Precalculus Name: _____

Logarithmic Functions

1. Change to logarithmic form.

a. $4^3 = 64$ b. $4^{-3} = \frac{1}{64}$ c. $t^r = s$

d. $3^5 = 243$ e. $3^{-4} = \frac{1}{81}$ f. $c^p = d$

g. $3^x = 4 - t$ h. $5^{7t} = \frac{a+b}{a}$ i. $(0.7)^t = 5.3$

j. $7^x = 100p$ k. $3^{-2x} = \frac{P}{F}$ l. $(0.9)^t = \frac{1}{2}$

2. Change to exponential form.

a. $\log_2 32 = 5$ b. $\log_3 \frac{1}{243} = -5$ c. $\log_t r = p$

d. $\log_3 81 = 4$ e. $\log_4 \frac{1}{256} = -4$ f. $\log_v w = q$

g. $\log_3 (x+2) = 5$ h. $\log_2 m = 3x + 4$ i. $\log_b 512 = \frac{3}{2}$

j. $\log_6 (2x-1) = 3$ k. $\log_4 P = 5 - x$ l. $\log_a 343 = \frac{3}{4}$

3. Solve for t using logarithms.

a. $2a^{\frac{t}{3}} = 5$ b. $3a^{4t} = 10$

c. $A = Ba^{Ct} + D$ d. $L = Ma^{\frac{t}{N}} - P$

4. Change to logarithmic form.

a. $10^5 = 100,000$ b. $10^{-3} = 0.001$ c. $10^x = y + 1$

d. $e^4 = D$ e. $e^{2t} = 3 - x$ f. $e^{0.1t} = x + 2$

5. Change to exponential form.

a. $\log x = 50$ b. $\log x = 20t$ c. $\log x = y - 2$

d. $\ln x = 0.1$ e. $\ln w = 4 + 3x$ f. $\ln(z-2) = \frac{1}{6}$

6. Find the number, if possible.

a. $\log_5 1$ b. $\log_3 3$ c. $\log_4 (-2)$

d. $\log_7 7^2$ e. $3^{\log_3 8}$ f. $\log_5 125$

g. $\log_5 0$ h. $\log_6 6^7$ i. $\log_4 \frac{1}{16}$

j. $5^{\log_5 4}$ k. $\log_2 128$ l. $\log_3 243$

Applying Rules of Logarithms

In problems 1-4, write each expression in terms of a single logarithm with a coefficient of 1.

Example: $\log_b u^2 - \log_b v = \log_b\left(\frac{u^2}{v}\right)$

1. $\log_b m - \frac{1}{2}\log_b n$

2. $\log_b w + \log_b x - \log_b y$

3. $3\log_b x + 2\log_b y - \frac{1}{4}\log_b z$

4. $\frac{1}{3}\log_b w - 3\log_b x - 5\log_b y$

In problems 5-8, write each expression in terms of logarithms of first-degree polynomials.

Example: $\log_b \frac{(2x+1)^3}{(3x-5)^4} = 3\log_b(2x+1) - 4\log_b(3x-5)$

5. $\log_b\left((5x-4)^3(3x-5)^4\right)$

6. $\log_b \frac{(x-3)^5}{(5+x)^3}$

7. $\log_b \frac{x^2}{\sqrt{x+1}}$

8. $\log_b\left(x^4 + x^3 - 20x\right)$

Precalculus

Name: _____

Laws of Logarithms

ODDS

Common Logarithms	Natural Logarithms
1. $\log_a(uw) = \log_a u + \log_a w$	1. $\ln(uw) = \ln u + \ln w$
2. $\log_a\left(\frac{u}{w}\right) = \log_a u - \log_a w$	2. $\ln\left(\frac{u}{w}\right) = \ln u - \ln w$
3. $\log_a(u^c) = c\log_a u$	3. $\ln(u^c) = c\ln u$

Use the properties of logarithms to write the expression as a sum, difference, and/or constant multiple of logarithms.

1. $\log 5x$

2. $\log_3\left(\frac{x}{4}\right)$

3. $\log_8 t^{-3}$

4. $\ln \sqrt[3]{d}$

5. $\ln abc$

6. $\ln \frac{xy}{z}$

7. $\ln\left(\frac{x^2-1}{x^3}\right)$

8. $\ln z(z-1)^2$

9. $\ln \sqrt{\frac{x^2}{y^3}}$

10. $\ln \sqrt[3]{\frac{x}{y}}$

11. $\ln \frac{x^4\sqrt{y}}{z^5}$

12. $\ln \frac{x}{\sqrt{x^2+1}}$

13. $\log_5 \frac{x^5}{y^2z^3}$

14. $\log_7 \frac{\sqrt{x}y^5}{z^2}$