Some Examples of Equation-Writing in LaTeX

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1 Writing a Simple Equation

To display an unnumbered equation on a new line, just type: `\[ x' = 2x - 3. \]`. This will display as:

$$x' = 2x - 3.$$

If we want to get a numbered equation, we must type:

```
\begin{equation}
x' = 2x - 3.
\end\{equation}
```

This will display as:

$$x' = 2x - 3. \tag{1}$$

Now, suppose we want to write a differential equation in another form. Try `\[ \frac{dy}{dt} = 2y + 8.\]`. This displays as:

$$\frac{dy}{dt} = 2y + 8.$$

or, we may write `$$ y_t = 2y + 8.$$`:

$$y_t = 2y + 8.$$

Now, suppose we have a partial differential equation. To write it with the partial derivatives, we just do:

```
$$\frac{\partial^2 u\}{\partial^2 x} + \frac{\partial^2 u}{\partial^2 y} = 0.$$
```

This displays as:

$$\frac{\partial^2 u}{\partial^2 x} + \frac{\partial^2 u}{\partial^2 y} = 0.$$

Or, we may write `\[ u_{xx} + u_{yy} = 0.\]`, which displays as:

$$u_{xx} + u_{yy} = 0.$$

To add text to an equation do, for example:
`\[ y=mx+b, \$text{ where $m$ is the slope, } x \in (-\infty, \infty). \]`.
This displays as:

$$y = mx + b, \text{ where } m \text{ is the slope, } x \in (-\infty, \infty).$$

Note: You need to have included the `amstext` package at the beginning of the document (after the *\documentclass* command.)

If we want to write an equation with a two-line right-hand-side,

$$y(0) = \begin{cases} 1 & \text{if } x \leq 0, \\ -1 & \text{if } x > 0. \end{cases} \tag{2}$$

To write several equations together, we do the following:

$$\begin{aligned} u_t + u_x &= 0 \\ u(x,0) &= \begin{cases} 1 & \text{if } x \leq 0, \\ -1 & \text{if } x > 0. \end{cases} \end{aligned} \tag{3}$$

2 More complicated expressions

Here is one way we would write a matrix (using the *array* command and specifying spacing): $A = \begin{pmatrix} a_{11} & a_{12} & \dots & a_{1n} \\ a_{21} & a_{22} & \dots & a_{2n} \\ \vdots & \vdots & & \vdots \\ a_{n1} & a_{n2} & \dots & a_{nn} \end{pmatrix}$

Alternately, we may use the *pmatrix* command, which we can use if we add *\usepackage{amsmath}* to the preamble.

To write a system of equations with a left brace, we may do the following:

$$\begin{cases} x' = 3x - 2y + 3xy, \\ y' = 2x - 3y - 2xy, \\ x(0) = 0, \\ y(0) = 1 \end{cases} \tag{1}$$