A49: Solve Log Eqns (WKS)

24.3 Solving Logarithmic Equations

Extraneous Solution -- A solution that you get by doing all the correct algebra, but it doesn't actually work in the original equation. In the case of logs, it is because the input of the log must be greater than zero.

★ You must check answers when equation is originally a log ★

Method 1: log = log

★ DOESN'T ALWAYS WORK ★

Ex #1 $\log_3(2x-3) = \log_3(x+4)$

$2x-3 = x+4$ (−x, −x)

$x-3 = 4$ (+3, +3)

$\boxed{x = 7}$

check: $\log_3(2(7)-3) = \log_3(7+4)$

$\log_3(11) = \log_3(11)$

11

Ex #2 $\ln 10 - \ln(4x-6) = 0$ (+ln(4x−6), +ln(4x−6))

$\ln 10 = \ln(4x-6)$

$10 = 4x-6$ (+6, +6)

$16 = 4x$ (÷4, ÷4)

$\boxed{x = 4}$

check: $\ln(10) - \ln(4(4)-6) = 0$

$\ln(10) - \ln(10) = 0$

11

Ex #3 $\log_5(7x-2) = \log_5(3x+6)$

$7x-2 = 3x+6$ (−3x, −3x)

$4x-2 = 6$ (+2, +2)

$4x = 8$ (÷4, ÷4)

$\boxed{x = 2}$

check: $\log_5(7(2)-2) = \log_5(3(2)+6)$

$\log_5(12) = \log_5(12)$

11

Method 2: log = # (you use exponents)

Isolate the log, then "exponentiate" both sides.

⟹

Ex #4 $\log_4(3x-1)=2$

$4^{\log_4(3x-1)}=4^2$

$3x-1=16$

$+1 \quad +1$

$\frac{3x}{3}=\frac{17}{3}$

$\boxed{x=17/3}$

check $\log_4(3(\frac{17}{3})-1)=2$

$\log_4(16)=2$ ☺

Ex #5 $\log_2 x+\log_2(x+2)=3$

$\log_2[x(x+2)]=3$

$\log_2(x^2+2x)=3$

$2^{\log_2(x^2+2x)}=2^3$

$x^2+2x=8$

$-8 \quad -8$

$x^2+2x-8=0$

4×-2, -8, 2

$(x+4)(x-2)=0$

$x+4=0 \quad -4 \quad -4$

ext. $\rightarrow x=-4$

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

$\boxed{x=2}$

check $x=-4$

$\log_2(-4)$ ☹

check $x=2$

$\log_2 2+\log_2(2+2)=3$

1 1 ☺

Just because $x=-4$ doesn't automatically make it extraneous!

Ex #6 $\log_6(3x+4)=1$

$6^{\log_6(3x+4)}=6^1$

$3x+4=6$

$-4 \quad -4$

$\frac{3x}{3}=\frac{2}{3}$

$\boxed{x=2/3}$

check $\log_6(3(\frac{2}{3})+4)=1$

$\log_6(6)=1$

1 1 ☺

Ex #7 $\log_4(x+6)-\log_4 x=2$

$\log_4(\frac{x+6}{x})=2$

$4^{\log_4(\frac{x+6}{x})}=4^2$

$x(\frac{x+6}{x})=(16)x$

$x+6=16x$

$-x \quad -x$

$\frac{6}{15}=\frac{15x}{15}$

$\boxed{x=\frac{2}{5}}$

check $\log_4(\frac{2}{5}+6)+\log(\frac{2}{5})$

1 1 ☺

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