

Chapter P: Fundamental Concepts of Algebra 1

P.2: Exponents

Exponential Notation:

$Base \leftarrow b^{n \rightarrow \text{power or Exponent}} = b.b.b \dots \dots b \quad n \text{ times}$

b^n reads as “ b to the power of n ” or “ b to the n th power”.

Example 1:

A) $2^4 =$

B) $-2^4 =$

C) $(-2)^4 =$

D) $(-2)^5 =$

E) $-2^5 =$

Note:
$$\begin{cases} (-x)^n = x^n & \text{if } n \text{ is even number} \\ (-x)^n = -x^n & \text{if } n \text{ is odd number} \end{cases}$$

Product Rule: $b^m b^n = b^{m+n}$

$$(-9x^3y)(-2x^6y^4) =$$

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

A) $\frac{x^{14}}{x^{-7}} =$

B) $\frac{25a^{13}b^4}{-5a^2b^3} =$

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Zero –Exponent Rule: $b^0 = 1, b \neq 0$

A) $(-3)^0 =$

B) $-3^0 =$

Note: 0^0 is undefined

Negative –Exponent Rule:

$$b^{-n} = \frac{1}{b^n} \quad \frac{1}{b^{-n}} = b^n$$

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

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

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

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

Products to Powers: $(ab)^n = a^n b^n$

$$(-3x^2y^5)^2 =$$

Quotients to Powers: $\left(\frac{a}{b}\right)^n = \frac{a^n}{b^n}$

$$\left(-\frac{4}{x}\right)^3 =$$

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Simplifying Exponential Expressions:

Properties of exponents are used to simplify the exponential expressions. An exponential expression is simplified when

- No Parentheses appear.
- No powers are raised to powers.
- Each base occurs only ones.
- No negative or zero exponents appear.

Example 2:

Simplify Each Exponential Expression:

$$A) x^{-5} \cdot x^{10} =$$

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

$$C) (-3x^4y^5)^3 =$$

$$D) (-7xy^4)(-2x^5y^6) =$$

$$E) -\frac{35x^2y^4}{5x^6y^{-8}} =$$

$$F) \left(\frac{4x^2}{y} \right)^{-3} =$$

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$$H) \left(\frac{4a^{-5}b^3}{12a^3b^{-5}} \right)^0 =$$

$$I) \left(\frac{-20a^3b^4}{4a^6b^{-3}} \right)^{-2}$$

$$J) \left(\frac{-15a^4b^2}{5a^{10}b^{-3}} \right)^3 =$$

$$K) \frac{24x^3y^5}{32x^7y^{-9}} =$$