(1.) $2^x = 7$ here is the problem

$\log 2^x = \log 7$ take the log of each side

$x \log 2 = \log 7$ expand

$\frac{x \log 2}{\log 2} = \frac{\log 7}{\log 2}$ divide each side by log 2

$x = (\log 7)/(\log 2)$ cancel

$x = 2.8$ use calculator

(2.) $2^x = 3^{x+1}$ here is the problem

$\log 2^x = \log 3^{x+1}$ take the log of each side

$x \log 2 = (x + 1)(\log 3)$ expand

$x \log 2 = x \log 3 + \log 3$ multiply thru

$- x \log 3 \quad -x \log 3$ subtract this from each side

$x \log 2 - x \log 3 = \log 3$ subtract

$x(\log 2 - \log 3) = \log 3$ factor

$\frac{x(\log 2 - \log 3)}{\log 2 - \log 3} = \frac{\log 3}{\log 2 - \log 3}$ div ea side by this

$x = (\log 3)/(\log 2 - \log 3)$ cancel

$x = -2.7$ use calculator

(3.) $7^{2x-1} - 5^{3x} = 0$ here is the problem

$+5^{3x} \quad + 5^{3x}$ add 5^{3x} to each side

$7^{2x-1} = 5^{3x}$ add

$(2x - 1)\log 7 = 3x \log 5$ expand

$2x \log 7 - \log 7 = 3x \log 5$ multiply thru parentheses

$+ \log 7 \quad + \log 7$ add log 7 to each side

$2x \log 7 = 3x \log 5 + \log 7$ add

$- 3x \log 5 \quad - 3x \log 5$ subtract this fr ea side

$2x \log 7 - 3x \log 5 = \log 7$ subtract

$x(2 \log 7 - 3 \log 5) = \log 7$ factor

$\frac{x(2 \log 7 - 3 \log 5)}{(2 \log 7 - 3 \log 5)} = \frac{\log 7}{(2 \log 7 - 3 \log 5)}$ div ea side by this

$x = (\log 7)/2 \log 7 - 3 \log 5)$ cancel

$x = -2$ use calculator

(4.) $2^{3x} = 4^{x+1}$ here is the problem

$\log 2^{3x} = \log 4^{x+1}$ take the log of each side

$3x \log 2 = (x + 1)\log 4$ expand

$3x \log 2 = x \log 4 + \log 4$ multiply thru parentheses

$- x \log 4 \quad - x \log 4$ subtract this from each side

$3x \log 2 - x \log 4 = \log 4$ subtract

$x(3 \log 2 - \log 4) = \log 4$ factor

$\frac{x(3 \log 2 - \log 4)}{(3 \log 2 - \log 4)} = \frac{\log 4}{(3 \log 2 - \log 4)}$ div ea side by this

$x = (\log 4)/(3 \log 2 - \log 4)$ cancel

$x = 2$ use calculator

(ii.) Another way:

$2^{3x} = 4^{x+1}$ here is the problem

$(2)^{3x} = (2^2)^{x+1}$ write 4 as 2^2

$(2)^{3x} = (2)^{2x+2}$ multiply thru parentheses

$3x = 2x + 2$ cancel

$-2x \quad -2x$ subtract 2x from each side

$x = 2$ subtract

(5.) $5^{2x} = 7^{x+1}$ here is the problem

$\log 5^{2x} = \log 7^{x+1}$ take the log of each side

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

$2x \log 5 = x \log 7 + \log 7$ multiply thru parentheses

$- x \log 7 \quad - x \log 7$ subtract this from each side

$2x \log 5 - x \log 7 = \log 7$ subtract

$x(2 \log 5 - \log 7) = \log 7$ factor

$\frac{}{2 \log 5 - \log 7} \quad \frac{}{2 \log 5 - \log 7}$ div ea side by this

$x = (\log 7)/(2 \log 5 - \log 7)$ cancel

$x = 1.5$ use calculator

(6.) $2^{0.4x} = 7$ here is the problem

$\log 2^{0.4x} = \log 7$ take the log of each side

$0.4 \times \log 2 = \log 7$ expand

$\frac{0.4 \log 2}{0.4 \log 2} = \frac{\log 7}{0.4 \log 2}$ divide each side by this

$x = (\log 7/(0.4 \log 2)$ cancel

$x = 7$ use calculator

(1.) $2 \log x - \log 10x = 0$

$\log x^2 - \log 10x = 0$ condense

$\log (x^2/10x) = 0$ condense

$x^2/10x = 10^0$ write in exponential form

$(x/10) = 1$ simplify, cancel

$x = 10$ multiply each side by 10, cancel

(2.) $\log (40x - 1) - \log (x - 1) = 3$

$\log (40x - 1)/(x - 1) = 3$ condense

$(40x - 1)/(x - 1) = 10^3$ write in exponential form

$(40x - 1)/(x - 1) = 1000$ cube the 10

$40x - 1 = 1000x - 1000$ multiply ea side by $x - 1$, cancel

$-40x + 1 = -1000x + 1000$ multiply thru by -1

$-1 \quad - 1$ subtract 1 from each side

$-40x = -1000x + 999$ subtract

$+ 1000x \quad + 1000x$ add 1000x to each side

$960x = 999$ add

$\frac{}{960}$ $\frac{}{960}$ divide each side by 960

$x = 999/960$ cancel

$x = 333/320$ reduce

(3.) $\log_2 (x - 1) + \log_2 (x + 1) = 3$ here is the problem

$\log_2 (x - 1)(x + 1) = 3$ condense

$(x - 1)(x + 1) = 2^3$ write in exponential form

$x^2 - 1 = 8$ foil multiply combine like terms, cube the 2

$+ 1 + 1$ add 1 to each side

$x^2 = 9$ add

$x = 3$ take square roots

(4.) $\log 2 + 2 \log x = \log (5x + 3)$ here is the problem

$\log 2 + \log x^2 = \log (5x + 3)$ condense

$\log 2x^2 = \log (5x + 3)$ condense

$2x^2 = 5x + 3$ cancel the logs

$-5x \quad -5x$ subtract 5x from each side

$2x^2 - 5x = 3$ subtract

$-3 \quad -3$ subtract 3 from each side

$2x^2 - 5x - 3 = 0$ subtract

$(2x + 1)(x - 3) = 0$ factor

$x - 3 = 0$ set this factor equal to 0

$+ 3 \quad +3$ add 3 to each side

$x = 3$ add

(5.) $2 \log (3 - x) = \log 2 + \log (22 - 2x)$ here is the problem

$\log (3 - x)^2 = \log 2(22 - 2x)$ expand

$(3 - x)^2 = 2(22 - 2x)$ cancel the logs

$x^2 - 6x + 9 = 44 - 4x$ multiply

$+ 4x \quad + \quad 4x$ add 4x to each side

$x^2 - 2x + 9 = 44$ add

$- 44 \quad -44$ subtract 44 from each side

$x^2 - 2x - 35 = 0$ subtract

$(x - 7)(x + 5) = 0$ factor

$x + 5 = 0$ set this factor equal to 0

$-5 \quad -5$ subtract this from each side

$x = -5$

(6.) $2 \log x - \log (30 - 2x) = 1$ here is the problem

$\log x^2 - \log (30 - 2x) = 1$ expand

$\log (x^2)/(30 - 2x) = 1$ condense

$(x^2)/(30 - 2x) = 10$ write in exponential form

$x^2 = 300 - 20x$ multiply thru by 30 - 2x, cancel

$+ 20x \quad + \quad 20x$ add 20x to each side

$x^2 + 20x = 300$ add

$- \quad 300 \quad -300$ subtract 300 from each side

$x^2 + 20x - 300 = 0$ subtract

$(x + 30)(x - 10) = 0$ factor

$x - 10 = 0$ set this factor equal to 0

$+ \quad 10 \quad +10$ add 10 to each side

$x = 10$ add

(7.) $\log (x^2 + 3x) + \log 5x = 1 + \log 2x$ here is the problem

$\log (x^2 + 3x) + \log 5x = \log 10 + \log 2x$

[write 1 as log 10]

$\log 5x(x^2 + 3x) = \log 20x$ condense

$5x(x^2 + 3x) = 20x$ cancel logs

$5x^3 + 15x^2 = 20x$ multiply thru parentheses

$\frac{}{5} \quad \frac{}{5} \quad \frac{}{5}$ divide thru by 5

$x^3 + 3x^2 = 4x$ divide

$-4x \quad -4x$ subtract 4x from each side

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

$x(x^2 + 3x - 4) = 0$ factor

$x(x + 4)(x - 1) = 0$ factor

$x - 1 = 0$ set this factor equal to 0

$+ 1 \quad +1$ add 1 to each side

$x = 1$ add

(8.) $x^{\log x} = 100x$ here is the problem

$\log x^{\log x} = \log 100x$ take the log of each side

$(\log x)(\log x) = \log 100x$ expand

$(\log x)^2 = \log 100x$ use an exponent

$- \log 100x \quad - \log 100x$ subtract this from each side

$(\log x)^2 - \log 100x = 0$ subgract

$(\log x)^2 - \log 100 - \log x = 0$ expand

$(\log x)^2 - 2 - \log x = 0$ evaluate log 100

$(\log x)^2 - \log x - 2 = 0$ rearrange terms

$(\log x - 2)(\log x + 1) = 0$ factor

$\log x - 2 = 0$ set this factor = to 0

$+ \quad 2 \quad + 2$ add 2 to each side

$\log x = 2$ add

$x = 10^2$ write in exponential form

$x = 100$ square the 10

$\log x + 1 = 0$ set this factor equal to 0

-1 -1 subtract 1 from each side

log x = -1 subtract

$x = 10^{-1}$ write in exponential form

x = 0.01 raise 10 to the -1 power

results: x = 100 ; x = 0.01

(9.) $27^{x^2+1} = 243$ here is the problem

$(3^3)^{x^2+1} = 3^5$ write as powers of 3

$(3)^{3x^2+3} = 3^5$ multiply exponents

$3x^2 + 3 = 5$ cancel

-3 -3 subtract 3 from each side

$3x^2 = 2$ subtract

$\frac{3x^2}{3} = \frac{2}{3}$ divide each side by 3

$x^2 = 2/3$ cancel

$x = \sqrt{2/3}$ $x = -\sqrt{2/3}$ take square roots

(10.) $2^{x+1} = 7^{x+2}$ here is the problem

$\log 2^{x+1} = \log 7^{x+2}$ take the log of each side

$(x + 1)(\log 2) = (x + 2)(\log 7)$ expand

$x \log 2 + \log 2 = x \log 7 + 2 \log 7$ multiply thru

- log 2 - log 2 subtract log 2 fr ea side

x log 2 = x log 7 + 2 log 7 - log 2 subtract

- x log 7 - x log 7 subtract x log 7 fr ea side

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x log 2 - x log 7 = 2 log 7 - log 2 subtract

x(log 2 - log 7) = 2 log 7 - log 2 factor

$\frac{x(\log 2 - \log 7)}{\log 2 - \log 7} = \frac{2 \log 7 - \log 2}{\log 2 - \log 7}$ div ea side by this

x = (2 log 7 - log 2)/(log 2 - log 7) cancel

x = -2.6 use calculator