

Unit 2: Exponents & Roots

2.0 Review – Exponent Laws

Exponent laws are used to **simplify** operations involving powers of the **same base**.

1. Multiplying Powers

Ex. Simplify (express as a single power): $2^3 \times 2^2$

$$2 \cdot 2 \cdot 2 \times 2 \cdot 2$$

$$2^5$$

$$\text{Rule: } b^m \cdot b^n = b^{m+n}$$

Ex. Simplify:

a) $3^6 \cdot 3^5$

$$= 3^{11}$$

b) $(-5)^7 \times (-5)^3$

$$= (-5)^{10}$$

c) $(2x)(-3x^2)(x^3)$

$$-6x^6$$

2. Dividing Powers

Ex. Simplify (express as a single power): $2^5 \div 2^3 = 2 \cdot 2 \cdot 2 \cdot 2 \cdot 2$

$$\frac{2 \cdot 2 \cdot 2 \cdot 2 \cdot 2}{2 \cdot 2 \cdot 2}$$

$$= 2^2$$

$$\text{Rule: } \frac{b^m}{b^n} = b^{m-n}$$

Ex. Simplify:

a) $5^6 \div 5^2 = 5^4$

b) $\frac{(-6)^8}{(-6)^4} = (-6)^4$

c) $\frac{10x^{20}}{5x} = 2x^{19}$

3. Zero Exponent

Ex. $\frac{2^3}{2^3} = 1$

$$2^{3-3} = 2^0 = 1$$

$$\begin{array}{l} 2^3 = 8 \\ 2^2 = 4 \\ 2^1 = 2 \\ 2^0 = 1 \end{array} \quad \left| \begin{array}{l} \div 2 \\ \div 2 \\ \div 2 \\ \div 2 \end{array} \right.$$

$$\text{Rule: } b^0 = 1$$

Ex. Simplify:

a) $999,999,999^0 = 1$

b) $-3^0 = -1$

c) $(-3)^0 = 1$

4. Power of a Product

Ex. Simplify: $(2 \times 3)^3 = (2 \times 3)(2 \times 3)(2 \times 3)$

$$= 2 \cdot 2 \cdot 2 \cdot 3 \cdot 3 \cdot 3$$

$$= 2^3 \times 3^3$$

$$\text{Rule: } (ab)^n = a^n b^n$$

Ex. Simplify:

a) $(5 \times 4)^6$

$$= 5^6 \times 4^6$$

b) $(xyz)^4$

$$= x^4 y^4 z^4$$

***NOTE: Not for adding or subtracting!**

$$(5+4)^2 \neq 5^2 + 4^2$$

$$9^2 \neq 25 + 16$$

$$81 \neq 41$$

$$(x+y)^3 \neq x^3 + y^3$$

5. Power of a Quotient

Ex. Simplify: $\left(\frac{2}{3}\right)^4 = \left(\frac{2}{3}\right)\left(\frac{2}{3}\right)\left(\frac{2}{3}\right)\left(\frac{2}{3}\right)$

$$= \frac{2 \cdot 2 \cdot 2 \cdot 2}{3 \cdot 3 \cdot 3 \cdot 3} = \frac{2^4}{3^4}$$

Rule: $\left(\frac{a}{b}\right)^n = \frac{a^n}{b^n}$

Ex. Simplify: $\left(\frac{c}{d}\right)^7 = \frac{c^7}{d^7}$

6. Power of a Power

Ex. Simplify: $(2^2)^3 = (2^2)(2^2)(2^2)$

$$= 2^6$$

Rule: $(b^m)^n = b^{mn}$

Ex. Simplify:

a) $(3^4)^5$

$$= 3^{20}$$

b) $((q^2)^3)^4$

$$= q^{24}$$

c) $(2x^5)^3 = 2^3(x^5)^3$

$$= 2^3 x^{15}$$

***NOTE: Be careful not to confuse rule # 1 and rule #6!**

#1 $(3^4)(3^5) = 3^9$ vs. #6 $(3^4)^5 = 3^{20}$

Combinations:

Ex. Simplify, then evaluate:

a) $\frac{(2^3)^2 \times 2^5}{2^4 \times 2^1}$

$$= \frac{2^6 \times 2^5}{2^5} = \frac{2^{11}}{2^5} = 2^6$$

b) $\frac{(x^3y)^4(x^2)}{y}$

$$= \frac{x^{12}y^4 \cdot x^2}{y} = x^{14}y^3$$

Practice: WS. 3.0 / Evens