

calc_decimal_example

Student Group

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Table of Contents

$\$I.\text{quad}\$$ Calculation example for decimal value

Idea: The number $\$2658.47\$$ is only the representation with the numerals $\$[0..9]\$,$ but what is the value behind it?

so lets start

```
\begin{align*} \begin{smallmatrix} \color{black}{\text{number}:} & \color{black}{\{ } & \color{black}{\}} & \color{black}{\{2\}} & \color{black}{\{6\}} & \color{black}{\{5\}} & \color{black}{\{8.\}} & \color{black}{\{4\}} & \color{black}{\{7\}} \\ \color{white}{\text{index}:} & \color{white}{\{i\}} & \color{white}{\{3\}} & \color{white}{\{2\}} & \color{white}{\{1\}} & \color{white}{\{0\}} & \color{white}{\{-1\}} & \color{white}{\{-2\}} \\ \color{white}{\text{place value}:} & \color{white}{\{B^i\}} & \color{white}{\{10^3\}} & \color{white}{\{10^2\}} & \color{white}{\{10^1\}} & \color{white}{\{10^0\}} & \color{white}{\{10^{-1}\}} & \color{white}{\{10^{-2}\}} \\ \color{white}{\text{numerals}:} & \color{white}{\{z_i\}} & \color{white}{\{2\}} & \color{white}{\{6\}} & \color{white}{\{5\}} & \color{white}{\{8\}} & \color{white}{\{4\}} & \color{white}{\{7\}} \\ \color{white}{\text{calc}.:} & \color{white}{\{z_i \cdot B^i\}} & \color{white}{\{2000\}} & \color{white}{\{600\}} & \color{white}{\{50\}} & \color{white}{\{8\}} & \color{white}{\{0.4\}} & \color{white}{\{0.07\}} \\ \color{white}{\text{result}:} & \color{white}{\{\sum_i z_i \cdot B^i\}} & \color{white}{\{2658.47\}} \end{smallmatrix} \end{align*}
```

First: Put space between the numerals to see the thousands, hundreds, tens, ones, tenths, hundredths

```
\begin{align*} \begin{smallmatrix} \color{black}{\text{number}:} & \color{black}{\{ } & \color{black}{\}} & \color{black}{\{2\}} & \color{black}{\{6\}} & \color{black}{\{5\}} & \color{black}{\{8.\}} & \color{black}{\{4\}} & \color{black}{\{7\}} \\ \color{blue}{\text{index}:} & \color{blue}{\{i\}} & \color{blue}{\{3\}} & \color{blue}{\{2\}} & \color{blue}{\{1\}} & \color{blue}{\{0\}} & \color{blue}{\{-1\}} & \color{blue}{\{-2\}} \\ \color{white}{\text{place value}:} & \color{white}{\{B^i\}} & \color{white}{\{10^3\}} & \color{white}{\{10^2\}} & \color{white}{\{10^1\}} & \color{white}{\{10^0\}} & \color{white}{\{10^{-1}\}} & \color{white}{\{10^{-2}\}} \\ \color{white}{\text{numerals}:} & \color{white}{\{z_i\}} & \color{white}{\{2\}} & \color{white}{\{6\}} & \color{white}{\{5\}} & \color{white}{\{8\}} & \color{white}{\{4\}} & \color{white}{\{7\}} \\ \color{white}{\text{calc}.:} & \color{white}{\{z_i \cdot B^i\}} & \color{white}{\{2000\}} & \color{white}{\{600\}} & \color{white}{\{50\}} & \color{white}{\{8\}} & \color{white}{\{0.4\}} & \color{white}{\{0.07\}} \\ \color{white}{\text{result}:} & \color{white}{\{\sum_i z_i \cdot B^i\}} & \color{white}{\{2658.47\}} \end{smallmatrix} \end{align*}
```

Second: Write down the index for each position.

```
\begin{align*} \begin{smallmatrix} \color{black}{\text{number}:} & \color{black}{\{ } & \color{black}{\}} & \color{black}{\{2\}} & \color{black}{\{6\}} & \color{black}{\{5\}} & \color{black}{\{8.\}} & \color{black}{\{4\}} & \color{black}{\{7\}} \\ \color{black}{\text{index}:} & \color{black}{\{i\}} & \color{black}{\{3\}} & \color{black}{\{2\}} & \color{black}{\{1\}} & \color{black}{\{0\}} & \color{black}{\{-1\}} & \color{black}{\{-2\}} \\ \color{blue}{\text{place value}:} & \color{blue}{\{B^i\}} & \color{blue}{\{10^3\}} & \color{blue}{\{10^2\}} & \color{blue}{\{10^1\}} & \color{blue}{\{10^0\}} & \color{blue}{\{10^{-1}\}} & \color{blue}{\{10^{-2}\}} \\ \color{white}{\text{numerals}:} & \color{white}{\{z_i\}} & \color{white}{\{2\}} & \color{white}{\{6\}} & \color{white}{\{5\}} & \color{white}{\{8\}} & \color{white}{\{4\}} & \color{white}{\{7\}} \\ \color{white}{\text{calc}.:} & \color{white}{\{z_i \cdot B^i\}} & \color{white}{\{2000\}} & \color{white}{\{600\}} & \color{white}{\{50\}} & \color{white}{\{8\}} & \color{white}{\{0.4\}} & \color{white}{\{0.07\}} \\ \color{white}{\text{result}:} & \color{white}{\{\sum_i z_i \cdot B^i\}} & \color{white}{\{2658.47\}} \end{smallmatrix} \end{align*}
```


$\sum_{i=0}^7 z_i \cdot B^i$ & & $2658,47$ First: But space between the numerals to see the thousands, hundreds, tens, ones, tenths, hundredths

value		2	6	5	8 ,	4	7	
index	\$i\$	3	2	1	0	-1	-2	
B^i		10^3	10^2	10^1	10^0	10^{-1}	10^{-2}	
digit	z_i	2	6	5	8	4	7	
calc.	$\sum_{i=0}^7 z_i \cdot B^i$	2000	600	50	8	0.4	0.07	
Result	$\sum_{i=0}^7 z_i \cdot B^i$	2658,47						

aus (2+3)	$I_p = I_m = 0$	I_p und I_m sind damit definiert
aus (6)	$I_o = 1$	I_o ist damit bekannt, wenn I_1 bekannt ist
aus (7) und (3)	$I_1 - I_2 - I_o = 0$	
	$I_1 = 1, I_2 = I_o$	
	$I_1 = I_2 = I_o$	
	$I_1 = I_2 = I_o$	mit (8) und (9): $I_{\text{boxed}} = \frac{U_{\text{boxed}}}{R_{\text{boxed}}}$ und (5)
	$\frac{U_1}{R_1} = \frac{U_2}{R_2} = \frac{U_A}{R_1 + R_2}$	Spannungsteilerformel, $I = \text{const.}$
(10)	$U_2 = U_A \cdot \frac{R_2}{R_1 + R_2}$	Spannungsteilerformel

II. Betrachtung der Spannungsverstärkung

aus (0)	$A_V = \frac{U_A}{U_E}$	
	$A_V = \frac{U_A}{U_E}$	mit (4): $U_E = U_2 + U_D$
	$A_V = \frac{U_A}{U_2 + U_D}$	
	$A_V = \frac{U_A}{U_2 + U_D}$	mit (10): $U_2 = U_A \cdot \frac{R_2}{R_1 + R_2}$
	$A_V = \frac{U_A}{U_A \cdot \frac{R_2}{R_1 + R_2} + U_D}$	
	$A_V = \frac{U_A}{U_A \cdot \frac{R_2}{R_1 + R_2} + U_D}$	
	$A_V = \frac{U_A}{U_A \cdot \frac{R_2}{R_1 + R_2} + U_D}$	mit (1)
	$A_V = \frac{U_A}{U_A \cdot \frac{R_2}{R_1 + R_2} + U_D}$	
	$A_V = \frac{U_A}{U_A \cdot \frac{R_2}{R_1 + R_2} + U_D}$	
	$A_V = \frac{1}{\frac{R_2}{R_1 + R_2} + \frac{A_D}{U_A}}$	Erweitern mit $\frac{1}{U_A}$
	$A_V = \frac{1}{\frac{R_2}{R_1 + R_2} + \frac{A_D}{U_A}}$	mit $\frac{1}{U_A} \cdot \frac{A_D}{U_A} \rightarrow \infty$ 0\$
	$A_V = \frac{1}{\frac{R_2}{R_1 + R_2}}$	Bruch umformen
	$A_V = \frac{R_1 + R_2}{R_2}$	

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