

## Worksheet: The Dot Product

This worksheet has questions on the dot product between two vectors. Before attempting the questions below, you could read the study guide: [The Dot Product](#).

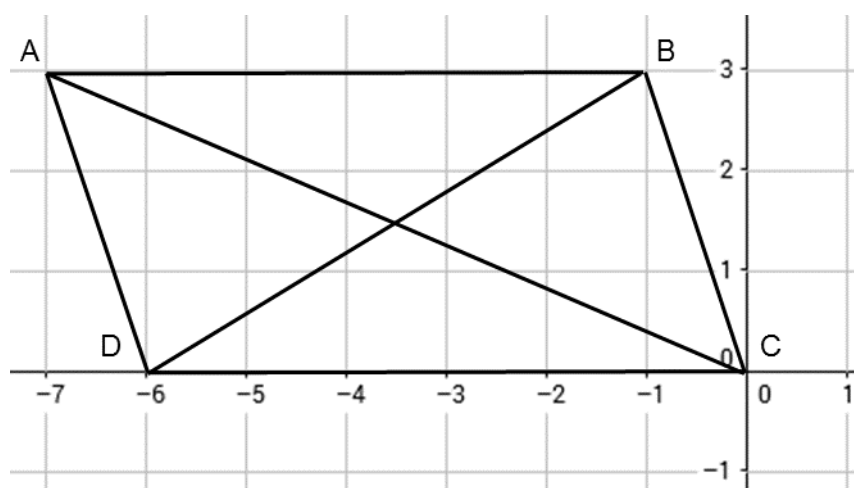
The Dot Product  
study guide



Model Answers  
to this sheet

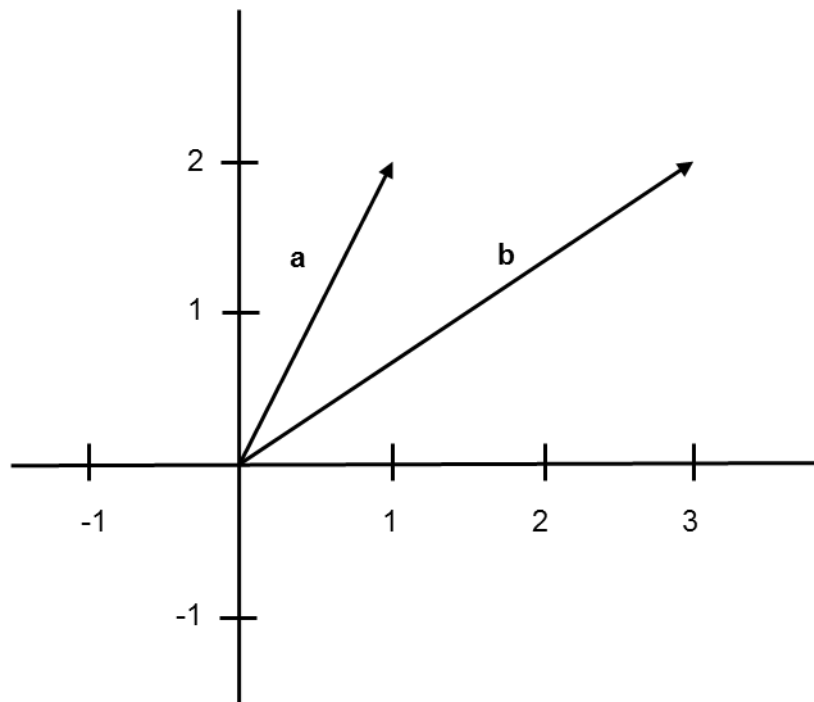


1. Look at the vectors in the parallelogram ABCD.



- a. Express the vectors  $\vec{CD}$ ,  $\vec{CA}$  and  $\vec{CB}$  in terms of the rectangular unit vectors  $\mathbf{i}$  and  $\mathbf{j}$ .
- b. What is the dot product of:
- $\vec{CD}$  and  $\vec{CA}$ ?
  - $\vec{CD}$  and  $\vec{BA}$ ?
  - $\vec{CD}$  and  $\vec{CB}$ ?
- c. Find the magnitude of the vectors  $\vec{CD}$  and  $\vec{CB}$  and using that and the dot product find the angle (in degrees) between the vectors  $\vec{CD}$  and  $\vec{CB}$ .

2. What is the dot product of  $\mathbf{a}$  and  $\mathbf{b}$  when the magnitude of  $\mathbf{a}$  is  $|\mathbf{a}| = 5$ , the magnitude of  $\mathbf{b}$  is  $|\mathbf{b}| = \sqrt{2}$  and the angle between them is  $\theta = 45^\circ$ .
3. Which of the following vectors are orthogonal (they have a dot product equal to zero)?
- a.  $(-2, -5, 1)$  and  $(4, -1, 3)$       b.  $(\frac{1}{2}, -6, 2)$  and  $(-4, 2, -1)$
- c.  $(1, -\frac{3}{2}, \frac{1}{8})$  and  $(0, \frac{1}{4}, 3)$       d.  $(-2, \frac{2}{3}, \frac{\sqrt{5}}{3})$  and  $(1, -1, \sqrt{5})$
4. In the graph below you have two vectors  $\mathbf{a}$  and  $\mathbf{b}$ .



- a. Express  $\mathbf{a}$  and  $\mathbf{b}$  in terms of the rectangular unit vectors  $\mathbf{i}$  and  $\mathbf{j}$ .
- b. Find  $\hat{\mathbf{b}}$ , the unit vector of  $\mathbf{b}$ .
- c. What is the scalar and the vector projection of  $\mathbf{a}$  onto  $\mathbf{b}$ ?



This worksheet is one of a series on mathematics produced by the Learning Enhancement Team with funding from the UEA Alumni Fund. Scan the QR-code with a smartphone app for [more resources](#).



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