Name: Key Date:
UNIT 9 LESSON 6

DO NOW
Write as a single log:

a) $3\log_2 a - \log_2 b$

$\log_2 \frac{a^3}{b}$

b) $\frac{1}{2}(\log_4 x + \log_4 y)$

$\log_4 \sqrt{xy}$

AIM: SOLVING LOG EQUATIONS USING LOG LAWS

Case 1: Logs on one side → Contract logs & rewrite in exponential form.

1. $\log_4 (x+3) - \log_4 (x-3) = 2$

$\log_4 \frac{x+3}{x-3} = 2$

$4^2 = \frac{x+3}{x-3}$

$16 = \frac{x+3}{x-3}$

$16x - 48 = x + 3$

$15x = 51$

$\boxed{x = \frac{51}{15}}$

2. $\log_2 x + \log_2 (x-4) = 5$

$\log_2 x(x-4) = 5$

$2^5 = x^2 - 4x$

$-32 \qquad -32$

$x^2 - 4x - 32 = 0$

$(x-8)(x+4) = 0$

$\boxed{x = 8}$ | $x = -4$

Case 2: Logs on both sides (Log = Log) → Cancel logs & Solve

3. $\log_2 (x^2 - 1) = \log_2 8$

$x^2 - 1 = 8$

$x^2 = 9$

$\boxed{x = \pm 3}$

4. $\log 64 = 2 \log x$

$\log 64 = \log x^2$

$64 = x^2$

$\pm 8 = x$

$\boxed{x = 8}$

Case 3: Combination of Case 1 and Case 2 → Contract logs 1st to get Log = Log and then solve logs.

5. $\log_4(4x)+\log_4(x)=\log_4 64$

$\log_4(4x\cdot x)=\log_4 64$

$\frac{4x^2}{4}=\frac{64}{4}$

$x^2=16$

$x=\pm 4$

$\boxed{x=4}$

6. $\log_5 x-\frac{1}{2}\log_5 16=\log_5 25$

$\log_5 \frac{x}{\sqrt{16}}=\log_5 25$

$\frac{x}{4}=25$

$\boxed{x=100}$

PARTNER PRACTICE:

7. $\log_2 x=\frac{1}{2}\log_2 81$

$\log_2 x=\log_2\sqrt{81}$

$x=\sqrt{81}$

$\boxed{x=9}$

8. $\log_4 18-\log_4 x=\log_4 6$

$\log_4 \frac{18}{x}=\log_4 6$

$\frac{18}{x}=6$

$6x=18$

$\boxed{x=3}$

9. $2\log_3 9+\log_3 x=\log_3 27$

$\log_3(9^2\cdot x)=\log_3 27$

$81x=27$

$\boxed{x=\frac{1}{3}}$

10. $\log_6(x+1)+\log_6(x-4)=1$

$\log_6(x+1)(x-4)=1$

$6^1=x^2-3x-4$

$x^2-3x-10=0$

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

$\boxed{x=5}$ $\quad x=-2$

13. $\log_3(2x-1)+\log_3(x+7)=3$

$\log_3(2x-1)(x+7)=3$

$2x^2+13x-7=27$

$2x^2+13x-34=0$

$x=\frac{-13\pm\sqrt{(13)^2-4(2)(-34)}}{2(2)}$ $\quad x=\frac{-13\pm\sqrt{441}}{4}$ $\quad \boxed{x=2}$

$x=-8.5$