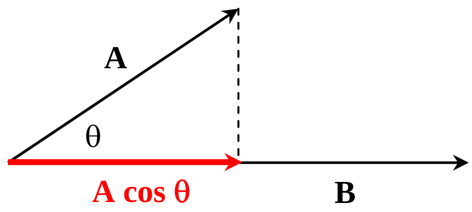
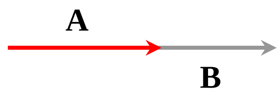
Visual Representation of the Dot Product (*Scalar Product*)



This shows that the dot product is the amount of **A** in the direction of **B** times the magnitude of **B**. This is extremely useful if you are interested in finding out how much of one vector is projected onto another or how similar 2 vectors are in direction. The following 5 cases summarize the possible interpretations of the dot product.

CASE I $\mathbf{A}\cdot\mathbf{B} = AB$

The interpretation is that all of A is projected onto B
(both **A** and **B** are in the same direction - *parallel*)



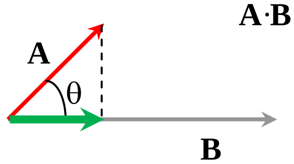
$$\theta = 0 \quad \rightarrow \quad \cos\theta = 1$$

CASE II $\mathbf{A}\cdot\mathbf{B} = C$

$0 < C < AB$

The interpretation is some of A is projected onto B
(**A** and **B** point in the same general direction, *how much depends on the value of* C)

A·B > 0

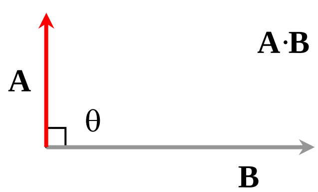


$$0 < \theta < \frac{\pi}{2} \quad \rightarrow \quad 0 < \cos\theta < 1$$

CASE III $\mathbf{A}\cdot\mathbf{B} = 0$

The interpretation is that none of A is projected onto B
(**A** and **B** are *perpendicular*)

A·B = 0

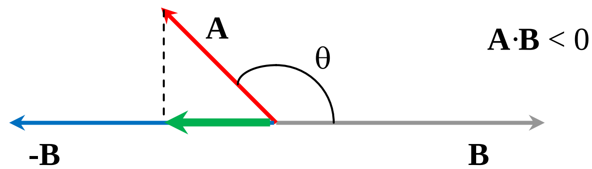


$$\theta = \frac{\pi}{2} \quad \rightarrow \quad \cos\theta = 0$$

CASE IV $\mathbf{A} \cdot \mathbf{B} = -D \qquad -AB < -D < 0$

The interpretation is some of A is projected onto -B

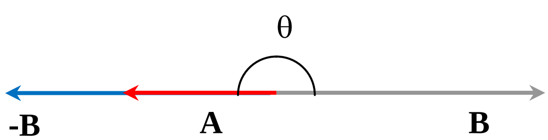
(**A** and **B** point in opposite directions, *how much depends on the value of* -D)



$$\frac{\pi}{2} < \theta < \pi \quad \rightarrow \quad -1 < \cos\theta < 0$$

CASE V $\mathbf{A} \cdot \mathbf{B} = -AB$ The interpretation is that all of A is projected onto -B

(**A** and **B** are *anti-parallel*: || *but in opposite directions*)



$$\theta = \pi \quad \rightarrow \quad \cos\theta = -1$$