LESSON MAKER PRO

Curve Clues

Read intercepts, asymptotes, and end behavior.

HIGH SCHOOL · MT.PLUS.ALG.EXP.4

MT.PLUS.ALG.EXP.4 "Graph logarithmic and exponential functions with and without the use of technology by identifying intercepts, asymptotes, and end behavior."

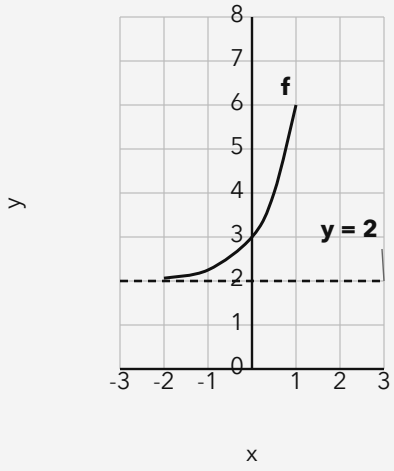
NAME _____ DATE _____

READ THE WHOLE GRAPH

For $y = a^x + k$, the horizontal asymptote is $y = k$, and the y-intercept is where $x = 0$. For $y = \log_a(x - h) + k$, the vertical asymptote is $x = h$. An asymptote shows a value the curve approaches, while an intercept is where the curve crosses an axis.

WORKED EXAMPLE

Use the graph to find the y-intercept, horizontal asymptote, and what happens to the curve as x decreases without bound.

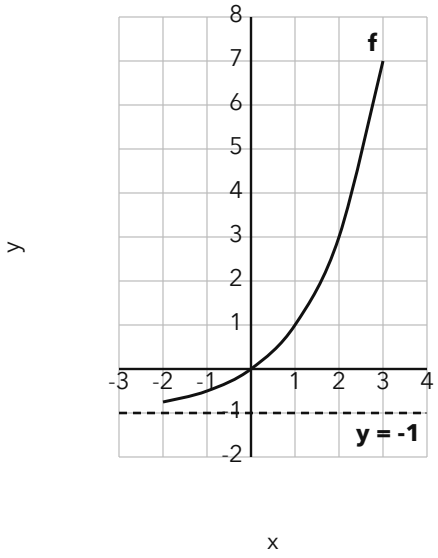


1. At x = 0, the curve crosses the y-axis at 3.
2. On the left, the curve gets closer to the dashed line y = 2.
3. As x decreases without bound, f(x) approaches 2.

Answer: Y-intercept: (0, 3). Horizontal asymptote: y = 2. As x approaches negative infinity, f(x) approaches 2.

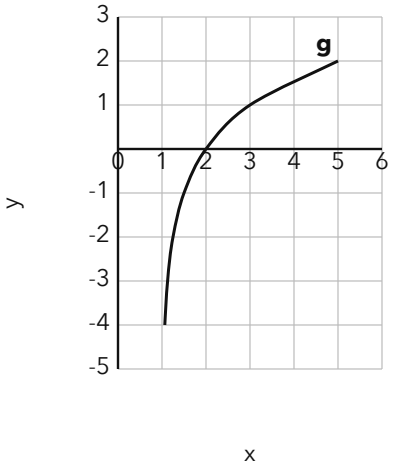
PRACTICE 6 problems

1 Use the graph to find the x-intercept and horizontal asymptote.



ANSWER _____

2 Use the graph to find the x-intercept and vertical asymptote.



ANSWER _____

3 Find the horizontal asymptote of $f(x) = 5^x - 4$.

ANSWER _____

4 Find the x-intercept of $g(x) = \log_3(x + 2)$.

ANSWER _____

5 For $h(x) = (1/2)^x + 3$, find the horizontal asymptote. What happens to h(x) as x increases without bound?

ANSWER _____

6 Find the x-intercept of $j(x) = \log_2(x - 4) + 1$.

ANSWER _____

APPLY IT Show your work

1 A phone's estimated resale price, in dollars, is $P(x) = 400(1/2)^x + 100$, where x is the number of years from now and $x \geq 0$. Find the graph's y-intercept and horizontal asymptote. What does each mean for the phone?

WORK SPACE

ANSWER _____

2 A playlist's file size is x megabytes, where $x > 0$. The number of times its size has doubled relative to 1 megabyte is $D(x) = \log_2(x)$. Find the graph's x-intercept and vertical asymptote. What happens to D(x) as the file size approaches 0?

WORK SPACE

ANSWER _____

CHALLENGE One step up

For $h(x) = 3 - \log_2(x - 2)$, find the vertical asymptote and x-intercept. Explain what happens to h(x) as x approaches the asymptote from the right and as x increases without bound.

WORK SPACE AND ANSWER

Curve Clues

PART 1 · PRACTICE

#	PROBLEM	ANSWER
1	Use the graph to find the x-intercept and horizontal asymptote.	**X-intercept: (0, 0). Horizontal asymptote: y = -1.**
2	Use the graph to find the x-intercept and vertical asymptote.	**X-intercept: (2, 0). Vertical asymptote: x = 1.**
3	Find the horizontal asymptote of $f(x) = 5^x - 4$.	**y = -4**
4	Find the x-intercept of $g(x) = \log_3(x + 2)$.	**(-1, 0)**
5	For $h(x) = (1/2)^x + 3$, find the horizontal asymptote. What happens to h(x) as x increases without bound?	**Horizontal asymptote: y = 3. As x approaches infinity, h(x) approaches 3.**
6	Find the x-intercept of $j(x) = \log_2(x - 4) + 1$.	**(9/2, 0)**

PART 2 · APPLY IT

1. **Y-intercept: (0, 500), meaning the estimated price now is $500. Horizontal asymptote: y = 100, meaning the estimated price approaches $100 as the years pass.** $P(0) = 400(1) + 100 = 500$. Since $(1/2)^x$ approaches 0 as x increases, P(x) approaches 100.
2. **X-intercept: (1, 0), so a 1-megabyte playlist has 0 doublings relative to 1 megabyte. Vertical asymptote: x = 0. As x approaches 0 from the right, D(x) decreases without bound.** $\log_2(1) = 0$ gives the x-intercept. The logarithm is defined only for $x > 0$, and its values decrease without bound as x approaches 0 from the right.

CHALLENGE

Vertical asymptote: x = 2. X-intercept: (10, 0), since $3 - \log_2(x - 2) = 0$ gives $x - 2 = 8$. As x approaches 2 from the right, h(x) increases without bound. As x increases without bound, h(x) decreases without bound.

Accept equivalent descriptions such as "approaches positive infinity" for "increases without bound." An asymptote is a line, so answers should give its equation.