

# GRAPHING LOGARITHMIC FUNCTIONS $f(x) = a \cdot \log_b(x \mp h) \pm k$

Step 1 Find & graph the VERTICAL ASYMPTOTE @

$$X = (\text{opposite}) h$$

Step 2 Identify 2 - 3 points to the right of your vertical asymptote using the table in your calculator.

Step 3 Connect the points & DO NOT cross the ASYMPTOTE.

~~~~~

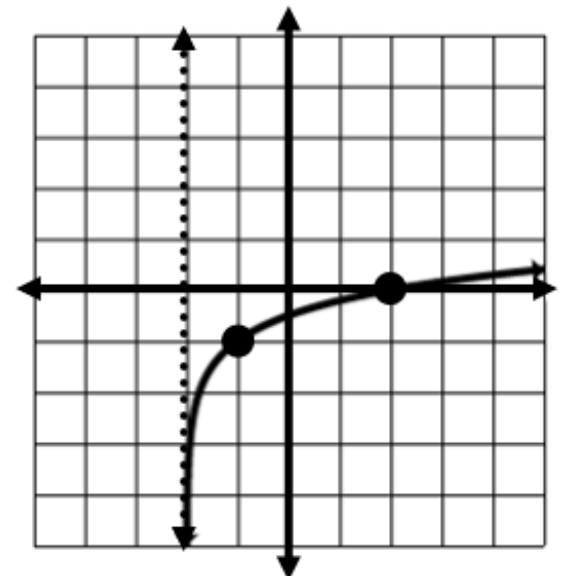
## EXAMPLE ~

$$f(x) = \log_4(x + 2) - 1$$

Step 1 Vertical Asymptote @  $x = -2$

Step 2 Points (using the table in the calculator)  $\rightarrow$   $(-1, 1)$  &  $(4, 0)$

Step 3  $\rightarrow$  Graph it all together!



# GRAPHING EXPONENTIAL FUNCTIONS $f(x) = a \cdot (b)^{x \mp h} \pm k$

Step 1 Find & graph the HORIZONTAL ASYMPTOTE @

$$y = k \longleftrightarrow$$

Step 2 Identify 2 - 3 points above (if  $+a$ ) OR below (if  $-a$ ) the horizontal asymptote using the table in your calculator.

Step 3 Connect the points & DO NOT cross the ASYMPTOTE.

~~~~~

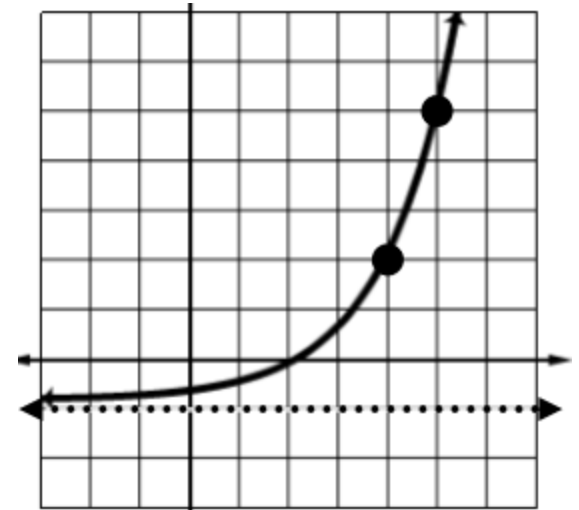
## EXAMPLE ~

$$f(x) = 3(2)^{x-4} - 1$$

Step 1 Horizontal Asymptote @  $y = -1$

Step 2 Points (using the table in the calculator)  $\rightarrow$   $(4, 2)$  &  $(5, 5)$

Step 3  $\rightarrow$  Graph it all together!



# Transformations of Logarithmic & Exponential Graphs

$$f(x) = a \cdot \log_b(x \mp h) \pm k$$

$$f(x) = a \cdot (b)^{x \mp h} \pm k$$

$$-a = \underline{\hspace{10cm}}$$

$$a > 1 = \underline{\hspace{10cm}}$$

$$0 < a < 1 = \underline{\hspace{10cm}}$$

$$-h = \underline{\hspace{10cm}}$$

$$+h = \underline{\hspace{10cm}}$$

$$+k = \underline{\hspace{10cm}}$$

$$-k = \underline{\hspace{10cm}}$$

## Characteristics of Logarithmic & Exponential Graphs

### EXPONENTIAL FUNCTIONS

**Asymptote:** horizontal @  $y = k$

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

**Range:**  $(k, \infty)$

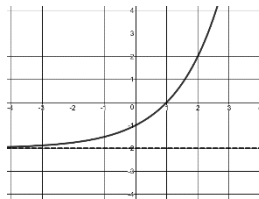
**Increase/Decrease:**

Increase from  $(-\infty, \infty)$

**End Behavior:**

LEFT  $\rightarrow k$

RIGHT  $\rightarrow \infty$



**Asymptote:** horizontal @  $y = k$

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

**Range:**  $(-\infty, k)$

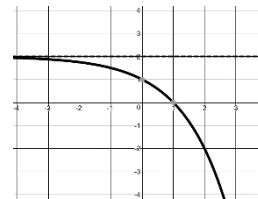
**Increase/Decrease:**

Decrease from  $(-\infty, \infty)$

**End Behavior:**

LEFT  $\rightarrow k$

RIGHT  $\rightarrow -\infty$



**Asymptote:** horizontal @  $y = k$

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

**Range:**  $(-\infty, k)$

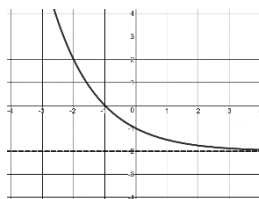
**Increase/Decrease:**

Decrease from  $(-\infty, \infty)$

**End Behavior:**

LEFT  $\rightarrow \infty$

RIGHT  $\rightarrow k$



**Asymptote:** horizontal @  $y = k$

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

**Range:**  $(-\infty, k)$

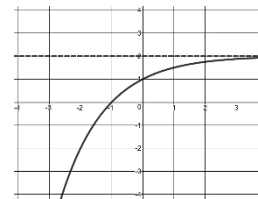
**Increase/Decrease:**

Increase from  $(-\infty, \infty)$

**End Behavior:**

LEFT  $\rightarrow -\infty$

RIGHT  $\rightarrow k$



### LOGARITHMIC FUNCTIONS

**Asymptote:** vertical @  $x = \text{opposite } h$

**Domain:**  $(\text{opposite } h, \infty)$

**Range:**  $(-\infty, \infty)$

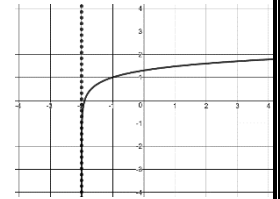
**Increase/Decrease:**

Increase from  $(\text{opposite } h, \infty)$

**End Behavior:**

LEFT  $\rightarrow \text{opposite } h$

RIGHT  $\rightarrow \infty$



**Asymptote:** vertical @  $x = \text{opposite } h$

**Domain:**  $(\text{opposite } h, \infty)$

**Range:**  $(-\infty, \infty)$

**Increase/Decrease:**

Decrease from  $(\text{opposite } h, \infty)$

**End Behavior:**

LEFT  $\rightarrow \text{opposite } h$

RIGHT  $\rightarrow -\infty$

