Summary of Exponent Operations

Any number can be written in the form

Numerical (coefficient) x base^{exponent} with base^{exponent} termed the exponential
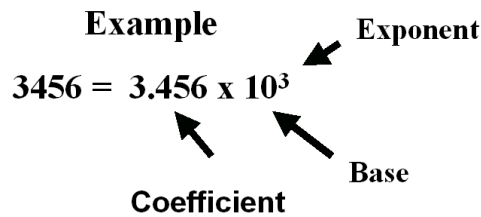
Example: 3456 can be written as 3.456 x 10^3

   3456 = the numerical or coefficient
   10^3 = the exponential
   10   = the base
   3   = the exponent

Example

$$3456 = 3.456 \times 10^3$$

Exponent

Base

Coefficient

On exams, pay particular attention to terms "exponential" and "exponent"

Examples

For Number: 5.91 x 10^5
Coefficient: 5.91
Exponential: 10^5
Base: 10
Exponent: 5

For Number: 210 x 10^{-8}
Coefficient: 210
Exponential: 10^{-8}
Base: 10
Exponent: -8

The Math for + Exponents
Exponent = a multiplying factor

4^2 = 4 x 4   = 16
2^4 = 2 x 2 x 2 x 2 = 16
5^3 = 5 x 5 x 5 = 125
10^6 = 10 x 10 x 10 x 10 x 10 x 10
10^6 = 1,000,000

The Math for – Exponents

Exponent = a dividing factor

4^{-2} = 1/4 x 1/4   = 1/16
2^{-4} = 1/2 x 1/2 x 1/ 2 x 1/2 = 1/16
5^{-3} = 1/5 x 1/5 x 1/5 = 1/125
10^{-6} = 1/10 x 1/10 x 1/10 x 1/10 x 1/10 x 1/ 10
10^{-6} = 0.000001

The Math for 0 Exponents

Any base^0 = 1

4^0 = 1
2^0 = 1
5^0 = 1
10^0 = 1

Expressing Numbers

Any number has a variety of exponentials:

Number	**=**	**Coefficient x**		**exponential**
n	**=**	**C**	**x**	**$10^{exponent}$**
33,700.	=	337,000.	X	10^{-1}
33,700.	=	33,700.	X	10^0
33,700.	=	3,370. x		10^1

Exponential Notation (+) exponents

The coefficient is *multiplied* by $10^{exponent}$

33,700.	=	33.7	X	10^3
33,700.	=	3.37	X	10^4

The decimal Point is moved to the right

33.7 ➔ 33,700   decimal moved right 3
 3.37 ➔ 33,700   decimal moved right 4

Exponential Notation (-) exponents

The coefficient is divided by $10^{exponent}$

33,700. = 337,000 x 10^{-1}
33,700. = 3,370,000 x 10^{-2}

The decimal Point is moved to the left
337,000 ➔ 33,700   decimal moved left 1
3,370,000 ➔33,700   decimal moved left 2

Exponential Notation (0) exponents

The Coefficient is multiplied by 1

33,700. = 33,700 x 10^0

Since 10^0 = 1
The decimal Point is not moved.

Standard exponential notation
"Scientific Notation"

coefficient
greater than or equal to one and less than ten
$$1 \leq C < 10$$

3 = yes
0.01 = no
134. = no

Which is in scientific notation?

$33,700 = \quad 337,000 \quad x \quad 10^{-1}$
$33,700 = \quad 33,700 \quad x \quad 10^{0}$
$33,700 = \quad 3,370 \quad x \quad 10^{1}$
$33,700 = \quad 337 \quad x \quad 10^{2}$
$33,700 = \quad 33.7 \quad x \quad 10^{3}$
$\mathbf{33,700 = \quad 3.37 \quad x \quad 10^{4}}$
$33,700 = \quad 0.337 \quad x \quad 10^{5}$

Express 15,208 in scientific notation

1. Determine the Coefficient
write down digits starting with the first nonzero digit
15208
2. Place decimal point between the 1st & 2nd digit
1.5208
3. Determine correct exponent (both number & sign)
$1.5208 \times 10^{\pm ?} = 15,208$
Count number of places the decimal needs to be moved
coefficient ➔ number
Move to right 4 places … so, exponent is 4

Expressing in scientific notation

$1.528 \times 10^{-4} = 0.0001528$
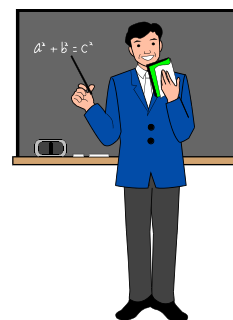$1.528 \times 10^{4} = 15280$
$1.528 \times 10^{0} = 1.528$

From the Coefficient
Move to left = less (-)
Move to right = more (+)
No Move = 0

3

Arithmetic Operations with Exponents

Multiplying
Multiplication of exponents ➔ exponents added
10^2 x 10^6 = 10^8
10^2 x 10^{-6} = 10^{-4}
10^{-2} x 10^{-6} = 10^{-8}

Numerical and exponents treated separately:

3 x 10^4 x 4 x 10^6 = 12 x 10^{10} ➔ 1.2 x 10^9
5 x 10^{24} x 36 x 10^{-8} = 180 x 10^{16} ➔ 1,8 x 10^{14}
3 x 10^{-12} x 4 x 10^{-16} = 12 x 10^{-28} ➔ 1,2 x 10^{-27}

Dividing
Division of exponents ➔ exponents subtracted

10^2 / 10^6 = 10^{-4}
10^2 / 10^{-6} = 10^8
10^{-2} / 10^{-6} = 10^4

Numerical and exponents treated separately:

3.0 x 10^4 / 4.0 x 10^6 = 0.75 x 10^{-2} ➔ 7.5 x 10^{-3}
5.0 x 10^{24} /   36 x 10^{-8} = 0.139 x 10^{26} ➔ 1.4 x 10^{25}
3.0 x 10^{-12} / 4.0 x 10^{-16} = 0.75 x 10^4 ➔ 7.5 x 10^3

Manual Addition or Subtraction

The exponents must be the same:
      add/subtract numerical portion and keep the same exponent

8.25 x 10^2 + 2.80 x 10^2 = 11.05 x 10^2 ➔ 1.105 x 10^3
8.25 x 10^2 - 2.80 x 10^2 = 5.45 x 10^2

If exponents are different, convert them to the same exponent; then add/subtract

8.25 x 10^4 + 2.80 x 10^2 ➔ 825 x 10^2 + 2.80 x 10^2 = 827.8 x 10^2 ➔ 8.28 x 10^4