

# calc\_decimal\_example

## Student Group

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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

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

2. Write down the index for each position.

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

3. calculate the place factor

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

$$\begin{matrix} \text{\color{black}\{\text{numeral}\}:} & \text{\color{black}\{}} & \text{\color{black}\{2}} & \text{\color{black}\{6}} & \text{\color{black}\{5}} & \text{\color{black}\{8}} & \text{\color{black}\{4}} \end{matrix}$$

```

\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\$

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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{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*}
```

## 6. Add all place values

\$\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{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*}
```

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

```

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

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