Sketching Graphs of Logarithmic Functions

Summary

All logarithm functions $y = \log_b(x)$, whatever the base $b > 1$, have the same shape as $y = \ln(x)$.

The domain of log functions are all positive reals; the range is all reals.

The y-axis is a vertical axis for logarithm functions.

The x-intercept for logarithm functions is (1, 0) because $\log_b(1) = 0$.

Since $\log_b(ax) = \log_b(a) + \log_b(x)$ the graph of $y = \log_b(ax)$ can be thought of as both a horizontal stretching (or compression) of the basic logarithm graph by a factor of a, or as a vertical shift of the same graph by $\log_b(a)$.

Problems

Do these problems without a calculator. for each function

a) Sketch a graph
b) Identify its domain and range
c) Identify the equation of its asymptote(s)
d) Identify the coordinates of its intercept(s)

1. $y = 3\ln(4x) + 1$

2. $y = \ln(x - 4) - 1$

3. Find all solutions to the equation $x \ln(3x) = x$

4. Find the x-intercept of the graph of $y = (9 + x) \ln(6 - x)$. Does the graph have a high point or a low point between the intercepts? Explain.

5. Does the graph of $y = 8 - 2x$ intersect the graph of $y = \ln(x)$? Find as small an interval of x-values as you can which you are certain must include a point of intersection. Explain.

6. How many times does the graph of $y = \ln(2x)$ intersect the graph of $y = 4 - \ln(-x)$. Explain.