

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?

so lets start

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

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

[illegible]
$$\begin{aligned} & \text{\color{black}\{\text{number}:}} \& \text{\color{black}\{}} \& \\ & \text{\color{black}\{2}} \& \text{\color{black}\{6}} \& \text{\color{black}\{5}} \& \text{\color{black}\{8.}} \& \text{\color{black}\{4}} \& \\ & \text{\color{black}\{7}} \\\text{\color{black}\{\text{index}:}} \& \text{\color{black}\{i}} \& \text{\color{black}\{3}} \& \\ & \text{\color{black}\{2}} \& \text{\color{black}\{1}} \& \text{\color{black}\{0}} \& \text{\color{black}\{-1}} \& \text{\color{black}\{-2}} \\\text{\color{blue}\{\text{place value}:}} \& \text{\color{blue}\{B^i}} \& \text{\color{blue}\{10^3}} \& \text{\color{blue}\{10^2}} \& \text{\color{blue}\{10^1}} \& \text{\color{blue}\{10^0}} \& \text{\color{blue}\{10^{-1}}} \& \text{\color{blue}\{10^{-2}}} \\\text{\color{white}\{}} \& \text{\color{white}\{}} \& \text{\color{white}\{1000}} \& \text{\color{white}\{100}} \& \\ & \text{\color{white}\{10}} \& \text{\color{white}\{1}} \& \text{\color{white}\{0.1}} \& \text{\color{white}\{0.01}} \end{aligned}$$

```
\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*} Third: calculate the place value
$\quad$
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\begin{align*} \begin{smallmatrix} \color{white}{\text{number}:} & \color{white}{} & \color{white}{2} & \color{white}{6} & \color{white}{5} & \color{white}{8.} & \color{white}{4} &
\color{white}{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*} First: But space between the numerals to
see the thousands, hundreds, tens, ones, tenths, hundredths
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\begin{align*} \begin{smallmatrix} \color{blue}{\text{number}:} & \color{blue}{} & \color{blue}{2} & \color{blue}{6} & \color{blue}{5} & \color{blue}{8.} & \color{blue}{4} &
\color{blue}{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{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{blue}{} & \color{blue}{} & \color{blue}{1000} &
\color{blue}{100} & \color{blue}{10} & \color{blue}{1} & \color{blue}{0.1} &
\color{blue}{0.01} \\ \color{blue}{\text{numerals}:} & \color{blue}{z_i} & \color{blue}{2} &
\color{blue}{6} & \color{blue}{5} & \color{blue}{8} & \color{blue}{4} & \color{blue}{7} \\
\color{blue}{\text{calc}.:} & \color{blue}{z_i \cdot B^i} & \color{blue}{2000} &
\color{blue}{600} & \color{blue}{50} & \color{blue}{8} & \color{blue}{0.4} &
\color{blue}{0.07} \\ \color{blue}{\text{result}:} & \color{blue}{\sum_i z_i \cdot B^i} & & &
\color{blue}{2658.47} \\ \end{smallmatrix} \end{align*} First: But 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}{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{black}{\text{place value}:} & \color{black}{B^i} & \color{black}{10^3} &
\color{black}{10^2} & \color{black}{10^1} & \color{black}{10^0} & \color{black}{10^{-1}} &
\color{black}{10^{-2}} \\ \color{black}{} & \color{black}{} & \color{black}{1000} &
\color{black}{100} & \color{black}{10} & \color{black}{1} & \color{black}{0.1} &
\color{black}{0.01} \\ \color{black}{\text{numerals}:} & \color{black}{z_i} & \color{black}{2} &
\color{black}{6} & \color{black}{5} & \color{black}{8} & \color{black}{4} & \color{black}{7} \\
\color{black}{\text{calc}.:} & \color{black}{z_i \cdot B^i} & \color{black}{2000} &
\color{black}{600} & \color{black}{50} & \color{black}{8} & \color{black}{0.4} &
\color{black}{0.07} \\ \color{black}{\text{result}:} & \color{black}{\sum_i z_i \cdot B^i} & & &
\color{black}{2658.47} \\ \end{smallmatrix} \end{align*} First: But space between the
numerals to see the thousands, hundreds, tens, ones, tenths, hundredths
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calc. & $z_i \cdot B^i$ & 2000 & 600 & 50 & 8 & 0.4 & 0.07 \\ \text{result} & \sum_i z_i \cdot B^i & & 2658.47 \\ \end{smallmatrix} \end{align*} 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	
$\frac{\quad}{\quad}$	$\frac{\quad}{\quad}$	$\frac{\quad}{\quad}$	$\frac{\quad}{\quad}$	$\frac{\quad}{\quad}$	$\frac{\quad}{\quad}$	$\frac{\quad}{\quad}$	$\frac{\quad}{\quad}$	$\frac{\quad}{\quad}$
$\frac{\quad}{\quad}$	$\frac{\quad}{\quad}$	$\frac{\quad}{\quad}$	$\frac{\quad}{\quad}$	$\frac{\quad}{\quad}$	$\frac{\quad}{\quad}$	$\frac{\quad}{\quad}$	$\frac{\quad}{\quad}$	$\frac{\quad}{\quad}$
$\frac{\quad}{\quad}$	$\frac{\quad}{\quad}$	$\frac{\quad}{\quad}$	$\frac{\quad}{\quad}$	$\frac{\quad}{\quad}$	$\frac{\quad}{\quad}$	$\frac{\quad}{\quad}$	$\frac{\quad}{\quad}$	$\frac{\quad}{\quad}$
$\frac{\quad}{\quad}$	$\frac{\quad}{\quad}$	$\frac{\quad}{\quad}$	$\frac{\quad}{\quad}$	$\frac{\quad}{\quad}$	$\frac{\quad}{\quad}$	$\frac{\quad}{\quad}$	$\frac{\quad}{\quad}$	$\frac{\quad}{\quad}$
value		2	6	5	8 ,	4	7	
index	i	3	2	1	0	-1	-2	
place value	B^i	$\frac{\quad}{\quad}$	$\frac{\quad}{\quad}$	$\frac{\quad}{\quad}$	$\frac{\quad}{\quad}$	$\frac{\quad}{\quad}$	$\frac{\quad}{\quad}$	$\frac{\quad}{\quad}$
digit	z_i	2	6	5	8	4	7	
calc.	$z_i \cdot B^i$	2000	600	50	8	0.4	0.07	
Result $\sum_i z_i \cdot B^i$		2658,47						
aus (2+3)	$\textcolor{blue}{l_p} = \textcolor{blue}{l_m} = 0$				l_p und l_m sind damit definiert			
$\frac{\quad}{\quad}$	$\frac{\quad}{\quad}$				$\frac{\quad}{\quad}$			
aus (6)	$\textcolor{blue}{l_o} = l_1$				l_o ist damit bekannt, wenn l_1 bekannt ist			
$\frac{\quad}{\quad}$	$\frac{\quad}{\quad}$				$\frac{\quad}{\quad}$			
aus (7) und (3)	$l_1 - l_2 - \textcolor{blue}{0} = 0$				$\frac{\quad}{\quad}$			
$\frac{\quad}{\quad}$	$\frac{\quad}{\quad}$				$\frac{\quad}{\quad}$			
$\frac{\quad}{\quad}$	$l_1 = l_2 = l_o$				$\frac{\quad}{\quad}$			
$\frac{\quad}{\quad}$	$\frac{\quad}{\quad}$				$\frac{\quad}{\quad}$			
$\frac{\quad}{\quad}$	$\textcolor{blue}{l_1} = \textcolor{blue}{l_2} = \textcolor{blue}{l_o}$				mit (8) und (9): $\boxed{} = \frac{\boxed{} \cdot \boxed{}}{\boxed{}} \cdot \boxed{} \cdot \boxed{}$ und (5)			
$\frac{\quad}{\quad}$	$\frac{\quad}{\quad}$				$\frac{\quad}{\quad}$			
$\frac{\quad}{\quad}$	$\frac{\quad}{\quad}$				Spannungsteilerformel, $l = \text{const.}$			
$\frac{\quad}{\quad}$	$\frac{\quad}{\quad}$				$\frac{\quad}{\quad}$			
(10)	$U_2 = U_A \cdot \frac{\quad}{\quad} \cdot \frac{\quad}{\quad} \cdot \frac{\quad}{\quad}$				Spannungsteilerformel			
$\frac{\quad}{\quad}$	$\frac{\quad}{\quad}$				$\frac{\quad}{\quad}$			

II. Betrachtung der Spannungsverstärkung

aus (0)	$\textcolor{blue}{A_V} = \frac{\quad}{\quad} \cdot \frac{\quad}{\quad}$	$\frac{\quad}{\quad}$
$\frac{\quad}{\quad}$	$\frac{\quad}{\quad}$	$\frac{\quad}{\quad}$
$\frac{\quad}{\quad}$	$A_V = \frac{\quad}{\quad} \cdot \frac{\quad}{\quad}$	mit (4): $U_E = U_2 + U_D$
$\frac{\quad}{\quad}$	$\frac{\quad}{\quad}$	$\frac{\quad}{\quad}$
$\frac{\quad}{\quad}$	$A_V = \frac{\quad}{\quad} \cdot \frac{\quad}{\quad}$	$\frac{\quad}{\quad}$
$\frac{\quad}{\quad}$	$\frac{\quad}{\quad}$	$\frac{\quad}{\quad}$
$\frac{\quad}{\quad}$	$A_V = \frac{\quad}{\quad} \cdot \frac{\quad}{\quad}$	mit (10): $U_2 = U_A \cdot \frac{\quad}{\quad} \cdot \frac{\quad}{\quad}$
$\frac{\quad}{\quad}$	$\frac{\quad}{\quad}$	$\frac{\quad}{\quad}$
$\frac{\quad}{\quad}$	$A_V = \frac{\quad}{\quad} \cdot \frac{\quad}{\quad} \cdot \frac{\quad}{\quad}$	$\frac{\quad}{\quad}$
$\frac{\quad}{\quad}$	$\frac{\quad}{\quad}$	$\frac{\quad}{\quad}$
$\frac{\quad}{\quad}$	$A_V = \frac{\quad}{\quad} \cdot \frac{\quad}{\quad} \cdot \frac{\quad}{\quad} \cdot \frac{\quad}{\quad}$	mit (1)
$\frac{\quad}{\quad}$	$\frac{\quad}{\quad}$	$\frac{\quad}{\quad}$
$\frac{\quad}{\quad}$	$A_V = \frac{\quad}{\quad} \cdot \frac{\quad}{\quad} \cdot \frac{\quad}{\quad} \cdot \frac{\quad}{\quad} \cdot \frac{\quad}{\quad}$	$\frac{\quad}{\quad}$
$\frac{\quad}{\quad}$	$\frac{\quad}{\quad}$	$\frac{\quad}{\quad}$
$\frac{\quad}{\quad}$	$A_V = \frac{\quad}{\quad} \cdot \frac{\quad}{\quad} \cdot \frac{\quad}{\quad} \cdot \frac{\quad}{\quad} \cdot \frac{\quad}{\quad} \cdot \frac{\quad}{\quad}$	$\frac{\quad}{\quad}$
$\frac{\quad}{\quad}$	$\frac{\quad}{\quad}$	$\frac{\quad}{\quad}$
$\frac{\quad}{\quad}$	$A_V = \frac{\quad}{\quad} \cdot \frac{\quad}{\quad} \cdot \frac{\quad}{\quad} \cdot \frac{\quad}{\quad} \cdot \frac{\quad}{\quad} \cdot \frac{\quad}{\quad} \cdot \frac{\quad}{\quad}$	$\frac{\quad}{\quad}$
$\frac{\quad}{\quad}$	$\frac{\quad}{\quad}$	$\frac{\quad}{\quad}$
$\frac{\quad}{\quad}$	$A_V = \frac{\quad}{\quad} \cdot \frac{\quad}{\quad} \cdot \frac{\quad}{\quad} \cdot \frac{\quad}{\quad} \cdot \frac{\quad}{\quad} \cdot \frac{\quad}{\quad} \cdot \frac{\quad}{\quad} \cdot \frac{\quad}{\quad}$	$\frac{\quad}{\quad}$
$\frac{\quad}{\quad}$	$\frac{\quad}{\quad}$	$\frac{\quad}{\quad}$
$\frac{\quad}{\quad}$	$A_V = \frac{\quad}{\quad} \cdot \frac{\quad}{\quad} \cdot \frac{\quad}{\quad} \cdot \frac{\quad}{\quad} \cdot \frac{\quad}{\quad} \cdot \frac{\quad}{\quad} \cdot \frac{\quad}{\quad} \cdot \frac{\quad}{\quad} \cdot \frac{\quad}{\quad}$	Bruch umformen
$\frac{\quad}{\quad}$	$\frac{\quad}{\quad}$	$\frac{\quad}{\quad}$
$\frac{\quad}{\quad}$	$A_V = \frac{\quad}{\quad} \cdot \frac{\quad}{\quad} \cdot \frac{\quad}{\quad} \cdot \frac{\quad}{\quad} \cdot \frac{\quad}{\quad} \cdot \frac{\quad}{\quad} \cdot \frac{\quad}{\quad} \cdot \frac{\quad}{\quad} \cdot \frac{\quad}{\quad}$	$\frac{\quad}{\quad}$
$\frac{\quad}{\quad}$	$\frac{\quad}{\quad}$	$\frac{\quad}{\quad}$

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