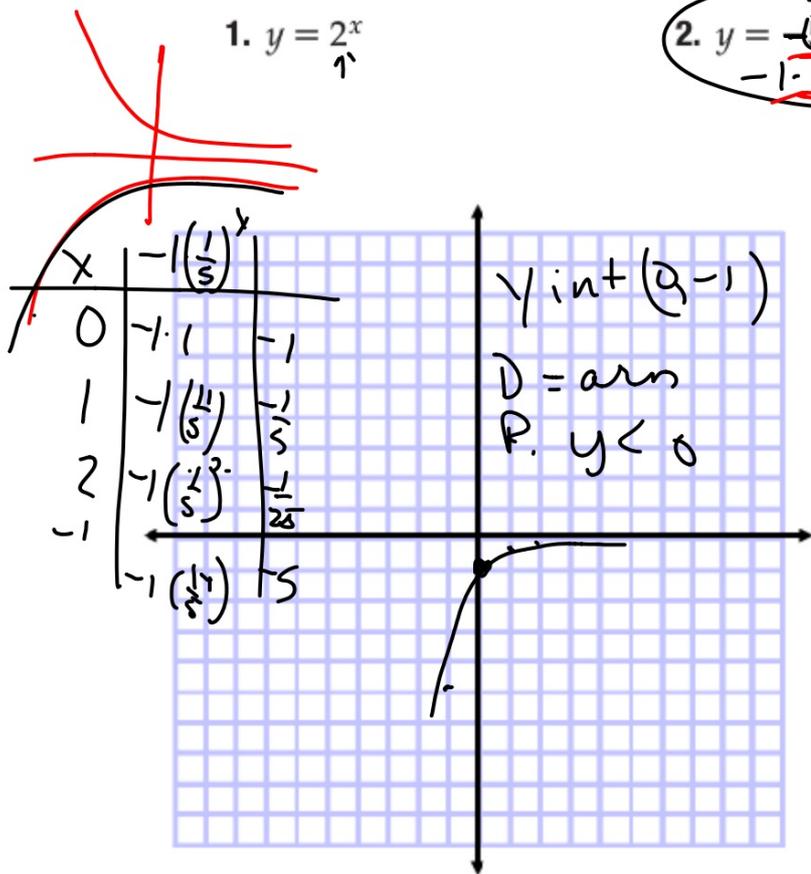
$f(x) = b^x$, $0 < b < 1$

GemA

whiteboards

ARN' $y > 0$

Examples 1–2 Graph each function. Find the y-intercept and state the domain and range.

(0, 1)

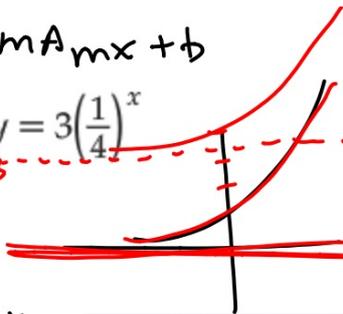**1.** $y = 2^x$

2. $y = -5^x$

$-1 \cdot 5^x$

3. $y = -\left(\dfrac{1}{5}\right)^x$

$-1\left(\dfrac{1}{5}\right)^x$

x	$-1\left(\dfrac{1}{5}\right)^x$	
0	$-1 \cdot 1$	-1
1	$-1\left(\dfrac{1}{5}\right)$	$-\dfrac{1}{5}$
2	$-1\left(\dfrac{1}{5}\right)^2$	$\dfrac{1}{25}$
-1	$-1\left(\dfrac{1}{5}\right)$	-5

Y int $(9, -1)$

$D = arn$

$R. \ y < 0$

1. What shape is it? ✓
2. Find ordered pairs (table) ✓
3. Follow order of operations in equation ✓
4. Answer the Question

G emA mx + b
$=$

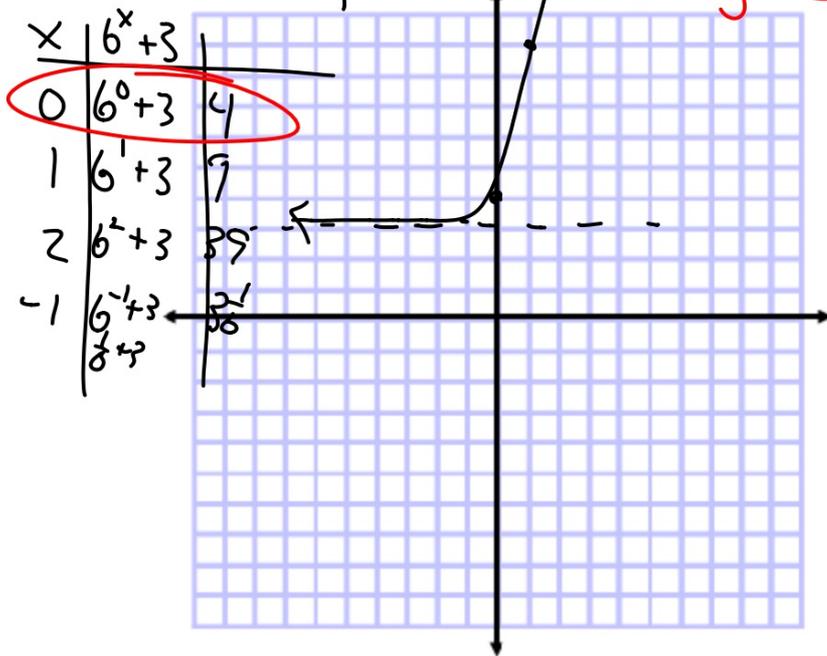**4.** $y = 3\left(\dfrac{1}{4}\right)^x$

$y = 3$

5. $f(x) = 6^x + 3$

up 3

$R \; y > 3$

x	$6^x + 3$	
0	$6^0 + 3$	4
1	$6^1 + 3$	9
2	$6^2 + 3$	39
-1	$6^{-1} + 3$	

Is it a multiplication rule?

4. Determine whether the set of data shown below displays exponential behavior.
Write *yes* or *no*. Explain why or why not.

x	0	3	6	9	12	15
y	12	16	20	24	28	32

no — adding rule

Is it a multiplication rule?

9.

x	2	4	6	8	10	12
y	1	4	16	64	256	~~1024~~ 2048

yes   mult by 4

Is it a multiplication rule?

8.

x	1	2	3	4	5	6
y	−4	−2	0	2	4	6

+2   +2   +2

3. BIOLOGY A certain bacteria population doubles every 20 minutes. Beginning with 10 cells in a culture, the population can be represented by the function $B = 10(2)^t$, where B is the number of bacteria cells and t is the time in 20 minute increments. How many will there be after 2 hours?

$$B = 10(2)^6$$

$$B = 10 \cdot 64$$

$$= 640$$