Work on HF after Quiz (11/7/2017) Tuesday work.

IB Pew HL 4F Change of Base: $\log_a b = \dfrac{\log b}{\log a} = \dfrac{\ln b}{\ln a}$

1. Solve $3^x = 79$ for x…

a. in base 3

$3^x = 79$

$\log_3 3^x = \log_3 79$

$x = \log_3 79$

b. in base 10

$3^x = 79$

$\log 3^x = \log 79$

$x \log 3 = \log 79$

$x = \dfrac{\log 79}{\log 3}$

c. in base e ⇒ ln

$3^x = 79$

$\ln 3^x = \ln 79$

$\dfrac{x \ln 3}{\ln 3} = \dfrac{\ln 79}{\ln 3}$

$x = \dfrac{\ln 79}{\ln 3}$

2. Rewrite $\log_2 x + \log_4 y$ as a single logarithm…

a. in base 2

$\log_2 x + \log_4 y$

$= \log_2 x + \dfrac{\log_2 y}{\log_2 4} = \log_2 x + \dfrac{\log_2 y}{2}$

$= \log_2 x + \frac{1}{2}\log_2 y = \log_2 x + \log_2 y^{\frac{1}{2}} = \log_2 x\sqrt{y}$

b. in base 4

$\log_2 x + \log_4 y$

$= \dfrac{\log_4 x}{\log_4 2} + \log_4 y = \dfrac{\log_4 x}{\frac{1}{2}} + \log_4 y$

$= 2\log_4 x + \log_4 y$

$= \log_4 x^2 y$

3. Simplify $\log_5 6 \times \log_4 5 \times \log_3 4 \times \log_2 3$

$\dfrac{\log 6}{\log 5} \times \dfrac{\log 5}{\log 4} \times \dfrac{\log 4}{\log 3} \times \dfrac{\log 3}{\log 2} = \dfrac{\log 6}{\log 2} = \log_2 6 = \dfrac{\ln 6}{\ln 2}$

Solve for x (Calculator is allowed)

4. $3^{2x} - 3(3^{x-1}) = +20$

$(3^x)^2 - 3(3^x)\cdot 3^{-1} - 20 = 0$

$(3^x)^2 - 3^x - 20 = 0 \Rightarrow (3^x - 5)(3^x + 4) = 0 \Rightarrow 3^x = 5$ OR $3^x = -4$

$x = \log_3 5$ OR $\dfrac{\log 5}{\log 3}$ OR $\dfrac{\ln 5}{\ln 3}$

5. $5(2^{2x}) - 3(2^x) = 2$

$5\cdot(2^x)^2 - 3(2^x) - 2 = 0 \Rightarrow (5\cdot 2^x + 2)(2^x - 1) = 0$

$5 \quad +2$

$1 \quad -1$

$2^x = -\frac{2}{5}$ $\quad 2^x = 1 \Rightarrow x = 0$

6. $1 - \log_5(x+2) = \log_{\frac{1}{5}} x$ (no calculator for this one)

$\log_5 5 - \log_5(x+2) + \log_5 x = 0$

$\log_5 5 - \log_5(x+2) = \dfrac{\log_5 x}{\log_5 \frac{1}{5}} = \dfrac{\log_5 x}{-1} = -\log_5 x \Rightarrow \log_5\left(\dfrac{5x}{x+2}\right) = 0 \Rightarrow \dfrac{5x}{x+2} = 5^0$

$\dfrac{5x}{x+2} = 1 \Rightarrow 5x = x + 2 \Rightarrow 4x = 2$

$x = \frac{1}{2}$