

Appendix: Wedge product

- ▶ Anticommutative

$$dA \wedge dB = -dB \wedge dA$$

$$dA \wedge dA = 0$$

- ▶ associative

$$(dA \wedge dB) \wedge dC = dA \wedge (dB \wedge dC)$$

Grassmann algebra:

linear space with wedge product
distributive

The Key Formula

- wedging the chain rule:

$$df = \left. \frac{\partial f}{\partial x} \right|_y dx + \left. \frac{\partial f}{\partial y} \right|_x dy$$

$$df \wedge dy = \left. \frac{\partial f}{\partial x} \right|_y dx \wedge dy$$

$$\left. \frac{\partial f}{\partial x} \right|_y = \frac{df \wedge dy}{dx \wedge dy}$$