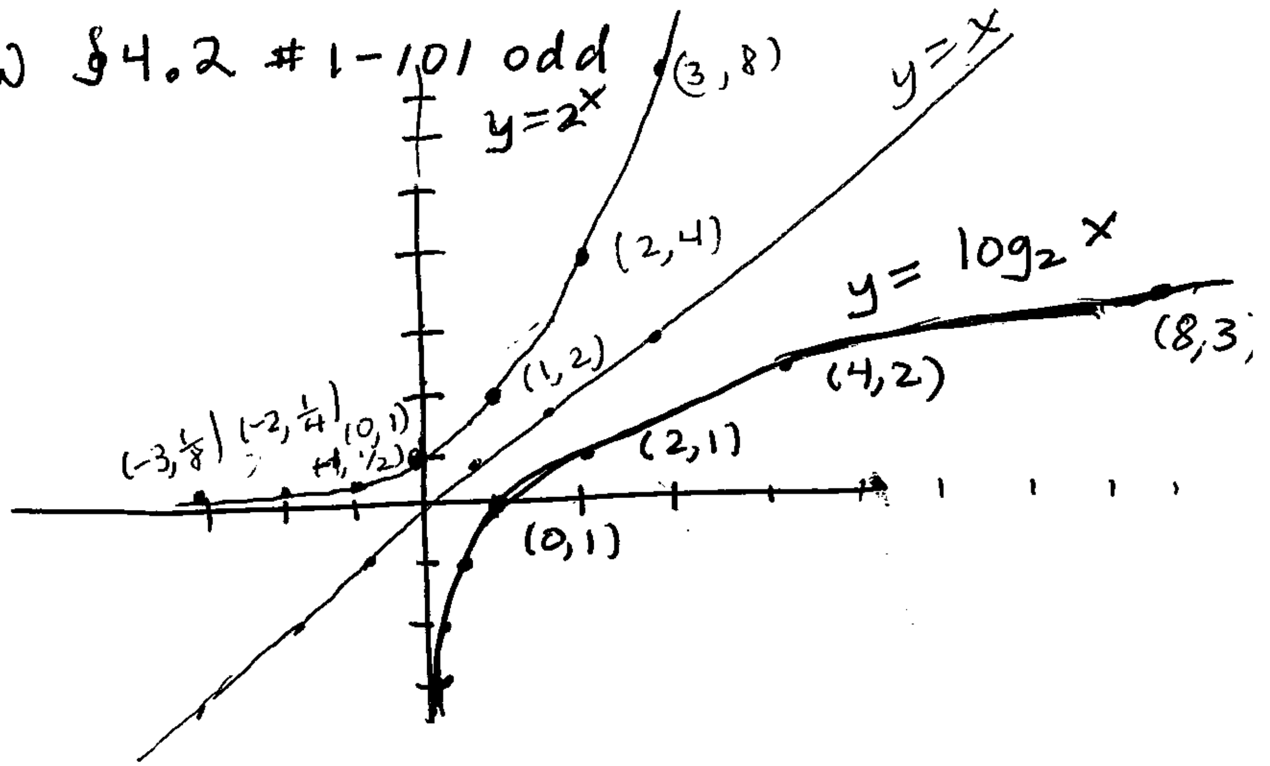
§4.2 Logarithmic Functions and Their Applications

- HW §4.2 #1-101 odd



The inverse of $y=2^x$ is $y=\log_2 x$.

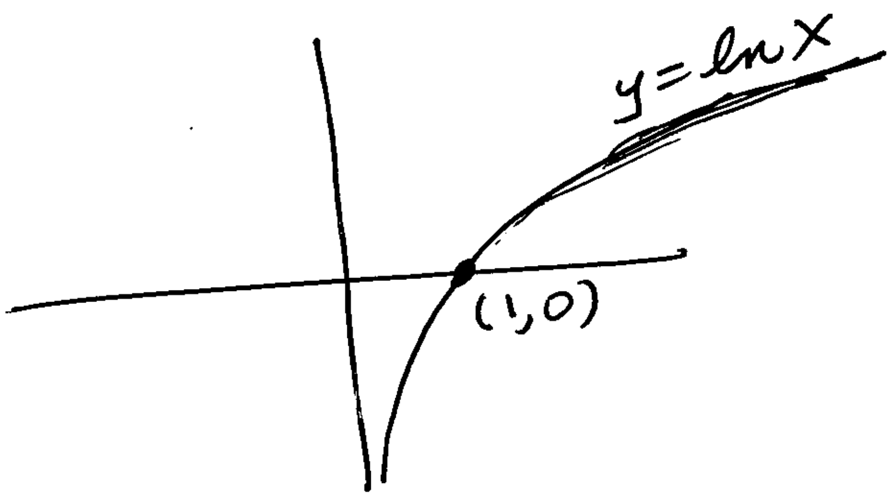
$y=\log_2 x$ is equivalent to $2^y=x$

$y=\log_2 x$

- increasing
- one-to-one
- invertible
- Domain: $x>0$
- Range: $\mathbb{R}$
- Vertical Asymptote: the y-axis

The natural log is written
$y = \ln x$.

- $y = \ln x$ is the inverse of $y = ex$
- $y = \ln x$ means $y = \log_e x$
- $y = \ln x$ means $e^y = x$



<u>EXAMPLE</u> Write the logarithm as an exponent.

SOLUTION

① $3 = \log_2 8$ $\quad$ $2^3 = 8$

exponent $\quad$ base

② $-2 = \log_5 \frac{1}{25}$ $\quad$ $5^{-2} = \frac{1}{25}$

③ $4 = \log_3 81$ $\quad$ $3^4 = 81$

EXAMPLE Write the exponent as a ~~so~~ logarithm.

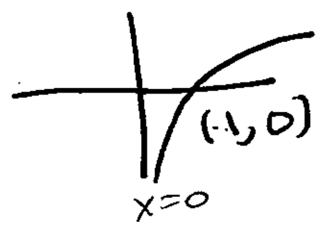
① $7 = 2^x$ ← exponent; base $\qquad x = \log_2 7$

② $a = 3^x$ ← exponent; base $\qquad x = \log_3 a$

- The Common Log. is $y = \log x$ which means $y = \log_{10} x$.

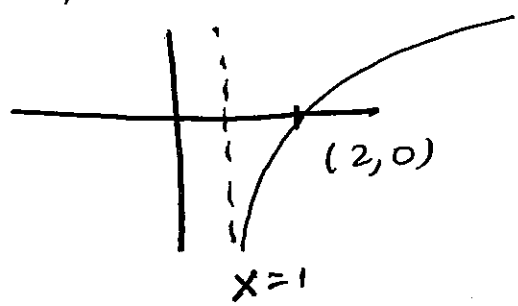
EXAMPLE Sketch the graph.

① $y = \ln x$



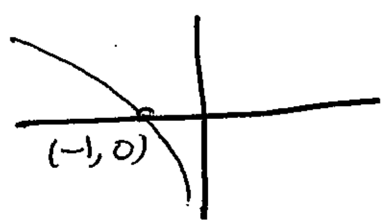
② $y = \ln(x-1)$

moves right by 1



③ $y = \ln(-x)$

reflect about y-axis



④ Bonus: $y = \ln|x|$

$$= \begin{cases} \ln x & \text{if } x > 0 \\ \ln(-x) & \text{if } x < 0 \\ \text{undef} & \text{if } x = 0 \end{cases}$$