

1. A HORIZONTAL ASYMPTOTE for a function are values of  $y$  that the function approaches when  $x \rightarrow \infty$  or  $x \rightarrow -\infty$  but never quite reach.

- a. For the function  $g(x) = 4 \cdot (3)^x + 1$ , what would happen to the value of  $y$  for large values of  $x$ ? For example, what is  $g(1000)$  or  $g(1,000,000)$ ? What about very small values of  $x$ ?  $g(-1000)$  or  $g(-1,000,000)$ ?

$$\text{As } x \rightarrow \infty, y \rightarrow \infty$$

$$\text{As } x \rightarrow -\infty, y \rightarrow 1$$

- b. Based on (a), what is the horizontal asymptote for  $g(x)$ ?

$$\text{H.A.: } y = 1$$

- c. What would be the horizontal asymptote of  $m(x) = 10 \cdot (0.8)^x - 4$ ? Explain how you know.

$$y = -4. \text{ As } x \rightarrow \infty, y \rightarrow -4$$

- d. What would be the horizontal asymptote of  $f(x) = b(m)^x + k$ ?

$$y = k$$

2. A VERTICAL ASYMPTOTE for a function are values of  $x$  that make  $y \rightarrow \infty$  or  $y \rightarrow -\infty$  (so these values of  $x$  are NOT in the DOMAIN).

- a. For the function  $g^{-1}(x) = \log_3\left(\frac{x-1}{4}\right)$ , for what value of  $x$  would  $g^{-1}(x)$  be undefined [Hint: what is  $\log_3(0)$ ?]

$$x = 1$$

- b. Based on (a), what is the vertical asymptote for  $g^{-1}(x)$ ?

$$x = 1$$

- c. What would be the vertical asymptote of  $n(x) = \log_5(x+2) - 3$ ? Explain how you know.

$$x = -2$$

3. Some functions move AWAY from an asymptote (as  $x$  gets larger), and some functions move TOWARDS an asymptote (as  $x$  gets larger). Which functions below do you think move TOWARDS their asymptote (choose all that apply)? Explain your choices.

$$f(x) = 14(1.19)^x$$

Away,  
it grows.

$$g(x) = 20(0.80)^{\frac{x}{2}} - 3$$

Toward,  
it decays

$$h(x) = 20(3)^{-x}$$

Toward,  
it decays

$$j(x) = 20(4)^{3x} + 1$$

Away,  
it grows.

4. Similarly, some functions move AWAY from an asymptote (as  $y$  gets larger), and some functions move TOWARDS an asymptote (as  $y$  gets larger). Which functions below do you think move TOWARDS their asymptote? (Choose all that apply). Explain your choices.

$$f(x) = \log_{1.19}\left(\frac{x}{14}\right)$$

Away

$$g(x) = 2\log_{0.80}\left(\frac{x+3}{20}\right)$$

Toward

$$h(x) = -\log_3\left(\frac{x}{20}\right)$$

Toward

$$j(x) = \log_4\left(\frac{x-1}{20}\right) + 3$$

Away

~~INVERSES~~