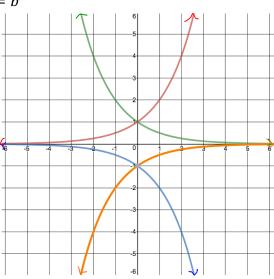


Part 1: Properties of Exponential Functions

General Equation: $y = a(b)^{k(x-d)} + c$ where the base function is $y = b^x$

There are 4 possible shapes for an exponential function

- **1)** a > 0 and b > 1 (ex. $y = 2^x$)
- **2)** a > 0 and 0 < b < 1 (ex. $y = \left(\frac{1}{2}\right)^x$)
- 3) a < 0 and b > 1 (ex. $y = -1(2)^x$)
- 4) a < 0 and 0 < b < 1 (ex. $y = -1\left(\frac{1}{2}\right)^{x}$)



To graph the base function $y = b^x$, Find the following key features:

- Horizontal asymptote
 - Starts at y = 0 and can be shifted by c
- *y intercept*
 - \circ set x = 0 and solve
 - At least one other point to be sure of shape
 - Common to choose x = 1 and solve for y

You can then use transformational properties of a, k, d, and c to graph a transformed function

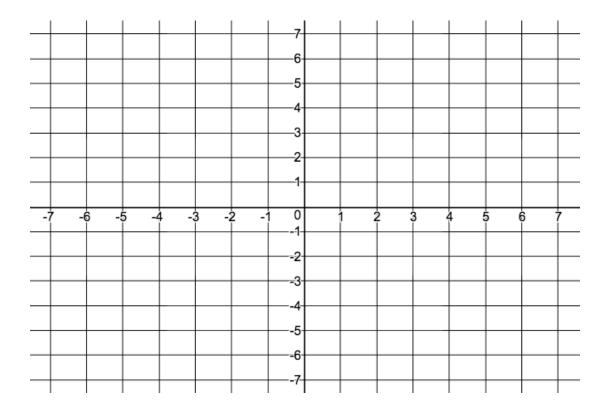
Part 2: Transformations of Exponential Functions

Example 1: Sketch the graph of $f(x) = 2(3)^{x+4} - 5$ and $g(x) = -3^{\frac{1}{2}x} + 4$ using transformations

$y = 3^x$									
x	у								

$f(x) = 2(3)^{x+4} - 5$								

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



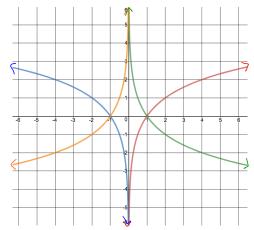
Part 3: Properties of Logarithmic Functions

General Equation: $y = a \log_b [k(x - d)] + c$ where the base function is $y = \log_b x$

Remember that $y = \log_b x$ is the inverse of the exponential function $y = b^x$

There are 4 possible shapes for a logarithmic function

- **1)** k > 0 and b > 1 (ex. $y = \log_2(x)$)
- 2) k > 0 and 0 < b < 1 (ex. $y = \log_{0.5}(x)$)
- **3)** k < 0 and b > 1 (ex. $y = \log_2(-x)$)
- 4) k < 0 and 0 < b < 1 (ex. $y = \log_{0.5}(-x)$)



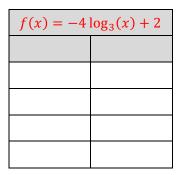
To graph the base function $y = \log_b x$, Find the following key features:

- Vertical asymptote
 - Starts at x = 0 and can be shifted by d
- x intercept
 - \circ set y = 0 and solve
- At least one other point to be sure of shape
 - Common to choose y = 1 and solve for x

Part 4: Transformations of Logarithmic Functions

Example 2: Sketch the graph of $f(x) = -4 \log_3(x) + 2$ and $g(x) = \log_3[-(x+2)] - 4$ using transformations

$y = \log_3(x)$									
x	у								



$g(x) = \log_3[-$	-(x+2)]-4

		I I					1		40		1			1					1
									-10										
									9										<u> </u>
					<u> </u>			-	8				<u> </u>	-					-
									_										
									7										
									6										
					<u> </u>					 	<u> </u>		<u> </u>	<u> </u>					<u> </u>
									3										
_					<u> </u>				2	 	<u> </u>		<u> </u>	<u> </u>					<u> </u>
									1-1-										<u> </u>
								1						1					
-10	-9 -	8 -7	7 -6	3 -	5 -4	4 -	3 -	2 -		1 2	2 ;	3 .	4 !	5 0	6	7 1	3 9	9 1	10
-10	-9 -	8 -7	7 -6	6 -	5 -4	4 -	3 -	2 -	1 0	1 2	2 :	3 -	4 !	5	6	7 1	3 9	9 1	10
-10	-9 -	8 -7	'-6	6 -	5 -4	4 -	3 -	2 -	-1-	1 2	2 :	3 .	4 !	5	6	7 1	3 !	9 1	10
-10	-9 -	8 -7	'-€	6 -	5 -4	4 -	3 -	2 -		 1 2	2 :	3 .	4 !	5	6	7	3 9	9 1	10
-10	-9 -	8 -7	'-6	3 -	5 -4	4 -	3 -	2 -	-1- -2-	1 2	2 :	3 -	4 4	5	6	7 1	3 !	9 1	10
-10	-9 -	8 -7	-6	6 -	5 -4	4 -	3 -	2 -	-1-	1 :	2 :	3	4 !	5	6	7 1	3 9	9 1	10
-10	-9 -	8 -7		6 -	5 -4	4 -	3 -	2 -	-1- -2-	1 :	2 :	3	4 !	5	6	7 8	3 9	9 1	10
-1'0	-9 -	8 -7	-6	3 -	5 -4	4 -	3 -	2 -*	1- 2- 3- 4-	1 :	2 :	3	4 !	5	6	7	3	9 1	
-10	-9 -	8 -7	-6	3 -	5 -4	4 -	3 -	2 -*	1- 2- 3-	1 2	2	3	4 4	5	6	7	3 9	9 1	
-10	-9 -	8 -7	-6	5 -	5 -4	4 -	3 -	2	1- 2- 		2	3	4 !	5	6	7	3	9 1	
-10	-9 -	8 -7	· _6	5 -	5 -4	4 -	3 -	2	-1- -2- -3- -4- -5- -6-		2	3	4 !	5	6	7	3	9 1	
-10	-9 -	8 -7	· -6	<u> </u>	5 -4	4 -	3 -	2	1- 2- 		2	3	4 !	5	6	7 1	3 !	9 1	
-10		8 -7	· -6	<u> </u>	5 -4	4 -	3 -	2 -	-1- -2- -3- -4- -5- -6- -7-		2	3	4 !	5	6		3 !	9 1	
-10		8 -7	· -6	ĵ -	5 -4	4 - 	3 -	2 -	-1- -2- -3- -4- -5- -6-		2	3	4 !	5	6		3 !	9 1	
10		8 -7		ĵ -	5	4 - 	3 -	2	-1- -2- -3- -4- -5- -6- -7- -8-		2	3	4 !	5	6		3 9	9 1	
10		8 -7			5	4 -	3 -	2	-1- -2- -3- -4- -5- -6- -7-			3	4 !		6		3 9	9 1	
10		8 -7			5	4 -	3 -	2	-1- -2- -3- -4- -5- -6- -7- -8-			3	4 !		6		3 9	9 1	