1. Solve for x.

(a) $5 * 10^{5x} = 3$
$10^(5x) = \frac{3}{5}$
$\log 10^(5x) = \log 0.6$
$5x = \log 0.6$
$x = \frac{\log 0.6}{5}$

(b) $6 = 2 * 10^{-3x}$
$3 = 10^( - 3x)$
$\log(3) = \log(10^( - 3x)$
$\log(3) = -3x$
$x = \frac{\log 3}{-3}$

(c) $5e^{3.1x} = 25$
$e^{3.1x} = 5$
$\ln e^{3.1x} = \ln 5$
$3.1x = \ln 5$
$x = \frac{\ln 5}{3.1}$

(d) $\log 10^x = 4$
$x = 4$

(e) $\ln(4 - x) = \frac{1}{2}$
$e^{0.5} = 4 - x$
$x = 4 - e^{0.5}$

(f) $\ln(x^2 - 3) = 0$
$e^0 = x^2 - 3$
$1 = x^2 - 3$
$4 = x^2$
$x = \pm 2$

(g) $2\log(2x + 5) + 6 = 0$
$\log(2x + 5) = -3$
$10^{-3} = 2x + 5$
$0.001 - 5 = 2x$
$-4.999 = 2x$
$x = -2.4995$

(h) $\ln(\ln 3x) = 0$
$e^0 = \ln 3x$
$1 = \ln 3x$
$e^1 = 3x$
$x = \frac{e^1}{3}$

(i) $\ln(x + 3) + \ln(x - 3) = \ln(7)$
$\ln[(x + 3)(x - 3)] = \ln(7)$
$x^2 - 9 = 7$
$x^2 = 16$
$x = \pm 4$
Answer is $x = 4$ since $-4$ doesn't work in the origional problem.

(j) $\log(x - 2) + \log(x + 4) = \log 7$
$\log[(x - 2)(x + 4)] = \log 7$
$x^2 + 2x - 8 = 7$
$x^2 + 2x - 15 = 0$
$(x + 5)(x - 3) = 0$
Answer x=3 since $-5$ doesn't work in the origional problem.

(k) $\log_x(15 - 2x) = 2$
$x^2 = 15 - 2x$
$x^2 + 2x - 15 = 0$
$x = -5$ or $x = 3$
Answer: $x = 3$

(l) $\log_x(12x - 20) = 2$
$x^2 = 12x - 20$
$x^2 - 12x + 20 = 0$
$(x - 2)(x - 10) = 0$
$x = 2$ or $x = 10$

2. Use the properties of logarithms to rewrite the following as the sum and/or difference of logarithms

(a) $\ln(x + 5)^4 e^5$
$\ln(x + 5)^4 + \ln e^5$
$4\ln(+5) + 5$

(b) $\log\left(\frac{100x^4}{y^3}\right)$
$\log 100 + \log x^4 - \log y^3$
$\log 10^2 + 4\log x - 3\log y$
$2 + 4\log x - 3\log y$

(c) $\log_5\left(\frac{x+3}{y^4 z^2}\right)$
$\log_5(x + 3) - \log_5 y^4 - \log_5 z^2$
$\log_5(x + 3) - 4\log_5 y - 2\log_5 z$

3. Write as a single logarithm.

(a) $7\log(x + 5) + 2\log(x + 1)$

$\log[(x + 5)^7(x + 1)^2]$

(b) $\log_2 x + 5\log_2(y + 1) + 2\log_2(z - 1)$

$\log_2[x(y + 1)^5(z - 1)^2]$

(c) $2\ln(x + 4) - 5\ln y + 3\ln z$

$\ln\left(\frac{(x+4)^2 z^3}{y^5}\right)$