Covert the following to a...

Log

1. $3^x = 32$

$\log_3 32 = x$

2. $r^{ab} = 17$

$\log_r 17 = ab$

3. $(7)^{x-2} = 8$

$\log_7 8 = x-2$

Exponential

4. $\log(x-3) = 2$

$10^2 = x-3$

5. $\ln x = 5$

$e^5 = x$

6. $\log_4(2x-1) = 2$

$4^2 = 2x-1$

Properties of Logs

Product Property $\log_b mn = \log_b m + \log_b n$	**Quotient Property** $\log_b \left(\frac{m}{n}\right) = \log_b m - \log_b n$
Power Property $\log_b m^n = n \log_b m$ exponent becomes a coefficient	*Change of Base Property $\log_b m = \frac{\log_r m}{\log_r b} = \frac{\log \text{ of}}{\log \text{ base}}$
One-to-One Property If $\log_b m = \log_b n$ then $m = n$.	**Inverse Property** $\log_b b^m = m$ and $b^{\log_b m} = m$

$\log_b b^m$

$m \log_b b$

$m(1)$

m

Example 1 Using the Product, Quotient, & Power Properties

$\log_b mn = \log_b m + \log_b n$	$\log_b\left(\frac{m}{n}\right) = \log_b m - \log_b n$	$\log_b m^n = n\log_b m$

Given: $\log_{13} 12 \approx 0.969$, $\log_{13} 10 \approx 0.898$

A] Find $\log_{13} 100 =$

$\log_{13} 10^2$

$2\log_{13} 10$

$2(.898) = 1.796$

B] Find $\log_{13} 120 =$

$\text{Log}_{13} 12 \cdot 10$

$\text{Log}_{13} 12 + \text{Log}_{13} 10$

$.969 + .898 = 1.867$

$\frac{5}{6} = \frac{10}{12}$

C] Find $\log_{13}\left(\frac{5}{6}\right) =$ $\log_{13}\left(\frac{10}{12}\right)$

$\log_{13} 5 - \log_{13} 6$

$\log_{13}(10) - \log_{13}(12)$

$.898 - .969 = -.071$

D] Find $\log_{13}\left(\frac{72}{5}\right) =$ $\log_{13}\left(\frac{144}{10}\right)$

$\log_{13} 72 + \log_{13} 5$

$\log_{13} 12 \cdot 6 - \log_{13} 5$

$\log_{13} 12 + \log_{13} 6 - \log_{13} 5$

$.969 + \log_{13} 6 - \log_{13} 5$

$\log_{13} 144 - \log_{13} 10$

$\log_{13} 12 \cdot 12 - \log_{13} 10$

$\log_{13} 12 + \log_{13} 12 - \log_{13}$

$.969 + .969 - .898$

1.04

Example 2 Using the Inverse Properties

$\log_b b^m = m$ and $b^{\log_b m} = m$

Use the powers table to make the base of the log and object of the log match. Then use the property

A] $\log_9 3^{2x}$

$\log_9 (3^2)^x \rightarrow \log_9 (9)^x \rightarrow$ X

B] $\log_2 16^x$

$\log_2 (2^4)^x \rightarrow \log_2 2^{4x} \rightarrow$ 4X

C] $\log_{27} 3^{6x}$

$\log_{27} (3^3)^{2x} \rightarrow \log_{27} (27)^{2x} \rightarrow$ 2X

D] $4^{\log_4 x^3}$ x^3

E] $3^{2\log_3 x}$

$3^{\log_3 x^2}$ x^2

F] $125^{\log_5 2x}$

$(5^3)^{\log_5 2x}$

$5^{\log_5 (2x)^3}$

$(2x)^3$ or $8x^3$

(6)

$2\log_8 x - 1\log_8 y$

$\log_8 x^2 - \log_8 y^{10}$

$\log_8 \frac{x^2}{y^{10}}$

(11) $\log_7 (u^4 \cdot v)^3$

$\log_7 u^{12} \cdot v^3$

$\log_7 u^{12} + \log_7 v^3$

$12\log_7 u + 3\log_7 v$