MATHEMATICS · GRADES 10-12

Dot products

Difficulty level: Advanced

Mathematics: Grades 10-12

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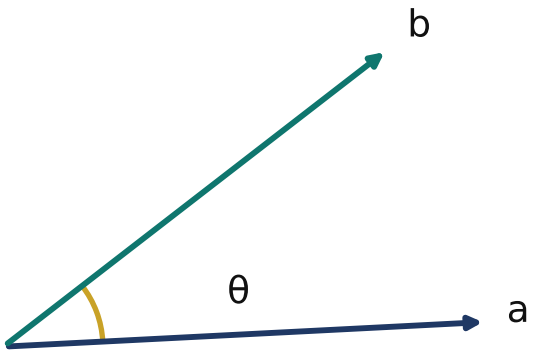
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Overview of the concept

This is how you work out how much of one push actually helps in the direction you want. Wind on your bike pushes partly forward and partly sideways, and only the forward part helps you go faster. The dot product picks out that useful part and ignores the rest. Engineers use the same idea to work out how much of a force is doing the job they care about.



$$a \cdot b = |a||b| \cos \theta$$



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Worked examples

EXAMPLE 1

Q Find (2, 3) dot (4, 1).

SOLUTION

Multiply matching components: 2 × 4 = 8, and 3 × 1 = 3

Add the products: 8 + 3 = 11

Dot product = 11

EXAMPLE 2

Q Find (1, 5) dot (-2, 3).

SOLUTION

Products: 1 × (−2) = −2, and 5 × 3 = 15

Add: −2 + 15 = 13

Dot product = 13

Practice questions

1 Find (1, 2) dot (3, 4).

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2 Find (5, 0) dot (2, 9).

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3 Find (2, 2) dot (2, 2).

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4 Find (3, 1) dot (-1, 3).

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5 Is a dot product a number or a vector?

A A number

B A vector

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6 Find (0, 6) dot (7, 0).

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7 Find (4, 3) dot (4, -3).

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8 **Find (3, -2) dot (1, 5).**

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9 **Find (6, 2) dot (3, 1).**

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10

How do you work out a dot product, in words?

A Add matching components and multiply the products

B Add all four numbers together

C Multiply matching components and add the products

D Multiply the first components and add the second components

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ANSWER KEY

1. 11

2. 10

3. 8

4. 0

5. A number

6. 0

7. 7

8. -7

9. 20

10. Multiply matching components and add the products

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