Math alignment examples

The document https://www.ntg.nl/maps/34/06.pdf shows examples how to do special math alignments in display mode in ConTeXt (and in LaTeX for comparison). We present the same examples here. They are created in OpTeX and the LaTeX source is shown for comparison.

Note that several examples here use the macro `\eqm` for placing an equation mark. The macro is defined by

```
\def\eqm{\toright\eqmark}
```

and the `\toright` macro is defined in OpTeX trick 0028 which is based on OpTeX trick 0020. I.e. the following macros are used here:

```
\refdecl{
   \def\Xpos#1#2#3{\sxdef{pos:#1}{{#2}{#3}\_currpage}}
}
\def\setpos[#1]{\openref\pdfsavepos
   \_ewref\Xpos{{#1}\unexpanded{{\the\pdflastxpos}{\the\pdflastypos}}}}

\def\posx [#1]{\_ea \posi   \romannumeral-`\.\trycs{pos:#1}{{0}{0}{0}{0}}sp}
\def\posy [#1]{\_ea \posii  \romannumeral-`\.\trycs{pos:#1}{{0}{0}{0}{0}}sp}
\def\pospg[#1]{\_ea \posiii \romannumeral-`\.\trycs{pos:#1}{{0}{0}{0}{0}}}

\def\posi   #1#2#3#4{#1}
\def\posii  #1#2#3#4{#2}
\def\posiii #1#2#3#4{#3}

\newcount\tomarginno
\def\toright#1{\_incr\tomarginno {\setpos[tr:\the\tomarginno]%
   \rlap{\kern-\posx[tr:\the\tomarginno]\kern\hoffset\kern\hsize\llap{#1}}}}
\def\toleft#1{\_incr\tomarginno {\setpos[tr:\the\tomarginno]%
   \rlap{\kern-\posx[tr:\the\tomarginno]\kern\hoffset\rlap{#1}}}}
```

and we have to run TeX twice.

Contents

1 Gather

```
\begin{gather}
   v = u  + at,           \\
   d = ut + \frac12 at^2.
\end{gather}


$$
  \displaylines{
     v = u  + at,              \eqm \cr
     d = ut + {1\over2} at^2.  \eqm
  }
$$
```

$$v = u + at, \tag{1}$$

$$d = ut + \frac{1}{2}at^2. \tag{2}$$

2 Left gather

```
\begin{align}
  & v = u + at,            \\
  & d = ut + \frac12 at^2.
\end{align}


$$
  \eqalignno{
     & v = u + at,               & \eqmark \cr
     & d = ut + {1\over2} at^2.  & \eqmark
  }
$$
```

$$v = u + at, \tag{1}$$

$$d = ut + \frac{1}{2}at^2. \tag{2}$$

3 Right gather

```
\begin{align}
  v = u + at ,           & \\
  d = ut + \frac12 at^2. &
\end{align}


$$
  \eqalignno{
     v = u + at,               && \eqmark \cr
     d = ut + {1\over2} at^2.  && \eqmark
  }
$$
```

$$v = u + at, \tag{1}$$

$$d = ut + \frac{1}{2}at^2. \tag{2}$$

4 Align

```
\begin{align}
  v &= u + at,            \\
  d &= ut + \frac12 at^2.
\end{align}

$$
  \eqalignno{
    v &= u + at,               & \eqmark \cr
    d &= ut + {1\over2} at^2.  & \eqmark
  }
$$
```

$$v = u + at, \tag{1}$$

$$d = ut + \frac{1}{2}at^2. \tag{2}$$

5 Split

```
\begin{equation} \begin{split}
  (x+1)^8 ={} & x^8 + 8 x^7 + 28 x^6 + 56 x^5 + 70 x^4 \\
              & + 56 x^3 + 28 x^2 + 8 x + 1.
\end{split} \end{equation}

$$
  \eqalign{
       (x+1)^8 = {}& x^8 + 8 x^7 + 28 x^6 + 56 x^5 + 70 x^4 \cr
                   & + 56 x^3 + 28 x^2 + 8 x + 1.
  } \eqmark
$$
```

$$\begin{aligned}(x+1)^8 = {} & x^8 + 8x^7 + 28x^6 + 56x^5 + 70x^4 \\ & + 56x^3 + 28x^2 + 8x + 1.\end{aligned} \tag{1}$$

6 Alignat

```
\begin{alignat}{2}
  \nabla\cdot \mathbf  E &= \frac{\rho}{\varepsilon_0}, \qquad
& \nabla\times \mathbf E &= -\frac{\partial \mathbf B}{\partial t},\\
  \nabla\cdot \mathbf  B &= 0,
& \nabla\times \mathbf B &= \mu_0{\mathbf j}+\varepsilon_0\mu_0
                            \frac{\partial \mathbf E}{\partial t}.
\end{alignat}

$$
  \eqalign{
     \nabla\cdot {\bf E}     &= {\rho\over\varepsilon_0}, \qquad
     && \nabla\times {\bf E} &= -{\partial {\bf B}\over\partial t}, \eqm\cr
     \nabla\cdot {\bf B}     &= 0,
     && \nabla\times {\bf B} &= \mu_0{\bf j}+\varepsilon_0\mu_0
                                {\partial {\bf E}\over \partial t}. \eqm
  }
$$
```

$$\nabla\cdot\mathbf{E} = \frac{\rho}{\varepsilon_0}, \qquad \nabla\times\mathbf{E} = -\frac{\partial\mathbf{B}}{\partial t}, \tag{1}$$

$$\nabla\cdot\mathbf{B} = 0, \qquad \nabla\times\mathbf{B} = \mu_0\mathbf{j} + \varepsilon_0\mu_0\frac{\partial\mathbf{E}}{\partial t}. \tag{2}$$

7 Flalign

```
\begin{flalign*}
  \nabla\cdot \mathbf  E &= \frac{\rho}{\varepsilon_0},
& \nabla\times \mathbf E &= -\frac{\partial \mathbf B}{\partial t}.\\
  \nabla\cdot \mathbf  B &= 0,
& \nabla\times \mathbf B &= \mu_0{\mathbf j}+\varepsilon_0\mu_0
                             \frac{\partial \mathbf E}{\partial t}.
\end{flalign*}

$$
  \eqspace=10em
  \eqalign{
     \nabla\cdot {\bf E}     &= {\rho\over\varepsilon_0}, \qquad
     && \nabla\times {\bf E} &= -{\partial {\bf B}\over\partial t}, \cr
     \nabla\cdot {\bf B}     &= 0,
     && \nabla\times {\bf B} &= \mu_0{\bf j}+\varepsilon_0\mu_0
                                {\partial {\bf E}\over \partial t}.
  }
$$
```

$$\nabla \cdot \mathbf{E} = \frac{\rho}{\varepsilon_0}, \qquad \nabla \times \mathbf{E} = -\frac{\partial \mathbf{B}}{\partial t},$$

$$\nabla \cdot \mathbf{B} = 0, \qquad \nabla \times \mathbf{B} = \mu_0 \mathbf{j} + \varepsilon_0 \mu_0 \frac{\partial \mathbf{E}}{\partial t}.$$

8 Intertext

```
\begin{align*}
  \cos 2\theta &= \cos^2 \theta + \sin^2 \theta \\
  \intertext{replace $\sin^2 \theta$ by $1 - \cos^2 \theta$}
  &= 2\cos^2 \theta - 1
\end{align*}

$$
  \eqalignno{
     \cos 2\theta &= \cos^2 \theta + \sin^2 \theta \cr
      \noalign{\hbox{replace $\sin^2 \theta$ by $1 - \cos^2 \theta$}}
                  &= 2\cos^2 \theta - 1
  }
$$
```

$$\cos 2\theta = \cos^2 \theta + \sin^2 \theta$$

replace $\sin^2 \theta$ by $1 - \cos^2 \theta$

$$= 2\cos^2 \theta - 1$$

9 Linear equations

```
\begin{alignat}{5}
    x_1 & {} + {}& x_2    &{} + {}& 6x_3 &{} = {}& 170, \\
   3x_1 & {} - {}& 110x_2 &{} - {}& x_3   &{} = {}& 4,  \\
  14x_1 & {} + {}& 13x_2  &{} + {}& 10x_3 &{} = {}& 25.
\end{alignat}

$$
  \thistable{\tablinespace=0pt \tabiteml={${}}\tabitemr={{}$}
             \tabstrut={\lower1.5ex\vbox to3.5ex{}}}
  \table{3{rc}r}{
     x_1 &+&    x_2  &+&  6x_3  &=& 170, \eqm \cr
    3x_1 &-& 110x_2  &-&   x_3  &=& 4,   \eqm \cr
   14x_1 &+&  13x_2  &+& 10x_3  &=& 25.  \eqm
```

```
  }
$$
```

$$
\begin{aligned}
x_1 + \quad x_2 + \; 6x_3 &= 170, && (1)\\
3x_1 - 110x_2 - \quad x_3 &= \quad 4, && (2)\\
14x_1 + \; 13x_2 + 10x_3 &= \quad 25. && (3)
\end{aligned}
$$

10 Matrix and Arrays

```
\begin{equation*}
\setlength{\arraycolsep}{1em}
  \begin{array}{ccc}
    A   &   B & C \\
    AA  &  BB & CC \\
    AAA & BBB & CCC
  \end{array}
\end{equation*}

$$
  \matrix{
    A   &   B & C    \cr
    AA  &  BB & CC   \cr
    AAA & BBB & CCC
  }
$$
```

$$
\begin{array}{ccc}
A & B & C \\
AA & BB & CC \\
AAA & BBB & CCC
\end{array}
$$

```
\begin{equation*}
\setlength{\arraycolsep}{1em}
  \begin{array}{lcr}
    A   &   B & C \\
    AA  &  BB & CC \\
    AAA & BBB & CCC
  \end{array}
\end{equation*}

$$
  \thistable{\tabstrut{}\tabiteml={\kern.5em${}}\tabitemr={{}$\kern.5em}}
  \table{lcr}{
    A   &   B & C  \cr
    AA  &  BB & CC \cr
    AAA & BBB & CCC
  }
$$
```

$$
\begin{array}{lcr}
A & B & C \\
AA & BB & CC \\
AAA & BBB & CCC
\end{array}
$$

11 Pmatrix

```
\begin{equation*}
  A = \begin{pmatrix} 1 \\ 2 \\ 3 \end{pmatrix}
\end{equation*}

$$
  \pmatrix {1\cr 2\cr 3}
$$
```

$$
A = \begin{pmatrix} 1 \\ 2 \\ 3 \end{pmatrix}
$$

$$
\begin{pmatrix} 1 \\ 2 \\ 3 \end{pmatrix}
$$

12 Delarray package

```
\begin{equation*}
  \begin{array}[b]({c}) 1 \\ 2 \\ 3 \end{array}
  \begin{array}[c]({c}) 1 \\ 2 \\ 3 \end{array}
  \begin{array}[t]({c}) 1 \\ 2 \\ 3 \end{array}
\end{equation*}

$$
  \def\mybox#1{\hbox{$\displaystyle{#1}$}}
  \raise3ex\mybox{\pmatrix {1\cr 2\cr 3}}
  \pmatrix {1\cr 2\cr 3}
  \lower3ex\mybox{\pmatrix {1\cr 2\cr 3}}
$$
```

$$\begin{pmatrix} 1 \\ 2 \\ 3 \end{pmatrix} \begin{pmatrix} 1 \\ 2 \\ 3 \end{pmatrix} \begin{pmatrix} 1 \\ 2 \\ 3 \end{pmatrix}$$

13 Cases

```
\begin{equation*}
  |x| =
  \begin{cases}
     x, & \text{if $x \ge 0$;} \\
    -x, & \text{otherwise.}
  \end{cases}
\end{equation*}

$$
  |x| = \cases {  x & if $x \ge 0$; \cr
                 -x & otherwise }
$$
```

$$|x| = \begin{cases} x & \text{if } x \ge 0; \\ -x & \text{otherwise} \end{cases}$$

```
\begin{equation*}
  f(x) =
  \begin{dcases}
    \int_0^x g(y)\,dy,    & \text{if $x \ge 0$;} \\
    \int_{-x}^0 g(y)\,dy, & \text{otherwise.}
  \end{dcases}
\end{equation*}

$$
  \let\ds=\displaystyle
  f(x) = \cases { \ds \int_0^x g(y)\,dy,    & if $x \ge 0$; \cr \noalign{\medskip}
                  \ds \int_{-x}^0 g(y)\,dy, & otherwise. }
$$
```

$$f(x) = \begin{cases} \displaystyle\int_0^x g(y)\,dy, & \text{if } x \ge 0; \\ \displaystyle\int_{-x}^0 g(y)\,dy, & \text{otherwise.} \end{cases}$$