

calc_decimal_example

Student Group

First Name	Surname	Matrikel Nr.

Table of Contents

Calculation example for decimal value

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

so lets start

1. Put space between the digits

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

2. Write down the index for each position.

$$\quad$$
$$\begin{matrix} \text{\color{black}\text{\text{numeral}:}} & \text{\color{black}} & \text{\color{black}\text{\text{2}}} & \text{\color{black}\text{\text{6}}} & \text{\color{black}\text{\text{5}}} & \text{\color{black}\text{\text{8.}}} & \text{\color{black}\text{\text{4}}} & \text{\color{black}\text{\text{7}}} \\ \text{\color{blue}\text{\text{index}:}} & \text{\color{blue}\text{\text{i}}} & \text{\color{blue}\text{\text{3}}} & \text{\color{blue}\text{\text{2}}} & \text{\color{blue}\text{\text{1}}} & \text{\color{blue}\text{\text{0}}} & \text{\color{blue}\text{\text{-1}}} & \text{\color{blue}\text{\text{-2}}} \\ \text{\text{place factor}:} & B^i & 10^3 & 10^2 & 10^1 & 10^0 & 10^{-1} & 10^{-2} \\ \text{\text{digits}:} & z_i & 2 & 6 & 5 & 8 & 4 & 7 \\ \text{\text{place value}:} & z_i \cdot B^i & 2000 & 600 & 50 & 8 & 0.4 & 0.07 \\ \text{\text{result}:} & \sum_i z_i \cdot B^i & & & & & & 2658.47 \end{matrix}$$

3. calculate the place factor

$$\quad$$
$$\begin{pmatrix} \text{numeral} & & & & \\ & 2 & & & \\ & & 6 & & \\ & & & 5 & \\ & & & & 8 \\ & & & & & 4 \end{pmatrix}$$

```

\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 factor}:} & \color{blue}{B^i} & \color{blue}{10^3} & \color{blue}
\color{blue}{10^2} & \color{blue}{10^1} & \color{blue}{10^0} & \color{blue}{10^{-1}} & \color{blue}
\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{digits}:} & \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{place value}:} & \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*}

```

3. calculate the place factor

(= ..., thousands, hundreds, tens, ones, tenths, ...)

```

\begin{align*} \begin{smallmatrix} \color{black}{\text{numeral}:} & \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 factor}:} & \color{blue}{B^i} & \color{blue}{10^3} & \color{blue}
\color{blue}{10^2} & \color{blue}{10^1} & \color{blue}{10^0} & \color{blue}{10^{-1}} & \color{blue}
\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{white}{\text{digits}:} & \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{place value}:} & \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*}

```

4. write down each digit of the numeral

$\$ \quad \$$

```

\begin{align*} \begin{smallmatrix} \color{black}{\text{numeral}:} & \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 factor}:} & \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{blue}{\text{digits}:} & \color{blue}{z_i} & \color{blue}{2} &
\color{blue}{6} & \color{blue}{5} & \color{blue}{8} & \color{blue}{4} & \color{blue}{7} \\
\color{white}{\text{place value}:} & \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*}

```

5. calculate the place value

\$\quad\$

```
\begin{align*} \begin{smallmatrix} \color{black}{\text{numeral:}} & \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 factor:}} & \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{digits:}} & \color{black}{z_i} & \color{black}{2} & \\ \color{black}{6} & \color{black}{5} & \color{black}{8} & \color{black}{4} & \color{black}{7} & \\ \color{blue}{\text{place value:}} & \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} \\ \color{white}{\text{result:}} & \color{white}{\sum_i z_i \cdot B^i} & & \\ \color{white}{2658.47} & \end{smallmatrix} \end{align*}
```

6. Add all place values

\$\quad\$

```
\begin{align*} \begin{smallmatrix} \color{black}{\text{numeral:}} & \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 factor:}} & \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{digits:}} & \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{place value:}} & \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{blue}{\text{result:}} & \color{blue}{\sum_i z_i \cdot B^i} & & \\ \color{blue}{2658.47} & \end{smallmatrix} \end{align*}
```

From:

<https://wiki.mexle.te.hs-heilbronn.de/> - **MEXLE Wiki**

Permanent link:

https://wiki.mexle.te.hs-heilbronn.de/introduction_to_digital_systems/calc_decimal_example?rev=1631669886

Last update: **2021/09/15 03:38**

