	EXPRESSION	MATHEMATICA SYNTAX
DERIVATIVES AND GRADIENTS	Partial derivatives of $f : \mathbb{R}^n \to \mathbb{R}$	
	$f_x = \frac{\partial f}{\partial x}$	`D[f[x,y], x]` or `D[f[x,y,z], x]`, etc.
	$f_y = \frac{\partial f}{\partial y}$	`D[f[x,y], y]` or `D[f[x,y,z], y]`, etc.
	Partial derivatives of $f : \mathbb{R}^n \to \mathbb{R}^m$	
	$\frac{\partial f_1}{\partial x}$	`D[f[x,y][[1]],x]` or `D[f[x,y,z][[1]], x]`, etc.
	$\frac{\partial f_2}{\partial x}$	`D[f[x,y][[2]],x]` or `D[f[x,y,z][[2]], x]`, etc.
		(alternatively, compute total derivative using the command given below, and read off the answer)
	Higher-order partial derivatives of $f : \mathbb{R}^n \to \mathbb{R}$	
	$f_{xx} = \frac{\partial^2 f}{\partial x^2}$	`D[f[x,y], x,x]` or `D[f[x,y], {x,2}]`
	$f_{yyyyy} = \frac{\partial^5 f}{\partial y^5}$	`D[f[x,y,z], {y,5}]`
	$f_{xy} = \frac{\partial^2 f}{\partial x \partial y}$	`D[f[x,y], x,y]`
	$\frac{\partial^{10} f}{\partial x^3 \partial y^2 \partial z^5}$	`D[f[x,y,z], {x,3},{y,2},{z,5}]`
	Total derivative of $\mathbf{f} : \mathbb{R}^n \to \mathbb{R}^m$	`D[f[x,y], {{x,y}}]` or `D[f[x,y,z], {{x,y,z}}]`, etc. (to get the answer as matrix, click MatrixForm)
	Total derivative of $\mathbf{f} : \mathbb{R} \to \mathbb{R}^m$	`f'[x]` or `f'[t]`, etc. (`f''[x]` and `f''[x]` do the obvious things)
	Gradient ∇f	`Grad[f[x,y], {x,y}]` or `Grad[f[x,y,z], {x,y,z}]`, etc. (or use total derivative command given above)
	Directional derivative $D_{\mathbf{u}} f(\mathbf{x})$	`Grad[f[x,y], {x,y}].Normalize[u]` or `Grad[f[x,y,z], {x,y,z}].Normalize[u]`

To substitute numerical values for x, y and z, do one of two things:

1. Define the derivative as a function of x, y and z, then ask *Mathematica* to plug in the values of x, y and z to your newly-defined function:

   Example: Suppose you wanted to compute $f_{xy}(3, 2, -5)$. You could execute these commands, one at a time:

   ```
   h[x_,y_,z_] = D[f[x,y,z], x, y]
   h[3,2,-5]
   ```

2. Follow any of the commands above with some syntax that causes *Mathematica* to substitute in numbers for the variables:

   Example: Suppose you wanted to compute $f_{xy}(3, 2, -5)$. You could execute this single command:

   ```
   D[f[x,y,z], x, y] /.x->3 /.y->2 /.z->-5
   ```

   In general, you follow the command with a series of `/.`*var*`->`*number* commands; this plugs in *number* to variable *var* in the preceding expression.