

8.4: Solving for the exponent  
using logs

From before; (like bases)

$$\begin{aligned} 2^x &= 32 \\ 2^x &= 2^5 \\ x &= 5 \end{aligned}$$

Bases not the same

$$\begin{aligned} 1) \quad 2^x &= 5 \\ \log 2^x &= \log 5 \\ x \log 2 &= \log 5 \\ x &= \frac{\log 5}{\log 2} \approx 2.32 \end{aligned}$$

$$\begin{aligned} 2) \quad 3^{2x-3} &= 7 \\ 2x-3 &= \frac{\log 7}{\log 3} \\ 2x &= \frac{\log 7}{\log 3} + 3 \\ 2x &\approx 4.77 \\ x &\approx 2.39 \end{aligned}$$

$$\begin{aligned} 3) \quad 2(5)^{x-1} + 5 &= 13 \\ 2(5)^{x-1} &= 8 \\ 5^{x-1} &= 4 \\ x-1 &= \frac{\log 4}{\log 5} \\ x &= \frac{\log 4}{\log 5} + 1 \end{aligned}$$

$$4) \quad 3^{x-1} = 5^{2x+3}$$

$$\log 3^{x-1} = \log 5^{2x+3}$$

$$(x-1) \log 3 = (2x+3) \log 5$$

$$(x-1)(0.4771) = (2x+3)(0.6990)$$

$$0.4771x - 0.4771 = 1.398x + 2.097$$

$$0.4771x - 1.398x = 2.097 + 0.4771$$

$$-0.9209x = 2.5741$$

$$x \approx -2.795$$

### 8.4 Practice

# 3, 4

go back & practice

# 1, 2, 5, 7

**BLM 8–5 Section 8.4 Extra Practice**

1. a) no solution b)  $\pm\sqrt{29}$  c) -3

2. a) 8 b) 2 c) -3

3. a) 1.79 b) 1.01 c) 13.6

4. a) -1.76 b) -1.81 c) -9.32

5. Example: If Nicole's work is preferred it is because it uses the definition of logarithm to convert 5 into  $\log_2 32$ . Once this is done, the logarithm can be dropped from both sides of the equation. If Joseph's work is preferred, it is because it converts the logarithmic equation into an exponential function.

6. Example: Samuel's error occurs in his first calculation:  $\log 500$  divided by  $\log 5$  does not equal  $\log 100$ . To solve the equation correctly, Samuel should first calculate the log of 500 and then divide this value by the log of 5.

$$\frac{\log 500}{\log 5} = x$$

$$\frac{2.69897...}{0.69897...} = x$$

$$x \approx 3.86$$

7. a) 2.59 b) 8 c) no solution d) 6