Converting to Base-n from Base-10

ID1050– Quantitative & Qualitative Reasoning

Steps for Converting from Base-10 to Base-n

- Use the base-n table for this type of conversion, too.
- Here, you are looking for the digits in base-n that will result in the base-10 number you are starting with
  1. Start your work in the farthest left column that is not bigger than your base-10 number
  2. Ask yourself 'how many times does that column's value divide my number?' You'll get an integer between 0 and the base-n. This is the digit for this column you were looking for. Write it down in the blank space.
  3. You'll also get a remainder (possibly zero). Write this number in the next column to the right.
  4. Now got back to step 2 and ask yourself 'how many times does this column's value divide my current number?'.
  5. Keep repeating until all of the blanks are filled.
- 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 $16_{\text{base-10}}$ to base-8

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

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 $1000_{\text{base-10}}$ to base-8

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 $33_{\text{base-10}}$ to base-3

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 $63_{\text{base-10}}$ to base-3

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 $13_{\text{base-10}}$ to base-2

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 $0.75_{\text{base-10}}$ to base-2

Only Base-2 digits 0,1

Conclusion

- Converting from a different base into base 10 involves creating a base-n table.
- For this task, you are trying to find the base-n digits for each column
- You start in the left-most column that is not bigger than your base-10 number.
- Divide your base-10 number by the column's value to find that column's digit. Move the remainder to the next column to the right and repeat.
- Do this until you have found the digits for each column.