

## 4.2: Log Facts

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recall  $f^{-1}(x) = y \Leftrightarrow f(y) = x$ .

~~Def~~ Graphs of  $\exp$  & graphs of the inverse.  
(w/D  $\mathbb{R}$ ).

Defn: Let  $b > 0$  &  $b \neq 1$ . The log fact w/ base  $b$ , denoted  $\log_b$  is defined by

$$\log_b(x) = y \Leftrightarrow b^y = x$$

So,  $\log_b(x)$  is the exponent to which base  $b$  must be raised to give  $x$ .

ex1: convert between forms.

$$10^5 = 100,000$$

$$2^3 = 8$$

$$2^{-3} = \frac{1}{8}$$

$$5^r = q$$

ex2: evaluate

$$\log_{10}(10,000)$$

$$\log_2(32)$$

$$\log_{0.1}(10)$$

$$\log_{16}(2)$$

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Common logs.

ex3: The loudness (dB) of a sound w/ intensity  $I$  ( $\text{in } \text{W}/\text{m}^2$ ) is given by  $\text{dB} = 10 \log\left(\frac{I}{I_0}\right)$  where  $I_0$  is the intensity of a barely audible sound.

- how many dB is  $I_0$  (more intense)
- a whisper is 1000x louder than  $I_0$ , how many dB
- a normal conversation is at 60 dB, how many times more intense is this than a whisper.

Basic Properties

- $\log_b(1) = 0$
- $\log_b(b) = 1$
- $\log_b(b^x) = x$
- $b^{\log_b(x)} = x, x > 0$

Natural log.

ex4: Find the domain of  $f(x) = \ln(4-x^2)$

ex5: Find the inverse of  $g(x) = 3 \cdot 10^{-4x}$

