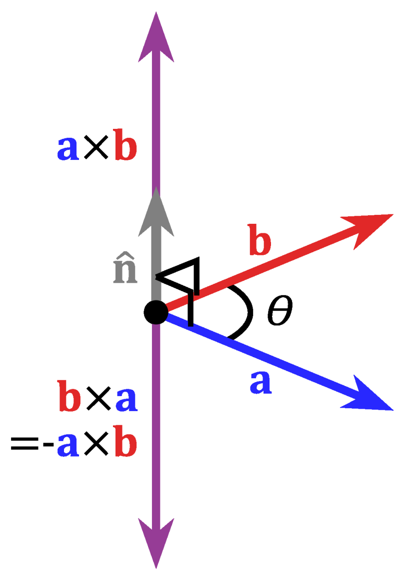
Cross product

In mathematics, the **cross product** or **vector product** is a binary operation on two vectors in three-dimensional space. It results in a vector which is perpendicular to both and therefore normal to the plane containing them. It has many applications in mathematics, physics, and engineering.

If the vectors have the same direction or one has zero length, then their cross product is zero. More generally, the magnitude of the product equals the area of a parallelogram with the vectors for sides; in particular for perpendicular vectors this is a rectangle and the magnitude of the product is the product of their lengths. The cross product is anticommutative and is distributive over addition. The space and product form an algebra over a field, which is neither commutative nor associative, but is a Lie algebra with the cross product being the Lie bracket.

Like the dot product, it depends on the metric of Euclidean space, but unlike the dot product, it also depends on the choice of orientation or "handedness". The product can be generalized in various ways; it can be made independent of orientation by changing the result to pseudovector, or in arbitrary dimensions the exterior product of vectors can be used with a bivector or two-form result. Also, using the orientation and metric structure just as for the traditional 3-dimensional cross product, one can in n dimensions take the product of $n - 1$ vectors to produce a vector perpendicular to all of them. But if the product is limited to non-trivial binary products with vector results, it exists only in three and seven dimensions.



The cross-product in respect to a right-handed coordinate system