Laws of Exponents

Understanding of Laws of Exponents

- Exponents help to express repeated multiplication of the same number easily.
- Laws of Exponents are simple rules that help to simplify expressions with exponents.
- These rules are used for multiplying, dividing, and raising powers to powers.

Important Points

- **Product Law:** $a^m \times a^n = a^{m+n}$
- **Quotient Law:** $a^m \div a^n = a^{m-n}$
- **Power of a Power Law:** $(a^m)^n = a^{mn}$
- **Power of a Product Law:** $(ab)^m = a^m b^m$
- **Power of a Quotient Law:** $\left(\frac{a}{b}\right)^m = \frac{a^m}{b^m}$
- $a^0 = 1$ for any non—zero a

Examples with Solutions

Example: Using Product Law

➢ **Simplify $2^3 \times 2^4$.**

Solution: $2^3 \times 2^4 = 2^{3+4} = 2^7 = 128$

Example: Using Quotient Law

➢ **Simplify $5^6 \div 5^2$.**

Solution: $5^6 \div 5^2 = 5^{6-2} = 5^4 = 625$

Example: Using Power of a Power Law

➢ **Simplify $(3^2)^3$.**

Solution: $(3^2)^3 = 3^{2\times3} = 3^6 = 729$

Example: Using Power of a Product Law

➢ **Simplify $(2 \times 5)^3$.**

Solution: $(2 \times 5)^3 = 2^3 \times 5^3 = 8 \times 125 = 1000$

Example: Using Power of a Quotient Law

➢ **Simplify $\left(\frac{4}{7}\right)^2$.**

Solution: $\left(\frac{4}{7}\right)^2 = \frac{4^2}{7^2} = \frac{16}{49}$

Summary Points

- To multiply with same bases, add exponents.
- To divide with same bases, subtract exponents.
- Raise power to another power by multiplying exponents.
- Distribute power over multiplication and division inside brackets.
- Any non-zero number raised to power 0 is 1.