DOT PRODUCT

of VECTORS

What is dot product?

- Dot product (or scalar product) of two vectors is a scalar quantity.
- It is an operation that takes two vectors as input, and returns a scalar number as output.
- The dot product is a value expressing the angular relationship between two vectors

How do I calculate dot product?

if $\vec{v} = \langle v_1, v_2 \rangle$ and $\vec{w} = \langle w_1, w_2 \rangle$,

then the dot product is

$$\vec{v} \cdot \vec{w} = v_1 w_1 + v_2 w_2$$

Examples:

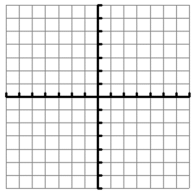
- Find each dot product.

a) $\langle 3,5 \rangle \cdot \langle 2,6 \rangle$

b) $\langle -2,4 \rangle \cdot \langle -1,-3 \rangle$

Orthogonal Vectors

- Two vectors are said to be orthogonal if $\vec{v} \cdot \vec{w} = 0$.
- "Orthogonal" means the vectors are perpendicular (form a 90° angle).
- Are $\langle 2, -3 \rangle$ and $\langle 6,4 \rangle$ orthogonal?



Angle Between Two Vectors

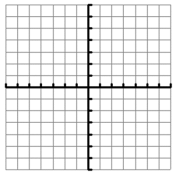
- If θ is between two non-zero vectors $\vec{v}$ and $\vec{w}$, then

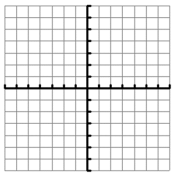
$$cos\theta = \frac{\vec{v} \cdot \vec{w}}{\|\vec{v}\|\|\vec{w}\|}$$

Examples: Use [0,360°)

- Find the angle between …

a) $\langle 3,5 \rangle$ and $\langle 2,6 \rangle$ b) $\langle -2,4 \rangle$ and $\langle -1,-3 \rangle$





Backwards Example

- If $\|\vec{a}\| = 4$ and $\|\vec{b}\| = 7$, and $\theta = 112^o$, find $\vec{a} \cdot \vec{b}$.