10) $10^{3x-10} = \left(\frac{1}{100}\right)^{6x-1}$

$10^{3x-10} = 10^{-2(6x-1)}$

$3x-10 = -12x+2$

$15x = 12$

$x = 4/5$

8.) $3^{3x-7} = 3^{4(12-3x)}$

$3x-7 = 48-12x$

$\frac{11}{3}$

5.) $2^{3(x-1)} = 2^{5(3x-2)}$

$3x-3 = 15x-10$

$7 = 12x$

$\frac{7}{12} = x$

11.) $(5^2)^{10x+8} = 5^{-3(4-2x)}$

$20x + 16 = -12 + 6x$

$14x = -28$

$x = -2$

4.6 Solving Exponential & Logarithmic Equations

Logic: another thing that penguins aren't very good at.

HW:

3 Types of Exponential Equations:

1. $a^x = b$, where a and b are integral powers of the same number

ex: $27^x = 9$

2. $a^x = b$, where a and b are NOT integral powers of the same number

ex: $3^x = 5$

3. quadratic form

ex: $3^{2x} + 3^x - 6 = 0$

REVIEW:

ex: Solve.

$$27^{3x-7} = 81^{12-3x}$$

Type 2

ex: Solve.

a) $3^x = 5$

$\log_3 5 = x$

$\frac{\log 5}{\log 3} = x$

$1.465 = x$

$3^x = 5$

$\log 3^x = \log 5$

$x \log 3 = \log 5$

$\frac{x \log 3}{\log 3} = \frac{\log 5}{\log 3}$

$x =$

ex: Solve.

b) $e^{x+1} = 10$

$$\ln e^{x+1} = \ln 10$$

$$(x+1) = \ln 10$$

$$x = -1 + \ln 10$$

$$x = 1.303$$

ex: Solve.

c) $3 \cdot 4^{x-7} + 6 = 54$

$4^{x-7} = 16$

$4^{x-7} = 4^2$

$x - 7 = 2$

$x = 9$

ex: Solve.

d) $2 \cdot 10^{x-3} - 3 = 37$

$\log 10^{x-3} = \log 20$

$(x-3) = \log 20$

$x = 3 + \log 20$

$= 4.301$

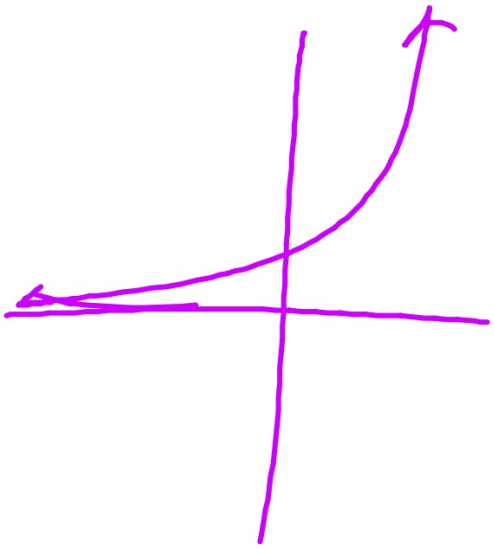
ex: Solve.

e) $2 - 5^{x-2} = 3$

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

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

$\emptyset$



ex: Solve.

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

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

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

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

$x\log 5 - x\log 3 = \log 5 + 2\log 3$ ← get xs on same side (+ constants)

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

← divide

$x = \frac{\log 5 + 2\log 3}{\log 5 - \log 3} = \frac{\log 5 + \log 9}{\log(5/3)} = \frac{\log 45}{\log(5/3)}$

ex: Solve.

g) $5^{2x-7} = 4^{x+1}$

$\log 5^{2x-7} = \log 4^{x+1}$

$(2x-7)\log 5 = (x+1)\log 4$

$2x\log 5 - 7\log 5 = x\log 4 + \log 4$

$2x\log 5 - x\log 4 = \log 4 + 7\log 5$

$x = \frac{\log 4 + 7\log 5}{\log 25 - \log 4} = 6.904$

$x = \frac{\log 312500}{\log(25|4)}$

Type 3

ex: Solve.

j) $2^{2x} - 5 \cdot 2^{x} - 24 = 0$

$X^2 - 5x - 24$

$(2^x - 8)(2^x + 3) = 0$ $(x - 8)(x + 3)$

$2^x - 8 = 0$ $2^x + 3 = 0$

$2^x = 8$ ~~$2^x = -3$~~

$X = 3$

ex: Solve.

k) $4^{2x} - 7 \cdot 4^{x} + 12 = 0$

$(4^x - 3)(4^x - 4) = 0$

$4^x = 3 \quad 4^x = 4$

$\log_4 3 = x \quad x = 1$

$.792 = \frac{\log 3}{\log 4} = x$

MIXED PRACTICE

ex: Solve.

a) $5 \cdot 2^{x} - 3 = 157$

5

b) $2 \cdot 3^{2x} + 4 \cdot 3^{x} - 12 = 0$

$3^{2x} - 4 \cdot 3^{x} - 12 = 0$

1.631

c) $8^{x+1} = 4^{x-3}$

-9

d) $\dfrac{81^{3-x}}{3^{x+1}} = \left(\dfrac{1}{3}\right)^{6x-5}$

-6

d) $\dfrac{3^{4(3-x)}}{3^{x+1}} = 3^{-1(6x-5)}$

$4(3-x) - (x+1) = -1(6x-5)$

e) $7^{x+10} = 3^{2x-1}$

81.801

3.) $\log_2\left(\frac{x^4}{32(y^8+2)}\right)^{1/2}$

$\frac{1}{2}\left[4\log_2 x^{\frac{4}{5}} - \log_2 32 - \log_2(y^8+2)\right]$

$$\frac{1}{2}\log_5(25x^2y^5)$$

$$\frac{1}{2}\left[\log_5 25 + 2\log_5 x + 5\log_5 y\right]$$

$$\frac{\log_5 25}{2}$$

$$\log\frac{1}{75} = \log 1 - \log 75$$

$$= 0 - (\log 5 + \log 5 + \log 3)$$

$$= 0 - (x + x + y)$$

$$-2x - y$$

$$\log_6 36$$

$$2$$