

HOMWORK: SOLVING LOG EQUATIONS PART 2

NAME: _____

DAY 6 DUE: _____

Solve each of the following equations. Check for extraneous solutions. Use your calculator to check your final answers.

1. $6^{3x-1} = 10^{x+7}$
 $\log 6^{3x-1} = \log 10^{x+7}$
 $(3x-1)\log 6 = x+7$
 $3x\log 6 - \log 6 = x+7$
 $3x\log 6 - x = 7 + \log 6$
 $x(3\log 6 - 1) = 7 + \log 6$

$$x = \frac{7 + \log 6}{3\log 6 - 1}$$

2. $4^{4-x} = 9^{2x+1}$
 $\ln 4^{4-x} = \ln 9^{2x+1}$
 $(4-x)\ln 4 = (2x+1)\ln 9$
 $4\ln 4 - x\ln 4 = 2x\ln 9 + \ln 9$
 $4\ln 4 - \ln 9 = 2x\ln 9 + x\ln 4$
 $4\ln 4 - \ln 9 = x(2\ln 9 + \ln 4)$

$$x = \frac{4\ln 4 - \ln 9}{2\ln 9 + \ln 4}$$

3. $10^{x+5} = 5^{3x-4}$
 $\log 10^{x+5} = \log 5^{3x-4}$
 $(x+5)\log 10 = (3x-4)\log 5$
 $x+5 = 3x\log 5 - 4\log 5$
 $x - 3x\log 5 = -4\log 5 - 5$
 $x(1 - 3\log 5) = -(4\log 5 + 5)$

$$x = \frac{-(4\log 5 + 5)}{1 - 3\log 5} = \frac{4\log 5 + 5}{3\log 5 - 1}$$

4. $4^{x+3} = 8^{6-x}$
 $(2^2)^{x+3} = (2^3)^{6-x}$
 $2^{2x+6} = 2^{18-3x}$
 $2x+6 = 18-3x$
 $5x = 12$

$$x = 12/5$$

5. $2^{2x} + 4(2^x) - 12 = 0$ Let $2x = a$

$$(2^x)^2 + 4(2^x) - 12 = 0$$

$$a^2 + 4a - 12 = 0$$

$$(a+6)(a-2) = 0$$

$$a = -6 \quad a = 2$$

$$\cancel{2^x = -6} \quad 2^x = 2$$

$$x = 1$$

6. $16^{x-5} = \left(\frac{1}{2}\right)^{2x-1}$
 $(2^4)^{x-5} = (2^{-1})^{2x-1}$
 $2^{4x-20} = 2^{-2x+1}$
 $4x-20 = -2x+1$
 $6x = 21$

$$x = 21/6$$

$$x = \frac{7}{2}$$

7. $4^x = 11$

$$\log_4 11 = x$$

$$x = \log_4 11$$

8. $2^x = 5$

$$\ln_2 5 = x$$

$$x = \ln_2 5$$

Solve each of the following equations. Check for extraneous solutions. Use your calculator to check your final answers.

$$1. \log_5(x^2 + x + 5) = 2$$

$$5^2 = x^2 + x + 5$$

$$25 = x^2 + x + 5$$

$$0 = x^2 + x - 20$$

$$0 = (x+5)(x-4)$$

$$\boxed{x = -5, 4}$$

$$2. \log_3(x^2 + 1) = 2$$

$$3^2 = x^2 + 1$$

$$9 = x^2 + 1$$

$$\sqrt{8} = \sqrt{x^2}$$

$$x = \pm\sqrt{8}$$

$$\boxed{x = \pm 2\sqrt{2}}$$

$$3. 2\log_3(x+4) - \log_3(9) = 2$$

$$\frac{\log_3(x+4)^2 - 2}{+2 \quad +2} = 2$$

$$\log_3(x+4)^2 = 4$$

$$3^4 = (x+4)^2$$

$$\sqrt{81} = \sqrt{(x+4)^2}$$

$$\pm 9 = x+4$$

$$-4 \quad -4$$

$$x = -4 \pm 9$$

$$x = -4 + 9, -4 - 9$$

$$x = 5, -13$$

$$\boxed{x = 5}$$

$$4. \log_{1/3}(x^2 + x) - \log_{1/3}(x^2 - x) = -1$$

$$\log_{1/3}\left(\frac{x^2+x}{x^2-x}\right) = -1$$

$$\left(\frac{1}{3}\right)^{-1} = \frac{x^2+x}{x^2-x}$$

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

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

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

$$2x^2 = 4x$$

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

$$2x(x-2) = 0$$

$$x = 0, 2$$

$$\boxed{x = 2}$$

$$5. \log_3(x-1) - \log_3(x+6) = \log_3(x-2) - \log_3(x+3)$$

$$\log_3\left(\frac{x-1}{x+6}\right) = \log_3\left(\frac{x-2}{x+3}\right)$$

$$\frac{x-1}{x+6} = \frac{x-2}{x+3}$$

$$(x-1)(x+3) = (x-2)(x+6)$$

$$x^2+2x-3 = x^2+4x-12$$

$$9 = 2x$$

$$\boxed{x = 9/2}$$

$$6. \log_{16}(x) + \log_4(x) + \log_2(x) = 7$$

$$\log_{16}x + \log_{16}x^2 + \log_{16}x^4 = 7$$

$$\log_{16}(x)(x^2)(x^4) = 7$$

$$\log_{16}x^7 = 7$$

$$16^7 = x^7$$

$$\boxed{x = 16}$$

$$7. \log_2x + \log_2(x+4) - \log_2(x-2) = 4$$

$$\log_2\left(\frac{x(x+4)}{x-2}\right) = 4$$

$$2^4 = \frac{x(x+4)}{x-2}$$

$$16 = \frac{x^2+4x}{x-2}$$

$$16(x-2) = x^2+4x$$

$$16x-32 = x^2+4x$$

$$\boxed{x = 4, 8}$$

$$8. \ln(5x-1) = 3$$

$$e^3 = 5x-1$$

$$+1 \quad +1$$

$$\frac{e^3+1}{5} = \frac{5x}{5}$$

$$\boxed{\frac{e^3+1}{5} = x}$$

$$x^2 - 12x + 32 = 0$$

$$(x-8)(x-4) = 0$$