Level 4 Solving Log Equations

We need to cancel the log and base. To do this we make it an exponent for the same base.

Y = 2^x and y = $\log_2 x$ are inverses and are reflected over the line y = x. So if you put $\log_2 x$ as the exponent in 2^x like: $2^{\log_2 x}$ then the 2 and $\log_2$ cancel leaving x. Let's look at the different ways to solve.

$\cancel{2}^{\cancel{\log_2}(x)}$

x

Ex A. Solve the following equation using each of the following methods $-10 + 4\log_3(n+3) = 10$

We need to get the "log" part alone 1st

$+10 \qquad +10$

$\frac{4 \cdot \log_3(n+3)}{4} = \frac{20}{4}$

$\boxed{\log_3(n+3) = 5}$

Method 1: Definition of logarithm

$\log_{base}(answer) = exponent$

$\boxed{base^{exponent} = answer}$

$\boxed{\log_3(n+3) = 5}$

the base is 3

the exponent is 5 because it is on the other side of the = from the log

$3^5 = n+3$

$243 = n+3$

$-3 \qquad -3$

$\boxed{n = 240}$

Method 2: Exponents as an inverse (same base)

make both sides exponents for same base

$\cancel{3}^{\log_3(n+3)} = 3^5$

match

bases cancel

$n + 3 = 3^5$

$\boxed{n = 240}$

Method 3: If both sides are already with only one log with the same base, the insides are equal

not ideal to use, only one side has log

$\log_3(n+3) = 5 \cdot \log_3 3$

Power rule

$\log_3(n+3) = \log_3(3^5)$

logs match

$n + 3 = 3^5$

$\boxed{n = 240}$

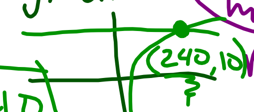
Method 4: Graph the system of the left and right sides of the equation. The x coordinate of the Intersection point is the solution.

always use original

$y = -10 + 4\log_3(n+3)$

$y = 10$

$\boxed{x = 240}$



Ex B. Solve the following equation using each of the following methods $\ln(x) + \ln(8) = \ln(3x + 30)$

You can only have max one log on each side

☆ Must condense 1st

☆ Product, Quotient, Power Rules

$\ln(8x) = \ln(3x+30)$

Method 1: Definition of logarithm

not ideal to use

$\boxed{Base^{Exponent} = answer}$

Pick one side to focus on

e is the base for ln

$\ln = \log_e$

the exponent is ln(8x) because it is on the other side of the = from log

$e^{\ln(8x)} = 3x+30$

$8x = 3x + 30$

$-3x \quad -3x$

$\frac{5x}{5} = \frac{30}{5}$

$\boxed{x = 6}$

Method 2: Exponents as an inverse (same base)

$\cancel{\ln}(8x) = \cancel{\ln}(3x+30)$

$\cancel{e} \qquad \cancel{e}$

both cancel

$8x = 3x + 30$

$\boxed{x = 6}$

Method 3: If both sides are already with only one log with the same base, the insides are equal

most ideal here

$\ln(8x) = \ln(3x+30)$

logs match

$8x = 3x + 30$

$\boxed{x = 6}$

Method 4: Graph the system of the left and right sides of the equation. The x coordinate of the Intersection point is the solution.

$y = \ln(x) + \ln(8)$

$y = \ln(3x+30)$

$\boxed{x = 6}$