Notes 4-2

Sec 1 H **Vertical Shifts of Exponential Functions** **Unit 4**

Using the parts to create the sequence in the table:

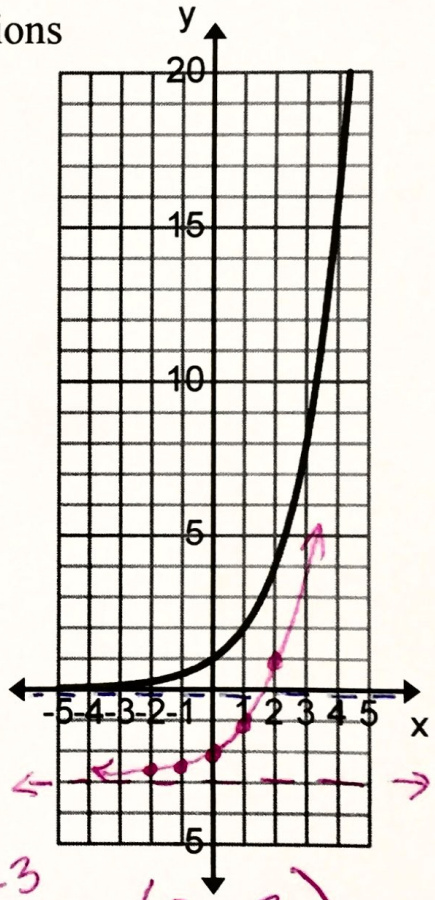
$y = a \cdot b^x$

a: initial value, y-int

b: common ratio

Example 1: Given the functions $f(x) = 2^x$ and $g(x) = 2^x - 3$, complete the following table and use it to graph both functions on the same graph.

x	Work	$f(x) = 2^x$	$g(x) = 2^x - 3$
-2		$\frac{1}{4}$	$-2\frac{3}{4}$
-1		$\frac{1}{2}$	$-2\frac{1}{2}$
0		1	-2
1		2	-1
2		4	1



How does the -3 affect the graph of the function?

What has happened? Shifting down 3

What is the y-intercept? $f(x)$: 2^x (0, 1) $g(x)$: $2^x - 3$ (0, −2)

Where is the asymptote? $f(x)$: x-axis, $y = 0$ $g(x)$: $y = -3$

Are the functions increasing or decreasing?

Are the functions above or below their asymptotes?

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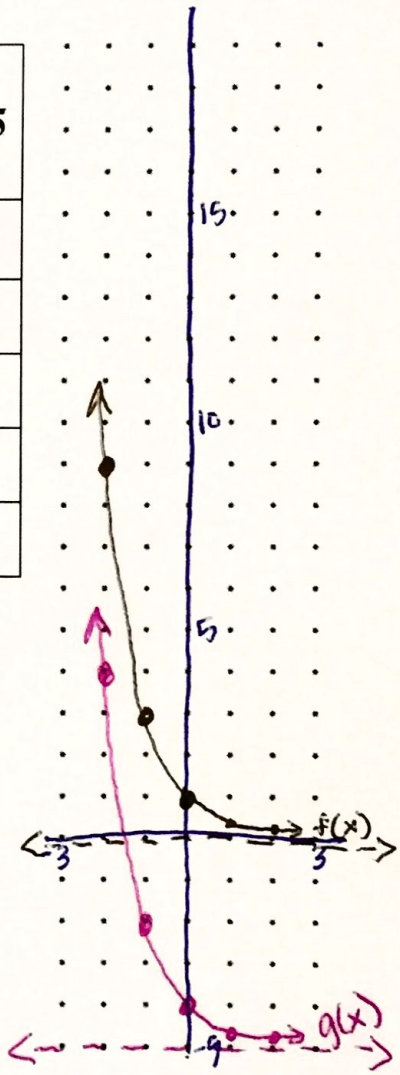
Sec 1 H **Vertical Shifts of Exponential Functions** **Unit 4**

Example 2: Given the parent function $f(x)=\left(\frac{1}{3}\right)^x$ and $g(x)=\left(\frac{1}{3}\right)^x-5$, which has been shifted vertically, fill in the table and complete the following questions.

x	Work	$f(x)=\left(\frac{1}{3}\right)^x$	$g(x)=\left(\frac{1}{3}\right)^x-5$
-2		9 ·3	9-5 4
-1		3 ·3	3-5 -2
0		1 ·1/3	1-5 -4
1		1/3 ·1/3	1/3-5 -4 2/3
2		1/9	1/9-5 -4 8/9

How does the -5 affect the graph of the function? What has happened?



What is the y-intercept? $f(x)$: (0, 1) ↓ 1-5

$g(x)$: (0, -4)

Where is the asymptote? $f(x)$: $y=0$ x-axis

$g(x)$: $y=-5$

Are the functions increasing or decreasing? How can we tell without graphing?

Are the functions above or below their asymptotes? How can we tell without graphing?