

1. Solve for x.

$$\begin{aligned} \text{(a)} \quad & 5 * 10^{5x} = 3 \\ & 10^{(5x)} = \frac{3}{5} \\ & \log 10^{(5x)} = \log 0.6 \\ & 5x = \log 0.6 \\ & x = \frac{\log 0.6}{5} \end{aligned}$$

$$\begin{aligned} \text{(b)} \quad & 6 = 2 * 10^{-3x} \\ & 3 = 10^{(-3x)} \\ & \log(3) = \log(10^{(-3x)}) \\ & \log(3) = -3x \\ & x = \frac{\log 3}{-3} \end{aligned}$$

$$\begin{aligned} \text{(c)} \quad & 5e^{3.1x} = 25 \\ & e^{3.1x} = 5 \\ & \ln e^{3.1x} = \ln 5 \\ & 3.1x = \ln 5 \\ & x = \frac{\ln 5}{3.1} \end{aligned}$$

$$\begin{aligned} \text{(d)} \quad & \log 10^x = 4 \\ & x = 4 \end{aligned}$$

$$\begin{aligned} \text{(e)} \quad & \ln(4 - x) = \frac{1}{2} \\ & e^{0.5} = 4 - x \\ & x = 4 - e^{0.5} \end{aligned}$$

$$\begin{aligned} \text{(f)} \quad & \ln(x^2 - 3) = 0 \\ & e^0 = x^2 - 3 \\ & 1 = x^2 - 3 \\ & 4 = x^2 \\ & x = \pm 2 \end{aligned}$$

$$\begin{aligned} \text{(g)} \quad & 2 \log(2x + 5) + 6 = 0 \\ & \log(2x + 5) = -3 \\ & 10^{-3} = 2x + 5 \\ & 0.001 - 5 = 2x \\ & -4.999 = 2x \\ & x = -2.4995 \end{aligned}$$

$$\begin{aligned} \text{(h)} \quad & \ln(\ln 3x) = 0 \\ & e^0 = \ln 3x \\ & 1 = \ln 3x \\ & e^1 = 3x \\ & x = \frac{e^1}{3} \end{aligned}$$

$$\begin{aligned} \text{(i)} \quad & \ln(x + 3) + \ln(x - 3) = \ln(7) \\ & \ln[(x + 3)(x - 3)] = \ln(7) \\ & x^2 - 9 = 7 \\ & x^2 = 16 \\ & x = \pm 4 \end{aligned}$$

Answer is  $x = 4$  since  $-4$  doesn't work in the original problem.

$$\begin{aligned} \text{(j)} \quad & \log(x - 2) + \log(x + 4) = \log 7 \\ & \log[(x - 2)(x + 4)] = \log 7 \\ & x^2 + 2x - 8 = 7 \\ & x^2 + 2x - 15 = 0 \\ & (x + 5)(x - 3) = 0 \\ & \text{Answer } x=3 \text{ since } -5 \text{ doesn't work in the} \\ & \text{original problem.} \end{aligned}$$

$$\begin{aligned} \text{(k)} \quad & \log_x(15 - 2x) = 2 \\ & x^2 = 15 - 2x \\ & x^2 + 2x - 15 = 0 \\ & x = -5 \text{ or } x = 3 \\ & \text{Answer: } x = 3 \end{aligned}$$

$$\begin{aligned} \text{(l)} \quad & \log_x(12x - 20) = 2 \\ & x^2 = 12x - 20 \\ & x^2 - 12x + 20 = 0 \\ & (x - 2)(x - 10) = 0 \\ & x = 2 \text{ or } x = 10 \end{aligned}$$

2. Use the properties of logarithms to rewrite the following as the sum and/or difference of logarithms

$$\begin{aligned} \text{(a)} \quad & \ln(x + 5)^4 e^5 \\ & \ln(x + 5)^4 + \ln e^5 \\ & 4 \ln(+5) + 5 \end{aligned}$$

$$\begin{aligned} \text{(b)} \quad & \log\left(\frac{100x^4}{y^3}\right) \\ & \log 100 + \log x^4 - \log y^3 \\ & \log 10^2 + 4 \log x - 3 \log y \\ & 2 + 4 \log x - 3 \log y \end{aligned}$$

$$\begin{aligned} \text{(c)} \quad & \log_5\left(\frac{x+3}{y^4 z^2}\right) \\ & \log_5(x + 3) - \log_5 y^4 - \log_5 z^2 \\ & \log_5(x + 3) - 4 \log_5 y - 2 \log_5 z \end{aligned}$$

3. Write as a single logarithm.

$$\text{(a)} \quad 7 \log(x + 5) + 2 \log(x + 1)$$

$$\log[(x + 5)^7(x + 1)^2]$$

$$\text{(b)} \quad \log_2 x + 5 \log_2(y + 1) + 2 \log_2(z - 1)$$

$$\log_2[x(y + 1)^5(z - 1)^2]$$

$$\text{(c)} \quad 2 \ln(x + 4) - 5 \ln y + 3 \ln z$$

$$\ln\left(\frac{(x+4)^2 z^3}{y^5}\right)$$