

calc_decimal_example

Student Group

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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\$ 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}{} & \color{white}{1000} & \color{white}{100} & \color{white}{10} & \color{white}{1} & \color{white}{0.1} \\ \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*}
```

2. Write down the index for each position.

\$\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{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}{1000} & \color{white}{100} & \color{white}{10} & \color{white}{1} & \color{white}{0.1} \\ \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*}

```

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*}

```

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}{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 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}{} & \color{blue}{} & \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

$$\begin{aligned} & \begin{smallmatrix} \text{numeral:} & & \\ \text{index:} & i & \\ \text{place factor:} & B^i & \\ \text{place value:} & z_i \cdot B^i & \end{smallmatrix} \\ & \begin{matrix} \text{2} & \text{6} & \text{5} & \text{8.} & \text{4} & \text{7} \\ \text{2} & \text{1} & \text{0} & \text{-1} & \text{-2} \\ \text{100} & \text{10} & \text{1} & \text{0.1} & \text{0.01} \end{matrix} \\ & \begin{matrix} \text{6} & \text{5} & \text{8} & \text{4} & \text{7} \\ \text{600} & \text{50} & \text{8} & \text{0.4} & \text{0.07} \end{matrix} \\ & \text{2658.47} \end{aligned}$$

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