



Converting from Base- n to Base-10

ID1050– Quantitative & Qualitative Reasoning

Steps for Converting from Base-n to Base-10

- The steps for converting from a different base to our familiar base-10 (decimal) system are similar to how we express numbers in base-10
 - Each column has a different value which depends on the base
 - Each column has a digit in it that is multiplied by the column's value
 - The sum of all of these multiplication results is the value of the number
- The difference is that the columns have values other than 'tens', 'hundreds', 'thousands', etc.
- Let's look at some examples:

Base-8 Positional Notation Chart

$8^3 = 512$	$8^2 = 64$	$8^1 = 8$	$8^0 = 1$	$8^{-1} = 1/8$	$8^{-2} = 1/64$
_____	_____	_____	_____●	_____	_____

Convert $20_{\text{base-8}}$ to base-10

Only Base-8 digits 0,1,2,3,4,5,6,7

Base-8 Positional Notation Chart

$8^3 = 512$	$8^2 = 64$	$8^1 = 8$	$8^0 = 1$	$8^{-1} = 1/8$	$8^{-2} = 1/64$
_____	_____	_____	_____●	_____	_____

Convert $0.24_{\text{base-8}}$ to base-10

Only Base-8 digits 0,1,2,3,4,5,6,7

Base-8 Positional Notation Chart

$8^3 = 512$	$8^2 = 64$	$8^1 = 8$	$8^0 = 1$	$8^{-1} = 1/8$	$8^{-2} = 1/64$
_____	_____	_____	_____●	_____	_____

Convert $702.1_{\text{base-8}}$ to base-10

Only Base-8 digits 0,1,2,3,4,5,6,7

Base-3 Positional Notation Chart

$3^3 = 27$	$3^2 = 9$	$3^1 = 3$	$3^0 = 1$	$3^{-1} = 1/3$	$3^{-2} = 1/9$
_____	_____	_____	_____●	_____	_____

Convert $120_{\text{base-3}}$ to base-10

Only Base-3 digits 0,1,2

Base-3 Positional Notation Chart

$3^3 = 27$	$3^2 = 9$	$3^1 = 3$	$3^0 = 1$	$3^{-1} = 1/3$	$3^{-2} = 1/9$
_____	_____	_____	_____●	_____	_____

Convert $2.1_{\text{base-3}}$ to base-10

Only Base-3 digits 0,1,2

Base-2 (binary) Positional Notation Chart

$2^3 = 8$	$2^2 = 4$	$2^1 = 2$	$2^0 = 1$	$2^{-1} = 1/2$	$2^{-2} = 1/4$
_____	_____	_____	_____●	_____	_____

Convert $1010_{\text{base-2}}$ to base-10

Only Base-2 digits 0,1

Base-2 (binary) Positional Notation Chart

$2^3 = 8$	$2^2 = 4$	$2^1 = 2$	$2^0 = 1$	$2^{-1} = 1/2$	$2^{-2} = 1/4$
_____	_____	_____	_____●	_____	_____

Convert $0.11_{\text{base-2}}$ to base-10

Only Base-2 digits 0,1

Base-2 (binary) Positional Notation Chart

$2^3 = 8$	$2^2 = 4$	$2^1 = 2$	$2^0 = 1$	$2^{-1} = 1/2$	$2^{-2} = 1/4$
_____	_____	_____	_____●	_____	_____

Convert $10.01_{\text{base-2}}$ to base-10

Only Base-2 digits 0,1

Conclusion

- Converting from a different base into base 10 involves creating a base-n table
- The columns in base-n have different values than our familiar base-10 columns
- Multiply each base-n digits by its column's value and add them all up to get the answer in base-10