Some Useful Formulas

grad$f = \nabla f$, div$\mathbf{F} = \nabla \cdot \mathbf{F}$, curl$\mathbf{F} = \nabla \times \mathbf{F}$

- $$\iiint\limits_D f(x,y,z)\,dV = \iiint\limits_{D'} f(r\cos\theta, r\sin\theta, z)r\,dz\,dr\,d\theta$$
- $$\iiint\limits_D f(x,y,z)\,dV = \iiint\limits_{D'} f(\rho\sin\phi\cos\theta, \rho\sin\phi\sin\theta, \rho\cos\phi)\rho^2\sin\phi\,d\rho\,d\theta\,d\phi$$
- $$\int_C f\,ds = \int_a^b f(\mathbf{r}(t))\|\mathbf{r}'(t)\|\,dt$$
- $$\int_C \mathbf{F}\cdot d\mathbf{r} = \int_a^b \mathbf{F}(\mathbf{r}(t))\cdot\mathbf{r}'(t)\,dt = \int_C \mathbf{F}\cdot\mathbf{T}\,ds$$
- $$\iint\limits_S f(x,y,z)\,dS = \iint\limits_D f(\mathbf{r}(u,v))\|\mathbf{r}_u\times\mathbf{r}_v\|\,dA$$
- $$\iint\limits_S \mathbf{F}\cdot d\mathbf{S} = \iint\limits_S \mathbf{F}\cdot\mathbf{n}\,dS = \iint\limits_D \mathbf{F}\cdot(\mathbf{r}_u\times\mathbf{r}_v)\,dA$$
- Green's Theorem
$$\int_{\partial D} P\,dx + Q\,dy = \iint\limits_D \left(\frac{\partial Q}{\partial x} - \frac{\partial P}{\partial y}\right)\,dA$$
- Stokes's Theorem
$$\int_C \mathbf{F}\cdot d\mathbf{r} = \iint\limits_S (\nabla\times\mathbf{F})\cdot d\mathbf{S}$$
- The Divergence Theorem
$$\iint\limits_S \mathbf{F}\cdot d\mathbf{S} = \iiint\limits_D \nabla\cdot\mathbf{F}\,dV$$
- $\cos^2\theta = \frac{1}{2} + \frac{1}{2}\cos(2\theta), \qquad \sin^2\theta = \frac{1}{2} - \frac{1}{2}\cos(2\theta)$