

MathQuest: Linear Algebra

Dot Products

1. What is the dot product of $\begin{bmatrix} 0 \\ 1 \\ -1 \end{bmatrix}$ and $\begin{bmatrix} 4 \\ 2 \\ -3 \end{bmatrix}$?

(a) $\begin{bmatrix} 0 \\ 2 \\ 3 \end{bmatrix}$

(b) 5

(c) 0

(d) The dot product cannot be computed for these vectors.

2. What is the dot product of $\begin{bmatrix} 0 \\ 1 \\ -2 \end{bmatrix}$ and $\begin{bmatrix} 4 \\ 0 \\ 0 \end{bmatrix}$?

(a) $\begin{bmatrix} 4 \\ 1 \\ -2 \end{bmatrix}$

(b) -4

(c) 0

(d) The dot product cannot be computed for these vectors.

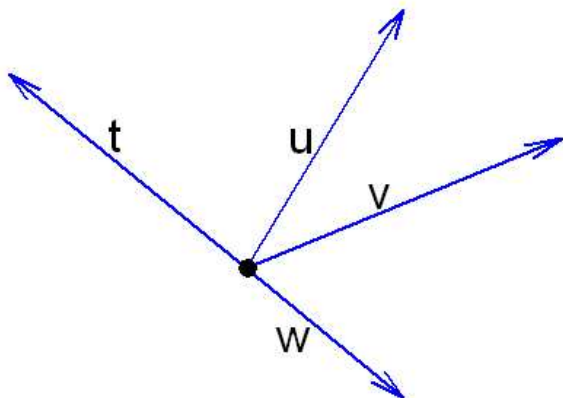
3. What can we say about two vectors whose dot product is negative?

(a) The vectors are orthogonal.

(b) The angle between the two vectors is less than 90° .

(c) The angle between the two vectors is greater than 90° .

4. Rank the dot products $u \cdot v$, $u \cdot t$ and $u \cdot w$.



- (a) $u \cdot v > u \cdot w > u \cdot t$
- (b) $u \cdot v > u \cdot t > u \cdot w$
- (c) $u \cdot w > u \cdot t > u \cdot v$
- (d) $u \cdot w > u \cdot v > u \cdot t$

5. **True or False** If x and y are $n \times 1$ vectors, then $x^T y = y^T x$.
6. **True or False** If x and y are $n \times 1$ vectors, then xy^T is an $n \times n$ matrix.
7. **True or False** If x and y are $n \times 1$ vectors, then $xy^T = yx^T$.
8. **True or False** If x and y are $n \times 1$ nonzero vectors, then xy^T is an $n \times n$ matrix with rank 1.
9. If A and B are matrices which can be multiplied, then the (i, j) -entry of AB is
 - (a) [the i^{th} row of A] \cdot [the j^{th} column of B]
 - (b) [the i^{th} column of A] \cdot [the j^{th} row of B]
 - (c) None of the above