

Exponential Equations

Solve each equation.

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

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

$$2x+3 = 0$$

$$2x = -3$$

$$x = -3/2$$

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

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

$$1-2x = 5$$

$$-2x = 4$$

$$x = -2$$

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

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

$$3x-2 = 0$$

$$3x = 2$$

$$x = 2/3$$

7) $6^{-2a} = 6^{2-3a}$

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

$$a = 2$$

9) $6^{3m} \cdot 6^{-m} = 6^{-2m}$

$$6^{2m} = 6^{-2m}$$

$$\begin{array}{r} 2m = -2m \\ +2m \quad +2m \end{array}$$

$$4m = 0$$

$$m = 0$$

11) $10^{-3x} \cdot 10^x = \frac{1}{10}$

$$10^{-2x} = 10^{-1}$$

$$-2x = -1$$

$$x = 1/2$$

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

$$3-2x = -x$$

$$\begin{array}{r} +2x \quad +2x \end{array}$$

$$3 = x$$

4) $3^{2a} = 3^{-a}$

$$2a = -a$$

$$\begin{array}{r} +a \quad +a \end{array}$$

$$3a = 0$$

$$a = 0$$

6) $4^{2p} = 4^{-2p-1}$

$$2p = -2p-1$$

$$4p = -1$$

$$p = -1/4$$

8) $2^{2x+2} = 2^{3x}$

$$2x+2 = 3x$$

$$\begin{array}{r} -2x \quad -2x \end{array}$$

$$2 = x$$

10) $\frac{2^x}{2^x} = 2^{-2x}$

$$2^0 = 2^{-2x}$$

$$0 = -2x$$

$$0 = x$$

12) $3^{-2x+1} \cdot 3^{-2x-3} = 3^{-x}$

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

$$-4x-2 = -x$$

$$\begin{array}{r} +4x \quad +4x \end{array}$$

$$-2 = 3x$$

$$-2/3 = x$$

$$13) 4^{-2x} \cdot 4^x = 64$$

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

$$-x = 3$$

$$\boxed{x = -3}$$

$$14) 6^{-2x} \cdot 6^{-x} = \frac{1}{216}$$

$$6^{-3x} = \frac{1}{6^3}$$

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

$$-3x = -3$$

$$\boxed{x = 1}$$

$$15) 2^x \cdot \frac{1}{32} = 32$$

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

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

$$x-5 = 5$$

$$\boxed{x = 10}$$

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

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

$$-p = 2p$$

$$0 = 3p$$

$$\boxed{0 = p}$$

$$17) 64 \cdot 16^{-3x} = 16^{3x-2}$$

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

$$4^3 \cdot 4^{-6x} = 4^{6x-4}$$

$$4^{-6x+3} = 4^{6x-4}$$

$$-6x+3 = 6x-4$$

$$3 = 12x-4$$

$$7 = 12x$$

$$18) \frac{81^{3n+2}}{243^{-n}} = 3^4$$

$$= \frac{(3^4)^{3n+2}}{(3^5)^{-n}} = 3^4$$

$$= \frac{3^{12n+8}}{3^{-5n}} = 3^4$$

$$\rightarrow 3^{17n+8} = 3^4$$

$$17n+8 = 4$$

$$17n = -4$$

$$\boxed{n = \frac{-4}{17}}$$

$$19) 81 \cdot 9^{-2b-2} = 27$$

$$3^4 \cdot (3^2)^{-2b-2} = 3^3$$

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

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

$$-4b = 3$$

$$\boxed{b = -3/4}$$

$$\boxed{7/12 = x}$$

$$20) 9^{-3x} \cdot 9^x = 27$$

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

$$3^{-6x} \cdot 3^{2x} = 3^3$$

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

$$-4x = 3$$

$$\boxed{x = -3/4}$$

$$21) \left(\frac{1}{6}\right)^{3x+2} \cdot 216^{3x} = \frac{1}{216}$$

$$(6^{-1})^{3x+2} \cdot (6^3)^{3x} = 6^{-3}$$

$$6^{-3x-2} \cdot 6^{9x} = 6^{-3}$$

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

$$6x-2 = -3$$

$$6x = -1$$

$$22) 243^{k+2} \cdot 9^{2k-1} = 9$$

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

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

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

$$9k+8 = 2$$

$$9k = -6$$

$$k = \frac{-6}{9} = \boxed{\frac{-2}{3}}$$

$$23) 16^r \cdot 64^{3-3r} = 64$$

$$(4^2)^r \cdot (4^3)^{3-3r} = 4^3$$

$$4^{2r} \cdot 4^{9-9r} = 4^3$$

$$4^{-7r+9} = 4^3$$

$$-7r+9 = 3$$

$$-7r = -6$$

$$\boxed{r = 6/7}$$

$$24) 16^{2p-3} \cdot 4^{-2p} = 2^4$$

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

$$2^{8p-12} \cdot 2^{-4p} = 2^4$$

$$2^{4p-12} = 2^4$$

$$4p-12 = 4$$

$$4p = 16$$

$$\boxed{p = 4}$$