

8.7

## Exponential Equations

### Rundown:

- The variables are exponents. We have to solve for the variable.
- The goal is to get the base numbers to be the same. If they are the same, then we can remove them and focus solely on the exponents.

Goal: Get the same base

1.  $5^x = 625$

$$\begin{array}{c} \wedge \\ 5 \ 125 \\ \wedge \\ 5 \ 25 \\ \wedge \\ 5 \ 5 \end{array}$$

$$5^x = 5^4$$

$$x = 4$$

2.  $3^x = 243$

$$\begin{array}{c} \wedge \\ 3 \ 81 \\ \wedge \\ 3 \ 27 \\ \wedge \\ 3 \ 9 \\ \wedge \\ 3 \ 3 \end{array}$$

$$3^x = 3^5$$

$$x = 5$$

3.  $6^{x-1} = 1296$

$$\begin{array}{c} \wedge \\ 6 \ 216 \\ \wedge \\ 6 \ 36 \\ \wedge \\ 6 \ 6 \end{array}$$

$$6^{x-1} = 6^4$$

$$\begin{array}{c} x-1 = 4 \\ +1 \quad +1 \\ \hline x = 5 \end{array}$$

4.  $2^{4x+3} = 2048$

$$\begin{array}{c} \wedge \\ 2 \ 1024 \\ \wedge \\ 2 \ 512 \\ \wedge \\ 2 \ 256 \\ \wedge \\ 2 \ 128 \\ \wedge \\ 2 \ 64 \\ \wedge \\ 2 \ 32 \\ \wedge \\ 2 \ 16 \\ \wedge \\ 2 \ 8 \\ \wedge \\ 2 \ 4 \\ \wedge \\ 2 \ 2 \end{array}$$

$$2^{4x+3} = 2^{11}$$

$$\begin{array}{r} 4x + 3 = 11 \\ -3 \quad -3 \\ \hline 4x = 8 \end{array}$$

$$\begin{array}{r} 4x = 8 \\ 4 \quad 4 \\ \hline x = 2 \end{array}$$

$$x = 2$$

$$5. 27^{x-1} = 3^1 \rightarrow 3^{3(x-1)} = 3^1$$

$$\begin{array}{c} 9 \wedge 3 \\ 3 \wedge 3 \end{array}$$

$$3^{(x-1)} = 1$$

$$3x - 3 = 1$$

$$\begin{array}{r} \frac{3x - 3 = 1}{+3 \quad +3} \\ \hline \frac{3x}{3} = \frac{4}{3} \end{array}$$

$$x = \frac{4}{3}$$

$$6. 64^{5x-4} = 2$$

$$\begin{array}{c} 2 \wedge 32 \\ 2 \wedge 16 \\ 2 \wedge 8 \\ 2 \wedge 4 \\ 2 \wedge 2 \end{array}$$

$$2^{6(5x-4)} = 2^1$$

$$6(5x-4) = 1$$

$$\begin{array}{r} 30x - 24 = 1 \\ +24 \end{array}$$

$$\begin{array}{r} 30x = 25 \\ \hline \frac{30x}{30} = \frac{25}{30} \end{array}$$

$$x = \frac{5}{6}$$

$$-3 = 9x + 3$$