Aim: How do we solve logarithmic equations? (Chapter 7.5)

Do now:

Solve each equation. To start, rewrite each side with a common base.

1. $125^{2x} = 25$

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

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

$6x = 2$

$x =$

2. $2^{3x-3} = 64$

$2^{3x-3} = 2^6$

3. $81^{3x} = 27$

I - Solving an Exponential Equation—Different Bases

1) Solve each equation. Round to the nearest ten-thousandth. Check your answers. To start, take the logarithm of each side.

4. $6^{4x} = 234$

$\log 6^{4x} = \log 234$

$4x \log 6 = \log 234$

$x = \dfrac{\log 234}{4 \log 6}$

$x \approx$

5. $3^{5x} = 375$

$\log 3^{5x} = \log 375$

6. $7^{3x} - 24 = 184$

2) Graphing Calculator Solve by graphing. Round to the nearest ten-thousandth.

7. $3^{6x} = 2000$

Let $Y_1 = 3^{6x}$ and $Y_2 = 2000$.

$x \approx$

8. $8^{3x} = 154$

9. $12^{4x} = 4600$

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II - Modeling With an Exponential Equation

Use the following formula for Exercise 10.

$$T(m) = a(1 + r)^m$$

- m = the number of minutes it takes for $\frac{3}{4}$ of the crowd to leave the stadium
- $T(m)$ = the number of people in the stadium after m minutes
- a = the number of people currently in the stadium
- r = the percent change in the number of people in the stadium

10. There are currently 100,000 people in a stadium watching a soccer game. When the game ends, about 3% of the crowd will leave the stadium each minute. At this rate, how many minutes will it take for $\frac{3}{4}$ of the crowd to leave the stadium?

III - Convert from Logarithmic Form to Exponential Form to solve each equation.

Exponential and Logarithmic Form	
Logarithmic Form $\log_b x = y$	Exponential Form $b^y = x$

11. $\log(2x + 4) = 3$

$2x + 4 = 10^3$

$2x = 996$

$x =$

12. $\log 4z - 3 = 2$

$\log 4z = 5$

13. $\log(2x - 8) = 2$

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IV - Use the properties of logarithms to solve each equation.

Product Property	Quotient Property	Power Property
$\log_b mn = \log_b m + \log_b n$	$\log_b \frac{m}{n} = \log_b m - \log_b n$	$\log_b m^n = n \log_b m$

14. $2 \log x + \log 4 = 3$

$\log x^2 + \log 4 = 3$

$\log 4x^2 = 3$

$4x^2 = 10^3$

$x^2 = 250$

$x \approx$

15. $\log y - \log 4 = 2$

$\log \frac{y}{4} = 2$

16. $\log 10 + \log 2x = 3$

17. Error Analysis Your friend used the following steps to solve the equation $\log x + \log 6 = 4$. What error did he make? What is the correct answer?

$\log x + \log 6 = 4$

$\log \frac{x}{6} = 4$

$\frac{x}{6} = 10^4$

$x = 6000$