Log and Exponent Equations

Math 130 *Kovitz*

Solve for x and check your answers in the original equation.

1. $\log_2(1-3x)+\log_2 2x=-3$.
2. $\dfrac{\log_2(x^3+x^2-4x)}{\log_2 x}=3$.
3. $6^{\log_{36} x}=x+0.09$.

   This problem is tricky. The first step might be either to use change of base on the exponent or to rewrite 6 as a power of 36.

Answers follow.

Answers.

1. $x=1/12$ or $x=1/4$.

   Check for $x=1/12$:

   $\log_2(1-3/12)+\log_2(1/6)=\log_2(3/4)+\log_2(1/6)=\log_2[(3/4)(1/6)]=\log_2(1/8)=-3$,

   so it checks.

   Check for $x=1/4$:

   $\log_2(1-3/4)+\log_2(1/2)=\log_2(1/4)+(-1)=-2+(-1)=-3$,

   so it checks.

2. $x=4$.

   Check: $\dfrac{\log_2(64+16-16)}{\log_2 4}=\dfrac{\log_2 64}{\log_2 4}=\dfrac{6}{2}=3$, so it checks.

   A common wrong answer is 3. It doesn't quite check because:

   $\dfrac{\log_2(27+9-12)}{\log_2 3}=\dfrac{\log_2 24}{\log_2 3}=\dfrac{4.58496}{1.58496}\approx 2.892789\neq 3.$

   This illustrates the important principle: *do not* round off a log or an exponent in the middle of a problem. Rounding off might have led to a conclusion that the wrong answer 3 satisfied the original equation.

3. $x=0.01$ or $x=0.81$.

   Check for $x=0.01$:

   Use a calculator to get $\log_{36} 0.01=\log 0.01/\log 36=-2/1.5563025=-1.285097209$.

   Then check that $6^{-1.285097209}=0.1=0.01+0.09$, so it checks.

   Chcek for $x=0.81$:

   Use a calculator to get $\log_{36} 0.81=\log 0.81/\log 36=-0.091514981/1.5563025=-0.058802823$.

   Then check that $6^{-0.058802823}=0.9=0.81+0.09$, so it checks.