LESSON MAKER PRO

Curve Clues

Read exponential growth and decay from graphs and equations.

HIGH SCHOOL · A2.F.1.4

A2.F.1.4 "Graph exponential and logarithmic functions. Identify the domain, range, asymptotes, and x- and y-intercepts using various methods and tools that may include calculators or other appropriate technology..."

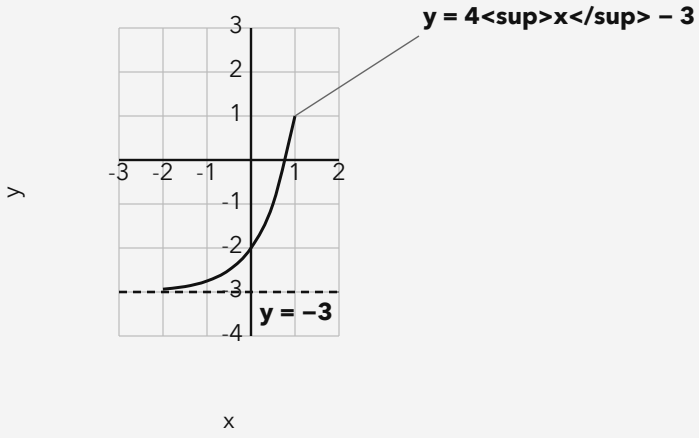
NAME _____ DATE _____

THE BIG IDEA

For $y = a \cdot b^x + k$, where $a > 0$, $b > 0$, and $b \neq 1$, the horizontal asymptote is $y = k$. The domain is all real numbers, the range is $y > k$, and the y-intercept is $(0, a + k)$. The graph shows growth when $b > 1$ and decay when $0 < b < 1$.

WORKED EXAMPLE

Use the graph of $y = 4^x - 3$ to find its horizontal asymptote, range, and y-intercept.

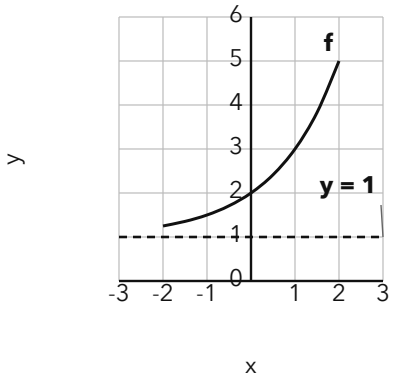


1. The curve approaches the dashed line, so the horizontal asymptote is $y = -3$.
2. The curve stays above that line, so the range is $y > -3$.
3. At $x = 0$, the curve crosses the y-axis at -2.

Answer: Asymptote: $y = -3$; range: $y > -3$; y-intercept: $(0, -2)$.

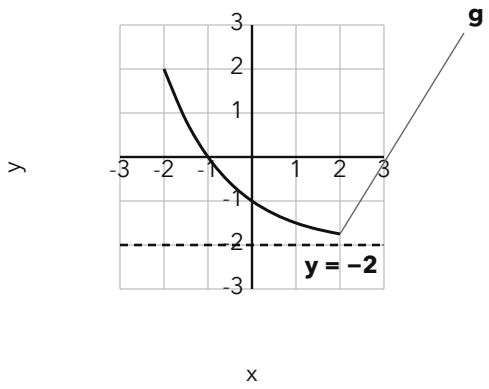
PRACTICE 6 problems

1 Use the graph to identify the horizontal asymptote and domain of f.



ANSWER _____

2 Use the graph to find the x-intercept of g. Does the graph show growth or decay?



ANSWER _____

3 Find both intercepts of $y = 2 \cdot 3^x - 6$.

ANSWER _____

4 Find the domain and range of $y = (1/3)^x + 2$.

ANSWER _____

5 For $y = (1/2)^x$, find the y-intercept and tell whether the function shows growth or decay.

ANSWER _____

6 For $y = 3 \cdot 2^x + 1$, find the horizontal asymptote and y-intercept.

ANSWER _____

APPLY IT Show your work

1 A new video has 200 total views on day 0. A model predicts that its total views double each day. How many total views does the model predict on day 3? Is this exponential growth or decay?

WORK SPACE

ANSWER _____

2 A phone battery starts at 80% charge. In a model, the charge halves each hour. What charge does the model predict after 2 hours? What is the horizontal asymptote of its charge graph?

WORK SPACE

ANSWER _____

CHALLENGE One step up

The functions $f(x) = 2^x - 4$ and $g(x) = 4 - 2^x$ have the same x-intercept but different horizontal asymptotes. Find the x-intercept and both asymptotes. Explain why the intercepts match.

WORK SPACE AND ANSWER

Curve Clues

PART 1 · PRACTICE

#	PROBLEM	ANSWER
1	Use the graph to identify the horizontal asymptote and domain of f.	**Horizontal asymptote: y = 1; domain: all real numbers.**
2	Use the graph to find the x-intercept of g. Does the graph show growth or decay?	**x-intercept: (−1, 0); decay.**
3	Find both intercepts of $y = 2 \cdot 3^x - 6$.	**x-intercept: (1, 0); y-intercept: (0, −4).**
4	Find the domain and range of $y = (1/3)^x + 2$.	**Domain: all real numbers; range: y > 2.**
5	For $y = (1/2)^x$, find the y-intercept and tell whether the function shows growth or decay.	**y-intercept: (0, 1); decay.**
6	For $y = 3 \cdot 2^x + 1$, find the horizontal asymptote and y-intercept.	**Horizontal asymptote: y = 1; y-intercept: (0, 4).**

PART 2 · APPLY IT

1. **1,600 total views; exponential growth.** Use $V = 200 \cdot 2^x$, with x measured in days. At x = 3, $V = 200 \cdot 8 = 1{,}600$; doubling is growth.
2. **20% charge; horizontal asymptote: y = 0.** Use $y = 80 \cdot (1/2)^x$, with x measured in hours. At x = 2, y = 20, and the charge approaches 0 as x increases.

CHALLENGE

Both x-intercepts are (2, 0). The asymptote of f is y = −4, and the asymptote of g is y = 4. Since g(x) = −f(x), the graphs are reflections across the x-axis, which leaves their shared x-intercept in place.

Accept interval notation for domains and ranges. In problem 2, accept "decreasing" for decay.