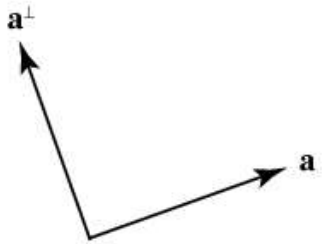
Direction Arrows On Lines

Perpendicular Vector

A vector perpendicular to a given vector $\mathbf{a}$ is a vector $\mathbf{a}^{\perp}$ (voiced "a-perp") such that $\mathbf{a}$ and $\mathbf{a}^{\perp}$ form a right angle.



In the plane, there are two vectors perpendicular to any given vector, one rotated $90°$ counterclockwise and the other rotated $90°$ clockwise. Hill (1994) defines $\mathbf{a}^{\perp}$ to be the perpendicular vector obtained from an initial vector

$$\mathbf{a} = \begin{bmatrix} a_x \\ a_y \end{bmatrix}$$

by a counterclockwise rotation by $90°$, i.e.,

$$\mathbf{a}^{\perp} = \begin{bmatrix} 0 & -1 \\ 1 & 0 \end{bmatrix} \mathbf{a} = \begin{bmatrix} -a_y \\ a_x \end{bmatrix}.$$

In the plane, a vector perpendicular to $\mathbf{a} = (a_x, a_y)$ can therefore be obtained by transposing the Cartesian components and taking the minus sign of one. This operation is implemented in the Wolfram Language as `Cross`[*ax*, *ay*].

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