LESSON MAKER PRO

Vector Connections

Use components to find dot products and compare directions.

HIGH SCHOOL · PC.NQ.E.11

PC.NQ.E.11 "Find the scalar (dot) product of two vectors as the sum of the products of corresponding components and explain its relationship to the cosine of the angle formed by two vectors."

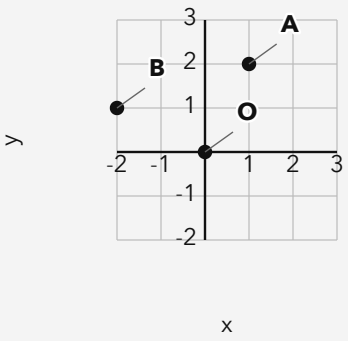
NAME _____ DATE _____

THE DOT PRODUCT

Multiply matching components and add: (a, b) · (c, d) = ac + bd. For nonzero vectors, the dot product also equals |u||v|cos θ, where θ is the angle between them. A positive dot product means the angle is acute, a negative one means it is obtuse, and zero means it is a right angle.

WORKED EXAMPLE

Use vectors OA and OB on the grid. Find their dot product and the cosine of the angle between them.



1. Read the vectors: OA = (1, 2) and OB = (-2, 1).
2. Multiply and add: OA · OB = 1(-2) + 2(1) = 0.
3. Each vector has length √5, so cos θ = 0/(√5 · √5) = 0.

Answer: Dot product: 0; cosine: 0.

PRACTICE 4 problems

1 Find (4, -5) · (3, 6).

ANSWER _____

2 Find (-3, 5) · (6, 4).

ANSWER _____

3 Find (3, -4, 5) · (6, 0, -3).

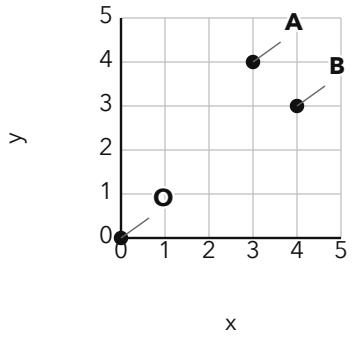
ANSWER _____

4 Find (5, 5) · (5, -5). Is the angle between the vectors acute, obtuse, or right?

ANSWER _____

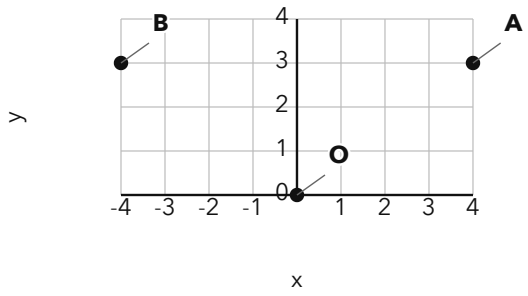
APPLY IT Show your work

1 In a game, two players move from O to A and from O to B on the grid. Find the dot product of their movement vectors and the cosine of the angle between them.



ANSWER _____

2 Two delivery robots leave O, one heading toward A and the other toward B. Find the dot product of their movement vectors. Is the angle between their paths acute or obtuse?



ANSWER _____

CHALLENGE One step up

Suppose $(x, 5) \cdot (3, -4) = 16$. Find x and the cosine of the angle between the vectors.

WORK SPACE AND ANSWER

ANSWER KEY

Vector Connections

PART 1 · PRACTICE

#	PROBLEM	ANSWER
1	Find (4, -5) · (3, 6).	**-18**
2	Find (-3, 5) · (6, 4).	**2**
3	Find (3, -4, 5) · (6, 0, -3).	**3**
4	Find (5, 5) · (5, -5). Is the angle between the vectors acute, obtuse, or right?	**0; right angle.**

PART 2 · APPLY IT

1. **Dot product: 24; cosine: 24/25.** The dot product is 3(4) + 4(3) = 24. Both movement vectors have length 5, so cos θ = 24/(5 · 5) = 24/25.
2. **Dot product: -7; obtuse angle.** The dot product is 4(-4) + 3(3) = -7. Because it is negative, the angle is obtuse.

CHALLENGE

x = 12; cosine = 16/65.

Accept equivalent forms of 16/65. For angle classifications, students can use the sign of the dot product.