

calc_decimal_example

Student Group

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\$I.\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?

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\begin{align*} \begin{smallmatrix} \color{black}{\text{number}:} & \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}{} & \color{white}{} & \color{white}{1000} & & \\ \color{white}{100} & \color{white}{10} & \color{white}{1} & \color{white}{0.1} & & \\ \color{white}{0.01} & \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*}
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\begin{align*} \begin{smallmatrix} \color{black}{\text{number}:} & \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}{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}{} & \color{white}{} & \color{white}{1000} & & \\ \color{white}{100} & \color{white}{10} & \color{white}{1} & \color{white}{0.1} & & \\ \color{white}{0.01} & \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*}
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\begin{align*} \begin{smallmatrix} \color{black}{\text{number}:} & \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}{} & \color{white}{} & \\ \color{white}{1000} & \color{white}{100} & \color{white}{10} & \color{white}{1} & \color{white}{0.1} & \\ \color{white}{0.01} & \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} & & & \end{smallmatrix} \end{align*}
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$\frac{\$}{\$}\backslash\frac{\$}{\$}\backslash\frac{\$}{\$}$		$\frac{\$}{\$}\backslash\frac{\$}{\$}\backslash\frac{\$}{\$}$	$\frac{\$}{\$}\backslash\frac{\$}{\$}\backslash\frac{\$}{\$}$	$\frac{\$}{\$}\backslash\frac{\$}{\$}\backslash\frac{\$}{\$}$	$\frac{\$}{\$}\backslash\frac{\$}{\$}\backslash\frac{\$}{\$}$	$\frac{\$}{\$}\backslash\frac{\$}{\$}\backslash\frac{\$}{\$}$	$\frac{\$}{\$}\backslash\frac{\$}{\$}\backslash\frac{\$}{\$}$	
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$\frac{\$}{\$}\backslash\frac{\$}{\$}\backslash\frac{\$}{\$}$		$\frac{\$}{\$}\backslash\frac{\$}{\$}\backslash\frac{\$}{\$}$	$\frac{\$}{\$}\backslash\frac{\$}{\$}\backslash\frac{\$}{\$}$	$\frac{\$}{\$}\backslash\frac{\$}{\$}\backslash\frac{\$}{\$}$	$\frac{\$}{\$}\backslash\frac{\$}{\$}\backslash\frac{\$}{\$}$	$\frac{\$}{\$}\backslash\frac{\$}{\$}\backslash\frac{\$}{\$}$	$\frac{\$}{\$}\backslash\frac{\$}{\$}\backslash\frac{\$}{\$}$	
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): $\frac{\$}{\$}\backslash\boxed{}=\frac{\$}{\$}\frac{\$}{\$}\boxed{}{\$}{\$}\boxed{}{\$}$ und (5)			
$\frac{\$}{\$}\backslash\frac{\$}{\$}\backslash\frac{\$}{\$}\backslash\frac{\$}{\$}\backslash\frac{\$}{\$}\backslash\frac{\$}{\$}$		$\frac{\$}{\$}\backslash\frac{\$}{\$}\backslash\frac{\$}{\$}\backslash\frac{\$}{\$}\backslash\frac{\$}{\$}\backslash\frac{\$}{\$}$			$\frac{\$}{\$}\backslash\frac{\$}{\$}\backslash\frac{\$}{\$}\backslash\frac{\$}{\$}\backslash\frac{\$}{\$}\backslash\frac{\$}{\$}$			
$\frac{\$}{\$}\backslash\frac{\$}{\$}$		$\frac{\$}{\$}\frac{\$}{\$}\{U_1\}\{R_1\}=\frac{\$}{\$}\frac{\$}{\$}\{U_2\}\{R_2\}=\frac{\$}{\$}\frac{\$}{\$}\{U_A\}\{R_1+_R_2\}\$$			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)		$\$_U_2=_U_A\backslash\cdot\frac{\$}{\$}\{R_2\}\{R_1+_R_2\}\$$			Spannungsteilerformel			
$\frac{\$}{\$}\backslash\frac{\$}{\$}\backslash\frac{\$}{\$}\backslash\frac{\$}{\$}\backslash\frac{\$}{\$}\backslash\frac{\$}{\$}$		$\frac{\$}{\$}\backslash\frac{\$}{\$}\backslash\frac{\$}{\$}\backslash\frac{\$}{\$}\backslash\frac{\$}{\$}\backslash\frac{\$}{\$}$			$\frac{\$}{\$}\backslash\frac{\$}{\$}\backslash\frac{\$}{\$}\backslash\frac{\$}{\$}\backslash\frac{\$}{\$}\backslash\frac{\$}{\$}$			