

4.4. Logarithms

$$y = \log_a x \quad \text{if and only} \\ \text{if } x = a^y$$

where $a > 0, a \neq 1$

log and exp. are inverses of each other

$$y = 10^x \quad / \quad y = \log(x) \quad \text{no base implies "10"}$$

$$y = e^x \quad / \quad y = \ln(x) \quad \ln \Rightarrow \text{base is "e"}$$

ex) change $e^c = 9$ to log. statement

$$\log_e 9 = c$$

$$\boxed{\ln 9 = c}$$

change $a^4 = 24$ to log.

$$\log_a(24) = 4$$

ex) change $\log_a 4 = 5$ to exp.

$$a^5 = 4$$

change $\ln(a) = -3$ to exp

$$e^{-3} = a$$

Evaluate logs "find the exact value"

use exponent statement and use the fact that

$$a^x = a^y \Rightarrow x = y$$

ex) evaluate $\log_2 16$

$$\log_2(2^4)$$

$$y = \log_2 16$$

$$2^y = 16$$

$$16 = 2 \cdot 2 \cdot 2 \cdot 2 = 2^4$$

$$y = 4 \Rightarrow \boxed{\log_2 16 = 4}$$

ex) evaluate $\log_3\left(\frac{1}{27}\right)$

(3)

$$y = \log_3\left(\frac{1}{27}\right)$$

$$3^y = \frac{1}{27}$$

$$27 = 3 \cdot 3 \cdot 3 = 3^3$$

$$3^y = \frac{1}{3^3}$$

$$3^y = 3^{-3}$$

$$y = -3$$

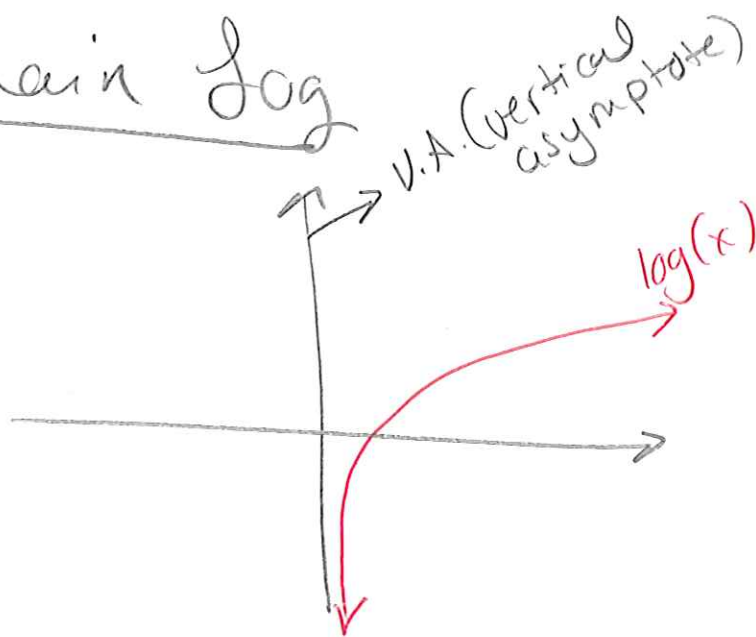
$$\log_3\left(\frac{1}{27}\right) = -3$$

Graph + Domain \log

$$y = \log(x)$$

$$D: (0, \infty)$$

$$R: (-\infty, \infty)$$



find domain of $f(x) = \log_2(x+3)$

$$\begin{aligned} x+3 &> 0 \\ \underline{-3} & \quad \underline{-3} \end{aligned}$$

$$x > -3$$

$$D: (-3, \infty)$$

find the domain of $g(x) = \log_7(-2x+3)$ (4)

$$\begin{array}{r} -2x+3 > 0 \\ \underline{-3} \quad \underline{-3} \end{array}$$

$$\begin{array}{r} -2x > -3 \\ \underline{-2} \quad \underline{-2} \end{array}$$

$$x < 3/2$$

$$D: (-\infty, 3/2)$$

Calculator:

evaluate $\ln\left(\frac{2}{3}\right) \approx -.405$

evaluate $\frac{\ln(2)}{3} \approx .231$

evaluate $\frac{\ln(2)}{\ln(3)} \approx .631$



Assign 4.4: 9-24 all, 25-31 all,
38, 49-52