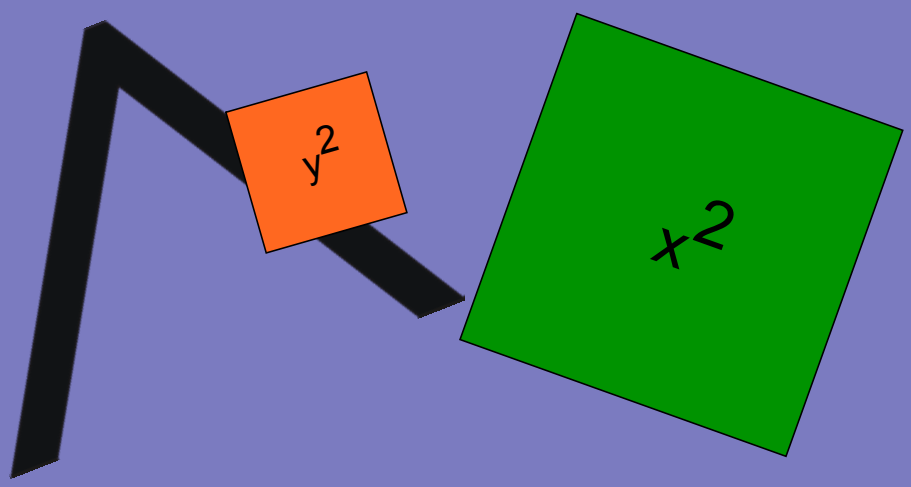
# Solving Exponential Equations




**Example 1**

$$4^{2p} = 4^{-2p-1}$$

matching the bases.

4x exponents equal

$\therefore 2p = -2p - 1$

$2p + 2p = -1$

$4p = -1$

$p = -\frac{1}{4}$

**Example 2**

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

bases are matched!

$\therefore 3-2x = -x$

$3 = -x+2x$

$3 = x$

**Example 3**

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

bases are matched!

$\therefore 2x+2 = 3x$

$2x-3x = -2$

$-x = -2$

$x = 2$

## Example 4

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

bases are matched

$\therefore -2a = 2 - 3a$

$-2a + 3a = 2$

$a = 2$

## Example 5

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

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

power law (added exponents)

matched bases

$\therefore -4x - 2 = -x$

$-2 = -x + 4x$

$-2 = 3x$

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

**Example 6**

$$3^{1-2x} = 243$$

$$3^{1-2x} = 3^{5}$$

$$\therefore 1-2x = 5$$

$$\therefore 1-2x = 5$$

$$-2x = 5-1$$

$$-2x = 4$$

$$x = -2$$

**Example 7**

$$4^{-2x} \cdot 4^{x} = 64$$

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

$$\therefore -x = 3$$

$$x = -3$$

**Example 8**

$$6^{-2x} \cdot 6^{-x} = \frac{1}{216}$$

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

$\therefore -3x = -3$

$x = 1$

**Example 9**

$$2^{x} \cdot \frac{1}{32} = 32$$

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

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

$\therefore x - 5 = 5$

$x = 10$

**Example 10**

$$9^{-3x} \cdot 9^{x} = 27$$

$$9^{-2x} = 27$$

$$3^2 \qquad 3^3$$

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

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

$$\therefore -4x = 3$$

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

**Example 11**

$$81 \cdot 9^{-2b-2} = 27$$

$$9^2 \cdot 9^{-2b-2} = 27$$

$$9^{-2b} = 27$$

$$(3^2)^{-2b} = 3^3$$

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

$$\therefore -4b = 3$$

$$b = \frac{-3}{4}$$

## Example 12

$$243^{k+2} \cdot 9^{2k-1} = 9$$

$$(3^5)^{k+2} \cdot (3^2)^{2k-1} = 3^2$$

$$3^{5k+10} \cdot 3^{4k-2} = 3^2$$

$$3^{9k+8} = 3^2$$

$$\therefore 9k+8 = 2$$

$$9k = 2-8$$

$$9k = -6$$

$$k = -\frac{6}{9}$$

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

## Example 13

$$16^{2p-3} \cdot 4^{-2p} = 2^4$$

**Example 14**

$$4^{2x+3} = 1$$

$$4^{2x+3} = 4^0$$

$$\therefore 2x+3=0$$

$$2x=-3$$

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