

VECTOR/SCALAR LINE/SURFACE INTEGRALS

	Line Integrals	Surface Integrals
Parametrization	$\mathbf{x} : [a, b] \rightarrow \mathbb{R}^n$	$\mathbf{X} : D \rightarrow \mathbb{R}^3$
Length/Area	$\int_a^b \ \mathbf{x}'(t)\ dt$	$\iint_D \ \mathbf{T}_s \times \mathbf{T}_t\ ds dt$
Scalar Integral	$\int_{\mathbf{x}} f ds = \int_a^b f(\mathbf{x}(t)) \ \mathbf{x}'(t)\ dt$	$\iint_{\mathbf{X}} f dS = \iint_D f(\mathbf{X}(s, t)) \ \mathbf{T}_s \times \mathbf{T}_t\ ds dt$ $= \iint_D f(\mathbf{X}(s, t)) \ \mathbf{N}(s, t)\ ds dt$
Vector Integral	$\int_{\mathbf{x}} \mathbf{F} \cdot ds = \int_a^b \mathbf{F}(\mathbf{x}(t)) \cdot \mathbf{x}'(t) dt$	$\iint_{\mathbf{X}} \mathbf{F} \cdot d\mathbf{S} = \iint_D \mathbf{F}(\mathbf{X}(s, t)) \cdot (\mathbf{T}_s \times \mathbf{T}_t) ds dt$ $= \iint_D \mathbf{F}(\mathbf{X}(s, t)) \cdot \mathbf{N}(s, t) ds dt$