

5.3 Evaluating Logarithms

recall:

$$\begin{aligned} \text{a) } 2^3 &= 8 \\ \log_2 8 &= 3 \end{aligned}$$

$$\text{b) } \left(\frac{1}{2}\right)^{-4} = 16$$

$$\log_{\frac{1}{2}} 16 = -4$$

Ex 1 Evaluate the following:

$$\text{a) } \log_3 27$$

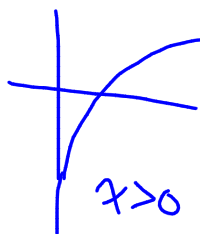
$$\begin{aligned} &= \log_3 3^3 \\ &= 3 \end{aligned}$$

$$\text{b) } \log_4 \left(\frac{1}{64}\right)$$

$$\begin{aligned} &= \log_4 \left(\frac{1}{4}\right)^3 \\ &= \log_4 4^{-3} \\ &= -3 \end{aligned}$$

$$\text{c) } \log_2(-4)$$

UNDEFINED



$$\text{d) } \log_3(\sqrt[3]{9})$$

$$\begin{aligned} &= \log_3 (9)^{\frac{1}{3}} \\ &= \log_3 (3^2)^{\frac{1}{3}} \\ &= \log_3 3^{\frac{2}{3}} \\ &= \frac{2}{3} \end{aligned}$$

Argument must be greater than zero

Ex 2 Determine the approximate value of the following

$$\log_3 16$$

$$= \log_3 3^? \rightarrow \text{between 2 \& 3}$$

$$\hat{=} \log_3 3^{2.5}$$

$$\hat{=} 2.5$$

\rightarrow Approximate!

Consider the following

$$\log_5 1 = x$$

$$5^x = 1$$

$$5^x = 5^0$$

$$\therefore x = 0$$

$$\downarrow$$

$$\log_a 1 = 0$$

exponential
form

$$\log_6 6^x = y$$

$$6^y = 6^x$$

$$\therefore y = x$$

General Rules:

$$\downarrow$$

$$\log_a a^x = x$$

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

write in log form

$$a^x = y \Leftrightarrow \log_a y = x$$

$$\log_6 y = \log_6 x$$

$$\therefore y = x$$

$$\downarrow$$

$$a^{\log_a x} = x$$

Ex 3 Evaluate the following.

a) $\log_5 125 - \log_5 25$

$$= \log_5 5^3 - \log_5 5^2$$

$$= 3 - 2$$

$$= 1$$

b) $\log 1$

$$= 0$$

understood

$$\left\{ \begin{array}{l} = \log_{10} 1 \\ = \log_{10} 10^0 \\ = 0 \end{array} \right.$$

c) $\log_7 \sqrt{7}$

$$= \log_7 7^{\frac{1}{2}}$$

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

d) $\log_2 16 - \log_2 32$

$$= \log_2 2^4 - \log_2 2^5$$

$$= 4 - 5$$

$$= -1$$

e) $\log_9 3$

$$= \log_9 \sqrt{9}$$

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

f) $\log_4 32$ ~~*~~ ??

$$= \log_4 2^5$$

$$= \log_4 (4^{\frac{5}{2}})$$

$$= \log_4 4^{\frac{5}{2}}$$

$$= \frac{5}{2}$$

Homework 5.3:
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9-11, 17

