Like 12.2

ex $9^{3x+1} = 81^{2x-5}$

$9^{3x+1} = (9^2)^{2x-5}$

$9^{3x+1} = 9^{4x-10}$

thus $3x+1 = 4x-10$

$-3x \quad +10 \quad -3x \quad +10$

$11 = x$

$9^{34} = 81^{17}$

$9^{34} = (9^2)^{17}$

ex $2^{5x} = \left(\frac{1}{4}\right)^{3x+1}$

$2^{5x} = (4^{-1})^{3x+1}$

$2^{5x} = 4^{-3x-1}$

$2^{5x} = (2^2)^{-3x-1}$

$2^{5x} = 2^{-6x-2}$

So...

$5x = -6x - 2$

$+6x \quad +6x$

$11x = -2$

$x = \frac{-2}{11}$

$2^{5\left(\frac{-2}{11}\right)} \qquad \left(\frac{1}{4}\right)^{3\left(\frac{-2}{11}\right)+1}$

$2^{-10/11} \qquad \left(\frac{1}{4}\right)^{5/11}$

$\left(\frac{2}{3}\right)^{2x} = \left(\frac{9}{4}\right)^{x+1}$

$\left(\frac{2}{3}\right)^{2x} = \left(\left(\frac{4}{9}\right)^{-1}\right)^{x+1}$

$\left(\frac{2}{3}\right)^{2x} = \left(\frac{4}{9}\right)^{-x-1}$

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

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

$\left(\frac{2}{3}\right)^{2\left(-\frac{1}{2}\right)} \stackrel{?}{=} \left(\frac{9}{4}\right)^{-\frac{1}{2}+1}$

$\left(\frac{2}{3}\right)^{-1} \stackrel{?}{=} \left(\frac{9}{4}\right)^{\frac{1}{2}}$

$\frac{3}{2} \qquad \frac{3}{2}$

thus,

$2x = -2x - 2$

$+2x \quad +2x$

$4x = -2$

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

$4^{x} = 8^{x+1}$

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

$2^{2x} = 2^{3x+3}$

then...

$2x = 3x + 3$

$-3x \quad -3x$

$-x = 3$

$x = -3$

$4^{-3} \qquad 8^{-3+1}$

$4^{-3} \qquad 8^{-2}$

$\frac{1}{64} \qquad \frac{1}{64}$

12.3 p. 770 **Defn** log form $y = \log_a x$ $\longleftrightarrow$ exp form $a^y = x$

"log base a of x"

ex4 $3^6 = 729 \longrightarrow \log_3 729 = 6$

ex6 $\left(\frac{1}{6}\right)^{-3} = 216 \longrightarrow \log_{\frac{1}{6}} 216 = -3$

ex8 $36^{\frac{1}{2}} = 6 \longrightarrow \log_{36} 6 = \frac{1}{2}$

(what power of 36 gives 6)

ex10 $\sqrt[3]{343} = 7$

$343^{\frac{1}{3}} = 7 \longrightarrow \log_{343} 7 = \frac{1}{3}$

ex 12 $16^{-3/4} = \frac{1}{8} \rightarrow \log_{16} \frac{1}{8} = -\frac{3}{4}$

ex $2^3 = 8 \longrightarrow \log_2 8 = 3$

(what power of 2 gives us 8)

ex 16 $\log_2 512 = 9 \rightarrow 2^9 = 512$

ex 18 $\log_{100} 100 = 1 \longrightarrow 100^1 = 100$

ex 20 $\log_\pi 1 = 0 \longrightarrow \pi^0 = 1$

$\log_a a = 1 \longrightarrow a^1 = a$

$\log_a 1 = 0 \longrightarrow a^0 = 1$

ex 22 $\log_{64} 2 = \frac{1}{6} \longrightarrow 64^{\frac{1}{6}} = 2$

ex 24 $\log_{\frac{1}{8}} \frac{1}{2} = \frac{1}{3} \longrightarrow \left(\frac{1}{8}\right)^{\frac{1}{3}} = \frac{1}{2}$

ex 26 $\log_{10} 10^{-2} = -2 \longrightarrow 10^{-2} = 10^{-2}$

argument

ex 30 $x = \log_{125} 5 \longrightarrow 125^x = 5$

$(5^3)^x = 5^1$

$5^{3x} = 5^1$

then $3x = 1$

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

ex 32 $\log_x 5 = \frac{1}{2} \rightarrow x^{\frac{1}{2}} = 5$

$(\sqrt{x})^2 = (5)^2$

$x = 25$

ex 34 $\log_x 64 = -6 \rightarrow x^{-6} = 64$

$x^{-6} = 64$

$\sqrt[6]{\frac{1}{x^6}} = \sqrt[6]{64}$

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

$1 = 2x$

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

$x^6 \cdot \frac{1}{x^6} = 64 \cdot x^6$

$\frac{1}{64} = \frac{64x^6}{64}$

$\sqrt[6]{\frac{1}{64}} = \sqrt[6]{x^6}$

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

ex 36 $\log_4 x = 0 \rightarrow 4^0 = x$

$x = 1$

ex 38 $\log_x 1 = 0 \rightarrow x^0 = 1$

x = any positive # other than 1

The base of a logarithm has to be positive & can't be 1.

ex40 $\log_x \frac{1}{10} = -1 \rightarrow x^{-1} = \frac{1}{10}$

$\frac{1}{x} = \frac{1}{10}$

$x = 10$

ex42

$\log_{81} 27 = x \rightarrow 81^x = 27$

$(3^4)^x = 3^3 \rightarrow 4x = 3$

$x = \frac{3}{4}$

ex44 $\log_{\sqrt{2}} (\sqrt{2})^9 = x \rightarrow (\sqrt{2})^x = (\sqrt{2})^9$

$x = 9$

ex46

$\log_4 \sqrt{64} = x \rightarrow 4^x = \sqrt{64}$

$4^x = 8$

$(2^2)^x = 2^3 \rightarrow 2x = 3$

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

ex ~~48~~ 47 $\log_4(2x+4) = 3$

$4^3 = 2x+4$

$64 = 2x+4$

$-4 \qquad -4$

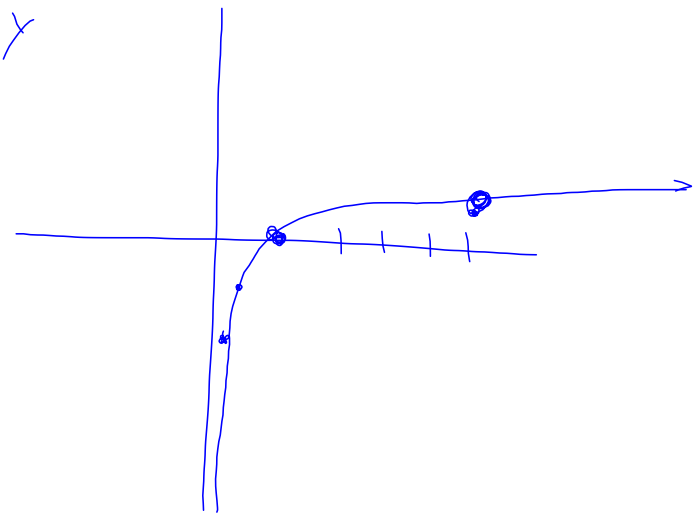
$60 = 2x$

$30 = x$

ex 50 $y = \log_5 x \iff 5^y = x$

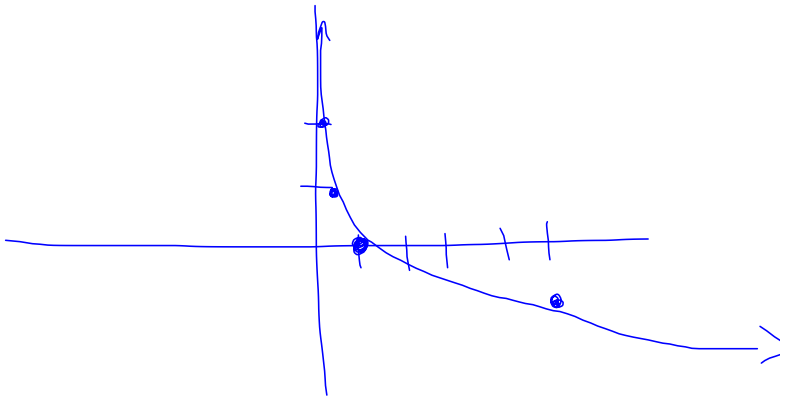
$\log_5 x = y$

x	y
$\frac{1}{25}$	-2
$\frac{1}{5}$	-1
1	0
5	1
25	2



ex 52 $y = \log_{\frac{1}{5}} x \longrightarrow \left(\frac{1}{5}\right)^y = x$

x	y
25	-2
5	-1
1	0
$\frac{1}{5}$	1
$\frac{1}{25}$	2



ex 62 $f(x) = 51.47 + 6.044 \log_2 x$

a) $x = 1 \rightarrow 1980 \rightarrow f(1) = 51.47 + 6.044 \log_2 1$ (·0)

$x = 2 \rightarrow 1981$

$y = \log_2 1$

$2^y = 1$

$y = 0$

b) 1987 $x = 8$ ($\log_2 8$, 3)

$f(8) = 51.47 + 6.044$

$= 51.47 + 18.132$

$= 69.602$