

8.2 Transformations of Logarithmic Functions



"I can apply transformations to the logarithmic (parent) function, both algebraically and graphically."

Complete "*INVESTIGATE the Math*" on pp.452-454 (A to N) using **desmos**

Quick demo, adjusting the domain and range, and

$y = \log_{10}(x)$

✓ X-Axis
 $-10 \leq x \leq 20$ Step:

✓ Y-Axis
 $-5 \leq y \leq 5$ Step:

Solutions (from Guide) on next slide.

When finished:

READ EXAMPLE 1 and its Solution on p. 454,
then read EXAMPLE 2 and its Solution on p. 456.

Today's Entertainment: pp.457-458 457 #1bc, 3b, 4ii, 4iv, 4vi*, 5bde, 7, 8*, 9, 11

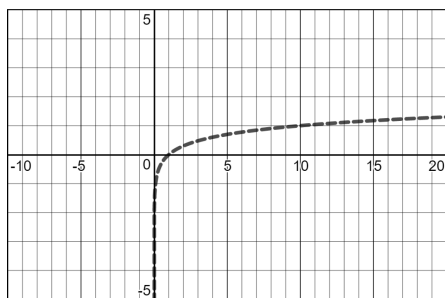
*Note: *The answer for 4vi(a) is incorrect*

The answer for 8a should be $f(x) = -3\log_{10}\left(\frac{1}{2}(x-5)\right) + 2$

The answer for 8b should be (25, -1).

8.2 Transformations of Logarithmic Functions (*Solutions*)

A.



$$y = a \log(k(x-d)) + c$$

- B., C. Changing the value of d translates the graph horizontally d units. The vertical asymptote shifts from $x = 0$ to $x = d$. The x -intercept shifts from $(1, 0)$ to $(1 + d, 0)$. If $d > 0$, the graph shifts right; if $d < 0$, the graph shifts left.
- D., E. Changing the value of c translates the graph vertically c units. The vertical asymptote does not change. The x -intercept shifts from $(1, 0)$ to $(1, c)$. If $c > 0$, the graph shifts up; if $c < 0$, the graph shifts down.
- F. Translate the graph d units horizontally (direction determined by the sign), and c units vertically (direction determined by the sign).
- G., H. Changing the value of a stretches (when $|a| > 1$) or compresses (when $0 < |a| < 1$) the graph. When the a is negative, the graph is reflected in the x -axis.
- I., J. Changing the value of k compresses or stretches the graph. When $|k| > 1$, the graph is compressed horizontally by a factor of $|\frac{1}{k}|$.

When $0 < |k| < 1$, the graph is stretched horizontally by a factor of $|\frac{1}{k}|$. If k is negative, the graph is reflected in the y -axis.

- K. If $|a| > 1$, the graph should be stretched vertically by a factor of $|a|$. If $0 < |a| < 1$, the graph should be compressed vertically by a factor of $|\frac{1}{a}|$. If $|k| > 1$, the graph should be compressed horizontally by a factor of $|\frac{1}{k}|$. If $0 < |k| < 1$, the graph should be stretched horizontally by a factor of $|\frac{1}{k}|$. If a is negative, the graph is reflected in the x -axis. If k is negative, the function is reflected in the y -axis.

Answers to Reflecting

L. $y = \log_{10}(x - d)$: $D = \{x \in \mathbf{R} | x > d\}$, $R = \{y \in \mathbf{R}\}$

$y = \log_{10}x + c$: $D = \{x \in \mathbf{R} | x > 0\}$, $R = \{y \in \mathbf{R}\}$

$y = \log_{10}(kx)$: $D = \text{when } k > 0 \{x \in \mathbf{R} | x > 0\}$, $R = \{y \in \mathbf{R}\}$

$D = \text{when } k < 0 \{x \in \mathbf{R} | x < 0\}$, $R = \{y \in \mathbf{R}\}$

$y = a \log_{10}x$: $D = \{x \in \mathbf{R} | x > 0\}$, $R = \{y \in \mathbf{R}\}$

- M. The functions can be written in the same form as transformed functions of other types, making it possible to determine the values of a , k , c , and d .
- N. The graph is stretched or compressed horizontally, depending on the value of k and is stretch or compressed vertically, depending on the value of a . If $k < 0$, the graph is reflected across the y -axis. If $a < 0$, the graph is reflected across the x -axis. The graph is translated vertically $|c|$ units and is translated horizontally $|d|$ units.