

## My funny little ODE/PDE package

Start by first having `odesandpdes.sty` downloaded in an accessible directory, or in the same directory as your overleaf `main.tex`, using it by inserting;

```
\usepackage{odesandpdes}
```

into the preamble, Ideally after `amsmath/mathtools`. There are a couple notation options, which can be set document-wide with;

```
\usepackage[notation=<option>]{odesandpdes}
```

The options included are based on  $f(x)$  of the three most common notations (according to Wikipedia), Lagrange, Leibniz, and Newton. However, if you wish to change it on a section to section basis, the command `\setDE{notation=<option>}` will change the form of the subsequent uses.

The commands take the general form;

```
\ode[<variable>]{<function>} and \pde[<variable>]{<function>}
```

While this should be sufficient for most use, there are a couple of tricks incorporated into the mechanism that makes this package better than the generic `\newcommand*\ode[2][t]{...}`.

Including automatic assignment of degree and starred variants. Example;

```
\begin{align*}
\ode N(t) = N(t) * t \&\& \ode N(t,x) = N(t,x) + \ode[x]^2 N(t,x) \&\& \pde*[f]^2
\end{align*}
```

$$\frac{dN(t)}{dt} = N(t) * t \qquad \frac{dN(t,x)}{dt} = N(t,x) + \frac{d^2 N(t,x)}{dx^2} \qquad \frac{\partial^2}{\partial f^2}$$

The `\ode` command will scan for an exponent between `[<variable>]` and `{<function>}`. Should there is indeed an exponent, that exponent gets ‘yinked’ away and processed in accordance to the style of notation. In the case of Lagrange or Newton notation, there is the `maxprimes=<integer>` option for either the package or the `\setDE{<option>}` command;

```
\usepackage[maxprimes=<integer>]{odesandpdes} and/or
\setDE{maxprimes=<integer>}
```

3 being the default.

There was rational in choosing to check for the exponent immediately after the macro command opposed to checking for the exponent at the end after the function. As, often you would want add a higher degree very quickly as opposed to after defining the function. `\ode^2{f(x)}` as opposed to `\ode{f(x)}^2`. As well, with the “proper” spacing, there is little need for the use of the braces, so as to help promote an easier workflow without always needed to worry about the damn brace. Not that one can not use the brace for personal taste. For the sake of parity, the `\pde` command will also take its variable in brackets.

The following examples all take the identical form, shown in the following verbatim enviroment.

```
\begin{align*}
\ode f(x)      && \ode[x]{f(x)} && \ode^1 f(x)      && \ode[x]^5 {f(x)}\\
\ode*          && \ode*[x]      && \ode*^2          && \ode*[x]^6      \\
\pde[t]{f(x)} && \pde[x] f(x)    && \pde[t]^3{f(x)} && \pde[x]^7 f(x) \\
\pde*[t]       && \pde*[x]       && \pde*[t]^4      && \pde*[x]^8
\end{align*}
```

`\setDE{notation=Lagrange}` *and/or* `\usepackage[notation=Lagrange]{odesandpdes}`

$f'(x)$	$f(x)'$	$f'(x)$	$f(x)^{(5)}$
$f'(t)$	$f'(x)$	$f''(t)$	$f^{(6)}(x)$
$f(x)_t'$	$f_x'(x)$	$f(x)_t'''$	$f_x^{(7)}(x)$
$f_t'(t)$	$f_x'(x)$	$f_t^{(4)}(t)$	$f_x^{(8)}(x)$

`\setDE{notation=Leibniz}` *and/or* `\usepackage[notation=Leibniz]{odesandpdes}`

$\frac{df(x)}{dt}$	$\frac{df(x)}{dx}$	$\frac{d^1}{dt^1}f(x)$	$\frac{d^5}{dx^5}f(x)$
$\frac{d}{dt}$	$\frac{d}{dx}$	$\frac{d^2}{dt^2}$	$\frac{d^6}{dx^6}$
$\frac{\partial}{\partial t}f(x)$	$\frac{\partial}{\partial x}f(x)$	$\frac{\partial^3 f(x)}{\partial t^3}$	$\frac{\partial^7 f(x)}{\partial x^7}$
$\frac{\partial}{\partial t}$	$\frac{\partial}{\partial x}$	$\frac{\partial^4}{\partial t^4}$	$\frac{\partial^8}{\partial x^8}$

`\setDE{notation=Newton}` *and/or* `\usepackage[notation=Newton]{odesandpdes}`

$\dot{f}(x)$	$f(\dot{x})$	$\dot{f}(x)$	$\overset{5}{f}(\overset{5}{x})$
$\dot{\dot{f}}(x)$	$\dot{\dot{f}}(x)$	$\ddot{f}(x)$	$\overset{6}{f}(\overset{6}{x})$
$\dot{\dot{\dot{f}}}(x)$	$\dot{\dot{\dot{f}}}(x)$	$\overset{4}{f}(\overset{4}{x})$	$\overset{7}{f}(\overset{7}{x})$
$\dot{\dot{\dot{\dot{f}}}}(x)$	$\dot{\dot{\dot{\dot{f}}}}(x)$	$\overset{8}{f}(\overset{8}{x})$	$\overset{9}{f}(\overset{9}{x})$

`\setDE{maxprimes=7}` *and/or* `\usepackage[maxprimes=7]{odesandpdes}`

$f'$	$f''$	$f'''$	$f''''$	$f'''''$	$f''''''$	$f'''''''$	$f^{(8)}$	$f^{(9)}$
$\overset{1}{f}$	$\overset{2}{f}$	$\overset{3}{f}$	$\overset{4}{f}$	$\overset{5}{f}$	$\overset{6}{f}$	$\overset{7}{f}$	$\overset{8}{f}$	$\overset{9}{f}$