Let us assume that the total traction acting on the surface of a material volume $V(t)$ is given by the formula

$$\int_{\partial V(t)} \boldsymbol{t}(\boldsymbol{n}, \boldsymbol{x}, t)\,\mathrm{ds}, \tag{1}$$

where $\boldsymbol{t}(\boldsymbol{n}, \boldsymbol{x}, t)$ is the *traction* acting on the surface ds with unit outward normal $\boldsymbol{n}$, and let $\boldsymbol{t}(\boldsymbol{n}, \boldsymbol{x}, t)$ be a sufficiently smooth function. Show that there exists a tensorial quantity $\mathbb{T}(\boldsymbol{x}, t)$ such that

$$\boldsymbol{t}(\boldsymbol{n}, \boldsymbol{x}, t) = \mathbb{T}(\boldsymbol{x}, t)\boldsymbol{n}. \tag{2}$$

The tensor $\mathbb{T}$ is referred to as the Cauchy stress tensor.