

Growth and Logs

Solve equations and map key graph features.

HIGH SCHOOL • MA.912.AR.5

MA.912.AR.5 "Write, solve and graph exponential and logarithmic equations and functions in one and two variables."

NAME _____

DATE _____

MATCH FORMS AND FEATURES

To solve an exponential equation, rewrite both sides with the same base when possible, then set the exponents equal. To solve a logarithmic equation, use the definition of a logarithm or combine logs with the same base. Exponential graphs have horizontal asymptotes, while logarithmic graphs have vertical asymptotes.

WORKED EXAMPLE

Solve $5^{(x-2)} = 125$.

1. Rewrite 125 as 5^3 .
2. Set the exponents equal: $x - 2 = 3$.
3. Add 2 to both sides: $x = 5$.

Answer: $x = 5$

PRACTICE 6 problems

1 Solve $3^{(x+1)} = 81$.

ANSWER _____

2 Solve $\log_4(x) = 3$.

ANSWER _____

3 Solve $27^{(x-1)} = 1/9$.

ANSWER _____

4 Solve $\ln(x) = 0$.

ANSWER _____

5 For $y = 3^x - 4$, give the points for $x = 0$, $x = 1$, and $x = 3$. Then state the horizontal asymptote.

ANSWER _____

6 For $y = \log_3(x) - 1$, give the points for $x = 1$, $x = 3$, and $x = 9$. Then state the vertical asymptote.

ANSWER _____

APPLY IT Show your work

- 1** A student club streams a tournament. Its live-viewer model is $V = 4(3^t)$, where t is the number of hours after the stream starts. How many hours after the start will the model show 108 viewers?

WORK SPACE

ANSWER _____

- 2** In a coding challenge, a player's level is modeled by $L = \log_3(p)$, where p is the number of points earned. How many points are needed to reach level 4?

WORK SPACE

ANSWER _____

CHALLENGE One step up

CHALLENGE

Solve $\log_3(x - 1) + \log_3(x - 3) = 2$. State which solution is valid and why.

PART 1 · PRACTICE

#	PROBLEM	ANSWER
1	Solve $3^{(x+1)} = 81$.	x = 3
2	Solve $\log_4(x) = 3$.	x = 64
3	Solve $27^{(x-1)} = 1/9$.	x = 1/3
4	Solve $\ln(x) = 0$.	x = 1
5	For $y = 3^x - 4$, give the points for $x = 0$, $x = 1$, and $x = 3$. Then state the horizontal asymptote.	Points: (0, -3), (1, -1), (3, 23); horizontal asymptote: y = -4
6	For $y = \log_3(x) - 1$, give the points for $x = 1$, $x = 3$, and $x = 9$. Then state the vertical asymptote.	Points: (1, -1), (3, 0), (9, 1); vertical asymptote: x = 0

PART 2 · APPLY IT

- t = 3 hours** Set $4(3^t)$ equal to 108 and divide by 4 to get $3^t = 27$. Since $27 = 3^3$, $t = 3$.
- p = 81 points** Set $\log_3(p)$ equal to 4. Rewrite in exponential form as $p = 3^4 = 81$.

CHALLENGE

$x = 2 + \sqrt{10}$. The other solution, $2 - \sqrt{10}$, is invalid because both logarithm inputs must be positive, so x must be greater than 3.

Accept equivalent forms such as $x = (4 + \sqrt{40})/2$ for the challenge. For graph items, accept correctly labeled equivalent point sets only if they use the requested x-values and give the correct asymptote.