

13.9 Summary

The main results of this chapter are all higher-dimensional versions of the Fundamental Theorem of Calculus. Notice that in each case we have an integral of a “derivative” over a region on the left side, and the right side involves the values of the original function only on the boundary of the region.

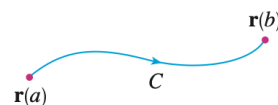
Fundamental Theorem of Calculus

$$\int_a^b F'(x) dx = F(b) - F(a)$$



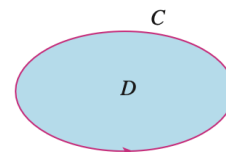
Fundamental Theorem for Line Integrals

$$\int_C \nabla f \cdot d\mathbf{r} = f(\mathbf{r}(b)) - f(\mathbf{r}(a))$$



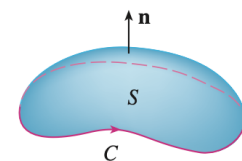
Green's Theorem

$$\iint_D \left(\frac{\partial Q}{\partial x} - \frac{\partial P}{\partial y} \right) dA = \int_C P dx + Q dy$$



Stokes' Theorem

$$\iint_S \text{curl } \mathbf{F} \cdot d\mathbf{S} = \int_C \mathbf{F} \cdot d\mathbf{r}$$



Divergence Theorem

$$\iiint_E \text{div } \mathbf{F} dV = \iint_S \mathbf{F} \cdot d\mathbf{S}$$

