### Warmup

- 1.  $\log_{10} 7 + \log_{10} (n-2) = \log_{10} 6n$  14
- 2.  $\log_{10}(m+3) \log_{10}m = \log_{10}4$  1
- 3.  $\log_{10} x + \log_{10} x + \log_{10} x = \log_{10} 27$  3
- 4.  $4 \log_5 x \log_5 4 = \log_5 4$  2
- 5.  $\log_2 15 + \log_2 14 \log_2 105 = \log_2 x$  2 6.  $2\log_3 x + \log_3 \frac{1}{10} = \log_3 5 + \log_3 2$  10 7.  $\log_4(x+2) + \log_4(x-4) = 2$  6

Properties

$$\log_3 x^5 = 5 \log_3 x$$
$$\log_3 xy = \log_3 x + \log_3 y$$
$$\log_7 \frac{x}{y} = \log_7 x - \log_7 y$$

$$4 \log_5 x - \log_5 4 = \log_5 x^4 - \log_5 4$$
$$= \log_5 \frac{x^4}{4}$$

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Combine into one log

1. 
$$2\log x^2 - 3\log \sqrt{x} - 2$$

 $\log \frac{x^2 \sqrt{x}}{100}$ 

2. 
$$\log_4\left(x\left(\log_2\frac{\sqrt{2}}{2}\right)\right) - \log_8 16$$
  
 $\log_4\frac{-x\sqrt[3]{2}}{16}$ 

## 6.6 - Solving Exponential and Logarithmic Equations

Solve

$$3^{\log_3 x} = 3x - 4$$
$$x = 3x - 4$$
$$x = 2$$

Simplify

1. 
$$6^{\log_6(x+2)} = 2x - 6$$
 2.  $4^{\log_2(x+1)} = 25$ 

$$x = 8 \qquad \qquad x = 4, \not \rightarrow 6$$

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 $10^{x} = 27$   $\log_{10} 10^{x} = \log_{10} 27$   $x = \log_{10} 27$  use a calculator x = 1.43...

Solve

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Solve  

$$10^{x} = 27$$
  
 $\log_{10} 10^{x} = \log_{10} 27$   
 $x = \log_{10} 27$  use a calculator  
 $x = 1.43...$ 

#### Practice

1.  $10^{-3x} = 0.28$  2.  $100^{-x} = \log_3(3\log_5 125)$ 

0.18 -0.15

What about if not the same base? 
$$5^x = 27$$

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Logarithm Change of Base Property Proof

 $k = \log_a x$  $5^k = 27$  $k = \log_5 27$  $a^k = x$  $k = \frac{\log 27}{\log 5}$  $\log_{h}(a^{k}) = \log_{h} x$  $k \log_{h} a = \log_{h} x$  $k = \frac{1.431}{0.699}$  $k = \frac{\log_b x}{\log_b a}$ k = 2.048 $\log_a x = \frac{\log_b x}{\log_b a}$  $5^{2.048} = 27$ 

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**Changing Bases** 

$$5^{k} = 27$$
  
 $k = \log_{5} 27$   
 $k = \frac{\log 27}{\log 5} = 2.048$ 

Simplify

1.  $3^x = 40$  2.  $12^{-2x} = \log_2 133$ 

-1-

x = 3.36 x = -0.39

What about? 
$$6^{(x+2)} = 24^{(-2x+1)}$$

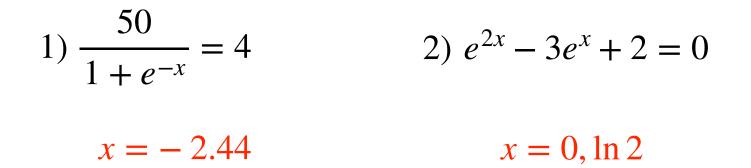
# 6.6 - Solving Exponential and Logarithmic Equations

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### Solve the expression $2e^{12x} = 17$ $e^{12x} = \frac{17}{2}$

$$12x = \log_e 8.5$$
  $x = 0.17833$ 

#### Practice



# 6.6 - Solving Exponential and Logarithmic Equations

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### Solve the expression

log x + log(x - 1) = log(4x) x<sup>2</sup> - x = 4x log x(x - 1) = log(4x) x<sup>2</sup> - 5x = 0log(x<sup>2</sup> - x) = log(4x) x(x - 5) = 0 x = ¥ 5

### Practice

- 1)  $\log_2 3 + \log_2 x = \log_2 5 + \log_2 (x 2)$ 2)  $\log_2 (x^2 - x - 2) = \log_2 2$ x = 5
  - x = -2, 3

### 6.6 - Solving Exponential and Logarithmic Equations

**Solving Equations** 

$$12^{2x} = 48$$
$$\log_{12} 12^{2x} = \log_{12} 48$$
$$2x = \log_{12} 48$$
$$x = \frac{\log 48}{2\log 12} = 0.8$$

$$\log_{e} x = \ln x$$
  

$$\ln e^{5} = 5$$
  

$$\ln 4 - \ln 10 = \ln \frac{4}{10}$$
  

$$= \ln 0.4 = -0.92$$

#### Practice

1.  $\ln 3x = 2$  x = 2.462.  $\ln 3 + \ln 2x = \ln 36$  x = 1.393.  $3e^{2x} + 2 = 50$ x = 1.39