Lesson Notes 7-4 Characteristics of Logarithmic Functions

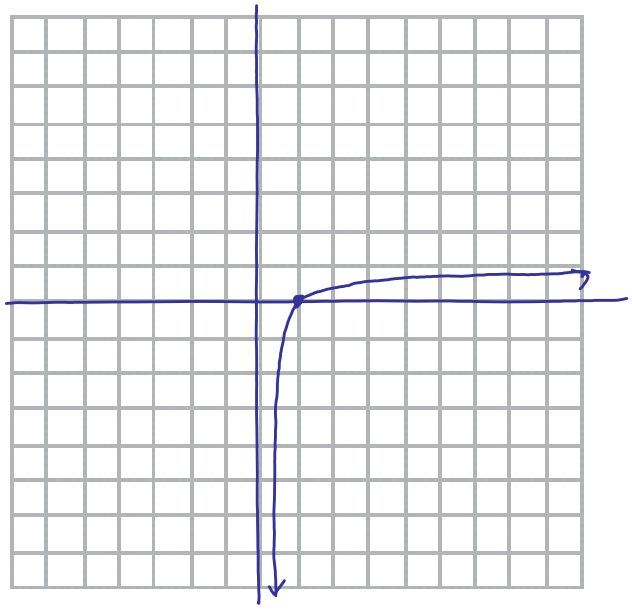
The function $y = \log_{10}x$ is equivalent to $x = 10^y$, so a logarithm is an exponent. The meaning of $\log_{10}x$ is "the exponent that must be applied to base 10 to get the value of x". For example, $\log_{10}100 = 2$.

The expression $\log_{10}x$ is known as the common logarithm or a logarithm with a base of 10. The expression is often written without the 10, so the two functions $y = \log_{10}x$ and $y = \log x$ are equivalent.

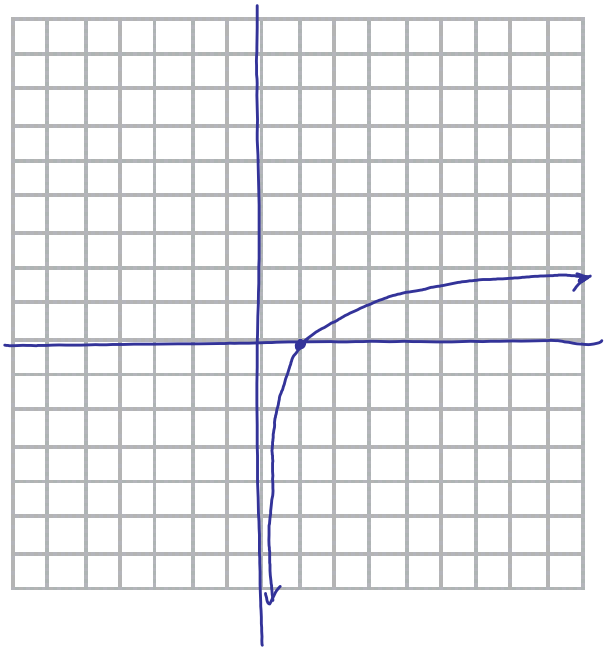
The symbol e is a constant known as Euler's number. It is an irrational number that equals 2.718…. A logarithm with base e is called the natural logarithm and is written as lnx.

Complete the table of values for the following functions and graph the function on the grid provided.

x	f(x) = logx
-1	undefined
0	undefined
1	0
2	0.301
3	0.477
4	0.602
5	0.699
6	0.778
7	0.845
8	0.903
9	0.954
10	1



x	g(x) = 2logx
-1	undefined
0	undefined
1	0
2	0.602
3	0.954
4	1.204
5	1.398
6	1.556
7	1.690
8	1.806
9	1.908
10	2



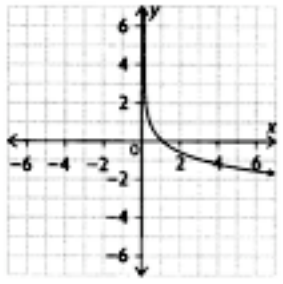
Example 1: Complete the table to predict the characteristics of each function.

Function	x-intercept	Number of y-intercepts	End Behaviour	Domain	Range	Increasing (+) or Decreasing (-)
y = -4logx	1	none	$1V \to 1$	$x > 0$	$y \in \mathbb{R}$	decreasing
y = 13lnx	1	none	$1V \to 1$	$x > 0$	$y \in \mathbb{R}$	increasing
y = 20logx	1	none	$1V \to 1$	$x > 0$	$y \in \mathbb{R}$	increasing
y = -10lnx	1	none	$1V \to 1$	$x > 0$	$y \in \mathbb{R}$	decreasing

Example 2: Match each function with it corresponding graph.

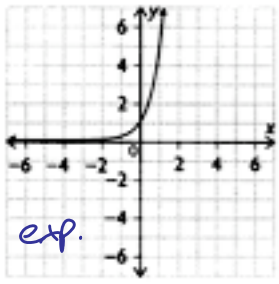
i) $y = 3.6\log x$ ↙ increasing (ii) $y = -2\log x$ ↙ dec (iii) $y = 5^x$ exponential

a)



ii

b)



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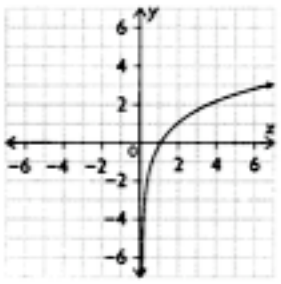
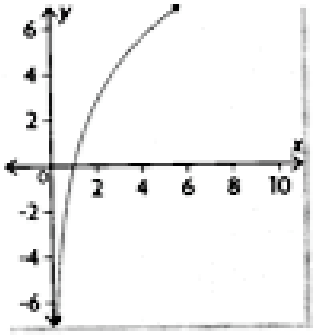
c)



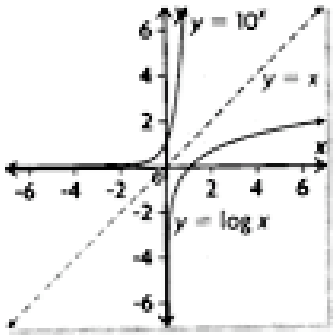
i

The graph of a logarithmic function of the form f(x) = alogx or f(x) = alnx will look like one of the following cases.

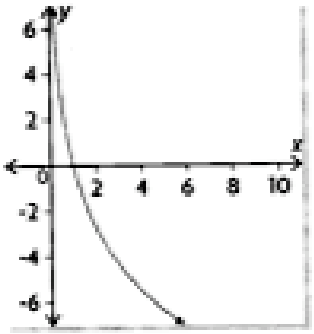
Case 1: an increasing function, where $a > 0$



- The graph of $y = \log x$ is a reflection of the graph of $y = 10^x$ about the line $y = x$.



Case 2: a decreasing function, where $a < 0$



- The graph of $y = \ln x$ is a reflection of the graph of $y = e^x$ about the line $y = x$.