

Chapter – 12

Exponents and Powers

- Numbers with negative exponents obey the following laws of exponents.

$$(a) a^m \times a^n = a^{m+n}$$

$$(b) a^m \div a^n = a^{m-n}$$

$$(c) (a^m)^n = a^{mn}$$

$$(d) a^m \times b^m = (ab)^m$$

$$(e) \quad \quad \quad 0 = 1$$

$$(f) \frac{a^m}{b^m} = \left(\frac{a}{b} \right)^m$$

- Very small numbers can be expressed in standard form using negative exponents.
- Use of Exponents to Express Small Number in Standard form:
 - Very large and very small numbers can be expressed in standard form.
 - Standard form is also called scientific notation form.
 - A number written as $m \times 10^n$ is said to be in standard form if m is a decimal number such that $1 \leq m < 10$ and n is either a positive or a negative integer.

Examples: $150,000,000,000 = 1.5 \times 10^{11}$.

- Exponential notation is a powerful way to express repeated multiplication of the same number. For any non-zero rational number 'a' and a natural number n, the product $a \times a \times a \times \dots \times a$ (n times) $= a^n$. It is known as the nth power of 'a' and is read as 'a' raised to the power n'. The rational number a is called the base and n is called exponent.