Vector Calculus Identities

The divergence of the curl is equal to zero:

$$\nabla\cdot(\nabla \times B) = 0$$

The curl of the gradient is equal to zero:

$$\nabla \times \nabla f = 0$$

More vector identities

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Divergence Theorem

The volume integral of the divergence of a vector function is equal to the integral over the surface of the component normal to the surface.

$$\oint \nabla\cdot E \, dV = \oint E\cdot dA$$

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Stokes' Theorem

The area integral of the curl of a vector function is equal to the line integral of the field around the boundary of the area.

$$\oint \nabla \times E \cdot dA = \oint E \cdot dL$$

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Vector Identities

In the following identities, u and v are scalar functions while A and B are vector functions. The overbar shows the extent of the operation of the del operator.

$$A \times (B \times C) = (C \times B) \times A = B(A \cdot C) - C(A \cdot B)$$

$$\nabla(uv) = u\nabla v + v\nabla u$$

$$\nabla(A \cdot B) = A \times (\nabla \times B) + (A \cdot \nabla)B + B \times (\nabla \times A) + (B \cdot \nabla)A$$

$$\nabla \cdot uA = u\nabla \cdot A + A \cdot \nabla u$$

$$\nabla \cdot (A \times B) = B \cdot \nabla \times A - A \cdot \nabla \times B$$

$$\nabla \times (uA) = u\nabla \times A - A \times \nabla u$$

$$\nabla \times (A \times B) = (B \cdot \nabla)A + A(\nabla \cdot B) - (A \cdot \nabla)B - B(\nabla \cdot A)$$

$$(\overline{\nabla \cdot A)B} = (A \cdot \nabla)B + B(\nabla \cdot A)$$

$$\nabla \times (\nabla \times A) = \nabla(\nabla \cdot A) - (\nabla \cdot \nabla)A$$

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