



# Dot Product of Vectors

Precalculus Worksheet · Grade 11-12 · numberbender.com

Name: \_\_\_\_\_

Date: \_\_\_\_\_

Score: / 10

## Learning Objectives

- Compute the dot product of two vectors using the formula  $u \cdot v = ac + bd$
- Apply scalar multiplication in combination with the dot product
- Use properties of the dot product to simplify expressions
- Evaluate compound dot product expressions involving three vectors

Evaluate each dot product expression and show all work in the space provided.

### 1. Find the dot product of the vectors.

$$(4, 5) \cdot (2, 3)$$

Answer: \_\_\_\_\_

---

### 2. Find the dot product of the vectors.

$$(1, 7) \cdot (6, 2)$$

Answer: \_\_\_\_\_

---

### 3. Find the dot product of the vectors.

$$(-3, 4) \cdot (5, -2)$$

Answer: \_\_\_\_\_

---

### 4. Let $u=(2,3)$ and $v=(4,1)$ . Find $u \cdot 2v$ .

$$u \cdot 2v$$

Answer: \_\_\_\_\_

---

### 5. Let $u=(1,2)$ , $v=(3,4)$ , and $w=(5,6)$ . Find $(u \cdot v)w$ .

$$(u \cdot v)w$$

Answer: \_\_\_\_\_

---

### 6. Let $u=(2,-1)$ and $v=(3,5)$ . Find $u \cdot 3v$ .

$$u \cdot 3v$$

Answer: \_\_\_\_\_

---

### 7. Let $u=(2,1)$ , $v=(1,3)$ , and $w=(4,-2)$ . Find $(u \cdot v)w$ .

$$(u \cdot v)w$$

Answer: \_\_\_\_\_

---



**8. Find the dot product of the vectors.**

$$(0, 9) \cdot (7, -4)$$

Answer: \_\_\_\_\_

---

**9. Let  $u=(5,-2)$  and  $v=(-1,4)$ . Find  $(2u) \cdot v$ .**

$$(2u) \cdot v$$

Answer: \_\_\_\_\_

---

**10. Let  $u=(3,2)$ ,  $v=(2,-1)$ , and  $w=(1,4)$ . Find  $(u \cdot v)w$ .**

$$(u \cdot v)w$$

Answer: \_\_\_\_\_





This worksheet covers the dot product of two-dimensional vectors, including the basic formula  $u \cdot v = ac + bd$ , scalar multiples with the dot product such as  $u \cdot (kv)$ , and compound expressions like  $(u \cdot v)w$  that combine scalar and vector results.

## Solutions

---

1. Find the dot product of the vectors.

$$(4, 5) \cdot (2, 3)$$

- Multiply the first components: 4 times 2 equals 8.
- Multiply the second components: 5 times 3 equals 15.
- Add the two products: 8 plus 15 equals 23.

**Answer:** 23

---

2. Find the dot product of the vectors.

$$(1, 7) \cdot (6, 2)$$

- Multiply the first components: 1 times 6 equals 6.
- Multiply the second components: 7 times 2 equals 14.
- Add the two products: 6 plus 14 equals 20.

**Answer:** 20

---

3. Find the dot product of the vectors.

$$(-3, 4) \cdot (5, -2)$$

- Multiply the first components: negative 3 times 5 equals negative 15.
- Multiply the second components: 4 times negative 2 equals negative 8.
- Add the two products: negative 15 plus negative 8 equals negative 23.

**Answer:** -23

---

4. Let  $u=(2,3)$  and  $v=(4,1)$ . Find  $u \cdot 2v$ .

$$u \cdot 2v$$

- Multiply vector  $v$  by 2 to get the vector with components 8 and 2.
- Take the dot product of  $u$  and the new vector: 2 times 8 equals 16 and 3 times 2 equals 6.
- Add the products: 16 plus 6 equals 22.

**Answer:** 22

---

5. Let  $u=(1,2)$ ,  $v=(3,4)$ , and  $w=(5,6)$ . Find  $(u \cdot v)w$ .

$$(u \cdot v)w$$

- Find  $u \cdot v$  by multiplying components: 1 times 3 equals 3 and 2 times 4 equals 8, so  $u \cdot v$  equals 11.
- Multiply the scalar 11 by vector  $w$ : 11 times 5 equals 55 and 11 times 6 equals 66.
- The result is the vector with components 55 and 66.

**Answer:** (55, 66)

---



6. Let  $u=(2,-1)$  and  $v=(3,5)$ . Find  $u \cdot 3v$ .

$$u \cdot 3v$$

→ Multiply vector  $v$  by 3 to get the vector with components 9 and 15.

→ Take the dot product with  $u$ : 2 times 9 equals 18 and negative 1 times 15 equals negative 15.

→ Add the products: 18 plus negative 15 equals 3.

**Answer:** 3

---

7. Let  $u=(2,1)$ ,  $v=(1,3)$ , and  $w=(4,-2)$ . Find  $(u \cdot v)w$ .

$$(u \cdot v)w$$

→ Find  $u \cdot v$ : 2 times 1 equals 2 and 1 times 3 equals 3, so  $u \cdot v$  equals 5.

→ Multiply the scalar 5 by  $w$ : 5 times 4 equals 20 and 5 times negative 2 equals negative 10.

→ The result is the vector with components 20 and negative 10.

**Answer:** (20, -10)

---

8. Find the dot product of the vectors.

$$(0,9) \cdot (7,-4)$$

→ Multiply the first components: 0 times 7 equals 0.

→ Multiply the second components: 9 times negative 4 equals negative 36.

→ Add the products: 0 plus negative 36 equals negative 36.

**Answer:** -36

---

9. Let  $u=(5,-2)$  and  $v=(-1,4)$ . Find  $(2u) \cdot v$ .

$$(2u) \cdot v$$

→ Multiply vector  $u$  by 2 to get the vector with components 10 and negative 4.

→ Take the dot product with  $v$ : 10 times negative 1 equals negative 10 and negative 4 times 4 equals negative 16.

→ Add the products: negative 10 plus negative 16 equals negative 26.

**Answer:** -26

---

10. Let  $u=(3,2)$ ,  $v=(2,-1)$ , and  $w=(1,4)$ . Find  $(u \cdot v)w$ .

$$(u \cdot v)w$$

→ Find  $u \cdot v$ : 3 times 2 equals 6 and 2 times negative 1 equals negative 2, so  $u \cdot v$  equals 4.

→ Multiply the scalar 4 by  $w$ : 4 times 1 equals 4 and 4 times 4 equals 16.

→ The result is the vector with components 4 and 16.

**Answer:** (4, 16)

