given that:

$\log a = 2$

$\log b = 3$

Simplify the following expression:

Evaluate

$$3\log_b b^2 - 5\log_a(10b) + 6\log_{\frac{1}{a}} a^5 + 2\log_{\frac{1}{b}} a^3$$

$$3 \cdot 2 - 5\left[\log_a 10 + \log_a b\right] - 6\log_a a^5 - 2\log_b a^{-3}$$

$$6 - 5\frac{\log 10}{\log a} - 5\frac{\log b}{\log a} - 6(5) - 2 \cdot 3\log_b a$$

$$6 - 5\left(\frac{1}{2}\right) - 5\left(\frac{3}{2}\right) - 30 - 6\frac{\log a}{\log}$$

$$6 - \frac{5}{2} - \frac{15}{2} - 30 - 6\left(\frac{2}{3}\right)$$

$$\boxed{-38}$$

Strategies for simplifying
- one law at a time
- use law 7 to get rid of fraction bases
- once law 4/5 to break up logs w variables
- use law 8 to get variables out of base.

always convert radicals to exp #'s

$$\sqrt[n]{a^m} = a^{\frac{m}{n}}$$

$$\log_{\frac{1}{5}} \frac{\sqrt[2]{25^1}}{\sqrt[2]{5^1}}$$

$$\log_{\frac{1}{5}} \frac{25^{\frac{1}{2}}}{5^{\frac{1}{2}}}$$

$$\log_{\frac{1}{5}} \frac{(5^2)^{\frac{1}{2}}}{5^{\frac{1}{2}}} \quad \text{exp } ⑤$$

$$\log_{\frac{1}{5}} \frac{5^1}{5^{\frac{1}{2}}} \quad \text{exp } ⑥$$

$$\log_{\frac{1}{5}} 5^{1-\frac{1}{2}}$$

$$\log_{\frac{1}{5}} 5^{\frac{1}{2}}$$

$$-\log_5 5^{\frac{1}{2}} \quad ⑦$$

$$-\frac{1}{2} \quad ③$$

Evaluate

$$\log_{\frac{1}{2}} 8^{\frac{1}{3}} - \log_2 16^3$$

$$-\log_2 8^{\frac{1}{3}} - \log_2 16^3$$

(7)

-1 -1

Before using log 5

problem!

must factor out negative

$$-\left(\log_2 8^{\frac{1}{3}} + \log_2 16^3\right)$$

$$-\left(\log_2 8^{\frac{1}{3}} \cdot 16^3\right)$$

(4)

$$-\left(\log_2 (2^3)^{\frac{1}{3}} \cdot (2^4)^3\right)$$

exp (5)

$$-\left(\log_2 2^1 \cdot 2^{12}\right)$$

exp (1)

$$-\log_2 2^{13}$$

log (3)

$$-13$$

$$\log_c(m) - \log_c N = \log_c\left(\frac{m}{N}\right)$$

Rewrite the following as one single log

$3\log_2 9 - \frac{1}{2}\log_2 27$ (6)

$\log_2 9^3 - \log_2 27^{\frac{1}{2}}$

$\log_2 \frac{9^3}{27^{\frac{1}{2}}}$ (5)

$a\log_c m - b\log_c N = \log_c \frac{m^a}{N^b}$

law (4) $\log_c m^n = n\log_c m$

$\log_2 \frac{(3^2)^3}{(3^3)^{\frac{1}{2}}}$

$\log_2 \frac{3^6}{3^{3/2}}$

$\log_2 3^{6-3/2}$

$\log_2 3^{\frac{9}{2}}$

exp (2)

3 b) 7.25

7.24

2 c)

Unit 8: Solving Exp or Log Equations

aka find value of x $x = \_\_\_$

3 tools.

Solve:

$8 = 2^x$ $x = 3$

$\log_2 8 = x$

$x = \frac{\log 8}{\log 2}$ ⑧

$x = 3$

1st tool:

$y = a^x \rightarrow \log_a y = x$

Use when there's one exp # or one log w/ another #

Solve:

$$3^{x+1} = 3^{4}$$

$$x + 1 = 4$$

$$x = 3$$

$x = 3$

tool 2: a theorems

if $c^{x} = c^{y}$

then $x = y$

put exps equal to each other and solve

Solve

$$2^{x+1} = 2^{4x+5}$$

$$x + 1 = 4x + 5$$

$$-4 = 3x$$

$$\frac{-4}{3} = x$$

$f(x) = \left(\frac{3}{4}\right)^{5x-1}$ $h(x) = \left(\frac{3}{4}\right)^{-x-3}$ Solve

$$\left(\frac{3}{4}\right)^{5x-1} = \left(\frac{64}{27}\right)^{-x-3}$$

- 2 exp #'s, but different bases.

$$\left(\frac{3}{4}\right)^{5x-1} = \left(\frac{4^3}{3^3}\right)^{-x-3}$$

- try to rewrite #'s as powers w same base

$$\left(\frac{3}{4}\right)^{5x-1} = \left(\left(\frac{4}{3}\right)^3\right)^{-x-3}$$

law 3 of exp $\left(\frac{a}{b}\right)^n = \left(\frac{b}{a}\right)^{-n}$

$$\left(\frac{3}{4}\right)^{5x-1} = \left(\left(\frac{3}{4}\right)^{-3}\right)^{-x-3}$$ exp (3)

$$\left(\frac{3}{4}\right)^{5x-1} = \left(\frac{3}{4}\right)^{3x+9}$$ exp 5

tool 2

Solve.

$$2^{3x-1} = 5^{x+2}$$

tool 3: a theorem

if $a^x = b^y$

then $\log_{10} a^x = \log_{10} b^y$

$$\log_{10} 2^{3x-1} = \log_{10} 5^{x+2}$$

④

$$(3x-1)\log 2 = (x+2)\log 5$$

solve for x, but bring x's together

$$3x\log 2 - \log 2 = x\log 5 + 2\log 5$$

$+\log 2$ $+\log 2$

$$3x\log 2 - x\log 5 = 2\log 5 + \log 2$$

factor out x!

$$x(3\log 2 - \log 5) = (2\log 5 + \log 2)$$

$$\frac{x(3\log 2 - \log 5)}{(3\log 2 - \log 5)} = \frac{(2\log 5 + \log 2)}{(3\log 2 - \log 5)}$$

$$x = 8.32$$

Solve: $7^{4x+2} = \left(\frac{1}{343}\right)^{x-2}$

Solve: $\log_4(x-2) + \log_4 2x = 2$

Solve: $\log_{\frac{1}{2}}(4x^2 - 8x + 3) - 3 = \log_{\frac{1}{2}}(2x^2 + 2x - 4)$

Solving:

1. Figure out which tool
2. Rewrite the equation before using tool, by using the law of logs.

$4x + 2 = -3x + 6$

$7x = 4$

$x = \frac{4}{7}$

Solve:

(4)

$$\log_4(x-2) + \log_4 2x = 2$$

$$\log_4 (x-2)(2x) = 2$$

$$\log_4 (2x^2 - 4x) = 2$$

$y = a^x \rightarrow \log_a y = ?$

convert!

$x =$

$$4^2 = 2x^2 - 4x$$

$$16 = 2x^2 - 4x$$

2nd degree? use quad formula.

$$0 = 2x^2 - 4x - 16$$

$ax^2 + bx + c$

$a = 2$

$b = -4$

$c = -16$

$D = b^2 - 4ac$

$x = \dfrac{-b \pm \sqrt{D}}{2a}$