

Graphing Exponential Functions

$y = b^x$ $y = 3^x$

x	y
0	1
1	3

x	y
0	1
1	b

$y = a \cdot b^{x-h} + k$

$a > 0$ ref. over x-axis
 $a < 0$ Vertical Stretch
 h Hor. Shift
 k Vert. Shift

Domain: $(-\infty, \infty)$

Range: (k, ∞) if $a > 0$
 $(-\infty, k)$ if $a < 0$

Asymptote: $y = k$

X int: $(x, 0)$

Y int: $(0, y)$

End Behavior: $x \rightarrow -\infty, f(x) \rightarrow \pm\infty$ and $x \rightarrow \infty, f(x) \rightarrow \pm\infty$

Exponential Growth + Decay

Assume $a > 0$

$y = a \cdot b^{x-h} + k$

$b > 1 \rightarrow$ Growth

$0 < b < 1 \rightarrow$ Decay

1. $y = -5^x - 3$

Transformations: ref. over x-axis, down 3

State 3 points on Graph: (0, -4), (1, -8)

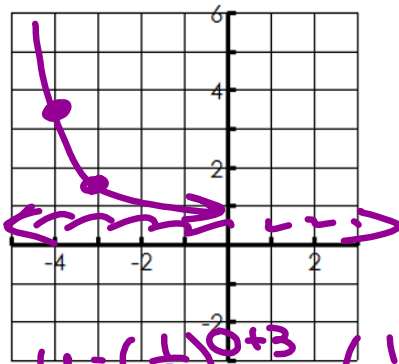
Domain: $(-\infty, \infty)$ Range: $(-\infty, -3)$

Asymptote: $y = -3$ Increasing or Decreasing

X-intercept: none Y-intercept: (0, -4)

End Behavior: $x \rightarrow -\infty, f(x) \rightarrow -3$
 $x \rightarrow \infty, f(x) \rightarrow -\infty$

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



$y = \left(\frac{1}{3}\right)^{0+3} = \left(\frac{1}{3}\right)^3 = \frac{1}{27}$

Transformations: left 3

State 3 points on Graph (-4, 3) (-3, 1)

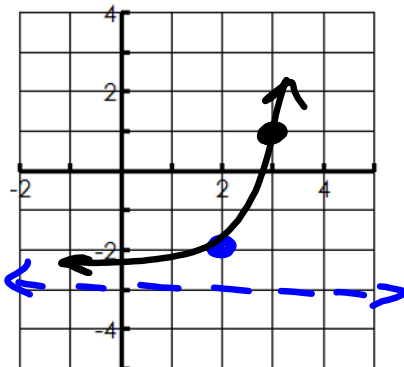
Domain $(-\infty, \infty)$ Range $(0, \infty)$

Asymptote $y=0$ Increasing or Decreasing

X-intercept none Y-intercept $(0, \frac{1}{27})$

End Behavior $x \rightarrow -\infty, f(x) \rightarrow \infty$
 $x \rightarrow \infty, f(x) \rightarrow 0$

3. $y = 4^{x-2} - 3$



$0 = 4^{x-2} - 3$
 $3 = 4^{x-2}$
 $x-2 = \log_4 3$
 $x = \log_4 3 + 2$
 $x = \frac{\log 3}{\log 4} + 2 \approx 2.8$

Transformations: right 2 down 3

State 3 points on Graph (2.8, 0) (3, 1)

Domain $(-\infty, \infty)$ Range $(-3, \infty)$

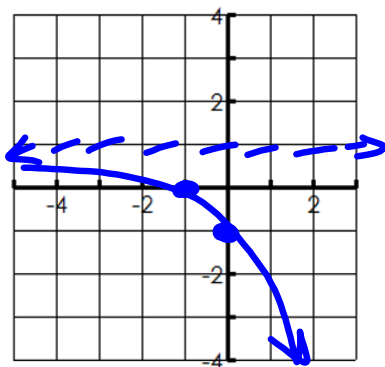
Asymptote $y = -3$ Increasing or Decreasing

X-intercept $(2.8, 0)$ Y-intercept $(0, -2.9)$

End Behavior $x \rightarrow -\infty, f(x) \rightarrow -3$
 $x \rightarrow \infty, f(x) \rightarrow \infty$

$y = 4^{0-2} - 3$
 $= \left(\frac{1}{4}\right)^2 - 3 = \frac{1}{16} - 3 = -2.9$

4. $y = -2^{x+1} + 1$



Transformations ref. over left 1 up 1

State 3 points on Graph (-1, 0) (0, -1)

Domain $(-\infty, \infty)$ Range $(-\infty, 1)$

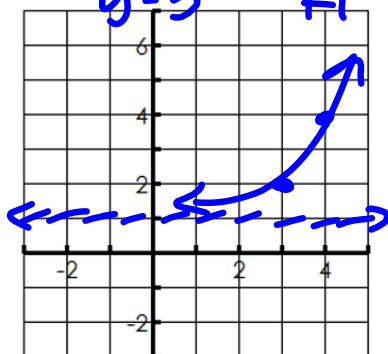
Asymptote $y = 1$ Increasing or Decreasing

X-intercept $(-1, 0)$ Y-intercept $(0, -1)$

End Behavior $x \rightarrow -\infty, f(x) \rightarrow \underline{1}$
 $x \rightarrow \infty, f(x) \rightarrow \underline{-\infty}$

5. $y = 3^{x-3} + 1$

$y = \frac{1}{27} + 1 = \frac{28}{27}$
 $y = 3^{0-3} + 1$



Transformations: right 3 up 1

State 3 points on Graph (3, 2) (4, 4)

Domain $(-\infty, \infty)$ Range $(1, \infty)$

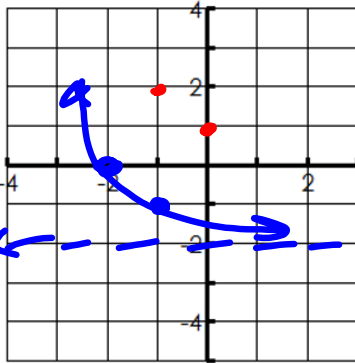
Asymptote $y = 1$ Increasing or Decreasing

X-intercept none Y-intercept $(0, \frac{28}{27})$

End Behavior $x \rightarrow -\infty, f(x) \rightarrow \underline{1}$
 $x \rightarrow \infty, f(x) \rightarrow \underline{\infty}$

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

$a=1$ $h=-1$ $k=-2$

Transformations: left 1 down 2

x	y
-1	-2
0	-3/2
-2	0

State 3 points on Graph

Domain: $(-\infty, \infty)$ Range: $(-2, \infty)$ Asymptote: $y = -2$ Increasing or DecreasingX-intercept: $(-2, 0)$ Y-intercept: $(0, -3/2)$ End Behavior
 $x \rightarrow -\infty, f(x) \rightarrow \infty$
 $x \rightarrow \infty, f(x) \rightarrow -2$

Write the equation:

① base 5, left 2, up 1, ref. over x-axis

$$y = a b^{x-h} + k$$

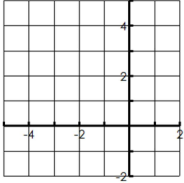
Growth or Decay?

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

② $y = .1 (.98)^{x-3}$

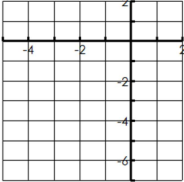
GSE Algebra II Unit 5B - Exponentials & Logs 5B.2 - Graphing Exp - Notes

3. $y = 2^{x+1}$



Transformations: _____
 State 3 points on Graph _____
 Domain _____ Range _____
 Asymptote _____ Increasing or Decreasing _____
 X-intercept _____ Y-intercept _____
 End Behavior $x \rightarrow \text{_____}, f(x) \rightarrow \text{_____}$
 $x \rightarrow \text{_____}, f(x) \rightarrow \text{_____}$

4. $y = -3^{x+1} - 2$



Transformations: _____
 State 3 points on Graph _____
 Domain _____ Range _____
 Asymptote _____ Increasing or Decreasing _____
 X-intercept _____ Y-intercept _____
 End Behavior $x \rightarrow \text{_____}, f(x) \rightarrow \text{_____}$
 $x \rightarrow \text{_____}, f(x) \rightarrow \text{_____}$

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

P.G. $+h$ $+k$

x	y
0	1
1	2

x	y
1	-2
2	-1

$a=1$ $h=1$ $k=-3$

$y = a \cdot b^{x-h} + k$
 b is the base.

Asymptote: $y = -3$

Transformations: right 1, down 3

State 3 points on Graph (1, -2) (2, -1)

Domain $(-\infty, \infty)$ Range $(-3, \infty)$
 $(-\infty, k)$ or (k, ∞)

Asymptote $y = -3$ Increasing or Decreasing _____

X-intercept $(2.6, 0)$ Y-intercept $(0, -2.5)$

End Behavior $x \rightarrow -\infty, f(x) \rightarrow -3$
 $x \rightarrow \infty, f(x) \rightarrow \infty$

$y = \left(\frac{1}{2}\right)^{x-1} - 1$
 Parent Graph $y = \left(\frac{1}{2}\right)^x$
 $a = -1, h = 1, k = -1$
 $y = a(b)^{x-h} + k$
 $y = \left(\frac{1}{2}\right)^{x-1} - 1$

Transformations: right down!
 State 3 points on Graph $(0,1)$ $(1,0)$
 Domain $(-\infty, \infty)$ Range $(-1, \infty)$
 Asymptote $y = -1$ Increasing or Decreasing
 X-intercept $(1,0)$ Y-intercept $(0,1)$
 End Behavior $x \rightarrow -\infty, f(x) \rightarrow \infty$
 $x \rightarrow \infty, f(x) \rightarrow -1$

Asymptote: $y = k$
 $y = -1$

3) $y = -3^x + 2$
 $y = 3^x$ Asym: $y = 2$
 $a = -1, h = 0, k = 2$
 $y = a \cdot b^{x-h} + k$
 $y = -1 \cdot 3^{x-0} + 2$
 $y = -3^x + 2$

Transformations: ref. over x-axis, up 2
 State 3 points on Graph $(0,1)$ $(1,-1)$
 Domain $(-\infty, \infty)$ Range $(-\infty, 2)$
 Asymptote $y = 2$ Increasing or Decreasing
 X-intercept $(0,0)$ Y-intercept $(0,1)$
 End Behavior $x \rightarrow -\infty, f(x) \rightarrow 2$
 $x \rightarrow \infty, f(x) \rightarrow -\infty$

