LaTeXMathematics Examples

Anirudh

November 5, 2019

Contents

1 Delimiters

See how the delimiters are of reasonable size in these examples

$$(a + b) \left[1 - \frac{b}{a + b} \right] = a,$$

$$\sqrt{|xy|} \le \left|\frac{x+y}{2}\right|,$$

even when there is no matching delimiter

$$\int_a^b u\frac{d^2v}{dx^2}\,dx = u\frac{dv}{dx}\bigg|_a^b - \int_a^b \frac{du}{dx}\frac{dv}{dx}\,dx.$$

2   Spacing

Differentials often need a bit of help with their spacing as in

$$\iint xy^2\,dx\,dy = \frac{1}{6}x^2y^3,$$

whereas vector problems often lead to statements such as

$$u = \frac{-y}{x^2+y^2}, \quad v = \frac{x}{x^2+y^2}, \quad \text{and} \quad w = 0$$

Occasionally one gets horrible line breaks when using a list in mathematics such as listing the first twelve primes $2, 3, 5, 7, 11, 13, 17, 19, 23, 2$ In such cases, perhaps include `\mathcode'\,="213B` inside the inline maths environment so that the list breaks: $2\,,3\,,5\,,7\,,11\,,13\,,$ $17\,,19\,,23\,,29\,,31\,,37$. Be discerning about when to do this as the spacing is different

3   Arrays

Arrays of mathematics are typeset using one of the matrix environments as in

$$\begin{bmatrix} 1 & x & 0 \\ 0 & 1 & -1 \end{bmatrix} \begin{bmatrix} 1 \\ y \\ 1 \end{bmatrix} = \begin{bmatrix} 1+xy \\ y-1 \end{bmatrix} \begin{bmatrix} 2 \\ 3 \end{bmatrix}$$

Case statements use cases:

$$|x| = \begin{cases} x, & \text{if } x > 0, \\ -x, & \text{if } x \leq 0. \end{cases}$$

Many arrays have lots of dots all over the place as in

$$\begin{array}{cccccc} -2 & 1 & 0 & 0 & \cdots & 0 \\ 1 & -2 & 1 & 0 & \cdots & 0 \\ 0 & 1 & -2 & 1 & \cdots & 0 \\ 0 & 0 & 1 & -2 & \ddots & \vdots \\ \vdots & \vdots & \vdots & \ddots & \ddots & 1 \\ 0 & 0 & 0 & \cdots & 1 & -2 \end{array}$$

4 Equation arrays

In the flow of a fluid film we may report

$$u_\alpha = \epsilon^2 \kappa_{xxx} \left(y - \frac{1}{2} y^2 \right), \tag{1}$$

$$v = \epsilon^3 \kappa_{xxx} y, \tag{2}$$

$$p = \epsilon \kappa_{xx}. \tag{3}$$

Alternatively, the curl of a vector field (u, v, w) may be written with only one equation number:

$$\begin{aligned} \omega_1 &= \frac{\partial w}{\partial y} - \frac{\partial v}{\partial z}, \\ \omega_2 &= \frac{\partial u}{\partial z} - \frac{\partial w}{\partial x}, \\ \omega_3 &= \frac{\partial v}{\partial x} - \frac{\partial u}{\partial y}. \end{aligned} \tag{4}$$

Whereas a derivation may look like

$$(p \wedge q) \vee (p \wedge \neg q) = p \wedge (q \vee \neg q) \quad \text{by distributive law} \quad (5)$$
$$= p \wedge T \quad \text{by excluded middle} \quad (6)$$
$$= p \quad \text{by identity} \quad (7)$$

5 Functions

Observe that trigonometric and other elementary functions are typeset properly, even to the extent of providing a thin space if followed by a single letter argument:

$$\exp(i\theta) = \cos\theta + i\sin\theta \,, \quad \sinh(\log x) = \frac{1}{2}\left(x - \frac{1}{x}\right).$$

With sub- and super-scripts placed properly on more complicated functions,

$$\lim_{q \to \infty} \|f(x)\|_q = \max_x |f(x)|,$$

and large operators, such as integrals and

$$e^x = \sum_{n=0}^{\infty} \frac{x^n}{n!} \quad \text{where } n! = \prod_{i=1}^{n} i \,,$$
$$\overline{U_\alpha} = \bigcap_\alpha U_\alpha \,.$$

In inline mathematics the scripts are correctly placed to the side in order to conserve vertical space, as in $1/(1 - x) = \sum_{n=0}^{\infty} x^n$.

6 Accents

Mathematical accents are performed by a short command with one argument, such as

$$\tilde{f}(\omega) = \frac{1}{2\pi} \int_{-\infty}^{\infty} f(x) e^{-i\omega x} \, dx \,,$$

or

$$\dot{\vec{\omega}} = \vec{r} \times \vec{I}\,.$$

7 Command definition

The Airy function, $\mathrm{Ai}(x)$, may be incorrectly defined as this integral

$$\mathrm{Ai}(x) = \int \exp(s^3 + isx)\, ds\,.$$