CCSS Advanced Algebra 4 Translating Exponents to Logarithms

1. Convert each exponential equation into a logarithmic equation and use a calculator to solve for x:

a. $3^x = 40$

$\log_3 3^x = \log_3 40$

$x = \log_3 40 = \frac{\log 40}{\log 3}$

$x = 3.36$

b. $12^{2x} = 1728$

$\log_{12} 12^{2x} = \log_{12} 1728$

$2x = \log_{12} 1728 = \frac{\log 1728}{\log 12}$

$2x = 3$, $x = 3/2$

c. $4^x + 5 = 40$

$4^x = 35$

$\log_4 4^x = \log_4 35$

$x = \log_4 35 = \frac{\log 35}{\log 4}$

$x = 2.56$

d. $\frac{10(2)^{x+4}}{10} = \frac{640}{10}$

$2^{x+4} = 64$

$\log_2 2^{x+4} = \log_2 64$

$x + 4 = 6$

$x = 2$

e. $5(3)^x - 7 = 42$

$\frac{5(3)^x}{5} = \frac{49}{5}$

$3^x = 49/5$

$\log_3 3^x = \log_3 (49/5)$

$x = \log_3 (49/5) = 2.08$

2. Convert each logarithmic equation into an exponential equation and use a calculator to solve for x:

a. $\log_8(x) = 2$

$8^{\log_8(x)} = 8^2$

$x = 64$

b. $\log_3(x + 5) = 4$

$x + 5 = 3^4$

$x + 5 = 81$

$x = 76$

c. $\log_2(x) + 3 = 2$

$\log_2 x = -1$

$2^{-1} = x$

$\frac{1}{2} = x$

d. $\frac{3\log_{10}(x)}{3} = \frac{-6}{3}$

$10^{\log_{10}(x)} = 10^{-2}$

$x = 10^{-2}$

$x = 1/100$

e. $2\log_6(x) - 1 = 5$

$\frac{2\log_6 x}{2} = \frac{6}{2}$

$6^{\log_6 x} = 6^3$

$x = 216$

3. Find the inverse of each function below:

a. $f(x) = 3(2)^x - 1$

$f^{-1}(x) = \log_2\left(\frac{x+1}{3}\right)$

b. $g(x) = 4^{x-3} + 5$

$g^{-1}(x) = \log_4(x - 5) + 3$

c. $h(x) = \log_3(x - 5) + 2$

$h^{-1}(x) = 3^{x-2} + 5$

d. $j(x) = 5\log_{10}(2x - 1)$

$j^{-1}(x) = \frac{10^{x/5} + 1}{2}$

4. Consider the tables below. For each table, complete problems a-c.
   a. Does the table show an exponential or a logarithmic function? How do you know?
   b. Create a table for the inverse function
   c. Write rules for the original table and for the inverse table.

Original — Log: x is multiplying, not y.

x	2/3	2	6	18	54
y	0	1	2	3	4

Inverse

x	0	1	2	3	4
y	2/3	2	6	18	54

Rules: f(x) = $\log_3\left(x \div \frac{2}{3}\right) = \log_3\left(\frac{3x}{2}\right)$ $f^{-1}(x) = \frac{2}{3}(3)^x$

Original — Exponential: y is multiplying

x	0	1	2	3	5	7
y	5/3	5	15	45	405	3645

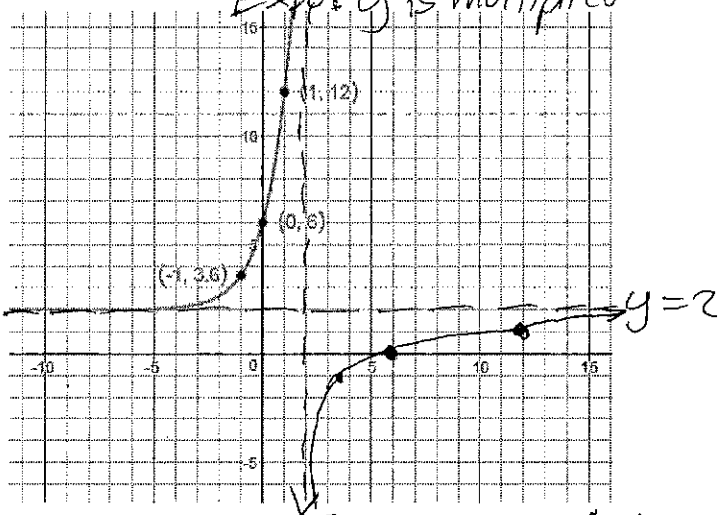
Inverse

x	5	45	405	3645
y	1	3	5	7

Rules: g(x) = $\frac{5}{3}(3)^x$ $g^{-1}(x) = \log_3\left(x \div \frac{5}{3}\right) = \log_3\left(\frac{3x}{5}\right)$

5. Consider the graphs below. For each graph, complete problems a-c.
   a. Does the graph depict an exponential or logarithmic curve? How do you know?
   b. Draw the inverse graph on the same coordinate plane
   c. Write rules for the original graph and the inverse graph.

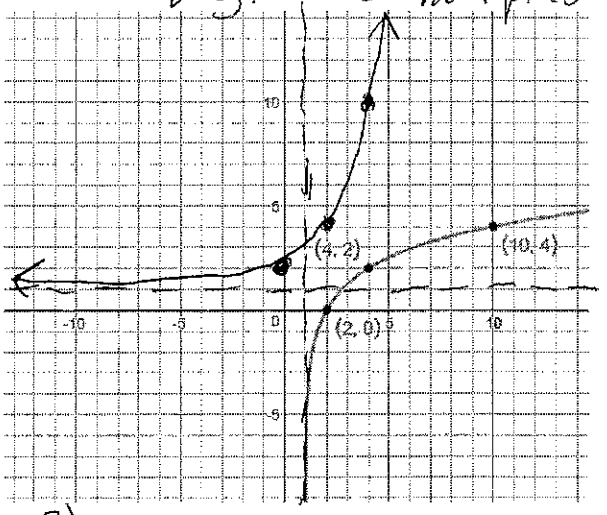
Expo: y is multiplied



x=2

$y = 4(2.5)^x + 2$

Log: x is multiplied



x=1

$y^{-1} = \log_{2.5}\left(\frac{x-2}{4}\right)$