

Common Logs $\log x = \log_{10} x$

Ex 1 $\log 1000 = \boxed{3}$ $\log_{10} 1000 = x$

$$10^x = 1000$$

$$10^x = 10^3$$

$$x = 3$$

$$\log 0.005832 = \boxed{-2.2341}$$

Natural logs $\ln x = \log_e x$

$$y_1 = \log x$$

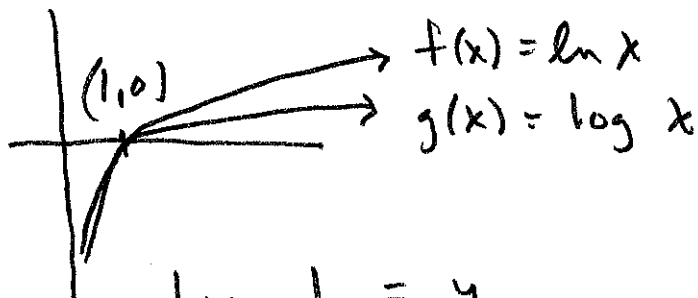
$$y_2 = \ln x$$

Window: $x_{\min} = 0$

$$x_{\max} = 5$$

$$y_{\min} = -2$$

$$y_{\max} = 3$$



$$\log_{10} 1 = 0$$

$$10^0 = 1$$

$$y = 0 \Rightarrow \text{point } (1, 0)$$

Valid for $x > 0$

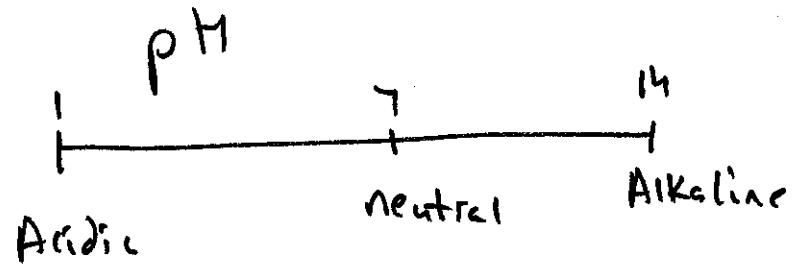
Ex 5 $\ln e^3 = \boxed{3}$

$$\Rightarrow \log_e e^3 = x$$

$$\ln 0.005832 = \boxed{-5.1444}$$

$$e^x = e^3$$

$$\boxed{x = 3}$$



$$pH = -\log [H_3O^+]$$

← hydronium ion concentration

Ex 2

Find the pH of a solution with

$$[H_3O^+] = 2.5 \times 10^{-4}$$

$$pH = -\log [2.5 \times 10^{-4}] = -\log [2.5 \text{ EE } -4]$$

$$= \boxed{3.6}$$

$$\downarrow - [\log 2.5 + \log 10^{-4}]$$

$$[H_3O^+] = 6.8 \times 10^{-6}$$

Find pH

$$pH = -\log [6.8 \times 10^{-6}] = -\log [6.8 \text{ EE } -6]$$

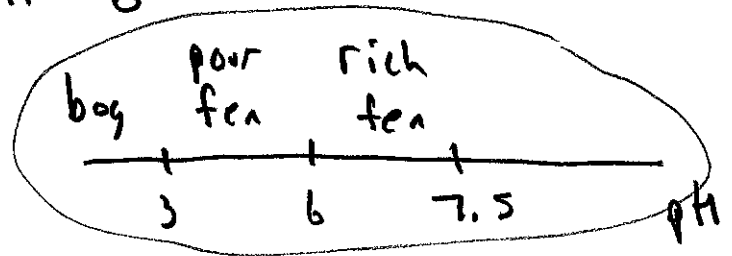
$$pH = \boxed{5.2}$$

Wetlands are classified as

rich fen $6 < \text{pH} < 7.5$

poor fen $3 < \text{pH} < 6$

bog $\text{pH} \leq 3$



Ex 3 Suppose hydronium ion concentration of a sample of water from a wetland is 6.3×10^{-5} . How is the wetland classified?

$$\text{pH} = -\log[6.3 \times 10^{-5}] \approx 4.2 \rightarrow \text{POOR FEN}$$

Ex 4 Loudness of Sound is measured in decibels (dB)

$$d = 10 \log \frac{I}{I_0} \leftarrow \text{reference level}$$

Find the decibel rating d of a sound with intensity $10,000 I_0$.

$$d = 10 \log \left(\frac{10,000 I_0}{I_0} \right)$$

$$= 10 \log(10,000)$$

$$d = 10(4) = \boxed{40}$$

Richter Scale
Earthquake

$$\log_{10} \frac{I}{I_0}$$