



math



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# Introduction

This manual is not a systematic discussion about math in `CONTEX`T but more a collection of wrap-ups. The file also serves as testcase. The content can change over time and can also serve as a trigger for discussions on the mailing list. Suggestions are welcome.

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Hasselt NL



# 1 Vertical spacing

The low level way to input inline math in  $\text{\TeX}$  is

$\$ e = mc^2 \$$

while display math can be entered like:

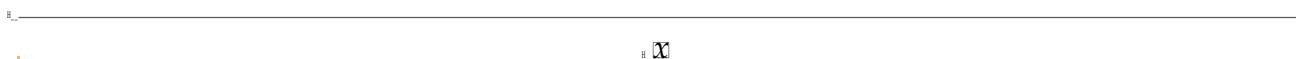
$$$ e = mc^2 $$$

The inline method is still valid, but for display math the  $$$$  method should not be used. This has to do with the fact that we want to control spacing in a consistent way. In  $\text{\ConTeXt}$  the vertical spacing model is rather stable although in  $\text{\MkIV}$  the implementation is quite different. It has always been a challenge to let this mechanism work well with space round display formulas. This has to do with the fact that (in the kind of documents that we have to produce) interaction with already present spacing is somewhat tricky.

Of course much can be achieved in  $\text{\TeX}$  but in  $\text{\ConTeXt}$  we need to have control over the many mechanisms that can interact. Given the way  $\text{\TeX}$  handles space around display math there is no real robust solution possible that gives visually consistent space in all cases so that is why we basically disable the existing spacing model. Disabling is easier in  $\text{\LuaTeX}$  and recent versions of  $\text{\MkIV}$  have been adapted to that.

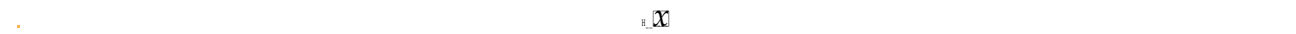
In pure  $\text{\TeX}$  what happens is this:

$$$ x $$$



A horizontal box (visualized by the thin rule on its baseline) get added which triggers a `baselineskip`. Then the formula is put below it. We can get rid of that box with `\noindent`:

`\noindent $$ x $$`



In addition (not shown here) vertical space is added before and after the formula and left- and rightskip on the edges. In fact typesetting display math goes like this:

- typeset the formula using display mode and wrap it in a box
- add an equation number, if possible in the same line, otherwise on a line below
- in the process center the formula using the available display width and required display indentation
- add vertical space above and below (depending also in displays being short in relation to the previous line)
- at the same time also add penalties that determine the break across pages

Apart from the spacing around the formula and the equation number, typesetting is not different from:

```
\hbox {$ \displaystyle x $}
```

So this is what we will use by default in `CONTEX` in order to better control spacing as spacing around math is a sensitive issue. Because math itself can have a narrow band, for instance a lone  $x$ , or relative much depth, as with  $y$ , or both depth and height as in  $(1,2)$  and  $x^2 + y_2$  and because a preceding line can have no or little depth and a following line little height, the visual appearance can become inconsistent. The default approach is to force consistent spacing, but when needed we can implement variants.

Spacing around display math is set up with `\setupformulas`:

```
\setupformulas
  [spacebefore=big,
   spaceafter=big]
```

When the whitespace is larger that setting wins because as usual the larger of blanks or whitespace wins.

In figures 1.1, figures 1.2 and 1.3 we see how things interact. We show lines with and without maximum line height and depth (enforced by struts) alongside.

Because we want to have control over the placement of the formula number but also want to be able to align the formula with the left or right edge of the text area, we don't use the native display handler by default. We still have a way to force this, but this is only for testing purposes. By default a formula is placed centered relative to the current text, including left and right margins.

```
\fakewords{20}{40}
```

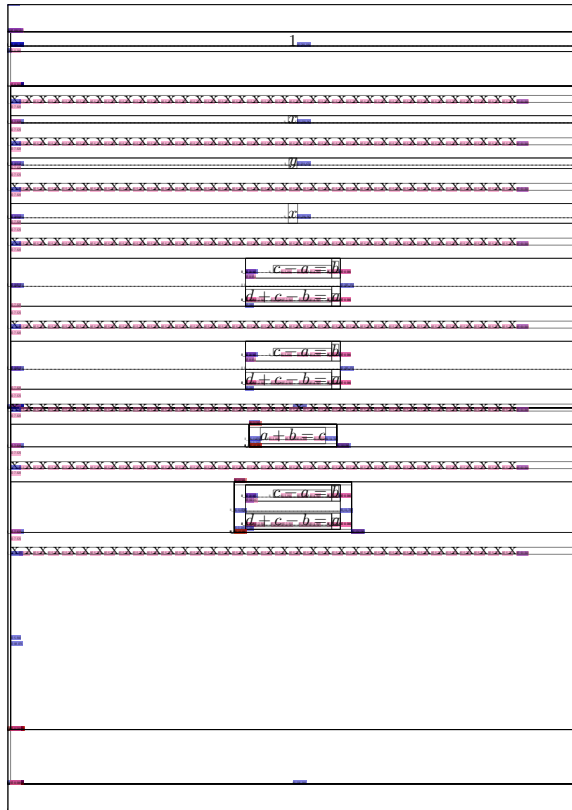
```
\startitemize
  \startitem
    \fakewords{20}{40}
    \placeformula
      \startformula
        \fakeformula
      \stopformula
    \stopitem
  \startitem
    \fakewords{20}{40}
  \stopitem
\stopitemize
```

```
\fakewords{20}{40}\epar
```

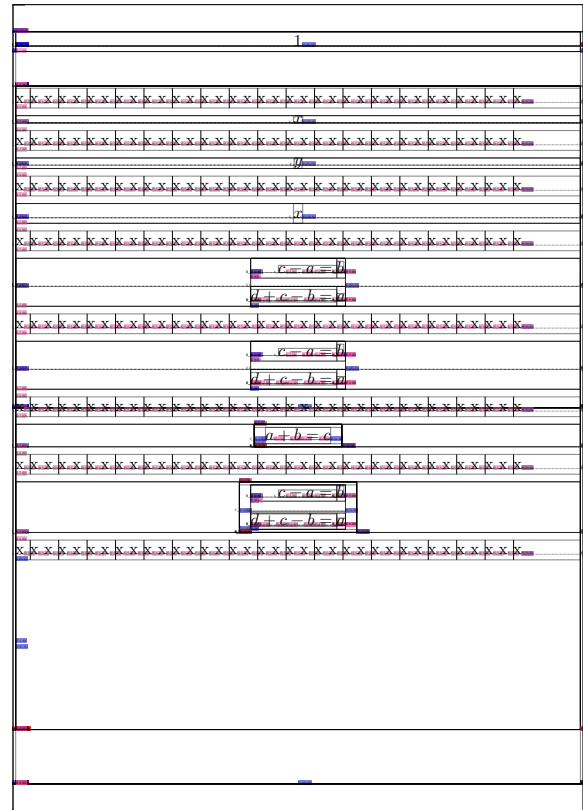




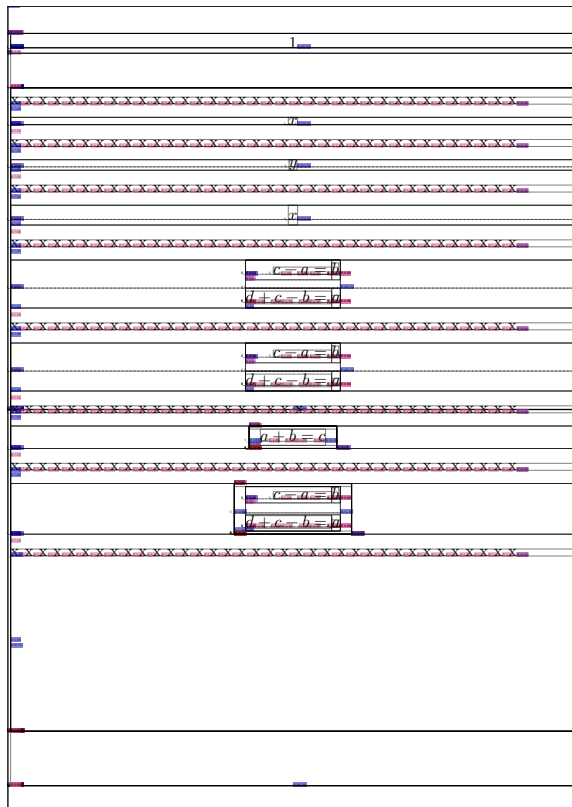




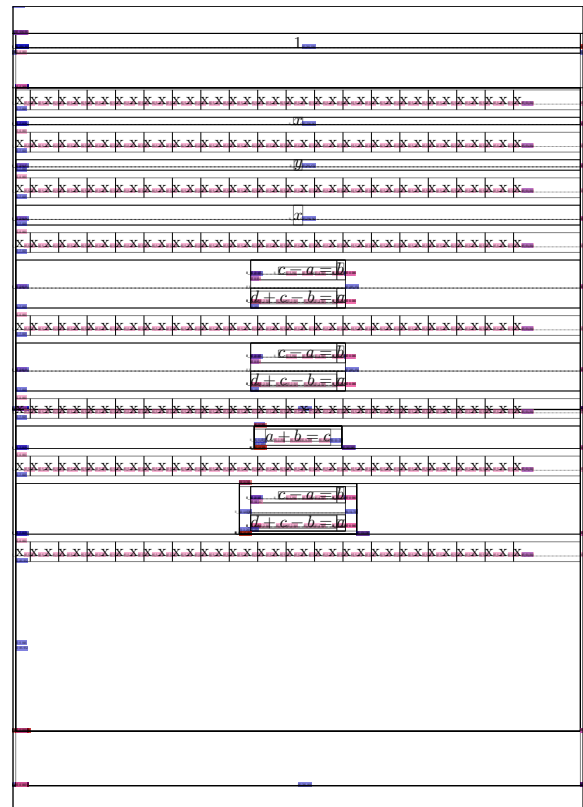
natural + none + ws medium



strut + none + ws medium



natural + medium + ws medium



strut + medium + ws medium

Figure 1.2 Whitespace the same as display spacing.

Handwriting practice sheet for the letter 'a'. The sheet is divided into four main sections, each containing a row of dashed lines for tracing and a row of solid lines for independent practice. The first section shows the letter 'a' in a box, followed by a row of dashed 'a's for tracing and a row of solid 'a's for independent practice. The second section shows the letter 'a' in a box, followed by a row of dashed 'a's for tracing and a row of solid 'a's for independent practice. The third section shows the letter 'a' in a box, followed by a row of dashed 'a's for tracing and a row of solid 'a's for independent practice. The fourth section shows the letter 'a' in a box, followed by a row of dashed 'a's for tracing and a row of solid 'a's for independent practice.

Handwriting practice sheet for the letter 'd'. The sheet features multiple rows of handwriting lines (top solid, middle dashed, bottom solid). Each row is preceded by a small blue box containing the letter 'd' and a red box containing the number '1'. The rows are filled with the letter 'd' written in a cursive style, with red 'X' marks indicating the correct placement and direction of strokes. The letter 'd' is shown in both its lowercase and uppercase forms. The sheet is designed to help children learn the correct formation and placement of the letter 'd' on handwriting lines.

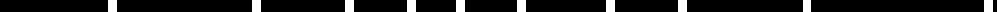
Handwriting practice sheet for the letter 'd' and the addition problem 'c + a = d'.

The sheet is divided into sections by horizontal lines. Each section contains a row of dashed lines for tracing and a row of solid lines for independent writing.

The letter 'd' is shown in a large format for tracing, followed by smaller versions. The addition problem 'c + a = d' is also shown in a large format for tracing, followed by smaller versions.

The sheet includes multiple rows of dashed lines for tracing and solid lines for independent writing. The letter 'd' is shown in a large format for tracing, followed by smaller versions. The addition problem 'c + a = d' is also shown in a large format for tracing, followed by smaller versions.

**Figure 1.3** Whitespace larger than display spacing.

• 

$$\begin{array}{cccccccccccccc}
 \blacksquare & \square & \blacksquare & \square & \blacksquare & \square & \blacksquare & \square & \blacksquare & \square & \blacksquare & \square \\
 \square & \blacksquare & \square & \blacksquare & \square & \blacksquare & \square & \blacksquare & \square & \blacksquare & \square & \blacksquare
 \end{array}$$

$$\blacksquare + \blacksquare + \blacksquare + \blacksquare = \blacksquare$$

(1.1)

[illegible]

In the next examples we explicitly align formulas to the left (`flushleft`), center (`middle`) and right (`flushright`):

```
\setupformulas[align=flushleft]
\startformula\fakeformula\stopformula
\setupformulas[align=middle]
\startformula\fakeformula\stopformula
\setupformulas[align=flushright]
\startformula\fakeformula\stopformula
```

The three cases show up as:

$$\begin{array}{l} \blacksquare\blacksquare + \blacksquare + \blacksquare = \blacksquare \\ \blacksquare\blacksquare + \blacksquare\blacksquare + \blacksquare + \blacksquare = \blacksquare \\ \blacksquare\blacksquare + \blacksquare + \blacksquare\blacksquare + \blacksquare + \blacksquare = \blacksquare\blacksquare \end{array}$$

You can also set a left and/or right margin:

[illegible]

With formula numbers these formulas look as follows:

$$\begin{array}{|c|} \hline \blacksquare \\ \hline \end{array} + \begin{array}{|c|} \hline \blacksquare \\ \hline \end{array} + \begin{array}{|c|} \hline \blacksquare \\ \hline \end{array} + \begin{array}{|c|} \hline \blacksquare \\ \hline \end{array} + \begin{array}{|c|} \hline \blacksquare \\ \hline \end{array} + \begin{array}{|c|} \hline \blacksquare \\ \hline \end{array} = \begin{array}{|c|} \hline \blacksquare \\ \hline \end{array} \quad (1.2)$$

$$\blacksquare + \blacksquare + \blacksquare + \blacksquare + \blacksquare + \blacksquare = \blacksquare \quad (1.3)$$

$$\blacksquare + \blacksquare + \blacksquare + \blacksquare = \blacksquare \quad (1.4)$$

and the same with margins:

$$\blacksquare + \blacksquare + \blacksquare + \blacksquare = \blacksquare \quad (1.5)$$

$$\begin{array}{|c|} \hline \blacksquare \\ \hline \end{array} + \begin{array}{|c|} \hline \blacksquare \\ \hline \blacksquare \\ \hline \end{array} + \begin{array}{|c|} \hline \blacksquare \\ \hline \end{array} + \begin{array}{|c|} \hline \blacksquare \\ \hline \end{array} + \begin{array}{|c|} \hline \blacksquare \\ \hline \blacksquare \\ \hline \end{array} = \begin{array}{|c|} \hline \blacksquare \\ \hline \blacksquare \\ \hline \blacksquare \\ \hline \end{array} \quad (1.6)$$

$$\blacksquare + \blacksquare + \blacksquare = \blacksquare \quad (1.7)$$

When the margin option is set to standard or yes the current indentation (when set) or left skip is added to the left side.

```
\setupformulas[align=flushleft]
\startformula \fakeformula \stopformula
\placeformula \startformula \fakeformula \stopformula
```

$$\square + \square + \square = \square$$

$$\frac{\square}{\square} + \frac{\square}{\square} + \frac{\square}{\square} + \frac{\square}{\square} = \frac{\square}{\square} \quad (1.8)$$

```
\setupformulas[align=flushleft,margin=standard]
\startformula \fakeformula \stopformula
\placeformula \startformula \fakeformula \stopformula
```

$$\blacksquare + \blacksquare + \blacksquare + \blacksquare + \blacksquare = \blacksquare$$

$$\begin{array}{|c|} \hline \blacksquare \\ \hline \end{array} + \begin{array}{|c|} \hline \blacksquare \\ \hline \end{array} + \begin{array}{|c|} \hline \blacksquare \\ \hline \end{array} = \begin{array}{|c|} \hline \blacksquare \\ \hline \end{array} \quad (1.9)$$

The distance between the formula and the number is only applied when the formula is left or right aligned.

```
\setupformulas[align=flushright,distance=0pt]
\startformula \fakeformula \stopformula
\placeformula \startformula \fakeformula \stopformula
```

$$\blacksquare + \blacksquare + \blacksquare + \blacksquare = \blacksquare$$

$$\frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2} = \frac{5}{2} \quad (1.10)$$

```
\setupformulas[align=flushright,distance=2em]
\startformula \fakeformula \stopformula
\placeformula \startformula \fakeformula \stopformula
```

$$\blacksquare + \blacksquare + \blacksquare + \blacksquare + \blacksquare = \blacksquare$$

$$\frac{\blacksquare}{\blacksquare} + \frac{\blacksquare}{\blacksquare} + \frac{\blacksquare}{\blacksquare} + \frac{\blacksquare}{\blacksquare} + \frac{\blacksquare}{\blacksquare} + \frac{\blacksquare}{\blacksquare} = \frac{\blacksquare}{\blacksquare} \quad (1.11)$$



## 2 Framing

The `\framed` macro is one of the core constructors in `CONTEXt` and it's used all over the place. This macro is unlikely to change its behaviour and as it has evolved over years it comes with quite some options and some can interfere with the expectations one has. In general using this macro works out well but you need to keep an eye on using struts and alignment.

```
\framed{$e=mc^2$}
```

The outcome of this is:

$$e = mc^2$$

There is a bit of offset (that you can set) but also struts are added as can be seen when we visualize them:

$$|e = mc^2|$$

These struts can be disabled:

```
\framed[strut=no]{$e=mc^2$}
```

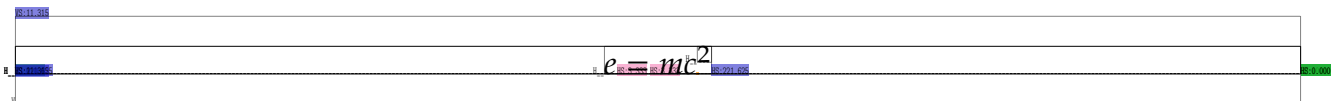
Now the result is more tight.

$$e = mc^2$$

These struts are the way to get a consistent look and feel and are used frequently in `CONTEXt`. We mention these struts because they get in the way when we frame a display formula. Let's first look at what happens when we just package a formula in a box:

```
\vbox\bgroup
  \startformula
    e = mc^2
  \stopformula
\egroup
```

We get:



Now there are a few properties of `displaymath` that one needs to keep in mind when messing around with them this way. First of all `displaymath` is meant to be used as part of the page stream. This means that spacing above and below is adapted to what comes before and after. It also means that, because formulas can be numbered, we have some settings that relate to horizontal placement.

The default vertical spacing is easy to get rid of:

```
\vbox\bgroup
  \startformula[packed]
```

```

        e = mc^2
    \stopformula
\egroup

```

This gives:

Another handy keyword is `tight`:

```

\ vbox\ bgroup
    \ startformula[tight]
        e = mc^2
    \ stopformula
\ egroup

```

This gives:

We can combine these two:

```

\ vbox\ bgroup
    \ startformula[packed,tight]
        e = mc^2
    \ stopformula
\ egroup

```

This gives:

Just in case you wonder why we need to go through these troubles: keep in mind that we are wrapping something (math) that normally goes in a vertical list with text above and below.

The `packed` and `tight` options can help when we want to wrap a formula in a frame:

```

\ framed
    [strut=no]
    {
        \ startformula[packed,tight]
            e = mc^2
        \ stopformula
    }

```

which renders as:



There is a dedicated math framed instance that is tuned to give better results and automatically switches to math mode:

```
\mframed {
  e = mc^2
}
```

becomes:

$$e = mc^2$$

Framing a formula is also supported as a option, where the full power of framed can be applied to the formula. We will illustrate this in detail on the next pages. For this we use the following sample:

```
\setuplayout[topspace=5mm,bottomspace=5mm,height=middle,header=1cm,footer=0cm]

\starttext

\startbuffer[sample]
  \enabletrackers[formulas.framed] \showboxes
  \startformula
    e = mc^2
  \stopformula
  \par
  \startformula
    e = mc^2
  \stopformula
  \startformula
    e = mc^2
  \stopformula
  \startformula
    e \dorecurse{12} { = mc^2 }
  \stopformula
  \startplaceformula
    \startformula
      e = mc^2
    \stopformula
  \stopplaceformula
  \startplaceformula
    \startformula
      e \dorecurse{12} { = mc^2 }
    \stopformula
  \stopplaceformula
\stopbuffer
```

```

\startbuffer[setup-b]
\setupformula
  [option=frame]
\stopbuffer

\startbuffer[setup-d]
\setupformulaframed
  [frame=on,
  %toffset=10pt,
  %boffset=10pt,
  foregroundcolor=white,
  background=color,
  backgroundcolor=gray]
\stopbuffer

\startbuffer[setup-c]
\setupformula
  [frame=number]
\stopbuffer

\startbuffer[all]
\start
  \typebuffer[setup-a]
  \getbuffer[setup-a]
  \getbuffer[sample]
  \typebuffer[setup-b]
  \typebuffer[setup-d]
  \getbuffer[setup-b]
  \getbuffer[setup-d]
  \getbuffer[sample]
  \typebuffer[setup-c]
  \getbuffer[setup-c]
  \getbuffer[sample]
  \page
\stop
\stopbuffer

\startbuffer
  \startbuffer[setup-a]
  \setupformula
    [align=flushleft]
  \stopbuffer
  \getbuffer[all]
  \startbuffer[setup-a]
  \setupformula

```

```

    [align=flushleft,location=left]
\stopbuffer
\getbuffer[all]

\startbuffer[setup-a]
\setupformula
    [align=middle]
\stopbuffer
\getbuffer[all]
\startbuffer[setup-a]
\setupformula
    [align=middle,location=left]
\stopbuffer
\getbuffer[all]

\startbuffer[setup-a]
\setupformula
    [align=flushright]
\stopbuffer
\getbuffer[all]
\startbuffer[setup-a]
\setupformula
    [align=flushright,location=left]
\stopbuffer
\getbuffer[all]
\stopbuffer

\getbuffer

\startbuffer[setup-b]
\setupformula
    [option={tight,frame}]
\stopbuffer

\getbuffer

\stoptext

```

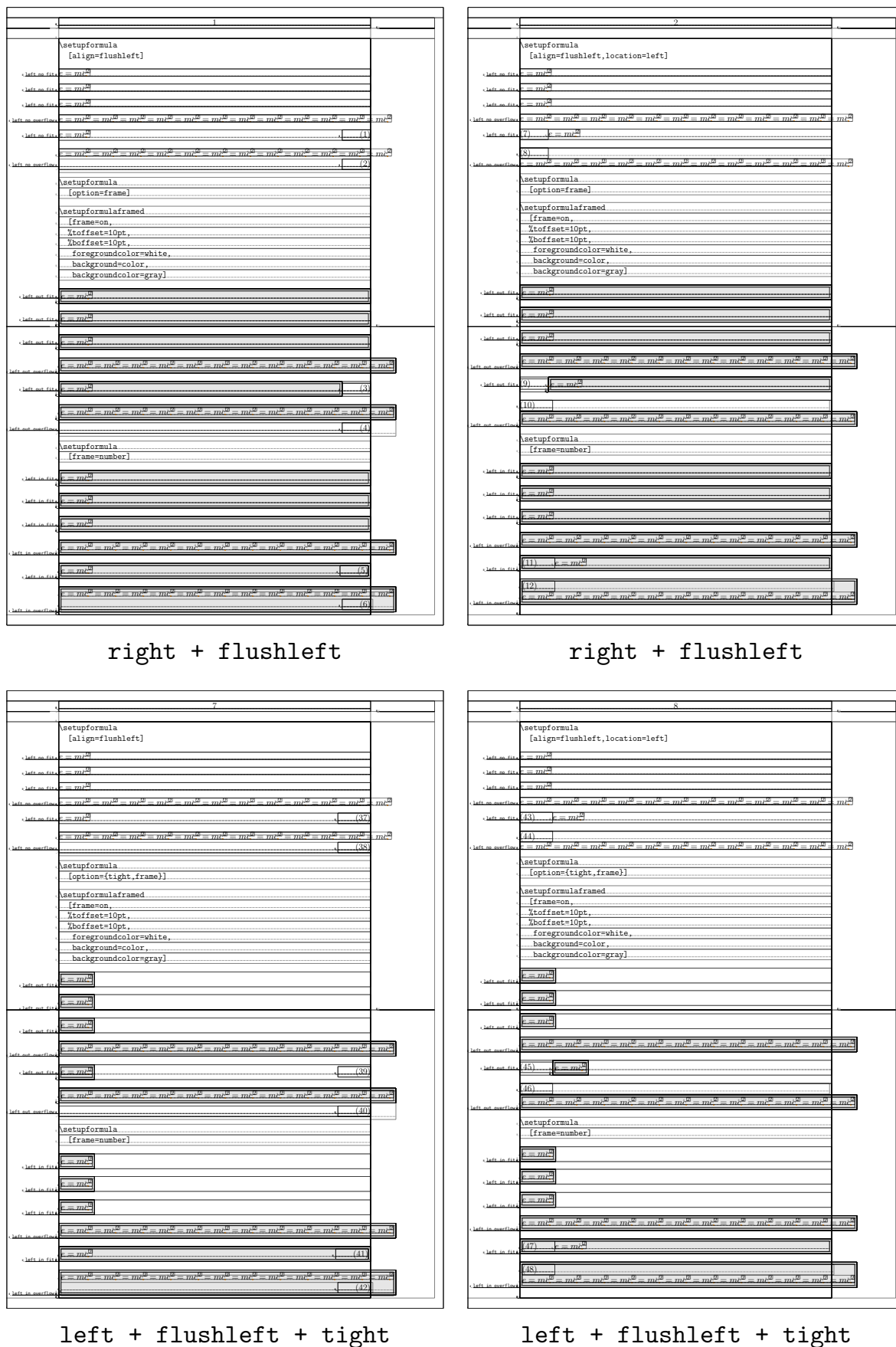
In figure 2.1, 2.2 and 2.3 you see some combinations. You can run this example on your machine and see the details.

With each formula class a framed variants is automatically created:

```

\defineformula
    [foo]

```



**Figure 2.1** Framed formulas flushed left.

3	
$\text{\textbackslash setupformula}$ [align=middle]	
$E = m^2$	
$E = m^2$	
$E = m^2$	
$E = m^2 = m^2 = m^2 = m^2 = m^2 = m^2 = m^2 = m^2 = m^2 = m^2 = m^2$	
$E = m^2$	(13)
$E = m^2 = m^2 = m^2 = m^2 = m^2 = m^2 = m^2 = m^2 = m^2 = m^2 = m^2$	(14)
$\text{\textbackslash setupformula}$ [option=frame]	
$\text{\textbackslash setupformulaframed}$ [frame=on, %offset=10pt, %offset=10pt, foregroundColor=white, background=color, backgroundcolor=gray]	
$E = m^2$	
$E = m^2$	
$E = m^2$	
$E = m^2 = m^2 = m^2 = m^2 = m^2 = m^2 = m^2 = m^2 = m^2 = m^2 = m^2$	
$E = m^2$	(15)
$E = m^2 = m^2 = m^2 = m^2 = m^2 = m^2 = m^2 = m^2 = m^2 = m^2 = m^2$	
$E = m^2$	(16)
$\text{\textbackslash setupformula}$ [frame=number]	
$E = m^2$	
$E = m^2$	
$E = m^2$	
$E = m^2$	
$E = m^2 = m^2 = m^2 = m^2 = m^2 = m^2 = m^2 = m^2 = m^2 = m^2 = m^2$	
$E = m^2$	(17)
$E = m^2 = m^2 = m^2 = m^2 = m^2 = m^2 = m^2 = m^2 = m^2 = m^2 = m^2$	
$E = m^2$	(18)

right + middle

4	
$\text{\textbackslash setupformula}$ [align=middle,location=left]	
$E = m^2$	
$E = m^2$	
$E = m^2$	
$E = m^2 = m^2 = m^2 = m^2 = m^2 = m^2 = m^2 = m^2 = m^2 = m^2 = m^2$	
$E = m^2$	(19)
$E = m^2$	(20)
$E = m^2 = m^2 = m^2 = m^2 = m^2 = m^2 = m^2 = m^2 = m^2 = m^2 = m^2$	
$\text{\textbackslash setupformula}$ [option=frame]	
$\text{\textbackslash setupformulaframed}$ [frame=on, %offset=10pt, %offset=10pt, foregroundColor=white, background=color, backgroundcolor=gray]	
$E = m^2$	
$E = m^2$	
$E = m^2$	
$E = m^2 = m^2 = m^2 = m^2 = m^2 = m^2 = m^2 = m^2 = m^2 = m^2 = m^2$	
$E = m^2$	(21)
$E = m^2$	(22)
$E = m^2 = m^2 = m^2 = m^2 = m^2 = m^2 = m^2 = m^2 = m^2 = m^2 = m^2$	
$\text{\textbackslash setupformula}$ [frame=number]	
$E = m^2$	
$E = m^2$	
$E = m^2$	
$E = m^2$	
$E = m^2 = m^2 = m^2 = m^2 = m^2 = m^2 = m^2 = m^2 = m^2 = m^2 = m^2$	
$E = m^2$	(23)
$E = m^2$	(24)
$E = m^2 = m^2 = m^2 = m^2 = m^2 = m^2 = m^2 = m^2 = m^2 = m^2 = m^2$	

right + middle

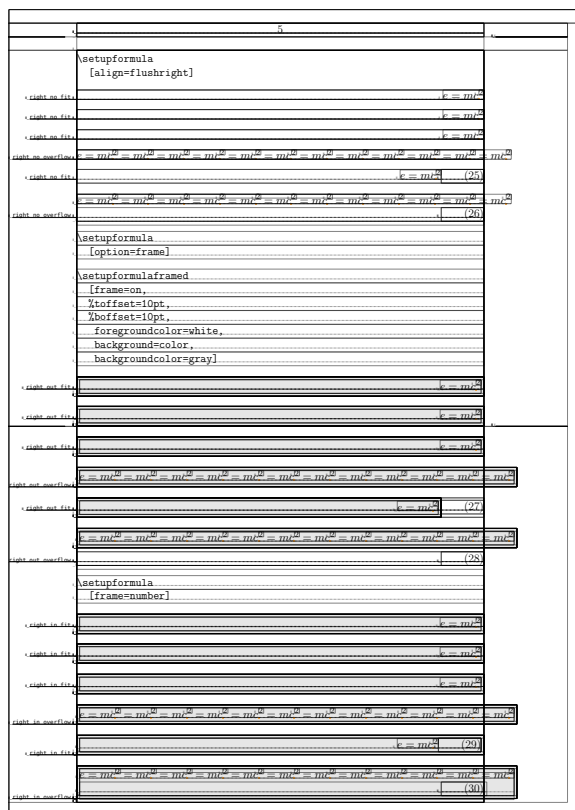
9	
$\text{\textbackslash setupformula}$ [align=middle]	
$E = m^2$	
$E = m^2$	
$E = m^2$	
$E = m^2 = m^2 = m^2 = m^2 = m^2 = m^2 = m^2 = m^2 = m^2 = m^2 = m^2$	
$E = m^2$	(49)
$E = m^2 = m^2 = m^2 = m^2 = m^2 = m^2 = m^2 = m^2 = m^2 = m^2 = m^2$	(50)
$\text{\textbackslash setupformula}$ [option={tight,frame}]	
$\text{\textbackslash setupformulaframed}$ [frame=on, %offset=10pt, %offset=10pt, foregroundColor=white, background=color, backgroundcolor=gray]	
$E = m^2$	
$E = m^2$	
$E = m^2$	
$E = m^2 = m^2 = m^2 = m^2 = m^2 = m^2 = m^2 = m^2 = m^2 = m^2 = m^2$	
$E = m^2$	(51)
$E = m^2 = m^2 = m^2 = m^2 = m^2 = m^2 = m^2 = m^2 = m^2 = m^2 = m^2$	
$E = m^2$	(52)
$\text{\textbackslash setupformula}$ [frame=number]	
$E = m^2$	
$E = m^2$	
$E = m^2$	
$E = m^2 = m^2 = m^2 = m^2 = m^2 = m^2 = m^2 = m^2 = m^2 = m^2 = m^2$	
$E = m^2$	(53)
$E = m^2 = m^2 = m^2 = m^2 = m^2 = m^2 = m^2 = m^2 = m^2 = m^2 = m^2$	(54)

left + middle + tight

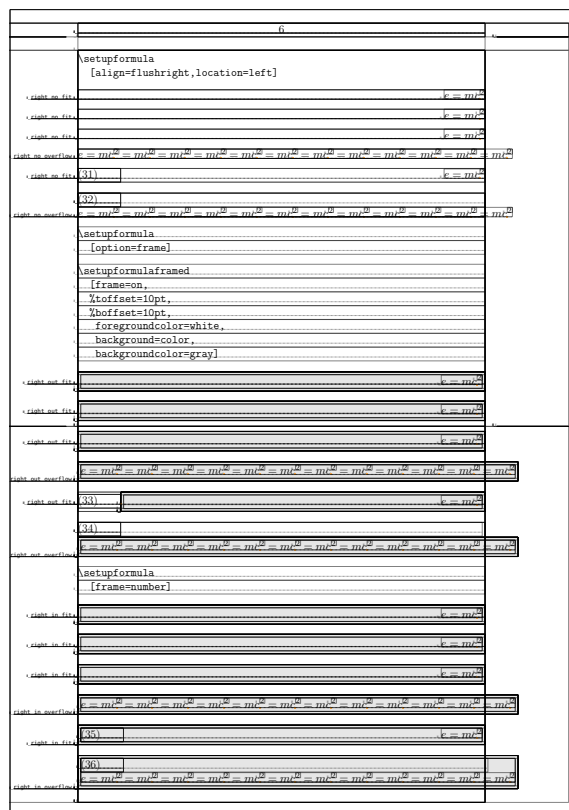
10	
$\text{\textbackslash setupformula}$ [align=middle,location=left]	
$E = m^2$	
$E = m^2$	
$E = m^2$	
$E = m^2 = m^2 = m^2 = m^2 = m^2 = m^2 = m^2 = m^2 = m^2 = m^2 = m^2$	
$E = m^2$	(55)
$E = m^2$	(56)
$E = m^2 = m^2 = m^2 = m^2 = m^2 = m^2 = m^2 = m^2 = m^2 = m^2 = m^2$	
$\text{\textbackslash setupformula}$ [option={tight,frame}]	
$\text{\textbackslash setupformulaframed}$ [frame=on, %offset=10pt, %offset=10pt, foregroundColor=white, background=color, backgroundcolor=gray]	
$E = m^2$	
$E = m^2$	
$E = m^2$	
$E = m^2 = m^2 = m^2 = m^2 = m^2 = m^2 = m^2 = m^2 = m^2 = m^2 = m^2$	
$E = m^2$	(57)
$E = m^2$	(58)
$E = m^2 = m^2 = m^2 = m^2 = m^2 = m^2 = m^2 = m^2 = m^2 = m^2 = m^2$	
$\text{\textbackslash setupformula}$ [frame=number]	
$E = m^2$	
$E = m^2$	
$E = m^2$	
$E = m^2 = m^2 = m^2 = m^2 = m^2 = m^2 = m^2 = m^2 = m^2 = m^2 = m^2$	
$E = m^2$	(59)
$E = m^2$	(60)
$E = m^2 = m^2 = m^2 = m^2 = m^2 = m^2 = m^2 = m^2 = m^2 = m^2 = m^2$	

left + middle + tight

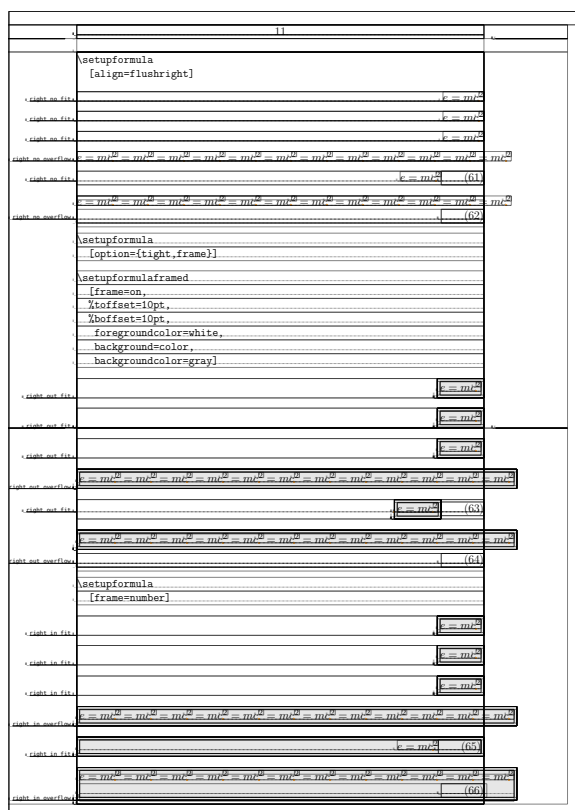
Figure 2.2 Framed formulas centered.



right + flushright



right + flushright



left + flushright + tight



left + flushright + tight

**Figure 2.3** Framed formulas flushed right.

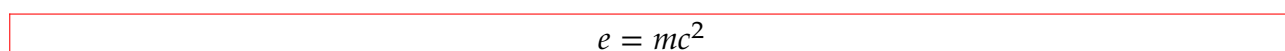
```

\setupformulaframed
  [foo]
  [frame=on,
   framecolor=red]

\startfooformula[frame]
  e=mc^2
\stopfooformula

```

This time you get a red frame:



$$e = mc^2$$

You can also frame the number, as in:

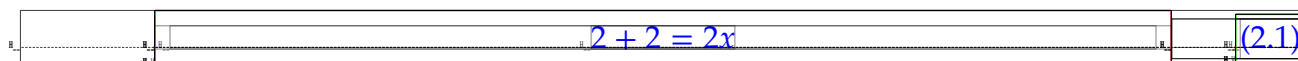
```

\setupformulaframed[framecolor=red,frame=on,offset=1ex]
\setupformula[option=frame,color=blue]
\setupformula[numbercommand={\inframed[framecolor=green]}]

\startplaceformula
  \startformula
    2 + 2 = 2x
  \stopformula
\stopplaceformula

```

The boxes get properly aligned:



$$2 + 2 = 2x$$

(2.1)





### 3 Combining formulas

Multiple formulas can be combined by wrapping them:

\fakewords{20}{30}

\startformula

$$a + b = c$$

\stopformula

\fakewords{20}{30}

\startformulas

\startformula

$$a + b = c$$

\stopformula

\startformula

$$d - e = f$$

\stopformula

\stopformulas

\fakewords{20}{30}

\startformulas

\startformula

$$\frac{\frac{x}{y}}{b} = c$$

\stopformula

\startformula

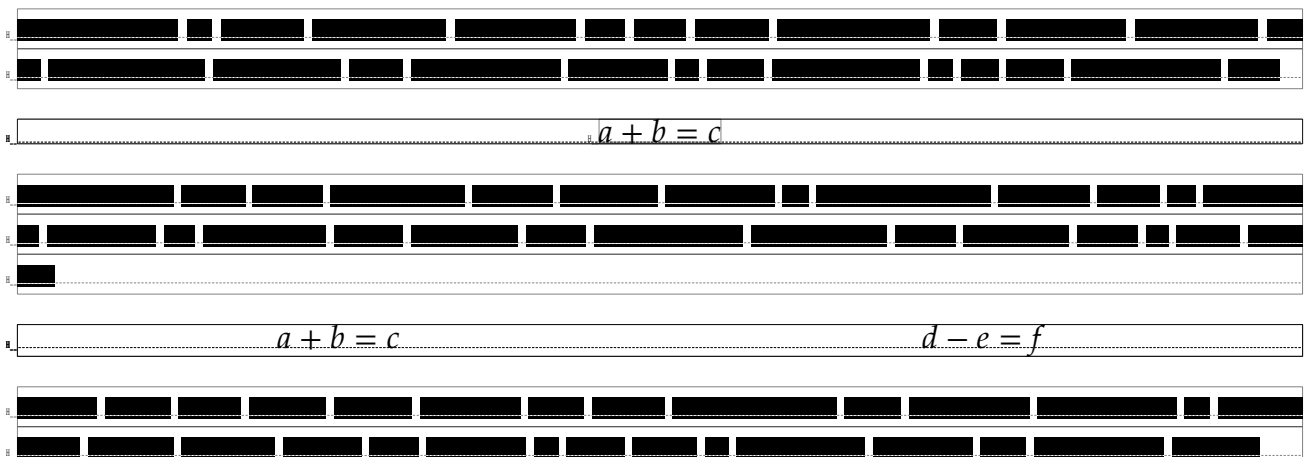
$$d - e = f$$

\stopformula

\stopformulas

`\fakewords{20}{30}`

When we bump the space around formulas to big we get this:



$\frac{x}{y} = c$	$d - e = f$
-------------------	-------------



The formulas get aligned on the baselline which in turn relates to the math axis of the formula.

## 4 Features

### 4.1 Default features

Math fonts are loaded in so called basemode, which gives them a traditional treatment in the engine. However, we do support features in basemode too, so setting them can influence what gets passed to  $\text{\TeX}$ . Also, in math mode, some font features (like `dtls` and stylistic alternates) are applied dynamically.

The default `mathematics` feature set is as follows:

<code>kern</code>	<code>yes</code>
<code>language</code>	<code>dflt</code>
<code>mathalternates</code>	<code>yes</code>
<code>mathitalics</code>	<code>yes</code>
<code>mode</code>	<code>base</code>
<code>script</code>	<code>math</code>

We don't discuss the exact meaning of these options here because normally you don't have to deal with them. If a math font demands something special, the place to deal with it is the related font goodie file.

This feature set is the parent of two other sets: `mathematics-l2r` and `mathematics-r2l`:

<code>kern</code>	<code>yes</code>
<code>language</code>	<code>dflt</code>
<code>mathalternates</code>	<code>yes</code>
<code>mathitalics</code>	<code>yes</code>
<code>mode</code>	<code>base</code>
<code>script</code>	<code>math</code>

This one is the same as the parent but the right-to-left variant is different:

<code>kern</code>	<code>yes</code>
<code>language</code>	<code>dflt</code>
<code>locl</code>	<code>yes</code>
<code>mathalternates</code>	<code>yes</code>
<code>mathitalics</code>	<code>yes</code>
<code>mode</code>	<code>base</code>
<code>rtlm</code>	<code>yes</code>
<code>script</code>	<code>math</code>

Eventually we need size related feature sets and again we define a parent and direction specific ones: `math-text`, `math-script` and `math-scriptscript`.

<code>kern</code>	<code>yes</code>
<code>language</code>	<code>dflt</code>
<code>mathalternates</code>	<code>yes</code>
<code>mathitalics</code>	<code>yes</code>
<code>mode</code>	<code>base</code>

script	math
ssty	no

kern	yes
language	dflt
mathalternates	yes
mathitalics	yes
mathsize	yes
mode	base
script	math
ssty	1

kern	yes
language	dflt
mathalternates	yes
mathitalics	yes
mathsize	yes
mode	base
script	math
ssty	2

The left-to-right sets `math-**-l2r` are:

kern	yes
language	dflt
mathalternates	yes
mathitalics	yes
mode	base
script	math
ssty	no

kern	yes
language	dflt
mathalternates	yes
mathitalics	yes
mathsize	yes
mode	base
script	math
ssty	1

kern	yes
language	dflt
mathalternates	yes
mathitalics	yes
mathsize	yes
mode	base

script	math
ssty	2

The right-to-left sets `math-*-r2l` are:

kern	yes
language	dflt
locl	yes
mathalternates	yes
mathitalics	yes
mode	base
rtlm	yes
script	math
ssty	no

kern	yes
language	dflt
locl	yes
mathalternates	yes
mathitalics	yes
mathsize	yes
mode	base
rtlm	yes
script	math
ssty	1

kern	yes
language	dflt
locl	yes
mathalternates	yes
mathitalics	yes
mathsize	yes
mode	base
rtlm	yes
script	math
ssty	2

There are a few extra sets defined but these are meant for testing or virtual math fonts. The reason for showing these sets is to make clear that the number of features is minimal and that math is a real script indeed.

The kern features is questionable. In traditional  $\text{\TeX}$  there are kerns indeed but in  $\text{\OpenType}$  math kerns are not used that way because a more advanced kerning feature is present (and that one is currently always enabled). We used to set the following but these make no sense.

`liga=yes, % (traditional) ligatures`

`tlig=yes`, % tex ligatures, like `--` and `---`  
`trep=yes`, % tex replacements, like the `'` quote

Math fonts normally have no ligatures and supporting the  $\TeX$  specific ones can actually be annoying. So, in today's  $\text{CON}\text{T}\text{E}\text{X}\text{T}$  these are no longer enabled. Just consider the following:

```
$- \kern0pt - \kern 0pt \mathchar"2D$
$- \kern0pt -- \kern 0pt \mathchar"2D \mathchar"2D$
$- \kern0pt --- \kern 0pt \mathchar"2D \mathchar"2D \mathchar"2D$
```

The `-` is mapped onto a minus sign and therefore several in succession become multiple minus signs. The `\mathchar"2D` will remain the character with that slot in the font so there we will see a hyphen. If we would enable the `tlig` feature several such characters would be combined into an endash or emdash. So how do we get these then? Because getting a hyphen directly involves a command, the same is true for its longer relatives: `\endash` and `\emdash`.

```
-- -
-- ---
-- --- ---
```

As convenience we have defined a special `\mathhyphen` command. Watch the fact that a text hyphen in math mode is a minus in math! As comparison we also show the plus sign.

command	math	text
<code>\mathhyphen</code>	-	-
<code>\texthyphen</code>	—	-
<code>-</code>	—	-
<code>+</code>	+	+
<code>\endash</code>	—	—
<code>\emdash</code>	—	—

## 4.2 Stylistic alternates

*todo*

## 4.3 Dotless variants

*todo*