VectorOperator

`VectorOperator[vector]`
will create a derivative operator taking the components from a Grassmann VectorForm and based on the current coordinates.

Details

- A VectorOperator treats basis vectors as partial derivatives with respect to their coordinate, for example $e_x \to \partial_x$.
- The result is a pure function linear derivative operator that may be applied to a Grassmann expression with coordinate symbols.
- A VectorOperator is displayed, and may be entered from the ∇ tab of the Common Operations palette, as $\partial_{\mathcal{V}}$[vector].
- A VectorOperator will evaluate when applied to general Grassmann expressions as $\partial_{\mathcal{V}}$[vector][expression].

Examples (1)

Basic Examples (1)

```
In[1]:= << GrassmannCalculus`
```

Work in the GrassmannPlane.

```
In[2]:= SetActiveAssociation[PublicGrassmannAtlas["Grassmann Plane"]]
        **S[f[__], g[__]]
```

A vector operator may be enterd by using the long name or the template from the ∇ tab of the Common Operations palette.

```
In[3]:= {VectorOperator[e_x - 3 e_y], ∂_𝒱[e_x - 3 e_y]}
Out[3]= {d𝒱[e_x - 3 e_y], d𝒱[e_x - 3 e_y]}
```

A vector operator evaluates on all Grassmann expressions but not on non-Grassmann expressions.

```
In[4]:= ∂_𝒱[e_x - 3 e_y] /@ {qqq, 3, x y^2 Cos[y], *0 + 3 e_x + x y e_x ∧ e_y} // Column
Out[4]= d𝒱[e_x - 3 e_y][qqq]
        0
        y^2 Cos[y] - 3 (2 x y Cos[y] - x y^2 Sin[y])
        -3 x e_x ∧ e_y + y e_x ∧ e_y
```

A DirectionalDerivative is just a `VectorOperator` restricted to scalar functions.

```
In[5]:= {∇⃗[2 e_x + 3 e_y, ⋆0 + x e_x + y e_y], ∂𝒱[2 e_x + 3 e_y]}[x^2 y]
        % // Through
Out[5]= {∇⃗[2 e_x + 3 e_y, ⋆0 + x e_x + y e_y], d𝒱[2 e_x + 3 e_y]}[x^2 y]

Out[5]= {x (3 x + 4 y), 3 x^2 + 4 x y}
```

The following is another way to implement a vector operator:

```
In[6]:= (2 e_x + 3 e_y)[x^2 y^3]
        % // Operate[VectorOperator, #] &
Out[6]= (2 e_x + 3 e_y)[x^2 y^3]

Out[6]= 9 x^2 y^2 + 4 x y^3
```

See Also

DirectionalDerivative ▪ **DerivationBreakout**

Related Guides

- Calculus
- Derivatives
- Grassmann Calculus