4.3D Using Logarithm Properties: Type III Problems

A. Type III Problems

There are a number of "simplifying-type" of problems that involve logarithms in exponents, I will call them "Type III". They rely on the use of Properties of Exponents in addition to Logarithm Properties

B. Review of Properties of Exponents

1. Product Rule: $b^x b^y = b^{x+y}$
2. Quotient Rule: $\frac{b^x}{b^y} = b^{x-y}$
3. Power Rule: $(b^x)^p = b^{xp}$

C. Method for Simplifying Type III Problems

1. First use Properties of Exponents (backward) to split up the exponent.
2. Inside the exponents, condense if possible.
3. Use the Annihilating Property

D. Examples

Example1: Simplify $e^{4-2\ln(x^3)}$

Solution

$$e^{4-2\ln(x^3)} = \frac{e^4}{e^{2\ln(x^3)}}$$ Property of Exponents (Quotient Rule-back.)

$$= \frac{e^4}{e^{\ln[(x^3)^2]}}$$ Condense Exponent

$$= \frac{e^4}{e^{\ln(x^6)}}$$ Annihilating Property

$$= \boxed{\frac{e^4}{x^6}}$$ Ans

Example2: Simplify $2^{3\log_2 x + 4}$

Solution

Property of Exponents: (Product Rule-back.) $\left(2^{3\log_2 x}\right)\left(2^4\right)$

Condense Exponent: $2^{\log_2(x^3)} \cdot 16$

Annihilating Property: $x^3 \cdot 16$

Ans: $\boxed{16x^3}$