CCSS Advanced Algebra 4 Asymptotes of Exponential and Logarithmic Functions

1. A HORIZONTAL ASYMPTOTE for a function are values of y that the function approaches when $x \to \infty$ or $x \to -\infty$ 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 $g(-1,000,000)$?

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

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

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

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

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

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

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

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.

$f(x) = 14(1.19)^x$ $g(x) = 20(0.80)^{\frac{x}{2}} - 3$ $h(x) = 20(3)^{-x}$ $j(x) = 20(4)^{3x} + 1$

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.

$f(x) = log_{1.19}(\frac{x}{14})$ $g(x) = 2log_{0.80}(\frac{x+3}{20})$ $h(x) = -log_3(\frac{x}{20})$ $j(x) = log_4(\frac{x-1}{20}) \div 3$