5.) (2 pts each, 4 pts total) Write each exponential equation in its equivalent logarithmic form.

a) $4^7 = 16384$

b) $0.001 = 10^{-3}$

6.) (2 pts each, 4 pts total) Evaluate the logarithms exactly. Show conversion to exponential form for full credit.

a) $\log_8 1 = X$ → Exponential form: $8^X = 1$ $X = 0$

b) $\log 10^{-5}$ $\log_{10} 10^{-5} = X$ Exponential form $10^X = 10^{-5}$ $X = -5$

7.) (8 pts total) State the domain of the logarithmic function. Please show work (do not simply graph).

$\{ f(x) = \log_3 (x - 2) \}$

X values

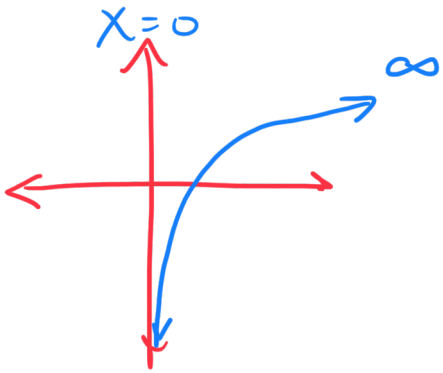
$\log_a \boxed{q} = b$ $q > 0$

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

$X - 2 > 0$

$+2 \quad +2$

$X > 2$



8.) (2.5 pts each, 5 pts total) Apply the properties of logarithms to simplify each expression.

a) $8^{3\log_8 5} = x$

exponential → logarithmic

$\log_8 x = 3\log_8 5$

$\log_8 x = \log_8 5^3$

$x = 5^3 = 125$

$\ln(e^x) = \ln 3$

$x = \ln 3$

b) $e^{\ln(x^2-4)} = 2$

$\ln\left(e^{\ln(x^2-4)}\right) = \ln 2$

$\ln(x^2-4) = \ln 2$

$x^2 - 4 = 2$

$+4 \quad +4$

$\sqrt{x^2} = \sqrt{6}$

$x = \pm\sqrt{6}$

9.) (5 pts each, 10 pts total) Write each expression as a sum or difference of logarithms.

$* \rightarrow +$ $\quad \div \rightarrow -$

a) $\log_b\left(\frac{x^2y^7z^{-3}}{a^4}\right)$

$\log_b x^2 + \log_b y^7 + \log_b z^{-3} - \log_b a^4$

$2\log_b x + 7\log_b y - 3\log_b z - 4\log_b a$

b) $\log_b\left(\frac{x^2+2x-3}{x^2-6x+8}\right)$

$\log_b \frac{(x-1)(x+3)}{(x-2)(x-4)}$

$\log_b(x-1) + \log_b(x-3) - \log_b(x-2) - \log_b(x-4)$

10.) (5 pts each, 10 pts total) Write each expression as a single logarithm.

a) $6\log_b a + 2\log_b c - 3\log_b d$

$4\log_b b = \log_b b^4 = x = 4$

$b^x = b^4$

$\log_b a^6 + \log_b c^2 - \log_b d^3$

$\log_b \frac{a^6 c^2}{d^3}$

b) $\frac{1}{2}\log e - 3\log f - 2\log h$

11.) (5 pts each, 10 pts total) Evaluate each logarithm using change-of-base formula.

a) $\log_9 23$ $= x$

$\log(9^x) = \log(23)$

$\log 9^x = \log 23$

$\frac{x \log 9}{\log 9} = \frac{\log 23}{\log 9}$

$x = \frac{\log 23}{\log 9}$

b) $\log_2 a$

12.) (5 pts each, 15 pts total) Solve each exponential equation. Leave answers as a fraction if necessary (no decimals).

a) $\log(3x + 4) = 2$

$\log_{10}(3x+4) = 2$ ← exponent

base

$10^2 = 3x+4$

$100 = 3x+4$

$-4 \quad -4$

$\frac{96}{3} = \frac{3x}{3}$

$x = 32$

b) $\log_2(x - 2) + \log_2(x + 4) = 4$

$\log_2(x-2)(x+4) = 4$

$2^4 = (x-2)(x+4)$ FOIL

$16 = x^2 + 4x - 2x - 8$

$16 = x^2 + 2x - 8$

$-16 \quad -16$

$0 = x^2 + 2x - 24$

$6 * -4 = -24$

$6 + -4 = 2$

$(x+6)(x-4) = 0$

$x = -6, 4$

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

13.) (1 pts each, 10 pts total) Complete the table by including the corresponding letter.

Graph Name	Model	Graph
Gaussian distribution bell	c	h
Logistic growth	d	g
Exponential growth	a	j
Logarithmic	e	f
Exponential decay	b	i

a) $f(t) = ce^{kt}\ k > 0$

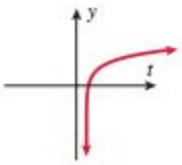
b) $f(t) = ce^{-kt}\ k > 0$

c) $f(x) = ce^{\frac{-(x-a)^2}{k}}$

d) $f(t) = \frac{a}{1 + ce^{-kt}}$

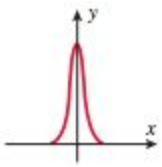
e) $f(t) = a + c\ log\ t$

f)



g)

h)



i)

j)