49.2: Introduction

Scientific notation indicates the number of 10's by which a coefficient is multiplied or divided. A negative exponent indicates the coefficient is divided by 10's, which means the decimal would move to the left for each negative power. A positive exponent indicates the coefficient is multiplied by 10's, which means the decimal would move to the right for each positive power. Numbers in the physical sciences can be very large or very small, making it cumbersome to write the entire number in standard notation, so powers of ten are used as a shorthand. When two numbers with powers of 10 are multiplied, the coefficients are multiplied, and then the powers of 10 exponents are added. When two numbers with powers of 10 are divided, the coefficients are divided, and then the powers of 10 exponents are subtracted.

The Meaning of Powers of 10

Table 49.2.1

Standard	Scientific	Powers of Ten
540, 000, 000, 000	5.4×10^{11}	$5.4 \times (10 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10 \times$
0.00000101	1.01×10^{-6}	$\frac{1.01}{(10 \times 10 \times 10 \times 10 \times 10 \times 10)}$

Table 49.2.2

Standard	Scientific	Decimal Places
540, 000, 000, 000	5.4×10^{11}	move decimal 11 places to the right
0.00000101	1.01×10^{-6}	move decimal 6 places to the left

Examples

Table 49.2.3: Multiply & Divide Powers of 10

$10^6 \times 10^2 = 10^8$	exponents: 6 + 2 = 8
$10^6 \times 10^{-2} = 10^4$	exponents: 6 + (−2) = 4
$10^6 \div 10^2 = 10^4$	exponents: 6 – 2 = 4
$10^6 \div 10^{-2} = 10^8$	exponents: 6 – (−2) = 8

Table 49.2.4: Multiply & Divide with Coefficients

$(2 \times 10^3) \times (4 \times 10^5)$	$(2 \times 4) \times 10^{3+5} = 8 \times 10^8$
$(2 \times 10^3) \div (4 \times 10^5)$	$(2 \div 4) \times 10^{3-5} = 0.5 \times 10^{-2}$

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