

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.

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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

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

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Examples:

- Find each dot product.

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

$$(3 \cdot 2) + (5 \cdot 6) = 6 + 30 = 36$$

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

$$(2) + (-12) = -10$$

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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).

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Examples:

- Are $\langle 2, -3 \rangle$ and $\langle 6, 4 \rangle$ orthogonal?

$$(2 \cdot 6) + (-3 \cdot 4) = 12 + -12 = 0$$

Yes ... the vectors are orthogonal

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Parallel Vectors

- Two vectors are said to be **parallel** if they are scalar multiples of one another.
- Example: $\langle 1, -5 \rangle$ and $\langle 2, -10 \rangle$ are parallel because $2\langle 1, -5 \rangle = \langle 2, -10 \rangle$.
- Parallel vectors would have the same direction and different magnitudes.

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