Exponential Inverses

KNOW	DO	UNDERSTAND
The inverse of an exponential is a log of the same base and knows the domain and range of a log function.	Can find the exact equation in base e to an exponential. Can graph an exponential function. Can use logs to solve exponentials.	*Inverse Characteristics*: Can analyze a log using exponential functions and then inverting.

Vocab & Notation

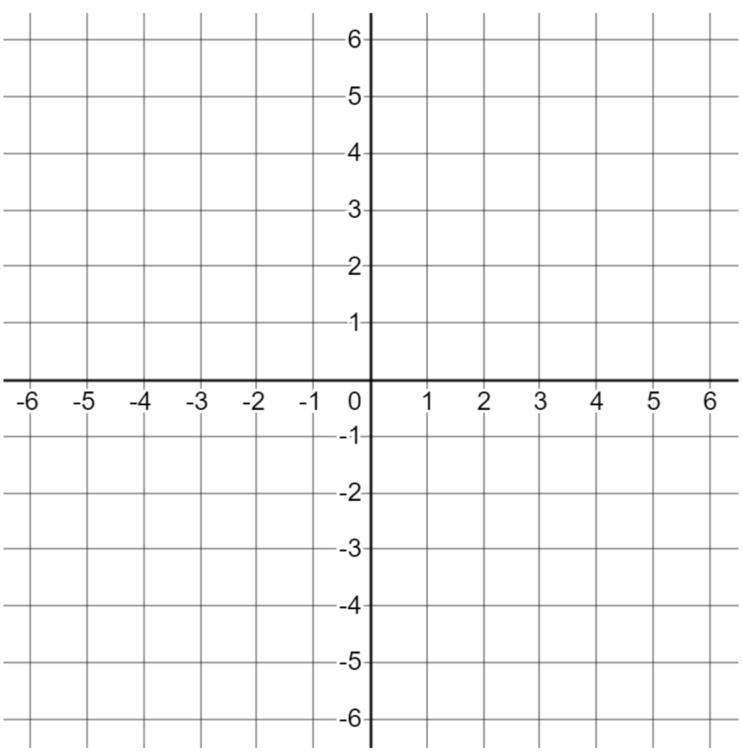
- Logarithm, $\log x$
- Natural log, $\ln x$

To graph an exponential, we work backwards. Identify the transformations that took place and then add those to the graph.

- Vertical shift
- Horizontal shift
- Vertical stretch
- Horizontal stretch
- Base

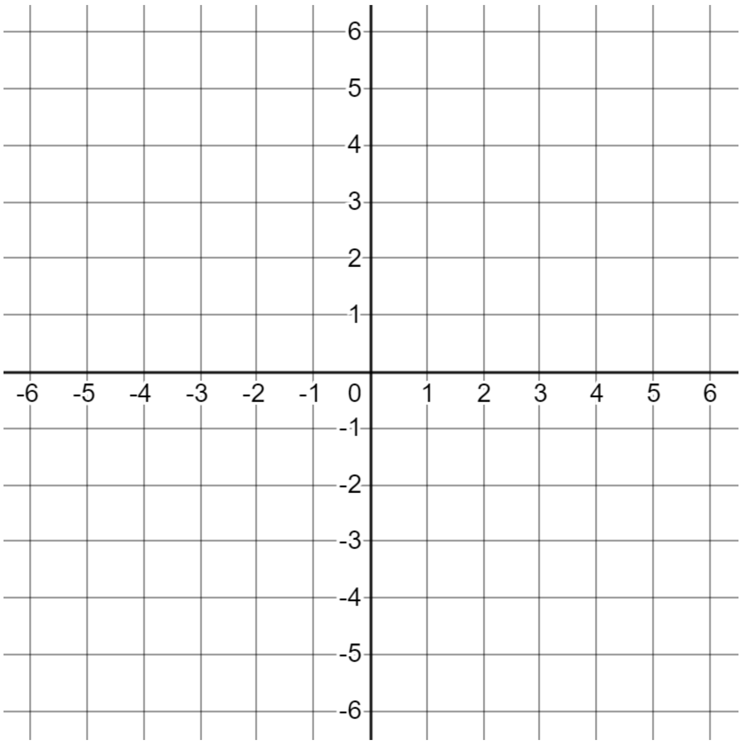
Example: Graph

$$f(x) = -3\left(\frac{5}{3}\right)^{\frac{x+1}{4}} + 6$$

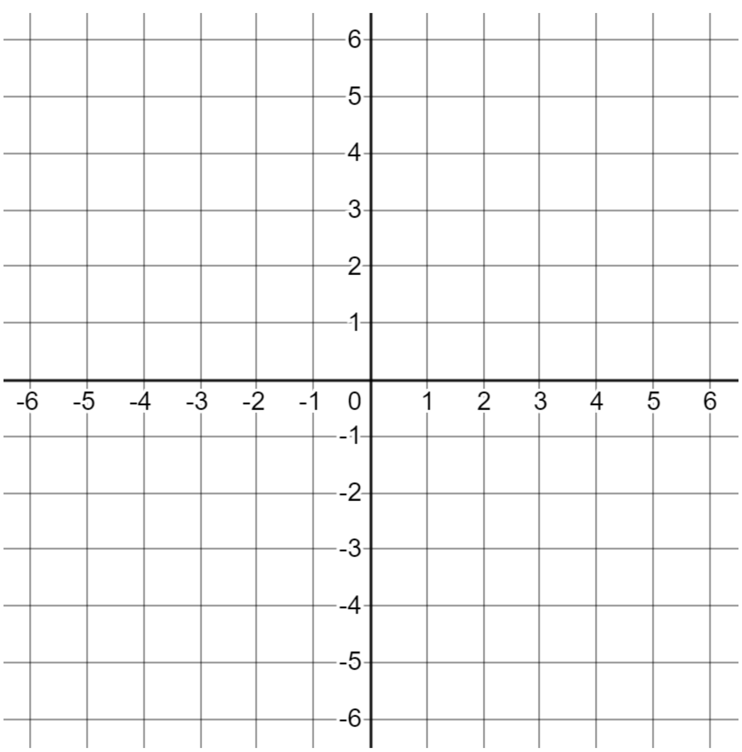


Practice: Graph the following functions.

$$g(x) = 2\left(\frac{2}{3}\right)^{\frac{x-2}{5}} - 1$$



$$h(x) = -7\left(\frac{2}{7}\right)^{\frac{x+4}{6}} + 4$$



Notice that the exponential function is

Since the exponential function $f(x) = b^x$ needs that the base $b > 0$ and $b \neq 1$, we have the same restriction on the function $f^{-1}(x) = \log_b x$.
There are three common bases that you will use depending on your field.

- Engineering: Base 10

- Science and Mathematics: Base e

- Computer Science: Base 2

Example: Solve for k

$500 = 10^k$ $\qquad$ $2 = e^k$ $\qquad$ $5 = \ln k$

Practice: Solve for x

$1200 = 10^x$ $\qquad$ $20 = e^x$ $\qquad$ $9 = \log_2 x$

$5 = \frac{1}{4^k}$ $\qquad$ $3 = \log k$ $\qquad$ $8 = \ln x$

$17 = \ln(e^k)$ $32 = 10^{\log k}$ $22 = \ln(\ln k)$

This now gives us the tool to put an exponential function b^x exactly in the form of e^{kx} and we can solve exponential functions.

Example: Find the zeros of the functions we graphed

$$f(x) = -3\left(\frac{5}{3}\right)^{\frac{x+1}{4}} + 6$$

$$g(x) = 2\left(\frac{2}{3}\right)^{\frac{x-2}{5}} - 1$$

Practice Problems: 8.1 page 380-381 # 1, 4-9, 12-15, 20-24