

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

2. Write down the index for each position.

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

3. calculate the place factor

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

```

\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}
{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{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}
{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{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=1631669444

Last update: **2021/09/15 03:30**

