	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]
	Hessian Hf	D[f[x,y], {{x,y},2}] or D[f[x,y,z], {{x,y,z}},2], etc.
	Jacobian $J(\mathbf{f}) = \det D\mathbf{f}$	Det[D[f[x,y], {{x,y}}]] or Det[D[f[x,y,z], {{x,y,z}}]], etc.

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.