Guidelines for Writing Formulae

1. It is important when writing formulas in papers that, just as with items other than formulas, they be written in such a way that they do not invite misinterpretation. Formulas written with consistent, systematically chosen symbols and typesets are easy to read, and to understand. Formulas included in a paper must follow the guidelines set forth here, both within the body text of the paper, and in any diagrams or tables.
2. Formulas shall consist of single-byte English letters, Greek letters, numerals, and other symbols (such as ×). The choice of whether to use slanted type or roman type shall be made in accordance with the regulations below. "Slanted type" here is being used to refer to both italic type (ex.: i) and oblique type (ex.: i). When writing a paper, either italic or oblique type may be used. When printing slanted type, English letters shall be set in italics, and Greek letters shall be set in oblique type.

Example	Font Used	Applies to
Ar, km, +, =	Times fonts, roman	Chemical symbols, units, operators, quantities, values
A, a, ε, σ	Times fonts or Symbol fonts, slanted	Scalar quantities, variables
$\boldsymbol{A}$, $\boldsymbol{a}$, $\boldsymbol{\varepsilon}$, $\boldsymbol{\sigma}$	Times fonts or symbol fonts, slanted	Vector quantities, tensor quantities, matrices

Supplementary Explanation

（a）The slanted form of the lower case l is l. Inform the editing committee when you wish to use ℓ instead.

（b）The SI prefi k (kilo) is set in roman type. The μ (micro) unit prefi is also set in roman type, as in μm. When used as a variable or physical constant, it is set in slanted type, as in μ.

（c）There are many similar looking horizontal line characters: the hyphen "-", the en dash "–", the em dash "—", and the minus symbol "−". When using a minus symbol, use the minus symbol character.

（d）Do not use the English X or x as a multiplication sign. When writing the paper, use a Times or Symbol font family single-byte × symbol.

（e）For differential operators, use roman type, as in d/dx. This also holds for integration: $\int f(x)\,\mathrm{d}x$. When using square brackets as operators, do not use the greater than or less than

symbols, as in <a, b>, but instead use the ⟨ and ⟩ symbols, as in $\langle a, b \rangle$.

(f) When using ellipsis, indicating that something is being omitted, adjust their height based on what is being omitted, as in, $a_1 + a_2 + \cdots + a_n$ and $a_1, a_2, \ldots, a_n$.

(g) When writing approximate numbers in English, use a swung dash, as in ~2 km. In approximate equations, do not write $A =$~2 km. Instead, write $A \approx 2$ km. In approximate equations, use the ≈ or ≒, as in $A \fallingdotseq 2$ km.

(h) Use roman type for functions, as in log, sin, exp, grad, mod.

(i) Use slanted type for the indices of vector and tensor components. For example, in the cases of σ_{ij}, x_i, x_{i+1}, the indices are i and j. The plus sign in the last example is an operator, and 1 is a numeral, so they are both written in roman type.

(j) Use slanted type for coordinates, as in x-axis.

(k) For dimensionless quantities such as Reynolds and Froude numbers, with established symbols, use roman type. Do not set the second letter as a superscript or subscript. Write them, instead, as in Re or Fr.

(l) Set the base of natural logarithm and the imaginary unit in roman type, as in e^x, $a + b\,\mathrm{i}$.

(m) Use slanted type for physical quantities in subscripts and superscripts, as in P_x.

(n) When the superscript represents a word, use roman type. For example, the density of mudstone and maximum horizontal stress should be written as ρ_{ms}, σ_{Hmax}. In the same way, in the case of matrix transposition, the T superscript in $\boldsymbol{A}^{\mathrm{T}}$ is set in roman type.

(o) When differentiating between an amount and a similar amount, as in a and a', use a prime symbol ′ for the latter value, not an apostrophe ’.

3. Choose symbols for physical quantities, variables, and constants in accordance with accepted practice. For example, density is ρ, acceleration due to gravity is g or g, etc. When an amount in a given category changes depending on conditions, avoid using a different symbol for each condition. For example, when there are several densities, depending on compaction, rock qualities, etc., instead of using different symbols, such as ρ, R, r, etc., use the ρ symbol for all densities, adding subscripts, accent symbols, and the like to differentiate between them, as in ρ', $\bar{\rho}$, ρ_{w}, ρ_z.

4. Even for display style formulas, which take up a single line by themselves, place a period at the end to indicate that the formula is the end of a sentence. The following is an example of this:

$$S = \pi r^2.$$

5. Summation symbols are written differently for display style and inline formatted formulas. In display style formulas, they are written as

$$\sum_{i=1}^{N}.$$

While in inline form they are written as $\sum_{i=1}^{N}$, with the summation range written as superscripts and subscripts. Symbols with equivalent differences also include lim and max. This formatting is used to avoid the skewing of line spacing by inline formulas. Therefore, items which exceed line spacing, such as square matrices, should be written using display style. Note, however, that column vectors are to be transposed, as in $(1, 0, 0, 0)^{\mathrm{T}}$. Unless there is a specifi reason to do so, do not write fractions in a format such as $\frac{1}{2}$. Instead, use a diagonal line, as in 1/2.

6. Place spaces between numbers and units in English (ex.: 100 km). When slanted type and roman type are used side-by-side, include a small space as appropriate to prevent them from overlapping. For example, do not use $f\log y$. Instead, use $f\,\log y$. Decide whether to include a small space before and after plus or minus symbols based on context. When being used as a binary operator on two items, as in $a + b$ or $a - b$, insert a small space before and after the symbol. When used to indicate positive or negative values, that is, as a unary operator on a single item, do not include a space between the symbol and the number, as in $+b$, $-b$, -0.1. The same applies to the compound symbols $\pm$ and $\mp$. Include spaces before and after equal signs and inequality signs. For example,

$$H(x) = \begin{cases} 0 & (x < 0) \\ 1/2 & (x = 0) \\ 1 & (x > 0) \end{cases}.$$

   $A + B = C$, for example, should not be written as $A{+}B{=}C$.

7. Multiple superscripts and subscripts (ex.: a^{b^c}) should only be used when there is no chance of confusion. If there is a chance of confusion, parentheses should be used to clarify the order of the exponents. For example, a^{b^p} can be mistaken for a^{bp}, so it should instead be written as $(a^b)^p$. Primes and asterisks should be handled in the same manner. a', a^* squared should not be written as a'^2 or a^{*2}, but as $(a')^2$ and $(a^*)^2$. In the same way, the squares of transposed matrices should be written as $(\boldsymbol{A}^{\mathrm{T}})^2$, not $\boldsymbol{A}^{\mathrm{T}^2}$ or $\boldsymbol{A}^{\mathrm{T}2}$. Complex exponential functions, such as $\mathrm{e}^{\cos(\theta+\theta_0^2)}$, should be written using exp, as in $\exp[\cos(\theta + \theta_0^2)]$.

8. Parentheses should be used appropriately to eliminate vagueness. One common example of vagueness is writing the denominator of a fraction on a single line. Generally, when writing a fraction such as $1/abcde$, everything beyond the slash is the denominator, so the fraction, as written, would not be interpreted as $(1/a) \times bcde$. Therefore, $\frac{1}{2}\cos\theta$ cannot be written in the form $1/2\cos\theta$. This vagueness would remain even if a multiplication sign were used, as in $1/2 \cdot \cos\theta$ or $1/2 \times \cos\theta$. This is because, unlike addition, multiplication and division have the same priority in execution sequencing. In display style, as well, when expressing fraction denominators or numerators on a single line, the same consideration must be given. For example, see the following:

$$\frac{E}{(\cos\theta)/2}.$$

Another example of unclear calculation order is:

$$\cos P\frac{\partial y}{\partial x}.$$

Written this way, it is unclear if the formula is $\cos(P\partial y/\partial x)$ or $(\partial y/\partial x)\cos P$. Also, parentheses must be used for $(n+1)$-dimensional.

9. Articles in the Journal of the Geological Society of Japan are printed in two column format. For long formulas which will not fi within a single printed column, divide the formula across multiple lines as shown below. It is important to consider the fina printed format when initially writing the paper. For example, the formula below would not fi on one line, so it has been split over two

$$\begin{aligned}\frac{\partial\xi}{\partial r}\tan\left(\theta+\phi+\frac{\pi}{4}\right)&\\ =\frac{\rho g}{2c_{\mathrm{Y}}}+\frac{\cos\theta}{\sqrt{2}\cos\left(\theta+\phi+\frac{\pi}{4}\right)}+C.&\end{aligned}\tag{1}$$

As shown in this example, indent the second and any subsequent lines. A formula split over 3 or more lines would look like this:

$$\begin{aligned}x=a+b+c+d+e+f+g+h+i+j&\\ +k+l+m+n+o+p+q+r+s&\\ +t+u+v+w+x+y+z.&\end{aligned}$$

In this example, the + immediately in front of the k and the t are binary operators, but addition operators, so there is a space after the +. As shown in Eq. (1), as a rule formulas should be divided at equal signs, addition signs, and subtraction signs. When dividing at a multiplication point, the multiplication symbol × should be inserted. For example,

$$\begin{aligned}\eta_0=\left[2(B^*)^{\frac{1}{n}}D^{\left(1-\frac{1}{n}\right)}\right]^{-1}&\\ \times\exp\left(\frac{Q}{nRT_0}\right).&\end{aligned}$$

You should avoid dividing matrices mid-way, but when it cannot be avoided, the following formatting should be used:

$$\begin{pmatrix}k & \ell & -fk\\ -k & 1-\ell & gk\\ -k-Rk & 1-\ell-R\ell & Efk\\ k & \ell & -Egk\end{pmatrix}\begin{pmatrix}-g\ell\\ -g+f\ell\\ -Ef+Eg\ell\\ -Ef\ell\end{pmatrix}\begin{pmatrix}a^{(1)}\\ b^{(1)}\\ a^{(2)}\\ b^{(2)}\end{pmatrix}=\begin{pmatrix}0\\0\\0\\0\end{pmatrix}.$$

Another possible approach is to change the formula itself to obviate the need for a line split. For example, by definin the ψ symbol as $\psi = \theta + \phi + \pi/4$, Eq. (1) can be shortened to:

$$\frac{\partial \xi}{\partial r} \tan \psi = \frac{\rho g}{2 c_{\mathrm{Y}}} + \frac{\cos \theta}{\sqrt{2} \cos \psi} + C.$$

Formulas with long numerators should be divided as shown below:

$$\begin{aligned} f(x) = \frac{1}{3x^2 + 3x + 1} \Big[& (Ax^3 + Bx^2 + Cx + D) \cos ax \\ & + (Ex^3 + Fx^2 + Gx + H) \sin ax \\ & + (Ix^3 + Jx^2 + Kx + L) \mathrm{e}^{-x} \Big]. \end{aligned}$$

Formulas with long denominators should represent the denominator within parentheses, to the -1 power, as in:

$$\begin{aligned} f(x) = \Big[& (Ax^3 + Bx^2 + Cx + D) \cos ax \\ & + (Ex^3 + Fx^2 + Gx + H) \sin ax \Big]^{-1}, \end{aligned}$$

or as in $f(x) = 1/A$ with definin the denominator as a separate formula,

$$\begin{aligned} A = & (Ax^3 + Bx^2 + Cx + D) \cos ax \\ & + (Ex^3 + Fx^2 + Gx + H) \sin ax. \end{aligned}$$

This guidelines were prepared for the The Journal of the Geological Society of Japan by Professor Atsushi Yamaji of Kyoto University, and we thank him for allowing us to use them here.

Progress in Earth and Planetary Science Editorial Office