

calc_decimal_example

Student Group

First Name	Surname	Matrikel Nr.

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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\$ to see the thousands, hundreds, tens, ones, tenths, hundredths

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\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{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 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}{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*}
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2. Write down the index for each position.

\$\quad\$

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\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{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}{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

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

```

\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

\$\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{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*}

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4. write down each digit of the numeral

\$\quad\$

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\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*}

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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}{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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6. Add all place values

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\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*}
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```
\begin{align*} \begin{smallmatrix} \color{blue}{\text{numeral:}} & \color{blue}{} & \color{blue}{} & \color{blue}{} & \color{blue}{} & \\ \color{blue}{2} & \color{blue}{6} & \color{blue}{5} & \color{blue}{8.} & \color{blue}{4} & \color{blue}{} \\ \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 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}{} & \color{blue}{1000} & \color{blue}{100} & \color{blue}{10} \\ & \color{blue}{1} & \color{blue}{0.1} & \color{blue}{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{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}{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 digits to see the thousands, hundreds, tens, ones, tenths, hundredths

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

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

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