Formulas—a catalogue

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• *A general remark*: amsart style or \usepackage{amsmath} required

1 One multiline formula

(1.1)
$$\begin{aligned} &aaaaaaaaaaaaaaaaaaaaaaaaaaaa \\ &\quad + bbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbb \\ &\quad \le ddddddddddddddddddddddddd. \end{aligned}$$

```
\begin{multline}\label{E:m1}
aaaaaaaaaaaaaaaaaaaaaaaaaaaa\\
+ bbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbb\\
\le ddddddddddddddddddddddddd.
\end{multline}
```

(1.2)
$$\begin{aligned} &aaaaaaaaaaaaaaaaaaaaaaaaaaaa \\ &\quad + bbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbb + ddddddddddd - ggggggggg \\ &\qquad \times eeeeeeeeeeeeeeeeeeeeee \\ &\quad \le ddddddddddddddddddddddddd. \end{aligned}$$

```
\begin{multline}\label{E:m2}
aaaaaaaaaaaaaaaaaaaaaaaaaaaa\\
\shoveleft{+ bbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbb + ddddddddddd - ggggggggg}\\
\shoveright{\times eeeeeeeeeeeeeeeeeeeeee}\\
\le ddddddddddddddddddddddddd.
\end{multline}
```

(1.3)
$$\begin{aligned} &aaaaaaaaaaaaaaaa + xxxxxxxxxxx \\ &\qquad < bbbbbbbbbbbbbbbbbbbbb \\ &\qquad\quad + [dddddd + eeeeeeee][hhhhhhhh - ggggggggggg] \\ &\qquad < ccccccccccccccccc. \end{aligned}$$

```
\begin{multline}\label{E:m3}
aaaaaaaaaaaaaaaa + xxxxxxxxxxx\\
  \begin{aligned}
   &< bbbbbbbbbbbbbbbbbbbbb\\
   &\quad + [dddddd + eeeeeeee][hhhhhhhh - ggggggggggg]\\
   &< ccccccccccccccccc.
  \end{aligned}
\end{multline}
```

(1.4)
$$\mathrm{Pascal}_3 = \begin{gathered} 1 \\ 1\ 2\ 1 \\ 1\ 3\ 3\ 1 \end{gathered}$$

```
\begin{equation}\label{E:pasc}
\mathrm{Pascal}_{3} = \begin{gathered}
                       1\\
                       1\ 2\ 1\\
                       1\ 3\ 3\ 1
                      \end{gathered}
\end{equation}
```

(1.5)
$$\begin{gathered} 1 \\ 1\ 2\ 1 \end{gathered} \qquad \begin{gathered} 1 \\ 1\ 2\ 1 \\ 1\ 3\ 3\ 1 \end{gathered}$$

```
\begin{equation}
\begin{split}
\begin{gathered}[b]
1\\
1\ 2\ 1
\end{gathered}
\qquad
\begin{gathered}[b]
1\\
1\ 2\ 1\\
1\ 3\ 3\ 1
\end{gathered}
\end{split}
\end{equation}
```

$$\begin{gathered}[t]
1\\
1\ 2\ 1
\end{gathered}
\qquad
\begin{gathered}[t]
1\\
1\ 2\ 1\\
1\ 3\ 3\ 1
\end{gathered}$$

```
\begin{equation*}
\begin{gathered}[t]
1\\
1\ 2\ 1
\end{gathered}
\qquad
\begin{gathered}[t]
1\\
1\ 2\ 1\\
1\ 3\ 3\ 1
\end{gathered}
\end{equation*}
```

$$\begin{aligned}[t]
A &= \begin{aligned}[t]
zt &= ztuv + [f_1(a,b,c,d,e,f,g,h),\\
&\qquad f_2(a,b,c,d,e,f,g,h),\\
&\qquad f_3(a,b,c,d,e,f,g,h)]
\end{aligned}\\
&= cccccccccccc
\end{aligned} \tag{1.6}$$

```
\begin{equation}\label{E:top}
\begin{aligned}[t]
A &= \begin{aligned}[t]
      zt = ztuv + [&f_1(a,b,c,d,e,f,g,h),\\
                   &f_2(a,b,c,d,e,f,g,h),\\
                   &f_3(a,b,c,d,e,f,g,h)]
     \end{aligned}\\
  &= ccccccccccccc\notag
\end{aligned}
\end{equation}
```

$$\begin{aligned}
xxxxx &= yyyyyyyyyyyyyy + [eeee\\
&\qquad\qquad \times zzzzzzzzzzzzzzzzz]\\
&= ttttttttttttttttt\\
&= vvvvvvvvvvv.
\end{aligned} \tag{1.7}$$

```
\usepackage{mathtools}
\begin{equation}\label{E:shove1}
\begin{aligned}[t]
xxxxx &=  yyyyyyyyyyyyyy + [eeee    \\
 \MoveEqLeft[-10] \times zzzzzzzzzzzzzzzzz] \\
   &= ttttttttttttttttttt  \\
   &= vvvvvvvvvvv.
\end{aligned}
\end{equation}
```

(1.8) Here you can place any statement, even taking several lines of text and including displayed formulas, like

$$aaaa = bbb.$$

(1.9) Next item.

```
\usepackage{enumitem}
\newcommand{\Item}{\refstepcounter{equation}\item}

\begin{enumerate}[label=(\theequation), ref=\theequation, leftmargin=2.5em]
\Item\label{E:text4} Here you can place any statement, even taking several lines
of text and including displayed formulas, like
\[
aaaa=bbb.
\]
\Item\label{E:text5}  Next item.
\end{enumerate}
```

2 Several formulas or sets of displayed conditions

$$aaaaaaaaaa = b, \quad cc = xxx, \quad dd = yyy, \tag{2.1}$$

$$mmmmmmmmmmmmmm = 0 \quad \text{for all } i = 1, \ldots, n. \tag{2.2}$$

```
\begin{gather}
aaaaaaaaaa = b,  \quad\    cc = xxx,   \quad\    dd = yyy, \label{E:g1}\\
mmmmmmmmmmmmmm = 0   \quad\   \text{for all }i=1,\ldots,n.  \label{E:g2}
\end{gather}
```

$$aaaaaaaaaa = b, \quad cc = xxx, \quad dd = yyy,$$

$$mmmmmmmmmmmmmm = 0 \quad \text{for all } i = 1, \ldots, n. \tag{2.3}$$

```
\begin{gather}
aaaaaaaaaa = b,  \quad\    cc = xxx,   \quad\    dd = yyy, \notag\\
mmmmmmmmmmmmmm = 0   \quad\   \text{for all }i=1,\ldots,n. \label{E:g3}
\end{gather}
```

$$aaaaaaaaaa = b, \quad cc = xxx, \quad dd = yyy,$$

$$mmmmmmmmmmmmmm = 0 \quad \text{for all } i = 1, \ldots, n.$$

```
\begin{gather*}
aaaaaaaaaa = b,  \quad\    cc = xxx,   \quad\    dd = yyy,\\
mmmmmmmmmmmmmm = 0   \quad\   \text{for all }i=1,\ldots,n.
\end{gather*}
```

$$\begin{aligned} aaaaaaaaaa &= b, \quad cc = xxx, \quad dd = yyy, \\ mmmmmmmmmmmmm &= 0 \quad \text{for all } i = 1, \dots, n. \end{aligned} \tag{2.4}$$

```
\begin{equation} \label{E:g4}
\begin{gathered}
aaaaaaaaaa = b,  \quad\    cc = xxx,   \quad\    dd = yyy,\\
mmmmmmmmmmmmm = 0   \quad\   \text{for all }i=1,\ldots,n.
\end{gathered}
\end{equation}
```

$$\begin{aligned} &aaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaa \\ &\qquad + bbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbb \\ &\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad \times yyyyyyyyyyy \\ &\qquad\qquad\qquad\qquad\qquad\qquad\qquad = xxxxxxxxxxxxxxxxxxxxxxxxxxxx, \end{aligned} \tag{2.5}$$

$$\begin{aligned} &ccccccccccccccccccccccccccccccccccccccc \\ &\qquad = ddddddddddddddddddddddddddddddddddddddddddd. \end{aligned} \tag{2.6}$$

```
\usepackage{mathtools}
\begin{gather}
\begin{multlined}[t][10cm] \label{E:m1}
aaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaa\\
+bbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbb\\
\shoveright{\times yyyyyyyyyy}\\
=xxxxxxxxxxxxxxxxxxxxxxxxxxx,
\end{multlined}\\
\begin{multlined}[t][10cm] \label{E:m2}
ccccccccccccccccccccccccccccccccccccccc\\
=ddddddddddddddddddddddddddddddddddddddd.
\end{multlined}
\end{gather}
```

$$\begin{aligned} xxxxx &= yyyyyyyyyyyyyy \\ &\qquad + zzzzzzzzzzzzzzzzz, \end{aligned} \tag{2.7}$$

$$bbb = ttttttttttttttttt, \tag{2.8}$$

$$hh = vvvvvvvvvvv. \tag{2.9}$$

```
\begin{align}
xxxxx &= yyyyyyyyyyyyyy      \label{E:a1}\\
      &\quad + zzzzzzzzzzzzzzzzz,  \notag\\
  bbb &= ttttttttttttttttt,  \label{E:a2}\\
  hh  &= vvvvvvvvvvv.        \label{E:a3}
\end{align}
```

$$\begin{aligned} xxxxx &= yyyyyyyyyyyyyy \\ &\quad + zzzzzzzzzzzzzzzzz, \\ bbb &= ttttttttttttttttt, \\ hh &= vvvvvvvvvvv. \end{aligned} \tag{2.10}$$

```
\begin{equation}\label{E:a4}
\begin{split}
xxxxx &= yyyyyyyyyyyyyy\\
      &\quad + zzzzzzzzzzzzzzzzz,\\
  bbb &= ttttttttttttttttt,\\
  hh  &= vvvvvvvvvvv.
\end{split}
\end{equation}
```

$$aaaaaaaaaaaaaaaaaaaaaa = bbbbbbbbbbbb, \tag{2.11}$$

$$\begin{aligned} bbbb &= xxxxxx, \\ ccccc &= yyyyyyy, \\ ddddddddd &= zzzzz. \end{aligned} \tag{2.12}$$

```
\begin{align}
\begin{split}
 aaaaaaaaaaaaaaaaaaaaaa &= bbbbbbbbbbbb,\\
                   bbbb &= xxxxxx,
\end{split}\label{Ea5}\\
\begin{split}
    ccccc &= yyyyyyy,\\
 ddddddddd &= zzzzz.\label{E:a6}
\end{split}
\end{align}
```

$$aaaaaaaaaaaaaaaaaaaaaa = bbbbbbbbbbbb, \tag{2.13}$$

$$\begin{aligned} bbbbbbbbbbbbbbbbbbbbbbbb &= xxxxxx, \\ ccccc &= yyyyyyy, \\ ddddddddd &= zzzzz. \end{aligned} \tag{2.14}$$

```
\begin{gather}
\begin{split}
& aaaaaaaaaaaaaaaaaaaaaa = bbbbbbbbbbbb,\\
& bbbbbbbbbbbbbbbbbbbbbbbb = xxxxxx,
\end{split} \label{E:a7}\\
\begin{split}
& ccccc = yyyyyyy,\\
& ddddddddd = zzzzz.
\end{split}\label{E:a8}
\end{gather}
```

$$aa = bbb, \qquad dd = ee \qquad \text{(by Lemma 2)},$$
$$hh = ii, \qquad ll = kkk \qquad \text{(by (2.14))}.$$

```
\begin{align*}
aa &= bbb,  &  dd &= ee   &  &\text{(by Lemma 2),}\\
hh &= ii,   &  ll &= kkk  &  &\text{(by \eqref{E:a8}).}
\end{align*}
```

$$aa = bbb, \quad dd = ee \quad \text{(by Lemma 2)}, \tag{2.15}$$
$$hh = ii, \quad ll = kkk \quad \text{(by (2.14))}. \tag{2.16}$$

```
\begin{alignat}{3}
aa &= bbb,\quad\  &  dd &= ee          &  &\text{(by Lemma 2),} \label{E:a9}\\
hh &= ii,         &  ll &= kkk\quad\   &  &\text{(by \eqref{E:a8}).\label{E:a10}}
\end{alignat}
```

$$\begin{aligned} aa &= bbb, \quad dd = ee \quad \text{(by Lemma 2)},\\ hh &= ii, \quad ll = kkk \quad \text{(by (2.14))}. \end{aligned} \tag{2.17}$$

```
\begin{equation}\label{E:a11}
\begin{alignedat}{3}
aa &= bbb,\quad\  &  dd &= ee          &  &\text{(by Lemma 2),}\\
hh &= ii,         &  ll &= kkk\quad\   &  &\text{(by \eqref{E:a8}).}
\end{alignedat}
\end{equation}
```

$$aa = bbb, \quad dd = ee \quad \text{(by Lemma 2)}, \tag{2.18a}$$
$$hh = ii, \quad ll = kkk \quad \text{(by (2.14))}. \tag{2.18b}$$

```
\begin{subequations}\label{E:suba}
\begin{alignat}{3}
aa &= bbb,\quad\  &  dd &= ee          &  &\text{(by Lemma 2),}  \label{E:suba1}\\
hh &= ii,         &  ll &= kkk\quad\   &  &\text{(by \eqref{E:a8}).} \label{E:suba2}
\end{alignat}
\end{subequations}
```

$$aaaaaaaaaaaaaaaaaaaaaa = bbbbbbbbbbbb, \tag{2.19a}$$
$$bbbbbbbbbbbbbbbbbbbbbb = xxxxxx,$$
$$ccccc = yyyyyyy, \tag{2.19b}$$
$$ddddddd = zzzzz.$$

```
\begin{subequations}\label{E:subg}
\begin{gather}
\begin{split}
& aaaaaaaaaaaaaaaaaaaaaa = bbbbbbbbbbbb, \\
& bbbbbbbbbbbbbbbbbbbbbb = xxxxxx,
\end{split}\label{E:subg1}\\
\begin{split}
& ccccc = yyyyyyy,\\
& ddddddd = zzzzz.
\end{split}\label{E:subg2}
\end{gather}
\end{subequations}
```

$$xxxxx = yyyyyyyyyyyyyy \tag{2.20}$$

(note that we have not used the full strength of (H) here, but only the concavity of f)

$$= ttttttttttttttttt$$
$$= vvvvvvvvvv.$$

```
\begin{align} \label{E:inter}
xxxxx &=  yyyyyyyyyyyyyy \\
\intertext{note that we have not used the full strength of $(H)$ here,
but only the concavity of $f$}
   &= ttttttttttttttttt \notag \\
   &= vvvvvvvvvv.  \notag
\end{align}
```

3 Using macros

$$\bigl(\tfrac{1}{2}(u+v)\bigr)^2 = \frac{u + \dfrac {v+z}{g+rh}}{n+1} + \Bigl(\prod_{i=1}^n A_i\Bigr)^2 + \biggl(\binom{u}{v}' + \|A \setminus B\|\biggr)^n.$$

```
\[
\bigl(\tfrac{1}{2}(u+v)\bigr)^2
= \frac{u + \dfrac {v+z}{g+rh}}{n+1}
+ \Bigl(\prod_{i=1}^n A_i\Bigr)^2
+ \biggl(\binom{u}{v}' + \|A\setminus B\|\biggr)^n.
\]
```

(C)
$$f(x) \overset{\alpha}{=} \begin{cases} \sqrt[3]{2/\sin x} & \text{if } x \in (0, \pi), \\ 0 & \text{otherwise.} \end{cases}$$

```
\[
f(x)\overset{\alpha} =
\begin{cases}
\sqrt[3]{2/\!\sin x}  &\text{if $x \in (0, \pi)$,}\\
0                     &\text{otherwise.}
\end{cases}
\tag{C}
\]
```

$$\mathbb{A} \xrightarrow{a+b+c+d} \mathbf{B} \xrightarrow[abc]{} \mathfrak{C} \,\square\, \boldsymbol{D} \xrightarrow{d^2} \mathsf{gdeg}\, E.$$

Macros:

```
\usepackage{amssymb}
\newcommand{\arr}{\xrightarrow}
\newcommand{\ssquare}{\mathbin{\square}}
\newcommand{\bA}{\mathbb{A}}
\newcommand{\BB}{\mathbf{B}}
\newcommand{\frC}{\mathfrak{C}}
\newcommand{\biD}{\boldsymbol{D}}
\DeclareMathOperator{\gdeg}{\mathsf{gdeg}}
```

Code:

```
\[
\bA \arr{a+b+c+d} \BB \arr[abc]{} \frC \ssquare \biD \arr{d^2} \gdeg E.
\]
```

$$\sum_{k<m,\,l<n}{}' \binom{m+n}{k+l} = \prod_{\substack{k+l+m=3\\2k-l+n\le 7}} a_{kl}$$

Macros:

```
\newcommand{\prsum}{\sideset{}{'}\sum}
\newcommand{\dprod}{\operatorname*{\prod\prod}}
```

Code:

```
\prsum_{k<m,\,l<n} \binom{m+n}{k+l}
= \dprod_{\substack{k+l+m=3\\2k-l+n\le 7}} a_{kl}
```

$$\operatorname*{w^*\text{-}lim}_{n\to\infty} a_n = \begin{pmatrix} \langle a,b\rangle & \langle a,c\rangle \\ \langle c,a\rangle & \langle b,c\rangle \end{pmatrix}$$

Macros:

```
\newcommand{\wstlim}{\mathop{w^*\textup{-lim}}}
\def\<#1>{\langle#1\rangle}
```

Code:

```
\[
\wstlim_{n\to\infty} a_{n} =
\begin{pmatrix}
\<a,b> & \<a,c>\\
\<c,a> & \<b,c>
\end{pmatrix}
\]
```

$$\mathcal{F}^1\mathbb{S}^{2+v}\mathbf{G}_4 + \mathcal{F}^2\mathbb{S}^3\mathbf{G}_{-4} + \mathcal{F}\mathbb{S}^2\mathbf{G}_7$$

Macros:

```
\newcommand{\obj}[3]{\mathcal{F}^{#1}\mathbb{S}^{#2}\mathbf{G}_{#3}}
```

Code:

```
\[
\obj{1}{2+v}{4} + \obj{2}{3}{-4} + \obj{}{2}{7}
\]
```
