

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?

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

$$\begin{aligned} & \text{\texttt{\textbackslash begin{align*} \textbackslash begin{smallmatrix} \textcolor{black}{\text{\texttt{\textbackslash text{number}:}} \& \textcolor{black}{\text{\texttt{\textbackslash}}}} \& \\ & \textcolor{black}{\text{\texttt{\textbackslash}}\texttt{2}} \& \textcolor{black}{\text{\texttt{\textbackslash}}\texttt{6}} \& \textcolor{black}{\text{\texttt{\textbackslash}}\texttt{5}} \& \textcolor{black}{\text{\texttt{\textbackslash}}\texttt{8.}} \& \textcolor{black}{\text{\texttt{\textbackslash}}\texttt{4}} \& \\ & \textcolor{black}{\text{\texttt{\textbackslash}}\texttt{7}} \textbackslash \textcolor{white}{\text{\texttt{\textbackslash text{index}:}} \& \textcolor{white}{\text{\texttt{\textbackslash}}\texttt{i}} \& \textcolor{white}{\text{\texttt{\textbackslash}}\texttt{3}} \& \\ & \textcolor{white}{\text{\texttt{\textbackslash}}\texttt{2}} \& \textcolor{white}{\text{\texttt{\textbackslash}}\texttt{1}} \& \textcolor{white}{\text{\texttt{\textbackslash}}\texttt{0}} \& \textcolor{white}{\text{\texttt{\textbackslash}}\texttt{-1}} \& \textcolor{white}{\text{\texttt{\textbackslash}}\texttt{-2}} \textbackslash \textcolor{white}{\text{\texttt{\textbackslash text{place value}:}} \& \textcolor{white}{\text{\texttt{\textbackslash}}\texttt{B^i}} \& \textcolor{white}{\text{\texttt{\textbackslash}}\texttt{10^3}} \& \\ & \textcolor{white}{\text{\texttt{\textbackslash}}\texttt{10^2}} \& \textcolor{white}{\text{\texttt{\textbackslash}}\texttt{10^1}} \& \textcolor{white}{\text{\texttt{\textbackslash}}\texttt{10^0}} \& \textcolor{white}{\text{\texttt{\textbackslash}}\texttt{10^{-1}}} \& \\ & \textcolor{white}{\text{\texttt{\textbackslash}}\texttt{10^{-2}}} \textbackslash \textcolor{white}{\text{\texttt{\textbackslash}}\texttt{}} \& \textcolor{white}{\text{\texttt{\textbackslash}}\texttt{}} \& \textcolor{white}{\text{\texttt{\textbackslash}}\texttt{1000}} \& \\ & \textcolor{white}{\text{\texttt{\textbackslash}}\texttt{100}} \& \textcolor{white}{\text{\texttt{\textbackslash}}\texttt{10}} \& \textcolor{white}{\text{\texttt{\textbackslash}}\texttt{1}} \& \textcolor{white}{\text{\texttt{\textbackslash}}\texttt{0.1}} \& \\ & \textcolor{white}{\text{\texttt{\textbackslash}}\texttt{0.01}} \textbackslash \textcolor{white}{\text{\texttt{\textbackslash text{numerals}:}} \& \textcolor{white}{\text{\texttt{\textbackslash}}\texttt{z_i}} \& \textcolor{white}{\text{\texttt{\textbackslash}}\texttt{2}} \& \\ & \textcolor{white}{\text{\texttt{\textbackslash}}\texttt{6}} \& \textcolor{white}{\text{\texttt{\textbackslash}}\texttt{5}} \& \textcolor{white}{\text{\texttt{\textbackslash}}\texttt{8}} \& \textcolor{white}{\text{\texttt{\textbackslash}}\texttt{4}} \& \textcolor{white}{\text{\texttt{\textbackslash}}\texttt{7}} \textbackslash \textcolor{white}{\text{\texttt{\textbackslash text{calc}:}} \& \textcolor{white}{\text{\texttt{\textbackslash}}\texttt{z_i \cdot B^i}} \& \textcolor{white}{\text{\texttt{\textbackslash}}\texttt{2000}} \& \\ & \textcolor{white}{\text{\texttt{\textbackslash}}\texttt{600}} \& \textcolor{white}{\text{\texttt{\textbackslash}}\texttt{50}} \& \textcolor{white}{\text{\texttt{\textbackslash}}\texttt{8}} \& \textcolor{white}{\text{\texttt{\textbackslash}}\texttt{0.4}} \& \\ & \textcolor{white}{\text{\texttt{\textbackslash}}\texttt{0.07}} \textbackslash \textcolor{white}{\text{\texttt{\textbackslash text{result}:}} \& \textcolor{white}{\text{\texttt{\textbackslash}}\texttt{\sum_i z_i \cdot B^i}}} \& \& \& \\ & \textcolor{white}{\text{\texttt{\textbackslash}}\texttt{2658.47}} \textbackslash \textcolor{white}{\text{\texttt{\textbackslash end{smallmatrix} \textbackslash end{align*}}} \textcolor{white}{\text{\texttt{\textbackslash}}\texttt{First: Put space between the numerals to}} \\ & \textcolor{white}{\text{\texttt{\textbackslash}}\texttt{see the thousands, hundreds, tens, ones, tenths, hundredths}} \end{aligned}$$

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

Second: But space between the numerals to see the thousands. hundreds. tens. ones. tenths. hundredths

$$\begin{matrix} \text{number} & \text{index} & i & \text{place value} & B^i & 10^3 & 10^2 & 10^1 & 10^0 & 10^{-1} & 10^{-2} \\ \hline 2 & 6 & 5 & 8 & 4 & 7 & 2 & 1 & 0 & -1 & -2 \\ \hline \end{matrix}$$

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

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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} \end{smallmatrix} \\ \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{align*}
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First: But space between the numerals to see the thousands, hundreds, tens, ones, tenths, hundredths

```
\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} \end{smallmatrix} \\ \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{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} \end{smallmatrix} \\ \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} \end{align*}
```

calc. & $z_i \cdot B^i$ & 2000 & 600 & 50 & 8 & 0.4 & 0.07 \\ 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	
$\frac{1}{B^i}$		$\frac{1}{10^3}$	$\frac{1}{10^2}$	$\frac{1}{10^1}$	$\frac{1}{10^0}$	$\frac{1}{10^{-1}}$	$\frac{1}{10^{-2}}$	
z_i		2	6	5	8	4	7	
$z_i \cdot B^i$		2000	600	50	8	0.4	0.07	
Result $\sum_i z_i \cdot B^i$		2658,47						
aus (2+3)		$I_p = I_m = 0$				I_p und I_m sind damit definiert		
$\frac{1}{B^i}$		$I_o = I_1$				I_o ist damit bekannt, wenn I_1 bekannt ist		
z_i		$I_1 - I_2 - I_o = 0$						
$z_i \cdot B^i$		$I_1 = I_2 = I_o$						
$\frac{1}{B^i}$		$I_1 = I_2 = I_o$						
$\frac{1}{B^i}$		$I_1 = I_2 = I_o$						
$\frac{1}{B^i}$		$I_1 = I_2 = I_o$						
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