May 7

Solve Natural Log Equations

natural log → ln

- always has a base of e

↑ number ≈ 2.718

Ex 1 Solve: $\ln x = 2$

$x = e^2$

$\boxed{x = 7.39}$

Ex 2 Solve: $\ln(5x+1) = 3$

$5x+1 = e^3$

$5x+1 = 20.09$

$-1 \quad -1$

$\frac{5x}{5} = \frac{19.09}{5}$

$\boxed{x = 3.82}$

Solve Log Equations Using Properties

Ex3 Solve: $\log_4 3 + \log_4 x = 2$

multiply

adding

*Property: Adding two logs is the same as multiplying in one log.

$\log_4 3x = 2$

$3x = 4^2$

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

$x = 5.33$

Ex4 Solve: $\log_2 6x - \log_2 3 = 5$

divide

subtracting

*Property: Subtracting two logs is the same as dividing in one log.

$\log_2 \frac{6x}{3} = 5$

$2x = 5$

$2x = 2^5$

$\frac{2x}{2} = \frac{32}{2}$

$x = 16$

Ex 5 Solve: $\log_6(3x) + \log_6(4x) = 1$

multiply ↙ ↘ adding

$\log_6(3x \cdot 4x) = 1$

$\log_6 12x^2 = 1$

$6^1 = 12x^2$

$12x^2 = 6$

$\frac{12x^2}{12} = \frac{6}{12}$

$\sqrt{x^2} = \sqrt{.5}$

$x = .71, -.71$

$\boxed{x = .71}$

* Inside a log cannot be negative.

$3(.71) = 2.13$ ✓

$4(.71) = 2.84$ ✓

$3(-.71) = -2.13$ X

Ex 6 Solve: $\ln(4x^7) - \ln(8x^6) = 2$

divide ↙ ↘ subtracting

$\ln\left(\frac{4x^7}{8x^6}\right) = 2$

$\ln .5x = 2$

$e^2 = .5x$

$\frac{.5x}{.5} = \frac{7.39}{.5}$

$\boxed{x = 14.78}$

EX1 Solve: $\log_2 x + \log_2 (x+6) = 4$

multiply

adding

$\log_2 x(x+6) = 4$

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

$x^2+6x = 2^4$

$x^2+6x = 16$

$-16 \quad +16$

$x^2+6x-16=0$

a: 1 b: 6 c: -16

$$x = \frac{-b \pm \sqrt{b^2-4ac}}{2a}$$

$$x = \frac{-(6) \pm \sqrt{(6)^2-4(1)(-16)}}{2(1)}$$

$$x = \frac{-6 \pm \sqrt{100}}{2} \rightarrow \sqrt{100} = 10$$

$$x = \frac{-6 \pm 10}{2}$$

$x = 2, -8$

$\boxed{x=2}$

check:

$(2) = 2$ ✓

$(2)+6 = 8$ ✓

$(-8) = -8x$

Ex 8 Solve: $\log x^2 - \log(4x-3) = 0$

dividing

subtracting

$\log \frac{x^2}{(4x-3)} = 0$

$10^{\log \frac{x^2}{(4x-3)}} = 10^0$

$\frac{x^2}{(4x-3)} = 10^0$

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

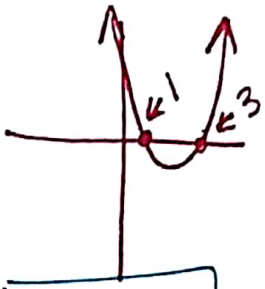
$x^2 = 4x - 3$

$-4x \quad -4x$

$x^2 - 4x = -3$

$+3 \quad +3$

$x^2 - 4x + 3 = 0$



$x = 1, 3$

check:

$(1)^2 = 1$ ✓

$4(1) - 3 = 1$ ✓

$(3)^2 = 9$ ✓

$4(3) - 3 = 9$ ✓