Expand using laws of logarithms:

(1.) $\log MN$ here is the problem

= $\log M + \log N$

(2.) $\log (M/N)$ here is the problem

= $\log M - \log N$

(3.) $\log M^p$ here is the problem

= $p \log M$

(4.) $\log \sqrt[p]{M}$ here is the problem

= $\log M^{1/p}$ write using a rational exponent

= $(1/p) \log M$ expand

(5.) $\log 27xy$ here is the problem

= $\log 27 + \log x + \log y$ expand

(6.) $\log (27x/y)$ here is the problem

= $\log 27 + \log x - \log y$ expand

(7.) $\log x^5$ here is the problem

= $5 \log x$ expand

(8.) $\log (9y^2/z^2$ here is the problem

= $\log 9 + 2 \log y - 2 \log z$ expand

(1.) $\log rst$ here is the problem

= $\log r + \log s + \log t$ expand

(2.) $\log x^5z$ here is the problem

= $5 \log x + \log z$ expand

(3.) $\log (r/s)$ here is the problem

= $\log r - \log s$ expand

(4.) $\log (\sqrt{x}/z)$ here is the problem

= $(1/2) \log x - \log z$ expand

(5.) $\log rt^{1/2}$ here is the problem

= $\log r + (1/2) \log t$ expand

(6.) $\log 9\sqrt[3]{z}$ here is the problem

= $\log 9 + (1/3) \log z$ expand

(7.) $\log (ab)^3$ here is the problem

= $3 \log a + 3 \log b$ expand

(8.) $\log (rt)^{1/2}$ here is the problem

= $(1/2) \log r + (1/2) \log t$ expand

(9.) $\log (xy/z^2)$ here is the problem

= $\log x + \log y - 2 \log z$ expand

(10.) $\log (\sqrt{a}/3b)$ here is the problem

= $(1/2) \log a - \log 3 - \log b$ expand

(11.) $\log (\sqrt[3]{x} * y^4)$ here is the problem

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

(12.) $\log \sqrt[5]{(a^4/b^2)}$ here is the problem

= $(4/5) \log a - (2/5) \log b$ expand

Solve:

(17.) $2^x = 8$ here is the problem

$2^x = 2^3$ write 8 as 2^3

$x = 3$ cancel

(18.) $4^x = 2$ here is the problem

$(2^2)^x = 2$ write 4 as 2^2

$2^{2x} = 2^1$ multiply exponents

$2x = 1$ cancel

$x = 1/2$ divide each side by 2, cancel

(19.) $2^x = 32$ here is the problem

$2^x = 2^5$ write 32 as 2^5

$x = 5$ cancel

(20.) $8^x = 2$ here is the problem

$(2^3)^x = 2^1$ write 8 as 2^3

$2^{3x} = 2^1$ multiply exponents

$\frac{3x}{3} = \frac{1}{3}$ cancel

divide each side by 3

$x = 1/3$ cancel

(21.) $8^x = 4$ here is the problem

$(2^3)^x = 2^2$ write as powers of 2

$2^{3x} = 2^2$ multiply exponents

$\frac{3x}{3} = \frac{2}{3}$ cancel

divide each side by 3

$x = 2/3$ cancel

(22.) $25^x = 5$ here is the problem

$(5^2)^x = 5^1$ write 25 as 5^2

$5^{2x} = 5^1$ multiply exponents

$\frac{2x}{2} = \frac{1}{2}$ cancel

divide each side by 2

$x = 1/2$ cancel

(23.) $8^x = 32$ here is the problem

$(2^3)^x = 2^5$ write as powers of 2

$2^{3x} = 2^5$ multiply exponents

$3x = 5$ cancel

$\frac{3x}{3} = \frac{5}{3}$ divide each side by 3

$x = 5/3$ cancel

(24.) $27^x = 3$ here is the problem

$(3^3)^x = 3^1$ write 27 as 3^3

$3^{3x} = 3^1$ multiply exponents

$3x = 1$ cancel

$\frac{3x}{3} = \frac{1}{3}$ divide each side by 3

$x = 1/3$ cancel

(25.) $27^x = 9$ here is the problem

$(3^3)^x = 3^2$ write as powers of 3

$3^{3x} = 3^2$ multiply exponents

$3x = 2$ cancel

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

$x = 2/3$ cancel

(26.) $2^x = 1/2$ here is the problem

$2^x = 2^{-1}$ write 1/2 as 2^{-1}

$x = -1$ cancel

(27.) $3^x = 1/9$ here is the problem

$3^x = 3^{-2}$ write 1/9 as 3^{-2}

$x = -2$ cancel

(28.) $9^{-x} = 1/27$ here is the problem

$(3^2)^{-x} = 3^{-3}$ write as powers of 3

$3^{-2x} = 3^{-3}$ multiply exponents

$-2x = -3$ cancel

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

$x = 3/2$ cancel

(44.) $3^{7x-1} = 9^{-2}$ here is the problem

$3^{7x-1} = (3^2)^{-2}$ write 9 as 3^2

$3^{7x-1} = 3^{-4}$ multiply exponents

$7x - 1 = -4$ cancel

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

$7x = -3$ add

$\frac{7x}{7} = \frac{-3}{7}$ divide each side by 7

$x = -3/7$ cancel

(45.) $16^{2x+3} = 8$ here is the problem

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

$2^{8x+12} = 2^3$ multiply exponents

$8x + 12 = 3$ cancel

$-12 \quad -12$ subtract 12 from each side

$8x = -9$ subtract

$\frac{8x}{8} = \frac{-9}{8}$ divide each side by 8

$x = -9/8$ cancel

(46.) $\dfrac{1}{5^{x+3}} = (1/25)^{[1/(4 - x)]}$

$5^{-x-3} = (5^{-2})^{[1/(4-x)]}$ write 1/25 as 5^{-2}

$5^{-x-3} = 5^{[-2/(4-x)]}$ multiply exponents

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

$x + 3 = 2/(4 - x)$ multiply thru by -1

$x + 3 = -2/(x - 4)$ rearrange like this

$x^2 - 4x + 3x - 12 = -2$ multiply ea side by x - 4

$x^2 - x - 12 = -2$ combine like terms

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

$x^2 - x - 10 = 0$ add

$x = [-b \pm \sqrt{b^2 - 4ac}]/(2a)$ use the quadratic formula

$x = [1 \pm \sqrt{1 - 4(1)(-10)}]/(2*1)$ make substitutions

$x = (1 \pm \sqrt{41})/2$

results: $x = (1 + \sqrt{41})/2$; $x = (1 - \sqrt{41})/2$

(47.) $5^{x^2+9} = 25^{-3x}$ here is the problem

$5^{x^2+9} = (5^2)^{-3x}$ write 25 as 5^2

$5^{x^2+9} = 5^{-6x}$ multiply exponents

$x^2 + 9 = -6x$ cancel the base 5's

$+ 6x \quad + 6x$ add 6x to each side

$x^2 + 6x + 9 = 0$ add

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

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

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

$x = -3$ subtract