

Vector Components

1. a) Let $\mathbf{A} = \langle 1, 3 \rangle$ and $\mathbf{B} = \langle 3, 4 \rangle$.

(i) Find the component of \mathbf{A} in the direction of \mathbf{B} .

(ii) Find the component of \mathbf{B} in the direction of \mathbf{A} .

b) Let $\mathbf{A} = \langle 3, 5, 7 \rangle$ and $\mathbf{B} = \langle 3, 4, 0 \rangle$. Find the component \mathbf{A} in the direction of \mathbf{B} .

Answer: a) (i) $|\mathbf{B}| = 5 \Rightarrow$ the component is $\mathbf{A} \cdot \frac{\mathbf{B}}{|\mathbf{B}|} = \langle 1, 3 \rangle \cdot \frac{\langle 3, 4 \rangle}{5} = \frac{15}{5} = 3$.

(ii) $|\mathbf{A}| = \sqrt{10} \Rightarrow \mathbf{B} \cdot \frac{\mathbf{A}}{|\mathbf{A}|} = \langle 3, 4 \rangle \cdot \frac{\langle 1, 3 \rangle}{\sqrt{10}} = \frac{15}{\sqrt{10}}$.

b) In three dimensions the formula is the same. The component is $\mathbf{A} \cdot \frac{\mathbf{B}}{|\mathbf{B}|} = \langle 3, 5, 7 \rangle \cdot \frac{\langle 3, 4, 0 \rangle}{5} = \frac{29}{5}$.

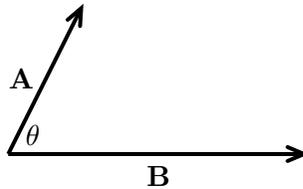
2. Let $\mathbf{A} = \langle a, 2 \rangle$ and $\mathbf{B} = \langle 1, 3 \rangle$. For what values of a is the component of \mathbf{A} along \mathbf{B} equal to 0? For what a is it negative?

Answer: The component is $\langle a, 2 \rangle \cdot \frac{\langle 1, 3 \rangle}{\sqrt{10}} = \frac{a+6}{\sqrt{10}}$.

This is 0 if $a = -6$.

This is negative if $a < -6$.

3. For which angle θ is the component of \mathbf{A} in the direction of \mathbf{B} equal to 0.



Answer: $\theta = \pi/2$.

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