For functions involving vectors, there are two possibilities. The input can be an n-variable vector, and the output can be an m-variable vector.

Calculus I Concept	n-Variable Input	Vector Output (Length m)
function $y = f(x)$	function $f(\overrightarrow{x}) = f(x_1, ..., x_n)$	vector-valued func. $\overrightarrow{f}(t) = (f_1(t), ..., f_m(t))$
linear function $f(x) = kx$	linear function $f(\overrightarrow{x}) = \overrightarrow{a} \cdot \overrightarrow{x}$	linear transformation $T(\overrightarrow{x}) = A\overrightarrow{x}$, A matrix
definition of limit $L = \lim_{x \to a} f(x)$ $\forall\, \epsilon > 0, \exists\, \delta > 0$ such that if $0 < \lvert x - a \rvert < \delta$, then $\lvert f(x) - L \rvert < \epsilon$	definition of limit $L = \lim_{\overrightarrow{x} \to \overrightarrow{a}} f(\overrightarrow{x})$ $\forall\, \epsilon > 0, \exists\, \delta > 0$ s.t. if $x \in B_\delta(a)$, then $\lvert f(\overrightarrow{x}) - L \rvert < \epsilon$	vector-valued limit $\overrightarrow{L} = \lim_{t \to a} \overrightarrow{f}(t)$ $= (\lim_{t \to a} f_1(t), ..., \lim_{t \to a} f_m(t))$ $\forall\, \epsilon > 0, \exists\, \delta > 0$ s.t. if $0 < \lvert t - a \rvert < \delta$, then $\left\lvert \overrightarrow{f}(t) - \overrightarrow{L} \right\rvert < \epsilon$
various limit properties	analogous limit properties	
continuous at $\overrightarrow{a}$: $\lim_{x \to a} f(x) = f(a)$	$\lim_{\overrightarrow{x} \to \overrightarrow{a}} f(\overrightarrow{x}) = f(\overrightarrow{a})$	$\lim_{x \to a} \overrightarrow{f}(x) = \overrightarrow{f}(a)$
definition of derivative $f'(x) = \lim_{h \to 0} \frac{f(x+h) - f(x)}{h}$	partial derivative $\frac{\partial f}{\partial x_i}(\overrightarrow{x}) = \lim_{h \to 0} \frac{f(x_1, ..., x_i + h, ..., x_n) - f(x_1, ..., x_i, ..., x_n)}{h}$	vector-valued derivative $f'(t)$ $= \lim_{h \to 0} \frac{\overrightarrow{f}(t+h) - \overrightarrow{f}(t)}{h} = (f_1'(t), ..., f_m'(t))$
	gradient $\overrightarrow{\nabla} f(\overrightarrow{x}) = \left(\frac{\partial f}{\partial x_1}(\overrightarrow{x}), ..., \frac{\partial f}{\partial x_n}(\overrightarrow{x})\right) = Jf^T$	
	directional derivative (direction of $\overrightarrow{u}$) $D_{\overrightarrow{u}} f(\overrightarrow{a})$ $= \lim_{h \to 0} \frac{f(\overrightarrow{a} + h\overrightarrow{u}) - f(\overrightarrow{a})}{h} = \overrightarrow{\nabla} f(\overrightarrow{x}) \cdot \overrightarrow{u}$	definition of differentiable function f $\lim_{\overrightarrow{x} \to \overrightarrow{a}} \frac{\left\lvert \overrightarrow{f}(x) - \overrightarrow{f}(a) - \overrightarrow{T}(\overrightarrow{x} - \overrightarrow{a}) \right\rvert}{\lvert \overrightarrow{x} - \overrightarrow{a} \rvert} = 0$
	total derivative: linear trans. $T = Df(\overrightarrow{a})$ $T(\overrightarrow{x}) = (Df(\overrightarrow{a}))(\overrightarrow{x}) = \overrightarrow{\nabla} f(\overrightarrow{a}) \cdot \overrightarrow{x}$	total derivative: linear trans. $T = \overrightarrow{D} f(\overrightarrow{a})$ $T(\overrightarrow{x}) = (Df(\overrightarrow{a}))(\overrightarrow{x}) = \left[\frac{\partial f_i}{\partial x_j}\right] \overrightarrow{x}$
$\frac{d}{dx}(f + g) = \frac{df}{dx} + \frac{dg}{dx}$	$\overrightarrow{\nabla}(f + g) = \overrightarrow{\nabla} f + \overrightarrow{\nabla} g$	$\frac{d}{dx}\left(\overrightarrow{f} + \overrightarrow{g}\right) = \frac{d\overrightarrow{f}}{dx} + \frac{d\overrightarrow{g}}{dx}$
$\frac{d}{dx}(f \cdot g) = f\frac{dg}{dx} + g\frac{df}{dx}$	$\overrightarrow{\nabla}(f \cdot g) = f\overrightarrow{\nabla} g + g\overrightarrow{\nabla} f$	$\frac{d}{dx}\left(\overrightarrow{f} \cdot \overrightarrow{g}\right) = f \cdot \frac{d\overrightarrow{g}}{dx} + g \cdot \frac{d\overrightarrow{f}}{dx}$
		$\frac{d}{dx}\left(\overrightarrow{f} \times \overrightarrow{g}\right) = f \times \frac{d\overrightarrow{g}}{dx} + g \times \frac{d\overrightarrow{f}}{dx}$
chain rule $\frac{d}{dx}((g \circ f)(x)) = \frac{dg}{dx}(f(x)) \cdot \frac{df}{dx}(x)$	If $u = g\left(\overrightarrow{f}(t)\right)$, $\frac{du}{dt} = \frac{\partial u}{\partial x_1}\frac{\partial x_1}{\partial t} + ... + \frac{\partial u}{\partial x_n}\frac{\partial x_n}{\partial t}$	If $u = g\left(\overrightarrow{f}(s, t)\right)$, $\frac{du}{ds} = \frac{\partial u}{\partial x_1}\frac{\partial x_1}{\partial s} + ... + \frac{\partial u}{\partial x_n}\frac{\partial x_n}{\partial s}$ $\frac{du}{dt} = \frac{\partial u}{\partial x_1}\frac{\partial x_1}{\partial t} + ... + \frac{\partial u}{\partial x_n}\frac{\partial x_n}{\partial t}$
implicit differentiation If $f(x, y) = 0$, $\frac{dy}{dx} = -\frac{\partial f / \partial x}{\partial f / \partial y}$.	Implicit Function Theorem If $f(\overrightarrow{x}) = 0$, $\frac{dx_i}{dx_j} = -\frac{\partial f / \partial x_j}{\partial f / \partial x_i}$.	
antiderivative $\int f(x)\, dx$	see page 4	$\int \overrightarrow{f}(t)\, dt = \int f_1(t)\, dt + ... + \int f_m(t)\, dt$