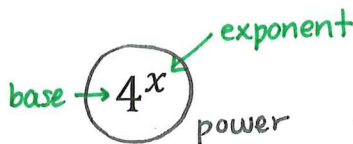


7.3 Solving Exponential Equations – part 1

Exponent Laws Review:



1) $x^m \cdot x^n = x^{m+n}$

2) $\frac{x^m}{x^n} = x^{m-n}$

3) $(x^m)^n = x^{m \cdot n}$

4) $x^{-m} = \frac{1}{x^m}$

5) $x^{\frac{m}{n}} = \sqrt[n]{x^m}$

6) $x^0 = 1$

Example 1: Write each expression as a power with a base of 3.

a) $\frac{1}{27}$

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

$= 3^{-3}$

b) 9^{2x}

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

$= 3^{4x}$

c) 81^{x-2}

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

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

$= 3^{4x-8}$

d) $(\sqrt[3]{81})^2$

$= (\sqrt[3]{3^4})^2$

$= (3^{\frac{4}{3}})^2$

$= 3^{\frac{8}{3}}$

Exponential Equation: An equation in which the variable is in the exponent.

Example 2: Solve $2^{2x+1} = 8$

① write both sides of the equation in the same base.

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

② Since both sides are single powers of the same base, the exponents must be equal.

$$2x + 1 = 3$$

③ solve the equation.

$$2x + 1 = 3$$

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

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

$x = 1$

Example 3: Solve $16^{x-1} = 64$

Rewrite with a base of 4 (base of 2 would have also worked)

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

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

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

exponents only : $2x-2 = 3$

$$\quad \quad \quad +2 \quad \quad +2$$

$$\frac{2x}{2} = \frac{5}{2}$$

$$x = \frac{5}{2}$$

Example 4: Solve $1 = 5^{2x+1}$

Rewrite with a base of 5

$$5^0 = 5^{2x+1}$$

exp. only : $0 = 2x+1$

$$\frac{-1}{2} = x$$

Example 5: Solve $27^{x+3} = \left(\frac{1}{9}\right)^{2x-5}$

Rewrite with a base of 3

$$(3^3)^{x+3} = \left(\frac{1}{3^2}\right)^{2x-5}$$

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

$$3^{3x+9} = 3^{-4x+10}$$

exp. only : $3x+9 = -4x+10$

$$\quad \quad \quad +4x - 9 \quad \quad +4x - 9$$

$$7x = 1$$

$$x = \frac{1}{7}$$

Example 6: Solve $25^{x+1} = \sqrt{5}$

Rewrite with a base of 5

$$(5^2)^{x+1} = 5^{\frac{1}{2}}$$

$$5^{2x+2} = 5^{\frac{1}{2}}$$

exp. only : $2x + 2 = \frac{1}{2}$

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

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

Example 7: Solve $\frac{2(81^{2x+1})}{7} = \frac{18}{2}$

$$81^{2x+1} = 9$$

Rewrite with a base of 9 (or 3)

$$(9^2)^{2x+1} = 9^1$$

$$9^{4x+2} = 9^1$$

exp. only : $4x + 2 = 1$

$$4x = -1$$

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