

Solve Exponential Equations

1. Rewrite each term to have the **same base**.
2. Use the properties of exponents to **simplify if necessary**.
3. Use the properties of equality to **set the exponents on both sides of the equation equal to each other**.
4. **Solve** for the unknown variable.

1. $2^x = 128$

$$2^x = 2^7$$

$$x = 7$$

2. $3^{3x+1} = 81$

$$3^{3x+1} = 3^4$$

$$3x+1 = 4$$

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

$$x = 1$$

3. $4^{x-3} = 64$

$$4^{x-3} = 4^3$$

$$x-3 = 3$$

$$\begin{array}{r} x-3 = 3 \\ +3 \quad +3 \\ \hline x = 6 \end{array}$$

4. $5^x = 15,625$

$$5^x = 5^6$$

$$x = 6$$

5. $6^{3x+2} = 216$

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

$$\begin{array}{r} 3x+2 = 3 \\ -2 \quad -2 \\ \hline \end{array}$$

$$\frac{3x}{3} = \frac{1}{3}$$

$$x = \frac{1}{3}$$

6. $4^{5x-3} = 16$

$$4^{5x-3} = 4^2$$

$$\begin{array}{r} 5x-3 = 2 \\ +3 \quad +3 \\ \hline \end{array}$$

$$5x = 5$$

$$x = 1$$

7. $8^x = 4096$

$$8^x = 8^4$$

$$x = 4$$

8. $9^{3x+3} = 6561$

$$9^{3x+3} = 9^4$$

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

$$3x = 1$$

$$x = \frac{1}{3}$$

1) $4^{3n-3} = \frac{1}{4}$

$$4^{3n-3} = \frac{1}{4^1}$$

$$4^{3n-3} = 4^{-1}$$

$$3n-3 = -1$$

$$3n = 2$$

$$\boxed{n = \frac{2}{3}}$$

3) $5^{-3k} = \frac{1}{25}$

$$5^{-3k} = \frac{1}{5^2}$$

$$5^{-3k} = 5^{-2}$$

$$-3k = -2$$

$$\boxed{k = \frac{2}{3}}$$

5) $5^{-3x} \cdot 625 = 25$

$$5^{-3x} \cdot 5^4 = 5^2$$

$$-3x+4 = 2$$

$$-3x = -2$$

$$x = \frac{2}{3}$$

2) $6^{-3r} = 6^{-r-1}$

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

$$-2r = -1$$

$$\boxed{r = \frac{1}{2}}$$

4) $3^5 \cdot 3^x = 3^4$

$$3^{5+x} = 3^4$$

$$5+x = 4$$

$$x = -1$$