## **Powers with Negative Exponents**

## Powers with Negative Exponents:

**Definition:** Powers with negative exponents represent the reciprocal or the inverse of a number raised to a positive exponent. In other words, if you have a number raised to a negative exponent, you can rewrite it as the reciprocal of the same number raised to the positive exponent.

**General Form:** If "a" is a non zero number, and "n" is a positive integer, then  $a^{-n} = \frac{1}{a^n}$ 

**Examples:** 

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i.  $2^{-3} = \frac{1}{2^3} = \frac{1}{8}$ ii.  $5^{-2} = \frac{1}{5^2} = \frac{1}{25}$ iii.  $x^{-4} = \frac{1}{x^4}$ 

**Negative Exponents Rule:** When you have a number with negative exponents, you can move it to the denominator of a fraction by changing the sign of the exponents to positive.

**Zero Exponents Rule:** Any non-zero number raised to the power of 0 is always 1. So,  $a^0 = 1$  for any non-zero "a"

## **Properties of Negative Exponents:**

When you multiply two numbers with negative exponents, the exponents add up to zero.

For example,  $a^{-2} \cdot a^2 = a^{(-2+2)} = a^0 = 1$ 

When you divide two numbers with negative exponents, the exponents subtract from each other.

For example,  $\frac{b^{-3}}{b^{-1}} = b^{(-3-(-1))} = b^{-2}$ .

When you raise a number with negative exponents to another power, you multiply the exponents.

For example,  $(c^{-2})^3 = c^{(-2.3)} = c^{-6}$ .

Examples of simplification:

i. 
$$3^{-2} \cdot 3^4 = 3^{(-2+4)} = 3^0 = 9$$

**ii.** 
$$\frac{2^{-3}}{2^{-3}} = 2^{(-3 - (-5))} = 2^2 = 4$$

iii. 
$$(4^{-2})^3 = 4^{(-2.3)} = 4^{-6}$$
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