# LOG EQUATIONS

1. GET EVERYTHING WITH A LOG ON ONE SIDE, NUMBERS ON OTHER SIDE
2. USE PROP. OF LOGS TO GET A SINGLE LOG
3. USE DEF. OF A LOG TO REWRITE IN EXP. FORM
4. SOLVE FOR X
5. SEMI CHECK ANSWERS

**(10)** $e^{4x} - 8e^{2x} - 20 = 0$

$u^2 - 8u - 20 = 0$

(QSD) $(u-10)(u+2)=0$

$u-10=0 \quad u+2=0$

$u=10 \quad u=-2$

$e^{2x}=10 \quad e^{2x}=-2$

$\ln e^{2x} = \ln 10 \quad \ln e^{2x} = \ln(-2)$

$2x = \ln 10$

$x = \frac{\ln 10}{2}$

**(11)** $\log_4(x-5)=3$

$4^3 = x-5$

$64 = x-5$

$64+5 = x$

$69 = x$

**(12)** $5\ln(3x-1)=15$

$\frac{5\ln(3x-1)}{5} = \frac{15}{5}$

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

$e^3 = 3x-1$

$e^3+1 = 3x$

$\frac{e^3+1}{3} = x$

**(13)** $\log_2 x + \log_2(x-6) = 4$

$\log_2 x(x-6) = 4$

$2^4 = x(x-6)$

$16 = x^2 - 6x$

(QSD) $0 = x^2 - 6x - 16$

$0 = (x-8)(x+2)$

$x-8=0 \quad x+2=0$

$x=8 \quad x=-2$

**(14)** $\log_3(x-1) - \log_3(x-5) = 2$

$\log_3 \frac{x-1}{x-5} = 2$

$3^2 = \frac{x-1}{x-5}$

$9 = \frac{x-1}{x-5}$

$9(x-5) = (x-5)\left(\frac{x-1}{x-5}\right)$

$9x-45 = x-1$

$9x-x = -1+45$

$8x = 44$

$\frac{8x}{8} = \frac{44}{8}$

$x = \frac{11}{2} = 5.5$

NOTE: IF EVERYTHING WAS A LOG THEN USE PROP. OF LOGS TO GET A SINGLE LOG ON BOTH SIDES, THEN DROP THE "LOG" PART

**(15)** $\log(x+1) - \log 5 = \log(4x-2)$

$\log \frac{x+1}{5} = \log(4x-2)$

$\frac{x+1}{5} = 4x-2$

$5\left(\frac{x+1}{5}\right) = 5(4x-2)$

$x+1 = 20x-10$

$x-20x = -10-1$

$-19x = -11$

$\frac{-19x}{-19} = \frac{-11}{-19}$

$x = \frac{11}{19}$

**(16)** $\ln(x+2) - \ln(x+4) = \ln(x+7) - \ln(x+11)$

$\ln \frac{x+2}{x+4} = \ln \frac{x+7}{x+11}$

$\frac{x+2}{x+4} = \frac{x+7}{x+11}$

$(x+4)(x+11)\left(\frac{x+2}{x+4}\right) = (x+4)(x+11)\left(\frac{x+7}{x+11}\right)$

$x^2 + 2x + 11x + 22 = x^2 + 7x + 4x + 28$

$13x + 22 = 11x + 28$

$13x - 11x = 28 - 22$

$2x = 6$

$\frac{2x}{2} = \frac{6}{2}$

$x = 3$