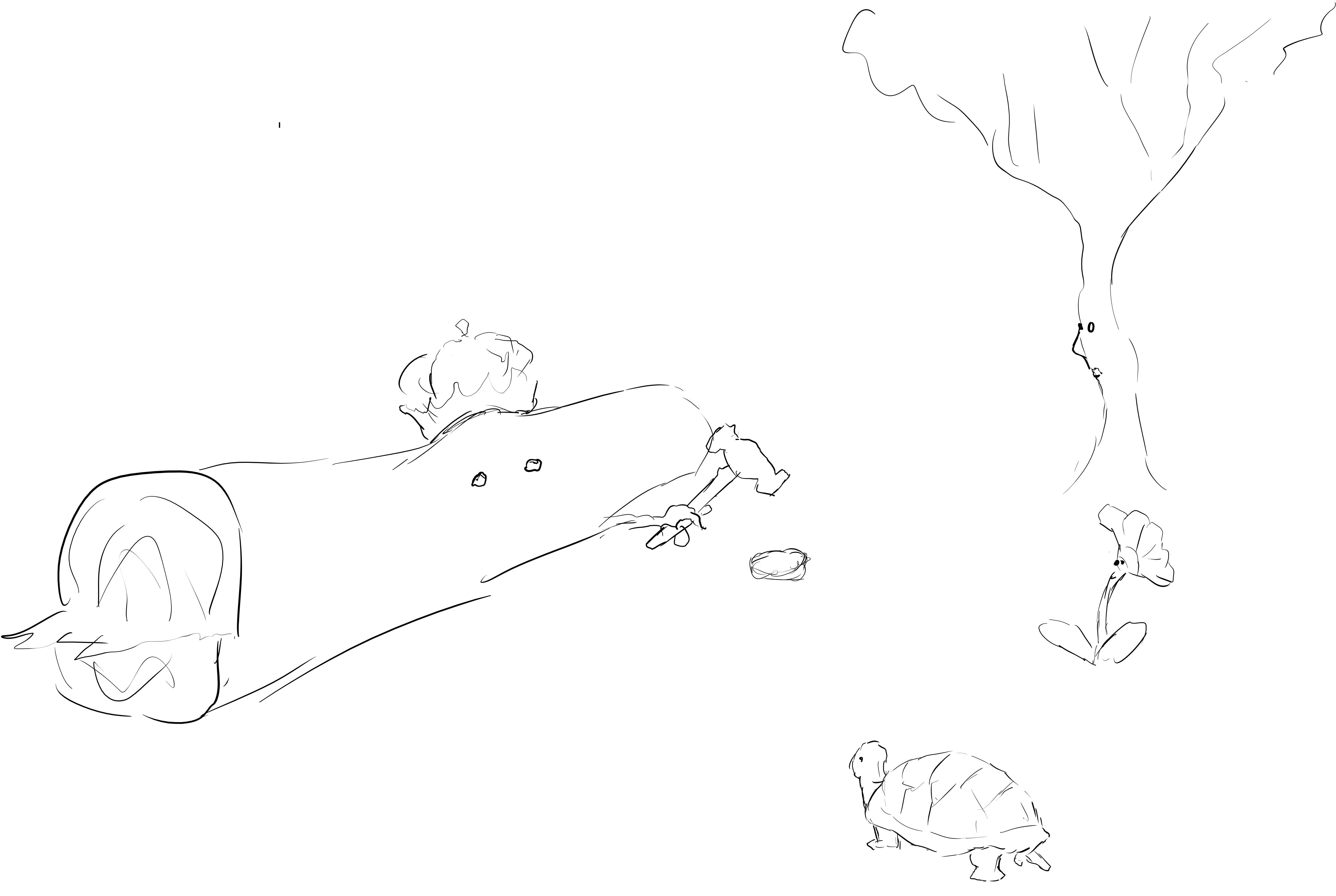


$$b^x = y \quad \equiv \quad \log_b(y) = x$$

$\log_b(y) \simeq$ # digits (of b) needed to represent y

$\log_2(y) \simeq$ how many times I can cut y in half

$$\log_b(x \cdot y) = \log_b(x) + \log_b(y)$$

$$\log_b(x) = \frac{\log_a(x)}{\log_a(b)}$$

4483

2102

34

messy

if x, y > 0

$$\log_{b}(x + y) = \max(\log_b(x), \log_b(y)) + \begin{matrix}0\\1\end{matrix}$$

10

$$\log_b\left(\frac{x}{y}\right) = \log_b\left(x \cdot y^{-1}\right) = \log_b(x) + \underbrace{\log_b\left(y^{-1}\right)} = \log_b(x) - \log_b(y)$$

$$\underbrace{\log_b\left(x^{a}\right)} = \log_b\left(\overbrace{x \cdot x \cdot x \cdots x}^{a}\right) = \overbrace{\log_b(x) + \log_b(x) + \cdots + \log_b(x)}^{a} = \underbrace{a \log_b(x)}$$

binary base-2 numbers

decimal base-10 numbers

2102

1000

$$\text{digits} = 1 + \lfloor \underbrace{\log_b(x)} \rfloor$$

bits to rep 17-digit #?

~57 bits

$$\underbrace{\log_{10}(2102)}_{4} = \frac{\overbrace{\log_2(2102)}}{\log_2(10)}$$

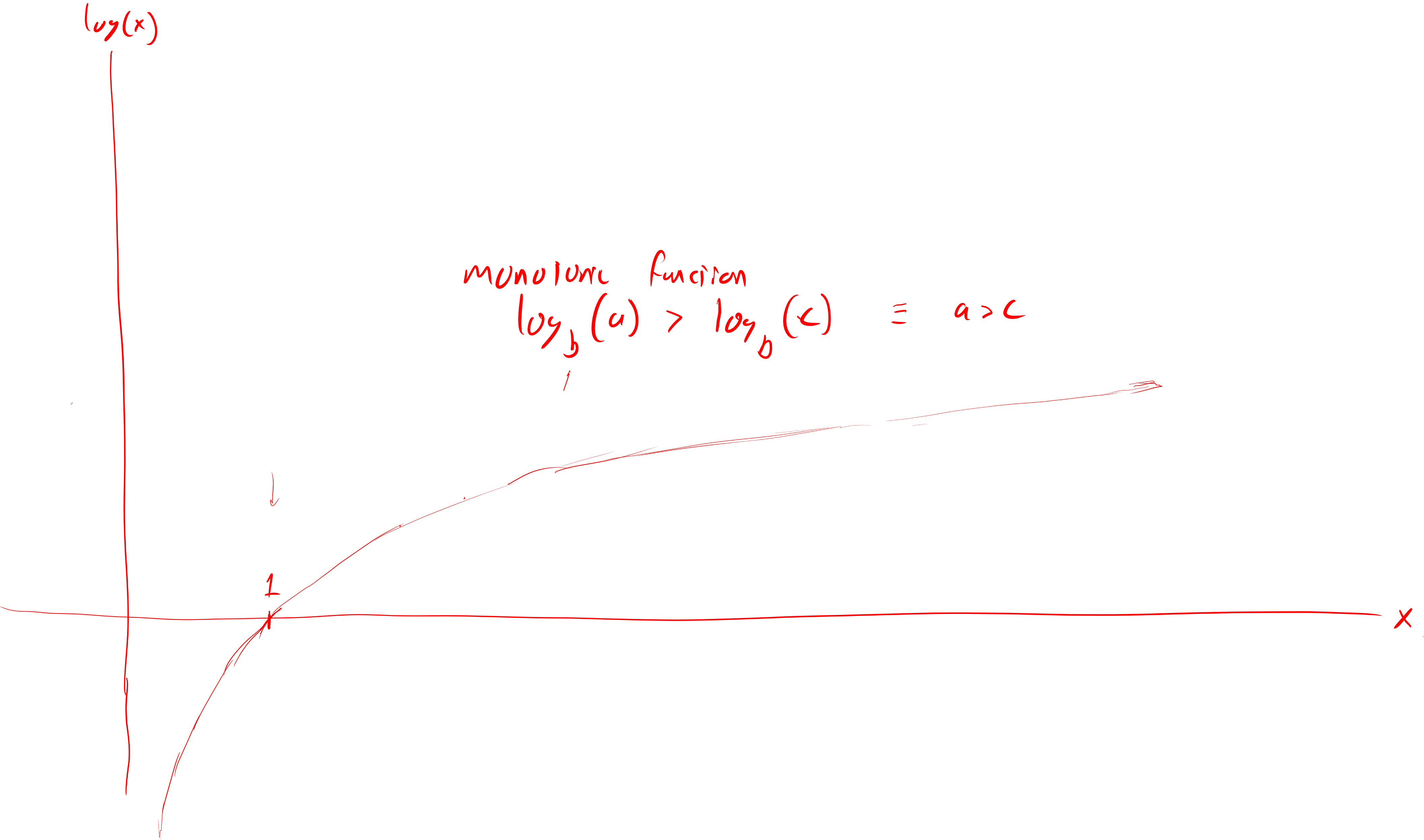
$\times \underbrace{3.3219\ldots} = \log_2(10)$

~12.6 bits

$$\log_b(1) = 0 \equiv b^0 = 1$$

monotonic function

$$\log_b(a) > \log_b(c) \equiv a > c$$



$$\log_{x^y}(z) = \frac{\log_x(z)}{\log_x(x^y)} = \frac{\log_x(z)}{y}$$

net : $\log_{256} = \log_{2^8}$

Hw : $\log_2$

$$\log_x(x^y) = y \cdot \log_x(x) = y \cdot 1 = y$$

$$\log_3(5) - \log_6(8)$$

$$- \log_3\left(5^{\log_3(6)}\right) = \log_3\left(6^{\log_3(5)}\right)$$

$$\cancel{\log_3(5+6)}$$

$$= \log_3(5) - \frac{\log_3(8)}{\log_3(6)} = \frac{\boxed{\log_3(5)\log_3(6)} - \log_3(8)}{\log_3(6)}$$

$$\log(a \cdot b) = \log(a) + \log(b)$$

$$\log\left(\frac{a}{b}\right) = \log(a) - \log(b)$$

$$\log(a^b) = b \cdot \log(a)$$

$$\log_b(x) = \frac{\log_c(x)}{\log_c(b)}$$

$$= \frac{\log_3\left(6^{\log_3(5)}\right) - \log_3(8)}{\log_3(6)}$$

$$= \frac{\log_3\left(\frac{6^{\log_3(5)}}{8}\right)}{\log_3(6)} = \log_6\left(\frac{6^{\log_3(5)}}{8}\right)$$

$$= \log_6\left(6^{\log_3(5)}\right) - \log_6(8)$$

$$= \log_3(5) - \log_6(8)$$

$$\log_3(5)\cdot\log_5(3) = 1 \qquad\qquad \log_x(y) = \frac{1}{\log_y(x)}$$

$$= \frac{\cancel{\log_b(5)}}{\cancel{\log_b(3)}}\cdot\frac{\cancel{\log_b(3)}}{\cancel{\log_b(5)}} = 1$$

$$\log_5\left(3^{\log_3(5)}\right) = \log_5(5) = 1$$

$$\log_3\left(5^{\log_5(3)}\right) = \log_3(3) = 1$$

$$\frac{\log_5(5)}{\cancel{\log_5(3)}}\,\cancel{\log_5(3)} = 1$$