7.5 notes: using logs!!

Use logs to solve for x...round to the nearest hundredth

1. $5^x = 62$

We need to get the x out of the exponent. If we take the log of both sides, then our power log rule will allow us to do that.

$\log 5^x = \log 62$ — take the log of both sides

common.

$x \log 5 = \log 62$ — now bring the x down as a coefficient

$\frac{x \log 5}{\log 5} = \frac{\log 62}{\log 5}$ — divide both sides by *log*5 to solve for x

Calculator ready

$x = \boxed{\frac{\log 62}{\log 5}} \approx 2.56$

use your calculator *log*(62) enter / *log*(5) enter; round to nearest hundredth

Will this work if we take the ln of both sides???? Let's see!!!

natural log

e

2. $2^{x+1} = 42$

$\ln(2^{x+1}) = \ln 42$

$\frac{(x+1)\ln 2}{\ln 2} = \frac{\ln 42}{\ln 2}$ — Use power property

$x+1 = \frac{\ln 42}{\ln 2}$

$\boxed{x = \frac{\ln 42}{\ln 2} - 1}$ calculator ready

$\boxed{x \approx 4.39}$

3. $8 + 4^x = 19$

$-8 \qquad -8$

isolate exp. part 1st before taking log of BOTH SIDES

$4^x = 11$

$\log 4^x = \log 11$

$\frac{x \log 4}{\log 4} = \frac{\log 11}{\log 4}$ ← calc ready

$\boxed{x \approx 1.73}$

4. $10 - 5^x = 4$

$-10 \qquad -10$

$\frac{-5^x}{-1} = \frac{-6}{-1}$

$5^x = 6$

$\log 5^x = \log 6$

$\frac{x \log 5}{\log 5} = \frac{\log 6}{\log 5}$

Calc ready

$x = \frac{\log 6}{\log 5}$

to nearest hundredth

$x \approx 1.11$

Other loose ends to tie up...

Evaluate:

1. $\log_5 19 = \frac{\log 19}{\log 5}$

$\log_5 19 = x$

$5^x = 19$

$\log 5^x = \log 19$

$\frac{x \cancel{\log 5}}{\cancel{\log 5}} = \frac{\log 19}{\log 5}$

Looks like what we just learned to solve, so solve.

so $x = \frac{\log 19}{\log 5}$

Now, try these. Look for a pattern.

2. $\log_{19} 499 = x = \frac{\log 499}{\log 19}$

$19^x = 499$

$\log 19^x = \log 499$

$x \log 19 = \log 499$

3. $\log_{95} 36 = \frac{\log 36}{\log 95}$

Change of Base Formula

For any positive numbers m,b and c with b ≠ 1 and c ≠ 1,

$$\log_b m = \frac{\log_c m}{\log_c b}$$

We are looking for a pattern...

Evaluate:

1. $\log_5 5^9$

Hint: Write in exponential form

$\log_5 5^9 = x$

$5^x = 5^9$

$\boxed{x = 9}$

2. $\log_7 7^8 = x$

$7^x = 7^8$

$\boxed{x = 8}$

3. $\log_3 3^{40} = x$

$3^x = 3^{40}$

$\boxed{x = 40}$

See anything????

4. $5^{\log_5 9}$

Hint: Write in log form

$5^{\log_5 9} = x$

$\log_5 x = \log_5 9$

so this must be equal

$\boxed{x = 9}$

5. $4^{\log_4 7}$

$\log_4 x = \log_4 7$

$\boxed{x = 7}$

6. $19^{\log_{19} 100} = x$

exponent

$\log_{19} x = \log_{19} 100$

$\boxed{x = 100}$

See anything????

$12^{\log_{12} 71} = 71$

Exponential-Logarithmic Inverse Properties

$$For\ \ b>0 and\ \ b\neq 1:$$

$$\log_b b^x = x \quad and \quad b^{\log_b x} = x \quad for \quad x>0$$

Try these (use log properties):

NO CALC

1. $\log_3 7 - \log_3 63$ $= \log_3\left(\frac{7}{63}\right)$

$= \log_3\left(\frac{1}{9}\right)$

$= \log_3\left(\frac{1}{3^2}\right)$

$= \log_3 3^{-2} = \boxed{-2}$

2. $\frac{1}{2}\log_2 6 - \log_2 \sqrt{48}$

$\frac{1}{2}\log_2 6 - \log_2 48^{1/2} = \frac{1}{2}\log_2 6 - \frac{1}{2}\log(48)$

$= \frac{1}{2}(\log_2 6 - \log_2 48)$

$= \frac{1}{2}\log_2 \frac{6}{48} = \frac{1}{2}\log_2 \frac{1}{8}$

$= \frac{1}{2}\log_2\left(\frac{1}{2^3}\right)$

$= \frac{1}{2}\log_2(2^{-3})$

$\frac{1}{2}(-3) = \boxed{\frac{-3}{2}}$

Solve this:

3. $\frac{2\log(x+2)}{2} = \frac{1}{2}$

$\log_{10}(x+2) = \frac{1}{2}$ what is the base? 10

go to exp. form

$10^{\frac{1}{2}} = x+2$

$\sqrt{10} = x+2$

$\sqrt{10} - 2 = x \leftarrow$ calc ready form