1-28

EXPONENTS

EXPONENTS ARE A WAY OF ABBREVIATING A SERIES OF MULTIPLECATIONS.

EXPONENT →

(OR POWER) $2^3 = 2 \cdot 2 \cdot 2 = 8$

↑ BASE

$3^2 = 3 \cdot 3 = 9$

SPECIAL INTEGER EXPONENTS

$2^1 = 2$ ANYTHING TO 1st POWER IS ITSELF

$3^0 = 1$ ANYTHING TO 0th POWER IS ONE

$(2^0) = 1$

$(-1)^0 = 1$

NEGATIVE INTEGER EXPONENTS

$4^{-1} = \frac{1}{4^1} = \frac{1}{4} = 0.25$

$4^{-2} = \frac{1}{4^2} = \frac{1}{16} = 0.0625$

$4^{-5} = \frac{1}{4^5} = \frac{1}{4 \cdot 4 \cdot 4 \cdot 4 \cdot 4} = \frac{1}{1024} = 0.000976563\ldots$

APPLY TO BASE = 10 (DECIMAL SYSTEM)

POWERS OF 10

$$\vdots$$
$$10^4 = 10 \cdot 10 \cdot 10 \cdot 10 = 10000$$
$$10^3 = 10 \cdot 10 \cdot 10 = 1000$$
$$10^2 = 10 \cdot 10 = 100$$
$$10^1 = 10 = 10$$
$$10^0 = 1 = 1$$
$$10^{-1} = \frac{1}{10} = 0.1$$
$$10^{-2} = \frac{1}{10 \cdot 10} = \frac{1}{100} = 0.01$$
$$\vdots \qquad\qquad \vdots$$

NUMBER – A VALUE, REGARDLESS OF HOW IT IS EXPRESSED OR REPRESENTED

'ONE' 'UNO' 1 $\frac{3}{3}$ 10^0 ...

DIGIT – A BASIC VALUE FROM WHICH OTHER VALUES CAN BE FORMED

FOR DECIMAL (BASE-10) SYSTEM,

(THE VALUES OF...) → 1, 2, 3, 4, 5, 6, 7, 8, 9, 0

(NO SYMBOL FOR 'TEN', WE REUSE '10')

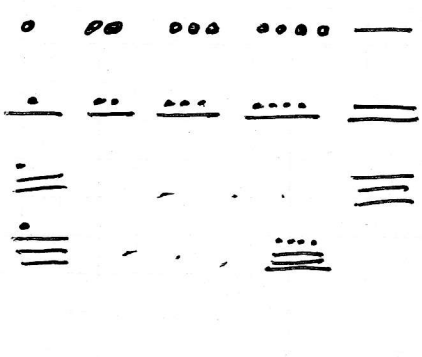
NUMERAL – SYMBOL WE USE FOR A DIGIT

ARABIC NUMERALS: 0, 1, 2, 3, 4, 5, 6, 7, 8, 9

ROMAN NUMERALS: I, V, X, L, C, D, M

1 5 10 50 100 500 1000

OTHER NUMERALS:

MAYANS 

AND ZERO 

MONEY (1¢) (5) (10) (25) (50) (1)

1¢ 5¢ 10¢ ... 100¢

0.01 0.05 0.10 1

REPRESENTING NUMBERS IN ROMAN NUMERALS

ORDINAL NOTATION (ORDER)

VI = 5 + 1 = 6

IV = 1 TAKEN FROM 5 = 5 − 1 = 4

MCMLXXI = 1000 + (1000 − 100) + 50 + 10 + 10 + 1

= 1971

(NO ZERO NEEDED)

ADDITION:

IX	9
+VIII	+8
XVII	17

DECIMAL SYSTEM USES BASE10 POSITIONAL NOTATION

POSITIONAL NOTATION: DIGIT HAVE A DIFFERENT VALUE DEPENDING ON WHICH COLUMN THEY ARE IN.

(REQUIRES A ZERO)

BASE DETERMINES THE VALUE OF A COLUMN

BASE-10 DIGITS: 0, 1, 2, 3, 4, 5, 6, 7, 8, 9

10^4	10^3	10^2	10^1	10^0	10^{-1}	10^{-2}	
TEN THO. 10000	THOU 1000	HUND 100	TEN 10	ONE 1	TENTH 1/10	1/100	1/1000
1	0	2	4	2			

$1 * 10{,}000 + 0 \cdot 1000 + 2 * 100 + 4 \cdot 10 + 2 \cdot 1$

10242

INTEGER FRACTION

ADDITION BECOMES EASIER

$$\begin{array}{r} {\scriptstyle 1\ \ \ \ } \\ 124. \\ +\ 68. \\ \hline 192. \end{array}$$

IN A DIFFERENT BASE, IN POSITIONAL NOTATION

BASE-8 (OCTAL)

DIGITS: 0, 1, 2, 3, 4, 5, 6, 7

8^3	8^2	8^1	8^0	8^{-1}	8^{-2}	8^{-3}
512	64	8	1	1/8	1/64	1/512
2	4	0	7	.		

$2*512 + 4*64 + 0*8 + 7*1$

$1024 + 256 + 0 + 7 = 1287$

$2407_8 = 1287_{10}$