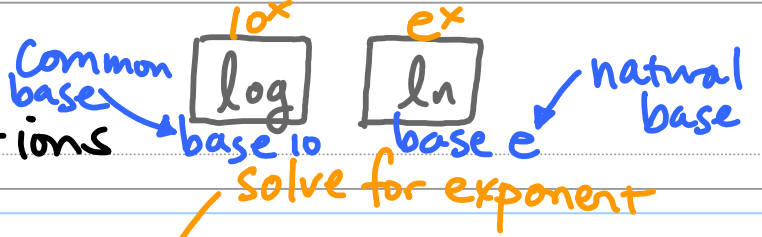


3/12
TUE

3.2) Logarithmic Functions



$$\left. \begin{aligned} 2^x = 4 &\rightarrow x=2 \\ 2^x = 8 &\rightarrow x=3 \end{aligned} \right\}$$

$$2^x = 5 \rightarrow ?$$

$x = \text{somewhere between } 2 \text{ \& } 3.$
 closer to 2

Exponential form \Leftrightarrow logarithmic form

$$2^x = 5$$

base \leftarrow 2, power \leftarrow x, result \leftarrow 5

$$\log_2 5 = x$$

"log base 2 of 5 equals x"

$$b^y = x$$

$$\log_b x = y$$

ex 1) $\log_4 16 = 2 \rightarrow$ exponential form

$$4^2 = 16$$

ex 2) $\log_6 216 = x$. Find x.

\rightarrow convert to exponential form: $6^x = 216$

Convert to the same base
 $6^x = 6^3$ (since $6 \cdot 6 \cdot 6 = 36 \cdot 6 = 216$)
 $\rightarrow x = 3$

ex 3) Change to log form.
 $\sqrt[3]{343} = 7$

$$\log_{343} 7 = \frac{1}{3}$$

ex 4) Change to log form: $e^y = 33$

$$\log_e 33 = y$$

aka

$$\ln 33 = y$$

ex 5) Use a calculator to find:

a) $\log_{10} 57 \approx 1.7559$

b) $\ln 33 \approx 3.4965$

$\log_{10} 57 = x$
 $10^{1.7559} = 57$

ex 6) Evaluate w/out a calculator.

a) $\log_2 4 = x$

b) $\log_3 \sqrt{3}$

$\log_3 \sqrt{3} = x$

→ convert to: $2^x = 4$
 exp form $x = 2$

$3^x = \sqrt{3}$
 $3^x = 3^{\frac{1}{2}}$
 $x = \frac{1}{2}$

c) $\log_5 \frac{1}{\sqrt{5}}$

$\log_5 \frac{1}{\sqrt{5}} = x$

$5^x = \frac{1}{\sqrt{5}}$

$5^x = \frac{1}{5^{\frac{1}{2}}}$
 $5^x = 5^{-\frac{1}{2}}$
 $x = -\frac{1}{2}$

Basic Properties of Logs

$\log_b b = 1$

$\log_b 1 = 0$

$b^x = b^1$

$b^x = 1$

Inverse Properties

$\log_b b^x = x$

$b^{\log_b x} = x$

ex 7) $\log_9 9 = 1$
 $9^x = 9^1$

ex 8) $\log_8 1 = 0$
 $8^x = 1$

ex 9) $\log_6 6^{15} = 15$

ex 10) $\log_7 7^8 = 8$

HW p 410
 #2-42 even
 82-100 even

ex 11) $\log_{10} .0001$

$\rightarrow \log_{10} \frac{1}{10000}$

$\rightarrow \log_{10} \frac{1}{10^4}$

$\rightarrow \log_{10} 10^{-4}$

base 10 → same base

$\rightarrow -4$

$$\text{ex 12) } \ln \sqrt[4]{e} \rightarrow \ln e^{\frac{1}{4}} \rightarrow \boxed{\frac{1}{4}}$$

$$\text{aka } \log_e \sqrt[4]{e} \rightarrow e^x = \sqrt[4]{e} \rightarrow e^x = e^{\frac{1}{4}}$$

$$\text{ex 13) } \ln e^{6x} \rightarrow \boxed{6x}$$