

Base expansion definition

Definition For b an integer greater than 1 and n a positive integer, the **base b expansion of n** is

$$(a_{k-1} \cdots a_1 a_0)_b$$

where k is a positive integer, a_0, a_1, \dots, a_{k-1} are (symbols for) nonnegative integers less than b , $a_{k-1} \neq 0$, and

$$n = \sum_{i=0}^{k-1} a_i b^i$$

Notice: *The base b expansion of a positive integer n is a string over the alphabet $\{x \in \mathbb{N} \mid x < b\}$ whose leftmost character is nonzero.*

| Base b | Collection of possible coefficients in base b expansion of a positive integer |
|--------------------------|--|
| Binary ($b = 2$) | $\{0, 1\}$ |
| Ternary ($b = 3$) | $\{0, 1, 2\}$ |
| Octal ($b = 8$) | $\{0, 1, 2, 3, 4, 5, 6, 7\}$ |
| Decimal ($b = 10$) | $\{0, 1, 2, 3, 4, 5, 6, 7, 8, 9\}$ |
| Hexadecimal ($b = 16$) | $\{0, 1, 2, 3, 4, 5, 6, 7, 8, 9, A, B, C, D, E, F\}$ letter coefficient symbols represent numerical values $(A)_{16} = (10)_{10}$ $(B)_{16} = (11)_{10}$ $(C)_{16} = (12)_{10}$ $(D)_{16} = (13)_{10}$ $(E)_{16} = (14)_{10}$ $(F)_{16} = (15)_{10}$ |

Base expansion examples

Examples:

$(1401)_2$

$(1401)_{10}$

$(1401)_{16}$

Base expansion review

Find and fix any and all mistakes with the following:

(a) $(1)_2 = (1)_8$

(b) $(142)_{10} = (142)_{16}$

(c) $(20)_{10} = (10100)_2$

(d) $(35)_8 = (1D)_{16}$

Base expansion final review

Convert $(2A)_{16}$ to

- binary (base ____)
- decimal (base ____)
- octal (base ____)
- ternary (base ____)