Typesetting math in LaTeX

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Basic operations

All the keys on the keyboard that you would spontaneously use for math, will work as advertised. For example,

```
x+[(2/3)-4]=7.35
```

gives

$$x + [(2/3) - 4] = 7.35$$

Exponents and subscripts

Use the caret symbol ^ for exponents, and superscripts in general:

```
x^n=-1
```

gives

$$x^n = -1$$

and

```
x_2 = x_1 + 3
```

gives

$$x_2 = x_1 + 3$$

If the superscript or the subscript contains more than one letter or number, enclose it all in curly brackets. For example,

```
x_{init}
```

gives

$$x_{init}$$

Fractions

```
\frac{x-1}{x+1}
```

gives

$$\frac{x-1}{x+1}$$

Roots

Square roots are easy:

```
\sqrt{-1}=i
```

gives

$$\sqrt{-1} = i$$

If the expression under the square root takes up more than one line, not a problem:

```
\sqrt{\frac{x-1}{x+1}}
```

gives

$$\sqrt{\frac{x-1}{x+1}}$$

Higher order roots take an option in square brackets:

```
\sqrt[5]{-1}
```

gives

$$\sqrt[5]{-1}$$

Brackets of different sizes

Sometimes you need large brackets around an expression that takes up more than one line. This is accomplished by adding `\left` and `\right` before the bracket symbol:

```
\left[ \left( \frac{x}{a} \right)^2-1 \right]
```

gives

$$\left[\left(\frac{x}{a} \right)^2 - 1 \right]$$

Greek letters

Simply spell out the letters beginning with a backslash, like `\alpha`, `\beta`, `\gamma`, and so on. Thus

```
A = \pi R^2
```

gives

$$A = \pi R^2$$

Derivatives

The ordinary derivative is typeset as a fraction:

```
\frac{df}{dx}
```

gives

$$\frac{df}{dx}$$

Partial derivatives are typed as follows:

```
\frac{\partial f}{\partial y}
```

giving

$$\frac{\partial f}{\partial y}$$

Calculus

The symbol for infinity is `\infty`, which comes out as ∞. To say that a function tends to infinity, write

```
f(x) \to \infty
```

which gives

$$f(x) \to \infty$$

A limit is represented by `\lim`. In the following expression, note the use of the underscore following `\lim`:

```
\lim_{x \to 0} x^2 = 0
```

looks like

$$\lim_{x \to 0} x^2 = 0$$

Sums and integrals

The symbol for a sum is `\sum`, and for an integral it is `\int`. Upper and lower bounds are typeset as subscripts and superscripts. For example

```
\sum_{n=1}^{\infty}x^n
```

gives

$$\sum_{n=1}^{\infty} x^n$$

and

```
\int_0^\infty e^{-x} dx
```

gives

$$\int_0^\infty e^{-x} dx$$

Standard functions

Standard functions are written as usual, beginning with a backslash, e.g. `\sin`, `\arctan`, or `\ln`. They are typeset in a different font than the usual one for variables. For example,

```
\phi = \arctan (0.5)
```

is typeset as

$$\phi = \arctan(0.5)$$

Vectors

A vector is typeset with an arrow on top with the `\vec` command. Thus

```
\vec{v}
```

gives

$$\vec{v}$$

And yes, you can typeset the time derivative of a vector by putting a dot on top:

```
\dot{\vec{v}}
```

gives the acceleration

$$\dot{\vec{v}}$$

A unit vector has a hat instead of an arrow. For example

```
\hat{r}
```

gives

$$\hat{r}$$

A word of caution: If you want to put a hat on top of an i or a j, it won't look so good:

```
\hat{i}
```

looks like this:

$$\hat{i}$$

The dot has to be removed from the i. This is accomplished by writing `\imath`, which gives an i without the dot, thus: $\imath$. And we can do the same for j, using `\jmath`, which gives $\jmath$. Thus we can write, for example,

```
\vec{r} = x \hat{\imath} + y \hat{\jmath} + z \hat{k}
```

which looks like this:

$$\vec{r} = x\hat{\imath} + y\hat{\jmath} + z\hat{k}$$

Finally, the vector cross product is typeset with the command `\times`, thus:

```
\vec{\omega}  \times \vec{r}
```

which gives

$$\vec{\omega} \times \vec{r}$$

This symbol can also be used to represent ordinary multiplication of numbers, by the way:

```
2 \times 3 = 6
```

looks rather nice:

$$2 \times 3 = 6$$

The vector dot product is typeset with the command `\cdot` (for "centered dot"). For example,

```
\vec{a} \cdot \vec{b}
```

gives

$$\vec{a} \cdot \vec{b}$$