4.7 EXPONENTIAL AND LOGARITHMIC FUNCTIONS

WE CAN USE LOGS TO SOLVE EXPONENTIAL FUNCTIONS

Ex| SOLVE $5^x = 9$

$$\log 5^x = \log 9$$

$$x \log 5 = \log 9$$

$$x = \frac{\log 9}{\log 5} = 1.37 \; (3sf)$$

Ex| SOLVE $6^x = 3^{x+1}$

$$\log 6^x = \log 3^{x+1}$$

$$x \log 6 = (x+1) \log 3$$

$$x \log 6 = x \log 3 + \log 3$$

$$x \log 6 - x \log 3 = \log 3$$

$$x (\log 6 - \log 3) = \log 3$$

$$x = \frac{\log 3}{\log 6 - \log 3}$$

WE CAN ALSO USE $\ln$ instead of $\log_{10}$

Ex) $e^{3x} = 5^{1-x}$

$$\ln e^{3x} = \ln 5^{1-x}$$

$$3x = (1-x) \ln 5$$

$$3x = \ln 5 - x \ln 5$$

$$3x + x \ln 5 = \ln 5$$

$$x (3 + \ln 5) = \ln 5$$

$$x = \frac{\ln 5}{3 + \ln 5}$$

HW 4P 1, 2, adegh
p.128

Ex) SOLVE $3 \times 6^{x-1} = 2 \times 3^{x+2}$, giving your answer in

the form $x = \dfrac{\ln a}{\ln b}$, where $a, b \in \mathbb{Z}^+$

example
2.6
p.128

Ans) $\ln(3 \times 6^{x-1}) = \ln(2 \times 3^{x+2})$

$\ln 3 + \ln 6^{(x-1)} = \ln 2 + \ln 3^{(x+2)}$

$\ln 3 + (x-1)\ln 6 = \ln 2 + (x+2)\ln 3$

$\ln 3 + x\ln 6 - \ln 6 = \ln 2 + x\ln 3 + 2\ln 3$

$x\ln 6 - x\ln 3 = \ln 2 + 2\ln 3 - \ln 3 + \ln 6$

$x(\ln 6 - \ln 3) = \ln 2 + \ln 3 + \ln 6$

$x = \dfrac{\ln 2 + \ln 3 + \ln 6}{\ln 6 - \ln 3} = \dfrac{\ln(2 \cdot 3 \cdot 6)}{\ln(2)} = \dfrac{\ln 36}{\ln(2)}$

HW 4Q p.129 1, 2, 3 abd

WE CAN, IF THE BASE OF THE LOG IS THE SAME, EQUATE THE **ARGUMENTS**

Ex) Solve $\log_5(2-x) = \log_5(6x-1)$

$(2-x) = 6x-1$

$3 = 7x$

$\dfrac{7}{3} = x$

HW 4R p.130 #1 a b d

↳ Sometimes it's better to convert to exponents

Ex) $\log_2 x + \log_2(x-2) = 3$

$\log_2(x(x-2)) = 3$

$2^3 = x(x-2)$

$x^2 - 2x = 8$

$x^2 - 2x - 8 = 0$

$(x-4)(x+2) = 0$

$x = 4$ or $x = -2$

Solution

✳ check to make sure
the solution is
valid for **all**

↳doesn't
work for $\log_2(-2)$

HW 4S p.131 1-5
1,2 abc   3,4