Name _____ Date _____ Period____

5.5 Solving Log Equations Notes

Warm up

$\log(-3) = ?$ use calc. [not possible]

$10^{?} = -3$

You can not take the log of a negative number.

Solve the exponential equation using change of base.

$4^x \cdot 4^{2x-9} = 64$

$4^{3x-9} = 64$ → combine expressions with same base

$4^{3x-9} = 4^3$ → exponents = since bases =

$3x - 9 = 3$

$3x = 12 \quad x = 4$

Solving Logarithmic Equations

Log = Log

1. Condense each side into a single log.
2. If $\log_a m = \log_a n$, *then* $m = n$.
3. Solve and check for extraneous solutions

1. $\log_5(5x+9) = \log_5 6x$

$5x + 9 = 6x$ ②

$-5x \quad -5x$

$x = 9$

③ Check your work!

$\log_5(5 \cdot 9 + 9) = \log_5(6 \cdot 9)$

$\log_5(54) = \log_5(54)$ ✓

2. $\log_9(6 - 3x) = \log_9(-2x)$

$6 - 3x = -2x$ ②

$6 = x$

③ check: extraneous log of (neg)

$\log_9(6 - 3(6)) = \log_9(-2 \cdot 6)$

$\log_9(-12) = \log_9(-12)$

accuracy ✓

∅

3. $\log_4 68 - \log_4 4 = \log_4(3n + 11)$

① $\log_4\left(\frac{68}{4}\right) = \log_4(3n+11)$

$\log_4(17) = \log_4(3n+11)$

② $17 = 3n + 11$

$6 = 3n$

$n = 2$

③ $\log_4 68 - \log_4(4) = \log_4(3 \cdot 2 + 11)$

$\log_4 68 - \log_4(4) = \log_4(17)$

$\log_4(17) = \log_4(17)$

accuracy ✓ + no extraneous

4. $2\log_4 m = \log_4(18 - 7m)$

$\log_4 m^2 = \log_4(18 - 7m)$ ①

$m^2 = 18 - 7m$ ②

$m^2 + 7m - 18 = 0$ quad.

$(m+9)(m-2) = 0$

$m = -9, 2$

check work ✓ ③

$m = 2$

Solving Logarithmic Equations

Log = number

1. Condense and isolate the log.
2. Rewrite the log into exponential form.
3. Solve and check for extraneous solutions

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

$2^6 = x-4$ ②

$64 = x-4$

$x = 68$

Check ✓ ③

$\log_2(68-4)=6$

$\log_2(64)=6$

$\log_2 2^6 = 6$ ✓

$6=6$ accurate

2. $\log_3(4x+8)-7=-3$

isolate log

① $\log_3(4x+8)=4$

② $3^4 = 4x+8$

$81 = 4x+8$

$73 = 4x$

$x = \frac{73}{4}$

③ Check ✓

$\log_3(4(\frac{73}{4})+8)-7=-3$

$\log_3(81)-7=-3$

$4-7=-3$ ✓ accurate

3. $2\log x - \log 4 = 2$

$\log x^2 - \log 4 = 2$ ①

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

② $10^2 = \frac{x^2}{4}$

$100 = \frac{x^2}{4}$

$400 = x^2$

$x = \pm\sqrt{400}$

$x = \pm 20$

orig. eq

$2\log(-20) - \log 4 = 2$

$x = -20$ is extraneous

③ check for accuracy + extraneous

$x=20$

4. $\log(x-3) + \log x = 1$

$\log(x-3)(x) = 1$ ①

$10^1 = (x-3)x$ ②

$x^2 - 3x = 10$

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

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

$x = -2, 5$

Check ③

$x=-2$

$1 = \log(-2-3) + \log(-2)$

$1 = \log(-5) + \log(-2)$

log of negative number

$1 = \log 10$ accurate

$\log(5-3) + \log 5 = 1$

$\log 2 + \log 5 = 1$

$\log 10 = 1$ ✓

$x=5$