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

$\log 3^{2x-1} = \log 5^{x+7}$	**- take logs of both sides**
(2x – 1)log 3 = (x + 7)log 5	**- bring the exponents out front**
(2x)log 3 – log 3 = (x)log 5 + log 3	**- distribute the brackets**
2xlog 3 – xlog 5 = 7log 5 + log 3	**- bring x's to one side**
x(2log 3 – log 5) = 7log 5 + log 3	**- Take out common factor of x from LHS**.
X = $\dfrac{7\log 5 + \log 3}{2\log 3 - \log 5}$	**- divide each side by the RHS**
X = 21.0337	**SOLVE with calculator**

2. $2^{x-1} = 23 \bullet 6^{3x}$

$\log 2^{x-1} = \log 23 + \log 6^{3x}$	**- take logs of both sides**
(x – 1)log 2 = log 23 + 3xlog 6	**- bring exponents out front**
xlog 2 – log 2 = log 23 + 3x log 6	**- distribute the brackets**
-log 2 – log 23 = 3xlog 6 –xlog 2	**- take x's to one side**
-log 2 – log 23 = x(3log 6 – log 2)	**- take out a common factor of x**
$\dfrac{-\log 2 - \log 23}{3\log 6 - \log 2} = x$	**- solve for x**

-.8176 = x

3. $\log_7 x = 3$

$7^3 = x$ **- because the x is easy to solve for, we don't need to do any tricks**

343 = x

4. $\log_x 5 = 4$

$x^4 = 5$ **- because the x is easy to solve for, we don't need to do any tricks.**

x = $\sqrt[4]{5}$

5. $\log_3 8 = x$

$3^x = 8$	**- write in exponential form**
$\log\ 3^x = \log 8$	**- Take logs of both sides**
xlog 3 = log 8	**- take exponent out to the front.**
X = $\dfrac{\log 8}{\log 3}$	**- solve for x**
X = 1.8928	**- use calculator to get answer**

6. log x + log (x + 1) = log 6

log x(x + 1) = log 6	**- squish the logs together.**
Log $(x^2 + x)$ = log 6	**- equal logs, equal numbers**
$x^2 + x = 6$	
$x^2 + x - 6 = 0$	**- bring all numbers to same side of the equal sign**.
(x + 3)(x – 2)	
x = -3, x = 2	

7. $\log_3 x + 4\log_3 x = \log_3 1024$

$\log_3 x + \log_3 x^4 = \log_3 1024$	**- put 4 back as an exponent so we can squish.**
$\log_3 x(x^4) = \log_3 1024$	**- squish the RHS together (log properties)**
$\log_3 x^5 = \log_3 1024$	**- equal logs, equal numbers**
$x^5 = 1024$	**-solve for x (get rid of exponent 5)**
x = $\sqrt[5]{1024}$	
x = $(1024)^{\frac{1}{5}}$	
x = $2^{\frac{10}{5}}$	
x = 2^2	
x = 4	

8.
$\log_5(x^3 - 64) - \log_5(x^2 + 4x + 16) = \log_5 3$

$\log_5 \frac{(x^3 - 64)}{(x^2 + 4x + 16)} = \log_5 3$	**- squish together**
$\frac{(x^3 - 64)}{(x^2 + 4x + 16)} = 3$	**- equal logs, equal exponents**
$\frac{(x-4)(x^2 + 4x + 16)}{(x^2 + 4x + 16)} = 3$	**- Factor a difference of cubes (use the form (a-b)(** $a^2 + ab + b^2$**)**
(x – 4) = 3	**- top trinomial and bottom trinomial cancel out**
x = 7	**- solve for x**

9. $\log(x^2 + 8x + 7) - \log(x + 7) = \log 2$

$\log (x + 7)(x + 1) - \log (x + 7) = \log 2$ **- factor the trinomial**

$\log \dfrac{(x+7)(x+1)}{(x+7)} = \log 2$ **-squish using log properties (cancel)**

$\log (x + 1) = \log 2$ **- equal logs, equal numbers**

$x + 1 = 2$

$x = 1$ **- solve for x**

10. $\log_3 x + \log_3 7 = 4$

$\log_3 7x = 4$ **-squish using log properties and put into exponential form.**

$3^4 = 7x$

$81 = 7x$ **- solve for x**

$11.7714 = x$

11. $\log_2 (x-1) + \log_2 (x+2) = 3$

$\log_2 (x-1)(x+2) = 3$ **- Use log properties to squish LHS**

$\log_2 (x^2 - x + 2x - 2) = 3$ **- use foil to expand the binomials**

$\log_2 (x^2 + x - 2) = 3$ **- combine like terms**

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

$8 = x^2 + x - 2$ **- combine like terms on one side**

$0 = x^2 + x - 10$

$\dfrac{1 \pm \sqrt{1 - 4(1)(-10)}}{2(1)}$ **- can not factor regular way so must use quadratic formula**

3.7016 or –2.7016

reject (-) answer

12. $4\log_4 x - 2\log_4 x = \log_4 28 - \log_4 7$

$\log_4 x^4 - \log_4 x^2 = \log_4 28 - \log_4 7$ **-use log properties to bring back exponents**

$\log_4 \dfrac{x^4}{x^2} = \log_4 \dfrac{28}{7}$ **-use log properties to squish together**

$\log_4 x^2 = \log_4 4$ **-reduce**

$x^2 = 4$ **-equal logs, equal numbers**

$x = \pm 2$ **do not reject negative**

13. $\log_3 x + \log_2 5 = \log_7 12$

$\frac{\log x}{\log 3} + \frac{\log 5}{\log 2} = \frac{\log 12}{\log 7}$ **- use log properties to get all the same base**

$\frac{\log x}{\log 3} + 2.3219 = 1.2770$ **- find the values for the logs without x's**

$\frac{\log x}{\log 3} = -1.0449$ **-multiply both sides by log 3**

log x = -.4985

$10^{-.4985} = x$ **- rewrite in exponential form or take antilog**

x = .3173

14. $\log_3 x + \log_4 6 = \log_2 x - \log_5 3$

$\frac{\log x}{\log 3} + \frac{\log 6}{\log 4} = \frac{\log x}{\log 2} - \frac{\log 3}{\log 5}$ **-use log properties to get the same base.**

$\frac{\log x}{\log 3} + 1.2925 = \frac{\log x}{\log 2} - .6826$ **- find the values for the logs without x's**

(log 2)(log x) + (log 2)(log 3)(1.2925) = (log 3)(log x) – (log 2)(log 3)(.6826)

- **multiply both sides by (log 2)(log 3) in order to get rid of the denominators**

(log 2)(log x) + .1856 = (log 3)(log x) - .0980 **- find the values of the logs**

(.3010)log x + .1856 = (.4771)log x - .0980 **- give the x's their own side**

(.3010 log x - .4771 log x) = -.0980 - .1856 **- take out a common factor of log x on the LHS**

log x (.3010 - .4771) = -.2836

log x (-.1761) = -.2836 **- divide both sides by -.1761**

log x = 1.6104 **- take the antilog or rewrite in exponential form**.

$10^{1.6104} = x$

40.8302 = x