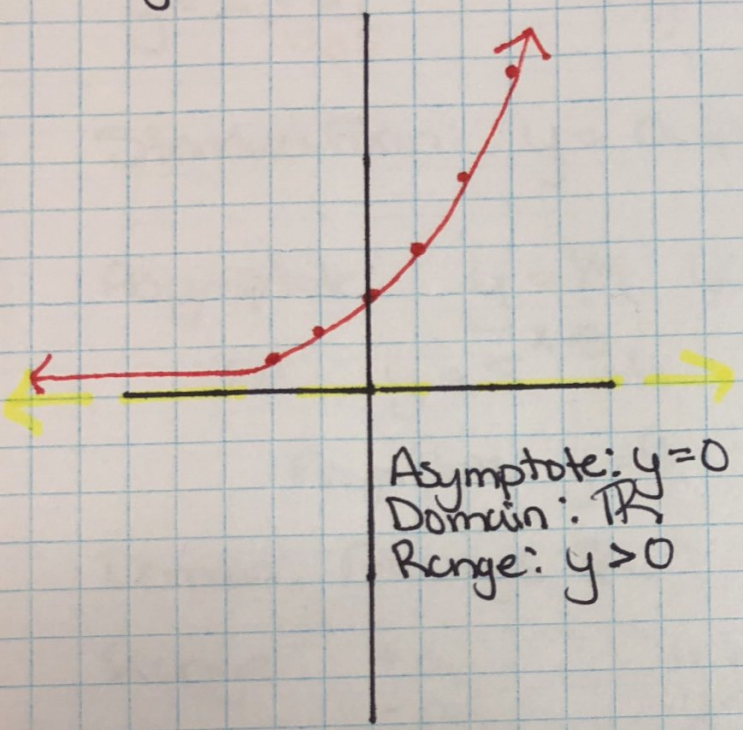
Exponential Functions and Graphing

Standard Form: $y = ab^x$

a: initial amount

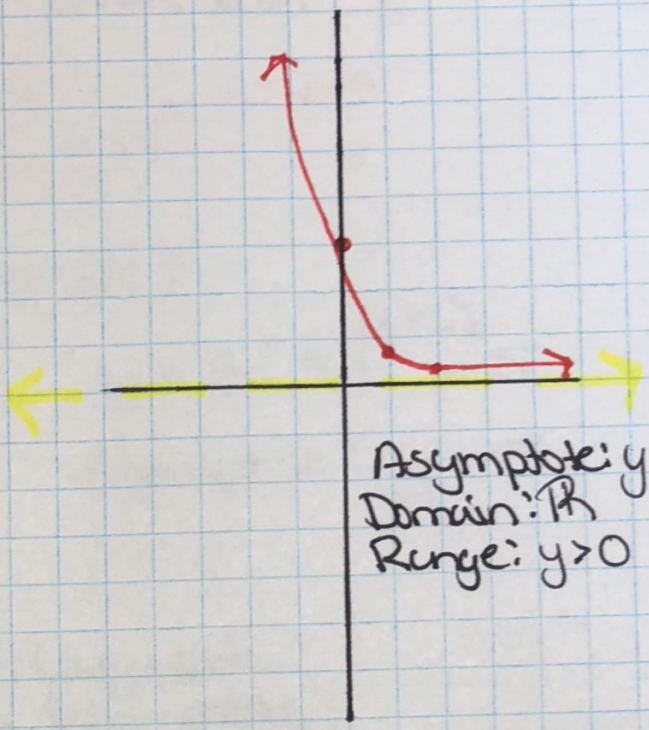
b: Rate of Growth $b > 1$ Growth $b < 1$ Decay

1) $y = 2\left(\frac{3}{2}\right)^x$



Asymptote: $y = 0$
Domain: $\mathbb{R}$
Range: $y > 0$

2) $y = 3\left(\frac{1}{4}\right)^x$



Asymptote: $y = 0$
Domain: $\mathbb{R}$
Range: $y > 0$

Function	Horizontal Shift	Vertical Shift	Domain	Range	Asymptote
1) $y = 2^x$	—	—	$\mathbb{R}$	$y > 0$	$y = 0$
2) $y = 2^x + 5$	—	Up 5	$\mathbb{R}$	$y > 5$	$y = 5$
3) $y = 2^x - 5$	—	Down 5	$\mathbb{R}$	$y > -5$	$y = -5$
4) $y = 2^{(x+5)}$	Left 5	—	$\mathbb{R}$	$y > 0$	$y = 0$
5) $y = 2^{(x-5)}$	Right 5	—	$\mathbb{R}$	$y > 0$	$y = 0$
6) $y = -2^x$	—	—	$\mathbb{R}$	$y < 0$	$y = 0$
	Reflection in x-axis				
7) $y = 3^{(x+2)} - 4$ (H. Shift ↓, V. Shift ↑)	Left 2	Down 4	$\mathbb{R}$	$y > -4$	$y = -4$

Horizontal Shift: is in the exponent
- positive - shifts left
- negative - shifts right

* moves in the opposite direction of the sign

$y = 2^{(x+5)}$ Left 5

Vertical Shift: is the constant
- positive - shifts up
- negative - shifts down

$y = 2^{x} + 5$ Up 5

Standard Form: $y = a\,b^{(x-h)} + k$ ← V. Shift

H. Shift

Asymptote: $y = k$ (constant)

Ex: $y = 5^{x-3} + 4$ Asymptote: $y = 4$

$y = 3\left(\frac{1}{4}\right)^{(x+2)} - 5$ Asymptote: $y = -5$

Domain: Always $\mathbb{R}$

Range: $+a$: $y > k$ (asymptote)
$-a$: $y < k$ (asymptote)

Find the shifts, domain, range, and asymptote.

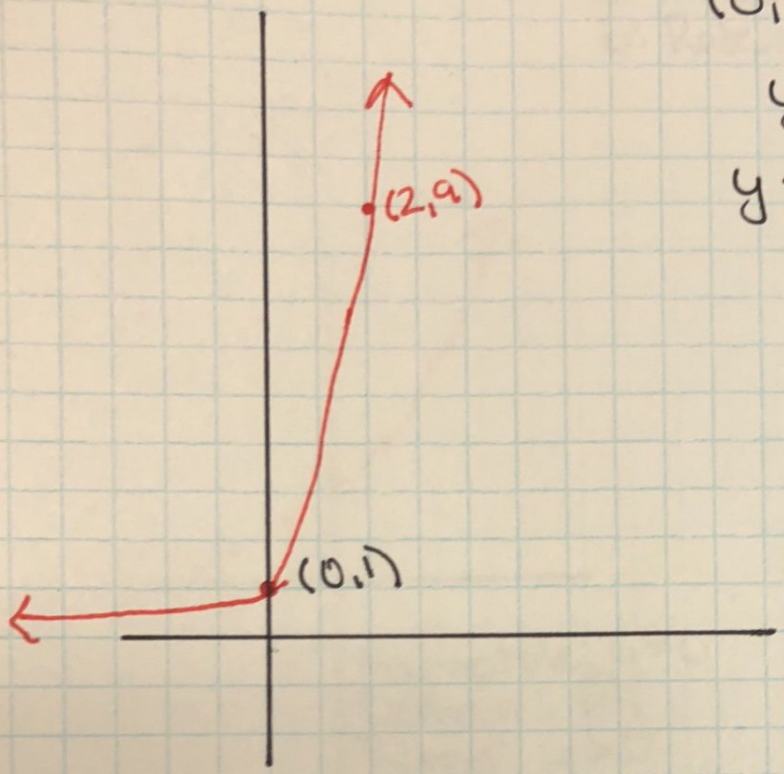
1) $y = 2(3)^{x-7} + 1$

H. Shift: Right 7
V. Shift: Up 1
Domain: $\mathbb{R}$
Range: $y > 1$
Asymptote: $y = 1$

2) $y = -\left(\frac{1}{4}\right)^{x+2} - 6$

H. Shift: Left 2
V. Shift: Down 6
Domain $\mathbb{R}$
Range: $y < -6$
Asymptote: $y = -6$

Find the exponential function $f(x) = ab^x$ whose graph is given.



$(0,1)$ $(2,9)$

$y = ab^x$

$y = 1(3)^x$