

calc_decimal_example

Student Group

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$\$1.\!\!\!\!\!\quad$ 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?

$$\begin{aligned} & \begin{matrix} \text{value} \\ \text{index} \\ \text{place value} \\ \text{numerals} \\ \text{calc.} \\ \text{result} \end{matrix} \\ & \begin{matrix} B^i \\ 10^3 \\ 10^2 \\ 10^1 \\ 10^0 \\ 10^{-1} \\ 10^{-2} \\ z_i \\ \sum_i z_i \cdot B^i \end{matrix} \\ & \begin{matrix} 2658.47 \end{matrix} \end{aligned}$$
$$\begin{aligned} & \text{\textcolor{black}{\text{value}}:} & \text{\textcolor{black}{}} & \text{\textcolor{black}{2}} & \text{\textcolor{black}{6}} & \text{\textcolor{black}{5}} & \text{\textcolor{black}{8.}} & \text{\textcolor{black}{4}} & \text{\textcolor{black}{7}} \\ & \text{\textcolor{blue}{\text{index}}:} & \text{\textcolor{blue}{i}} & \text{\textcolor{blue}{3}} & \text{\textcolor{blue}{2}} & \text{\textcolor{blue}{1}} & \text{\textcolor{blue}{0}} & \text{\textcolor{blue}{-1}} & \text{\textcolor{blue}{-2}} \\ & \text{\textcolor{white}{\text{place value}}:} & \text{\textcolor{white}{B^i}} & \text{\textcolor{white}{10^3}} & \text{\textcolor{white}{10^2}} & \text{\textcolor{white}{10^1}} & \text{\textcolor{white}{10^0}} & \text{\textcolor{white}{10^{-1}}} & \text{\textcolor{white}{10^{-2}}} \\ & \text{\textcolor{white}{1000}} & \text{\textcolor{white}{100}} & \text{\textcolor{white}{10}} & \text{\textcolor{white}{1}} & \text{\textcolor{white}{0.1}} & \text{\textcolor{white}{0.01}} \\ & \text{\textcolor{white}{z_i}} & \text{\textcolor{white}{2}} & \text{\textcolor{white}{6}} & \text{\textcolor{white}{5}} & \text{\textcolor{white}{8}} & \text{\textcolor{white}{4}} & \text{\textcolor{white}{7}} \\ & \text{\textcolor{white}{z_i \cdot B^i}} & \text{\textcolor{white}{2000}} & \text{\textcolor{white}{600}} & \text{\textcolor{white}{50}} & \text{\textcolor{white}{8}} & \text{\textcolor{white}{0.4}} & \text{\textcolor{white}{0.07}} \\ & \text{\textcolor{white}{\sum_i z_i \cdot B^i}} & \text{\textcolor{white}{2658.47}} \end{aligned}$$
$$\begin{aligned} & \begin{matrix} \text{value} \end{matrix} & & \\ & \{2\} & \{6\} & \{5\} & \{8\} & \{4\} & \\ & \{7\} & \begin{matrix} \text{index} \end{matrix} & \{i\} & \{3\} & \\ & \{2\} & \{1\} & \{0\} & \{-1\} & \{-2\} \\ & \begin{matrix} \text{place value} \end{matrix} & B^i & 10^3 & 10^2 & 10^1 & 10^0 & 10^{-1} & 10^{-2} \\ & & & & & & & & \\ & & & & & & & & \\ & \begin{matrix} \text{numerals} \end{matrix} & z_i & 2 & 6 & 5 & 8 & 4 & 7 \\ & \begin{matrix} \text{calc.} \end{matrix} & z_i \cdot B^i & 2000 & 600 & 50 & 8 & 0.4 & 0.07 \\ & \begin{matrix} \text{result} \end{matrix} & \sum_i z_i \cdot B^i & & & & & & \end{aligned}$$

$\frac{\$}{\$}\backslash\frac{\$}{\$}\backslash\frac{\$}{\$}$		$\frac{\$}{\$}\backslash\frac{\$}{\$}\backslash\frac{\$}{\$}$	$\frac{\$}{\$}\backslash\frac{\$}{\$}\backslash\frac{\$}{\$}$	$\frac{\$}{\$}\backslash\frac{\$}{\$}\backslash\frac{\$}{\$}$	$\frac{\$}{\$}\backslash\frac{\$}{\$}\backslash\frac{\$}{\$}$	$\frac{\$}{\$}\backslash\frac{\$}{\$}\backslash\frac{\$}{\$}$	$\frac{\$}{\$}\backslash\frac{\$}{\$}\backslash\frac{\$}{\$}$	
$\frac{\$}{\$}\backslash\frac{\$}{\$}\backslash\frac{\$}{\$}$		$\frac{\$}{\$}\backslash\frac{\$}{\$}\backslash\frac{\$}{\$}$	$\frac{\$}{\$}\backslash\frac{\$}{\$}\backslash\frac{\$}{\$}$	$\frac{\$}{\$}\backslash\frac{\$}{\$}\backslash\frac{\$}{\$}$	$\frac{\$}{\$}\backslash\frac{\$}{\$}\backslash\frac{\$}{\$}$	$\frac{\$}{\$}\backslash\frac{\$}{\$}\backslash\frac{\$}{\$}$	$\frac{\$}{\$}\backslash\frac{\$}{\$}\backslash\frac{\$}{\$}$	
$\frac{\$}{\$}\backslash\frac{\$}{\$}\backslash\frac{\$}{\$}$		$\frac{\$}{\$}\backslash\frac{\$}{\$}\backslash\frac{\$}{\$}$	$\frac{\$}{\$}\backslash\frac{\$}{\$}\backslash\frac{\$}{\$}$	$\frac{\$}{\$}\backslash\frac{\$}{\$}\backslash\frac{\$}{\$}$	$\frac{\$}{\$}\backslash\frac{\$}{\$}\backslash\frac{\$}{\$}$	$\frac{\$}{\$}\backslash\frac{\$}{\$}\backslash\frac{\$}{\$}$	$\frac{\$}{\$}\backslash\frac{\$}{\$}\backslash\frac{\$}{\$}$	
value		2	6	5	8 ,	4	7	
index	$\$i\$$	3	2	1	0	-1	-2	
place value	$\$B^{\$i\$}$	$\frac{\$}{\$}\small{10^3}$ $\frac{\$}{\$}\small{1000}$	$\frac{\$}{\$}\small{10^2}$ $\frac{\$}{\$}\small{100}$	$\frac{\$}{\$}\small{10^1}$ $\frac{\$}{\$}\small{10}$	$\frac{\$}{\$}\small{10^0}$ $\frac{\$}{\$}\small{1}$	$\frac{\$}{\$}\small{10^{-1}}$ $\frac{\$}{\$}\small{0.10}$	$\frac{\$}{\$}\small{10^{-2}}$ $\frac{\$}{\$}\small{0.01}$	
digit	$\$_z_i\$$	2	6	5	8	4	7	
calc.	$\$_z_i\backslash\cdot B^{\$i\$}$	2000	600	50	8	0.4	0.07	
Result $\frac{\$}{\$}\sum_i\{\$_z_i\backslash\cdot B^{\$i\$}\}$	2658,47							
aus (2+3)		$\frac{\$}{\$}\color{blue}\{I_p\}=\color{blue}\{I_m\}=0\$$			$\$I_p\$$ und $\$I_m\$$ sind damit definiert			
$\frac{\$}{\$}\backslash\frac{\$}{\$}\backslash\frac{\$}{\$}\backslash\frac{\$}{\$}\backslash\frac{\$}{\$}\backslash\frac{\$}{\$}$		$\frac{\$}{\$}\backslash\frac{\$}{\$}\backslash\frac{\$}{\$}\backslash\frac{\$}{\$}\backslash\frac{\$}{\$}\backslash\frac{\$}{\$}$			$\frac{\$}{\$}\backslash\frac{\$}{\$}\backslash\frac{\$}{\$}\backslash\frac{\$}{\$}\backslash\frac{\$}{\$}\backslash\frac{\$}{\$}$			
aus (6)		$\frac{\$}{\$}\color{blue}\{I_o\}=_I_1\$$			$\$I_o\$$ ist damit bekannt, wenn $\$I_1\$$ bekannt ist			
$\frac{\$}{\$}\backslash\frac{\$}{\$}\backslash\frac{\$}{\$}\backslash\frac{\$}{\$}\backslash\frac{\$}{\$}\backslash\frac{\$}{\$}$		$\frac{\$}{\$}\backslash\frac{\$}{\$}\backslash\frac{\$}{\$}\backslash\frac{\$}{\$}\backslash\frac{\$}{\$}\backslash\frac{\$}{\$}$			$\frac{\$}{\$}\backslash\frac{\$}{\$}\backslash\frac{\$}{\$}\backslash\frac{\$}{\$}\backslash\frac{\$}{\$}\backslash\frac{\$}{\$}$			
aus (7) und (3)		$\$I_1-_I_2-\color{blue}\{0\}=0\$$			$\frac{\$}{\$}\backslash\frac{\$}{\$}$			
$\frac{\$}{\$}\backslash\frac{\$}{\$}\backslash\frac{\$}{\$}\backslash\frac{\$}{\$}\backslash\frac{\$}{\$}\backslash\frac{\$}{\$}$		$\frac{\$}{\$}\backslash\frac{\$}{\$}\backslash\frac{\$}{\$}\backslash\frac{\$}{\$}\backslash\frac{\$}{\$}\backslash\frac{\$}{\$}$			$\frac{\$}{\$}\backslash\frac{\$}{\$}\backslash\frac{\$}{\$}\backslash\frac{\$}{\$}\backslash\frac{\$}{\$}\backslash\frac{\$}{\$}$			
$\frac{\$}{\$}\backslash\frac{\$}{\$}$		$\$I_1=_I_2=_I_o\$$			$\frac{\$}{\$}\backslash\frac{\$}{\$}$			
$\frac{\$}{\$}\backslash\frac{\$}{\$}\backslash\frac{\$}{\$}\backslash\frac{\$}{\$}\backslash\frac{\$}{\$}\backslash\frac{\$}{\$}$		$\frac{\$}{\$}\backslash\frac{\$}{\$}\backslash\frac{\$}{\$}\backslash\frac{\$}{\$}\backslash\frac{\$}{\$}\backslash\frac{\$}{\$}$			$\frac{\$}{\$}\backslash\frac{\$}{\$}\backslash\frac{\$}{\$}\backslash\frac{\$}{\$}\backslash\frac{\$}{\$}\backslash\frac{\$}{\$}$			
$\frac{\$}{\$}\backslash\frac{\$}{\$}$		$\frac{\$}{\$}\color{blue}\{I_1\}=\color{blue}\{I_2\}=\color{blue}\{I_o\}\$$			mit (8) und (9): $\frac{\$}{\$}_I_\boxed{}=\frac{\$}{\$}\frac{\$}{\$}_U_\boxed{}{\$}{\$}_R_\boxed{}{\$}{\$}$ und (5)			
$\frac{\$}{\$}\backslash\frac{\$}{\$}\backslash\frac{\$}{\$}\backslash\frac{\$}{\$}\backslash\frac{\$}{\$}\backslash\frac{\$}{\$}$		$\frac{\$}{\$}\backslash\frac{\$}{\$}\backslash\frac{\$}{\$}\backslash\frac{\$}{\$}\backslash\frac{\$}{\$}\backslash\frac{\$}{\$}$			$\frac{\$}{\$}\backslash\frac{\$}{\$}\backslash\frac{\$}{\$}\backslash\frac{\$}{\$}\backslash\frac{\$}{\$}\backslash\frac{\$}{\$}$			
$\frac{\$}{\$}\backslash\frac{\$}{\$}$		$\frac{\$}{\$}\frac{\$}{\$}_U_\boxed{}{\$}{\$}_R_\boxed{}{\$}{\$}=\frac{\$}{\$}\frac{\$}{\$}_U_\boxed{}{\$}{\$}_R_\boxed{}{\$}{\$}=\frac{\$}{\$}\frac{\$}{\$}_U_\boxed{}{\$}{\$}_R_\boxed{}{\$}{\$}+ \frac{\$}{\$}_R_\boxed{}{\$}{\$}$			Spannungsteilerformel, $\$I=\text{const.}\$$			
$\frac{\$}{\$}\backslash\frac{\$}{\$}\backslash\frac{\$}{\$}\backslash\frac{\$}{\$}\backslash\frac{\$}{\$}\backslash\frac{\$}{\$}$		$\frac{\$}{\$}\backslash\frac{\$}{\$}\backslash\frac{\$}{\$}\backslash\frac{\$}{\$}\backslash\frac{\$}{\$}\backslash\frac{\$}{\$}$			$\frac{\$}{\$}\backslash\frac{\$}{\$}\backslash\frac{\$}{\$}\backslash\frac{\$}{\$}\backslash\frac{\$}{\$}\backslash\frac{\$}{\$}$			
(10)		$\$_U_\boxed{}=_U_\boxed{}{\$}{\$}\frac{\$}{\$}\backslash\frac{\$}{\$}\frac{\$}{\$$						