Mathematical Equations in Latex (Part-1)

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There are two major modes of typesetting math in LaTeX one is embedding the math directly into your text by encapsulating your formula in dollar signs and the other is using a predefined math environment.

1 Mathematical modes

LATEX allows two writing modes for mathematical expressions: the inline math mode and the display math mode.

- inline math mode is used to write formulas that are part of a paragraph.
- display math mode is used to write expressions that are not part of a paragraph and are therefore put on separate lines.

1.1 Inline math mode

You can use any of these "delimiters" to typeset your math in inline mode. They all work and the choice is a matter of taste

a) Standard LaTeX practice is to write inline math by enclosing it between `\(...\)`:

> In physics, the mass-energy equivalence is stated by the equation $E = mc^2$, discovered in 1905 by Albert Einstein.

b) Instead of writing (enclosing) inline math between `\(...\)` you can use `$...$` to achieve the same result:

> In physics, the mass-energy equivalence is stated by the equation $E = mc^2$, discovered in 1905 by Albert Einstein.

c) Or, you can use `\begin{math}...\end{math}`:

> In physics, the mass-energy equivalence is stated by the equation $E = mc^2$, discovered in 1905 by Albert Einstein.

1.2 Display math mode

Display math mode has two versions which produce numbered or unnumbered equations. Let's look at a basic example:

The mass-energy equivalence is described by the famous equation:

$$E = mc^2$$

discovered in 1905 by Albert Einstein. In natural units ($c = 1$), the formula expresses the identity

$$E = m \tag{1}$$

2 The equation and align environment

The most useful math environments are the equation environment for typesetting single equations and the align environment for multiple equations and automatic alignment:

$$1 + 2 = 3$$
$$1 = 3 - 2$$

$$\begin{aligned} 1 + 2 &= 3 \\ 1 &= 3 - 2 \end{aligned}$$

The align environment will align the equations at the ampersand &. Single equations have to be separated by a linebreak. There is no alignment when using the simple equation environment. Furthermore, it is not even possible to enter two equations in that environment, it will result in a compilation error. The asterisk (e.g. equation*) only indicates that we don't want the equations to be numbered.

3 Fractions and more

LaTeX is capable of displaying any mathematical notation. It's possible to typeset integrals, fractions, and more. Every command has a specific syntax to use. We will demonstrate some of the most common LaTeX math features. We have also highlighted the possibility of combining various commands to create more sophisticated expressions.

$$f(x) = x^2$$
$$g(x) = \frac{1}{x}$$
$$F(x) = \int_b^a \frac{1}{3}x^3$$
$$gm(x) = \frac{1}{\sqrt{x}}$$

The more complex the expression, the more error-prone this is, it's important to take care of opening and closing the braces {}. It can take a long time to debug such errors.

More examples:
1)

$$x^3 + y^3 = 9 \tag{2}$$
$$x^2 + 2x + 4 = 0 \tag{3}$$
$$y^2 + 4y = 5 \tag{4}$$

$$v = u + at \tag{5}$$

$$v^2 = u^2 + 2as \tag{6}$$

$$s = ut + 1/2at^2 \tag{7}$$

$$\cos^2\theta + \sin^2\theta = 1 \tag{8}$$

$$cos2\theta = 1 - 2sin^2\theta \tag{9}$$

$$\log a = \log b \tag{10}$$

$$\log a + \log b = \log c + \log d \tag{11}$$

which can also be written as

$$\log ab = \log cd \tag{12}$$

2) The $BSRCS$ between two nodes i and j is expressed as in Equation (13):

$$BSRCS_{ij} = \frac{SR_i}{(\sum_k SR_k) - SR_i} \times \frac{SR_j}{(\sum_k SR_k) - SR_j}. \tag{13}$$