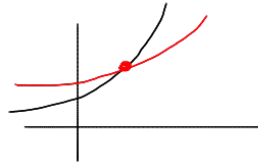


Mon. Week 7

## Exponential & Logarithmic Equations

Ex. Solve:

$$5 \cdot e^{3x-7} = 9e^{5x-4}$$



Goal: isolate  $x$

Strategy: work from outside-in.

$$\textcircled{1} \frac{5}{9} e^{3x-7} = e^{5x-4}$$

$$\textcircled{2} \frac{5}{9} e^{3x-7} \cdot \frac{1}{e^{-4}} = e^{5x} \cdot \frac{e^{-4}}{e^{-4}}$$

$$\textcircled{3} \frac{5}{9} e^{3x-7+4} = e^{5x}$$

$$\textcircled{4} \frac{5}{9} e^{-3} = e^{5x} \cdot e^{-3x}$$

$$\textcircled{5} \frac{5}{9} e^{-3} = e^{2x}$$

$$(e^A \cdot e^B = e^{A+B})$$

$$\textcircled{6} \ln\left(\frac{5}{9} e^{-3}\right) = \ln(e^{2x}) = 2x$$

$\downarrow$   
 $2x \cdot \underbrace{\ln(e)}_{=1}$

$$\frac{1}{2} \ln\left(\frac{5}{9} e^{-3}\right) = x$$

$$\frac{1}{2} \left[ \ln\left(\frac{5}{9} \cdot e^{-3}\right) \right]$$

$$\frac{1}{2} \left[ \ln\left(\frac{5}{9}\right) + \underbrace{\ln(e^{-3})}_{-3} \right]$$

$$\frac{1}{2} [\ln(5) - \ln(9) - 3] =$$

Ex

$$7 \cdot 2^{5x+4} = 3 \cdot 2^{3x-6}$$

Solve:

①

$$\frac{7}{3} 2^{5x} \cdot 2^4 = 2^{3x} \cdot 2^{-6}$$

②

$$\frac{7}{3} \cdot 2^4 \cdot 2^6 = 2^{-2x}$$

$$\log_2 \left( \frac{7 \cdot 2^{10}}{3} \right) = \log_2 (2^{-2x}) = -2x$$

③

$$\frac{7 \cdot 2^{10}}{3} = 2^{-2x}$$

$$\frac{\log_2 \left( \frac{7 \cdot 2^{10}}{3} \right)}{-2x} = x = \frac{\log_2 \left( \frac{7}{3} \right) + \log_2 2^{10}}{-2} = \frac{10 + \log_2 \left( \frac{7}{3} \right)}{-2}$$

④

$$\ln \left( \frac{7 \cdot 2^{10}}{3} \right) = \ln (2^{-2x}) = -2x \cdot \ln(2) = x (-2 \cdot \ln 2)$$

⑤

$$\frac{\ln \left( \frac{7 \cdot 2^{10}}{3} \right)}{-2 \cdot \ln(2)} = x$$

# Log Equations

ex goal: solve for x:

$$\log_2(x-5) + \log_2(x+7) = 3$$

$$\textcircled{1} \log_2((x-5)(x+7)) = 3$$

$$(\log_2(AB) = \log_2 A + \log_2 B)$$

$$\textcircled{2} \log_2(x^2 + 2x - 35) = 3$$

apply  
(def'n)

$$\textcircled{3} \log_2(x^2 + 2x - 35) = 3$$



$$\textcircled{4} (x^2 + 2x - 35) = 2^3$$

$$\textcircled{5} \begin{matrix} a=1 & b=2 & c=-43 \\ x^2 + 2x - 43 = 0 \end{matrix}$$

$$\textcircled{6} x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} = \frac{-2 \pm \sqrt{4 - 4 \cdot 1 \cdot (-43)}}{2} = \frac{-2 \pm \sqrt{176}}{2} \approx \frac{-2 \pm 13.1}{2} \approx \begin{matrix} + \frac{11.1}{2} \approx 6.5 \\ - \frac{15.1}{2} = -7.5 \end{matrix}$$

only  
sol'n

$\approx 6.5$

outside  
domain



$$\log_{17}(10) = S = \frac{\ln(10)}{\ln 17}$$



$$17^S = 10$$

$$S \cdot \ln 17 = \ln(17^S) = \ln(10)$$

$$\ln(x) = \log_e(x)$$

$$\log(x) = \log_{10}(x)$$