

Dot Product, Cross Product, and Geometric Applications

Vector products, orthogonality, projection, and applied vector reasoning.

Name _____ Date _____

32 main 2-up grid 2 pages

Completion Reward



Shown here as a small pack artifact, not a preview destination.

1. What does the dot product help measure geometrically?

- A. Alignment between vectors
- B. The area of the parallelogram between vectors
- C. A perpendicular vector to both inputs
- D. The midpoint of the two vectors

2. What is true if two nonzero vectors have dot product 0?

- A. They are parallel
- B. They have equal magnitude
- C. They are perpendicular
- D. They point the same way

3. What kind of object is the cross product of two 3D vectors?

- A. A scalar only
- B. Another vector
- C. An angle
- D. A matrix

4. What does projecting vector u onto vector v do?

- A. Finds the component of u in the direction of v
- B. Finds a vector perpendicular to both u and v
- C. Adds u and v into one resultant automatically
- D. Forces u and v to have the same magnitude

5. Which formula is the dot product of (a, b) and (c, d) ?

- A. $ad - bc$
- B. $a + b + c + d$
- C. $\sqrt{ac + bd}$
- D. $ac + bd$

6. Which pair is perpendicular?

- A. $(1, 2)$ and $(2, 1)$
- B. $(3, 0)$ and $(1, 1)$
- C. $(1, 2)$ and $(2, -1)$
- D. $(1, -1)$ and $(2, -2)$

7. What does $|u \times v|$ represent geometrically?

- A. The area of the parallelogram spanned by u and v
- B. The dot product of u and v
- C. The length of $u + v$
- D. The midpoint distance between the vector endpoints

8. What is $u \times v$ if u and v are parallel?

- A. A vector of magnitude 1
- B. The zero vector
- C. Always $u + v$
- D. Always the dot product

9. To check whether two vectors are perpendicular, what should you compute?

- A. Their magnitudes only
- B. Their dot product
- C. The midpoint between their endpoints
- D. The determinant of a 2×2 matrix no matter the dimension

10. To find the area of a parallelogram formed by two 3D vectors, what should you compute?

- A. The magnitude of the cross product
- B. The dot product
- C. The sum of the vector magnitudes
- D. The projection of one vector onto the other

11. A student says $(1, 2) \text{ dot } (3, 4) = 21$. What is wrong?

- A. The dot product should be negative
- B. The vectors are perpendicular
- C. They added the products incorrectly
- D. Nothing is wrong

12. A student says projection and dot product are the same thing. What is wrong?

- A. The dot product is a scalar, but projection is a vector or component along a direction
- B. Projection ignores direction completely
- C. Dot product always gives area
- D. Projection and dot product are identical whenever magnitudes match

13. Find $(2, 3) \text{ dot } (4, -1)$. Answer with a number.

14. Find $(1, -2) \text{ dot } (3, 5)$. Answer with a number.

15. Find $(1, 2) \text{ dot } (2, -1)$. Answer with a number.

16. Find $(1, 2, 3) \text{ dot } (4, 0, -1)$. Answer with a number.

17. If $|u \times v| = 12$, what is the area of the parallelogram formed by u and v ? Answer with a number.

18. If $|u \times v| = 18$, what is the area of the triangle formed by u and v ? Answer with a number.

19. For $u = (3, 4)$ and $v = (1, 0)$, what is $u \text{ dot } v$? Answer with a number.

20. For $u = (5, 0)$ and $v = (0, 2)$, what is $u \text{ dot } v$? Answer with a number.

21. Find the magnitude of $(0, 0, 6)$. Answer with a number.

22. Find $(1, 0, 0) \text{ dot } (0, 1, 0)$. Answer with a number.

23. Find $(2, -1, 4) \text{ dot } (1, 3, 0)$. Answer with a number.

24. If two unit vectors have dot product -1 , what is $\cos(\theta)$ between them? Answer with a number.

25. Write the dot product of (a, b) and (c, d) . Answer as an equation.
26. Write the dot product of (a, b, c) and (d, e, f) . Answer as an equation.
27. Write $(1, 0, 0) \times (0, 1, 0)$. Answer as a vector equation.
28. Write $(0, 1, 0) \times (1, 0, 0)$. Answer as a vector equation.
29. Write the scalar numerator used when projecting u onto v . Answer as an equation.
30. Write the expression for the area of the parallelogram formed by u and v . Answer as an equation.
31. Which value is $(2, 3)$ dot $(4, -1)$?
- A. 11
B. -5
C. -11
D. 5
32. If the dot product of two unit vectors is 1, what is true about them?
- A. They are perpendicular
B. They point in opposite directions
C. They point in the same direction
D. Their magnitudes are 0