LESSON MAKER PRO

Log Curve Quest

Solve, graph, and interpret logarithmic models.

HIGH SCHOOL · MA.912.AR.5.9

MA.912.AR.5.9 "Solve and graph mathematical and real-world problems that are modeled with logarithmic functions. Interpret key features and determine constraints in terms of the context."

NAME ______________________ DATE ____________

GRAPHING LOGARITHMS

For $y = \log_b(x-h) + k$, the logarithm input must be positive, so $x > h$. The graph has a vertical asymptote at $x = h$, and you can find points by choosing inputs that make $x-h$ a power of b.

WORKED EXAMPLE

Graph $y = \log_{11}(x-13) + 17$.

1. For a logarithm, $x-13$ must be positive, so $x > 13$.
2. At $x = 24$, $y = \log_{11}(11) + 17 = 18$, so plot (24,18).
3. At $x = 134$, $y = \log_{11}(121) + 17 = 19$, so plot (134,19).
4. Draw the vertical asymptote $x = 13$ and an increasing curve through the points.

Answer: Vertical asymptote: $x = 13$. Domain: $x > 13$. Points include (24,18) and (134,19).

PRACTICE 6 problems

1 Solve: $\log_3(x) = 4$.

ANSWER ____________

2 Solve: $\log_4(x + 6) = 2$.

ANSWER ____________

3 Solve $\log_2(3x - 4) = 3$. State the restriction on x.

ANSWER ____________

4 Graph $y = \log_3(x + 2) - 4$. State the vertical asymptote and plot three convenient points.

ANSWER ____________

5 Graph $y = -\log_2(x - 4) + 3$. State the vertical asymptote and plot two convenient points.

ANSWER ____________

6 For $y = \log_4(x + 8) - 3$, state the domain, range, vertical asymptote, and y-intercept.

ANSWER ____________

APPLY IT Show your work

1 At a school concert, sound level is modeled by $y = 10\log_{10}(x/10^{-12})$, where x is sound intensity in watts per square meter. If $y = 80$, find x. State the constraint on x and describe what happens to y as x approaches 0 from the right.

WORK SPACE

ANSWER ______________________

2 A coding platform models a user's rating with $y = 100\log_2(x + 4)$, where x is the number of challenge sets completed. A user has a rating of 300. Find x, then state the vertical asymptote and the contextual constraints on x.

WORK SPACE

ANSWER ______________________

CHALLENGE One step up

CHALLENGE

Solve $\log_3(x - 2) + \log_3(x - 4) = 2$. Explain why the other algebraic root is not valid.

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PART 1 · PRACTICE

#	PROBLEM	ANSWER
1	Solve: log_3(x) = 4.	**x = 81**
2	Solve: log_4(x + 6) = 2.	**x = 10**
3	Solve log_2(3x - 4) = 3. State the restriction on x.	**x = 4; restriction: x > 4/3**
4	Graph y = log_3(x + 2) - 4. State the vertical asymptote and plot three convenient points.	**Vertical asymptote: x = -2. Points: (-1,-4), (1,-3), (7,-2).**
5	Graph y = -log_2(x - 4) + 3. State the vertical asymptote and plot two convenient points.	**Vertical asymptote: x = 4. Points: (6,2), (12,0).**
6	For y = log_4(x + 8) - 3, state the domain, range, vertical asymptote, and y-intercept.	**Domain: x > -8. Range: all real numbers. Vertical asymptote: x = -8. y-intercept: (0,-3/2).**

PART 2 · APPLY IT

1. **x = 10^-4 watts per square meter. Constraint: x > 0. As x approaches 0 from the right, y decreases without bound.** Set 80 = 10log_10(x/10^-12), so log_10(x/10^-12) = 8. Then x/10^-12 = 10^8, giving x = 10^-4.
2. **x = 4 challenge sets. Vertical asymptote: x = -4. Contextual constraints: x is a whole number and x >= 0.** Set 300 = 100log_2(x + 4), so log_2(x + 4) = 3. Therefore x + 4 = 8 and x = 4.

CHALLENGE

x = 3 + sqrt(10). The other root, 3 - sqrt(10), is not valid because x - 4 must be positive.

Accept equivalent exact forms for coordinates, domains, and roots. For graphing items, accept any correct points on the curve along with the required vertical asymptote and correct curve direction.