

## Exercise 6.1 Evaluate – without rhsonly = True

```

1  {\theta, \varphi}::Coordinate.
2  {a,b,c,d,e,f,g,h#}::Indices(values={\theta, \varphi}, position=independent).
3
4  \partial{#}::PartialDerivative.
5
6  V := { V_{\theta} = \varphi, V_{\varphi} = \sin(\theta) }. # cdb(ex-0601.100,V)
7  dV := dV_{a b} -> \partial_{b}{V_{a}} - \partial_{a}{V_{b}}. # cdb(ex-0601.101,dV)
8
9  evaluate (dV, V) # cdb(ex-0601.102,dV)

```

Notice how `evaluate` has been applied to both the left and right hand sides of the rule.

$$V_a = [V_\theta = \varphi, V_\varphi = \sin \theta] \quad (\text{ex-0601.100})$$

$$dV_{ab} \rightarrow \partial_b V_a - \partial_a V_b \quad (\text{ex-0601.101})$$

$$\square_{ab} \begin{cases} \square_{\theta\theta} = dV_{\theta\theta} \\ \square_{\varphi\theta} = dV_{\varphi\theta} \\ \square_{\theta\varphi} = dV_{\theta\varphi} \\ \square_{\varphi\varphi} = dV_{\varphi\varphi} \end{cases} \rightarrow \square_{ab} \begin{cases} \square_{\varphi\theta} = \cos \theta - 1 \\ \square_{\theta\varphi} = 1 - \cos \theta \end{cases} \quad (\text{ex-0601.102})$$

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```

1  {\theta, \varphi}::Coordinate.
2  {a,b,c,d,e,f,g,h#}::Indices(values={\theta, \varphi}, position=independent).
3
4  \partial{#}::PartialDerivative.
5
6  V := { V_{\theta} = \varphi, V_{\varphi} = \sin(\theta) }. # cdb(ex-0601.200,V)
7  dV := dV_{a b} -> \partial_{b}{V_{a}} - \partial_{a}{V_{b}}. # cdb(ex-0601.201,dV)
8
9  evaluate (dV, V, rhsonly=True) # cdb(ex-0601.202,dV)

```

This is an improvement, only the right hnd side has been expanded into components.

$$V_a = [V_\theta = \varphi, V_\varphi = \sin \theta] \quad (\text{ex-0601.200})$$

$$dV_{ab} \rightarrow \partial_b V_a - \partial_a V_b \quad (\text{ex-0601.201})$$

$$dV_{ab} \rightarrow \square_{ab} \begin{cases} \square_{\varphi\theta} = \cos \theta - 1 \\ \square_{\theta\varphi} = 1 - \cos \theta \end{cases} \quad (\text{ex-0601.202})$$