The cases package*

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This provides a LaTeX environment `{numcases}` to produce multi-case equations with a separate equation number for each case. There is also `{subnumcases}` which numbers each case with the overall equation number plus a letter [8a, 8b, etc.]. The syntax is

```
\begin{numcases}{left_side}
  case_1 & explanation_1 \\
  case_2 & explanation_2 \\
  ...
  case_n & explanation_n
\end{numcases}
```

Each ⟨*case*⟩ is a math formula, and each ⟨*explanation*⟩ is a piece of lr mode text (which may contain math mode in `\(...\)` or `$...$`). The explanations are optional. Equation numbers are inserted automatically, just as for the `eqnarray` environment. In particular, the `\nonumber` command suppresses an equation number and the `\label` command allows reference to a particular case. In a `subnumcases` environment, a `\label` in the ⟨*left_side*⟩ of the equation gives the overall equation number, without any letter.

To use this package, include "`\usepackage{cases}`" after "`\documentclass`". You may also specify "`\usepackage[subnum]{cases}`" to force *all* `numcases` environments to be treated as `subnumcases`.

*This manual corresponds to cases v2.5, dated May 2002.

Question: Is there a `{numcases*}` environment for unnumbered cases?
Answer: There is a `{cases}` environment in $\mathcal{AMS}$-LaTeX, but it is just as convenient to stick with the canonical LaTeX array:

```
\[ left side = \left\{ \begin{array}...\end{array} \right. \]
```

Speaking of $\mathcal{AMS}$-math, they use an entirely different system of equation numbering, and this package uses ordinary LaTeX numbering.

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A simple example is:

```
\begin{numcases}{|x|=}
  x, & for $x \geq 0$\\
  -x, & for $x < 0$
\end{numcases}
```

Giving:

$$|x| = \begin{cases} x, & \text{for } x \geq 0 \quad (1) \\ -x, & \text{for } x < 0 \quad (2) \end{cases}$$

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Another example is calculating the square root of $c + id$. First compute

$$w \equiv \begin{cases} 0 & c = d = 0 \quad (3a) \\ \sqrt{|c|}\sqrt{\dfrac{1+\sqrt{1+(d/c)^2}}{2}} & |c| \geq |d| \quad (3b) \\ \sqrt{|d|}\sqrt{\dfrac{|c/d|+\sqrt{1+(c/d)^2}}{2}} & |c| < |d| \quad (3c) \end{cases}$$

Then, using w from eq. (3), the square root is

$$\sqrt{c+id} = \begin{cases} 0 & w = 0 \text{ (case 3a)} \quad (4a) \\ w + i\dfrac{d}{2w} & w \neq 0,\ c \geq 0 \quad (4b) \\ \dfrac{|d|}{2w} + iw & w \neq 0,\ c < 0,\ d \geq 0 \quad (4c) \\ \dfrac{|d|}{2w} - iw & w \neq 0,\ c < 0,\ d < 0 \quad (4d) \end{cases}$$

This was produced by:

```
Another example is calculating the square root of $c+id$. First compute
\begin{subnumcases}{\label{w} w\equiv}
 0    & $c = d = 0$\label{wzero}\\
\sqrt{|c|}\,\sqrt{\frac{1 + \sqrt{1+(d/c)^2}}{2}}   & $|c| \geq |d|$ \\
\sqrt{|d|}\,\sqrt{\frac{|c/d| + \sqrt{1+(c/d)^2}}{2}}   & $|c| < |d|$
\end{subnumcases}
Then, using $w$ from eq.~(\ref{w}), the square root is
\begin{subnumcases}{\sqrt{c+id}=}
0                     & $w=0$ (case \ref{wzero})\\
w+i\frac{d}{2w}       & $w \neq 0$, $c \geq 0$ \\
\frac{|d|}{2w} + iw   & $w \neq 0$, $c < 0$, $d \geq 0$ \\
\frac{|d|}{2w} - iw   & $w \neq 0$, $c < 0$, $d < 0$
\end{subnumcases}
```