

Notes 7.6 Analysis of Exponential Functions
Graphical, Numerical, and Analytical Approaches

Given the graph, equation, or table of values that represent an exponential function, state as many facts about the function as you possibly can. Each fact must be numbered, and justification must be provided based on the given information about the function.

1. The table of values below shows values on the graph of $H(x) = a \cdot b^{c(x-2)} + k$.

x	-6	-4	-1	2	5	7	9
$H(x)$	-1.001	-1.004	-1.064	-2	-16.63	-98.66	-611.4

$$\textcircled{1} \quad \lim_{x \rightarrow -\infty} H(x) = -1$$

$$\therefore \text{HA } y = -1$$

$$\therefore k = -1$$

$$\textcircled{2} \quad \lim_{x \rightarrow \infty} H(x) = -\infty$$

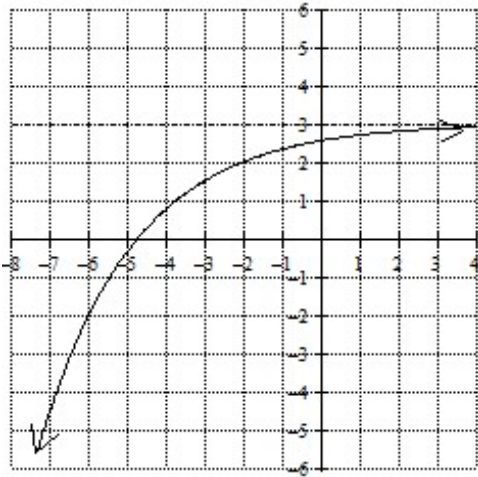
$\therefore c > 0$ ($H(x)$ goes away from HA)

$\therefore H(x)$ is exponential decay.

$\textcircled{3}$ All y -values of $H(x)$ are below the HA, $y = -1$

$$\therefore a < 0$$

2. The graph of $F(x) = a \cdot b^{c(x+2)} + k$ is given below.



- ① $\lim_{x \rightarrow \infty} F(x) = 3$
 $\therefore F(x)$ has a HA at $y = 3$
 $\therefore k = 3$
 $\therefore c < 0$ ($F(x)$ goes toward HA)

- ② $F(x)$ is below the HA of $y = 3$
 $\therefore a < 0$

- ③ $F(x)$ is increasing
 $\therefore F(x)$ is exponential growth.

3. The equation of a function, $G(x)$, is given below.

$$G(x) = -\left(\frac{3}{2}\right)^{-x-3} - 2$$

$$G(x) = -\left(\frac{3}{2}\right)^{-(x+3)} - 2$$

- ① $k = -2$
 $\therefore G(x)$ has a HA at $y = -2$
- ② $a < 0$
 $\therefore G(x)$ is below the x-axis
- ③ $c < 0$
 $\therefore \lim_{x \rightarrow \infty} G(x) = -2$
- ④ $\therefore G(x)$ has two reflections.
 $\therefore G(x)$ is exponential growth.

x	-9	-5	-3	-1	1	3	9
$H(x)$	513	33	9	3	1.5	1.125	1.002

The table of values for an exponential function of the form $H(x) = a \cdot b^{cx} + k$ is shown above. Use the table to answer the following questions.

4. Is $H(x)$ an exponential growth or decay function?
Give a reason for your answer.

$H(x)$ is decreasing at a decreasing rate.
 $\therefore H(x)$ is exponential decay

5. Describe the left and right end behavior of the function.

$$\lim_{x \rightarrow -\infty} H(x) = \infty \quad \lim_{x \rightarrow \infty} H(x) = 1$$

6. Identify the domain and range of the function.

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

7. What is the equation of the horizontal asymptote?

HA at $y=1$

8. What can be concluded about the value of a in the equation of $H(x)$? Give a reason for your answer.

$H(x)$'s y -values are all above 1
 $\therefore a > 0$

9. What can be concluded about the value of c in the equation of $H(x)$? Give a reason for your answer.

The y -values of $H(x)$ grow toward
 $y=1$, the HA.
 $\therefore c < 0$.

10. What can be concluded about the value of k in the equation of $H(x)$? Give a reason for your answer.

$H(x)$ is converging on $y=1$
 $\therefore k=1$

