

To find the dot product (also known as the scalar product) of two vectors B_1 and B_2 , we multiply their corresponding component coefficients along the three orthogonal spatial axes (i, j, k) and then sum those resulting products together. The dot product uniquely takes two vector inputs and maps them directly to a single real number scalar value, effectively removing all directional unit vectors from the final expression.

Using the vectors given in the problem statement:

$$B_1 = 3i - 3j + 7k$$

$$B_2 = 9i - 3j - 4k$$

We isolate the scalar coefficients for each directional axis and execute the calculation:

$$B_1 \cdot B_2 = (B_{1i} \cdot B_{2i}) + (B_{1j} \cdot B_{2j}) + (B_{1k} \cdot B_{2k})$$

$$B_1 \cdot B_2 = (3)(9) + (-3)(3) + (7)(-4)$$

$$B_1 \cdot B_2 = 27 + (-9) + (-28)$$

$$B_1 \cdot B_2 = 27 - 9 - 28 = -10$$

CALCULATOR TIPS:

Vector analysis problems are heavily featured in the mathematics and engineering mechanics portions of board exams. When dealing with multiple negative signs under time limits, skip manual multiplication to completely avoid sign errors. Use your calculator's dedicated internal vector registers instead:

The Vector Mode Calculator Shortcut (Casio fx-991ES Plus / ClassWiz)

Your scientific calculator can natively store vectors and execute a flawless dot product instantly.

1. **Enter Vector Mode:** Press **MODE 8** on the Casio fx-991ES Plus (or navigate to the Vector icon in the **MENU** on the fx-991EX ClassWiz).
2. **Define Vector A (B_1):** Press **1: VctA**, select **1** for 3 dimensions, and input the coefficients: **3, -3, 7**.
3. **Define Vector B (B_2):** Press **SHIFT 5 1 (Dim) → 2: VctB**, select **1** for 3 dimensions, and input the coefficients: **9, 3, -4**.
4. **Clear the Screen:** Hit the **AC** key. Your components are safely locked inside the system registers.
5. **Call the Command:** * Fetch Vector A: Press **SHIFT 5 3 (VctA)**.
 - **Insert the Dot Product Dot:** Press **SHIFT 5 7** (This calls the specialized internal dot function command string. *Do not use the standard x button*).
 - Fetch Vector B: Press **SHIFT 5 4 (VctB)**.
6. Your calculator screen will display: **VctA·VctB**. Press **=**, and the screen will show **-10**.