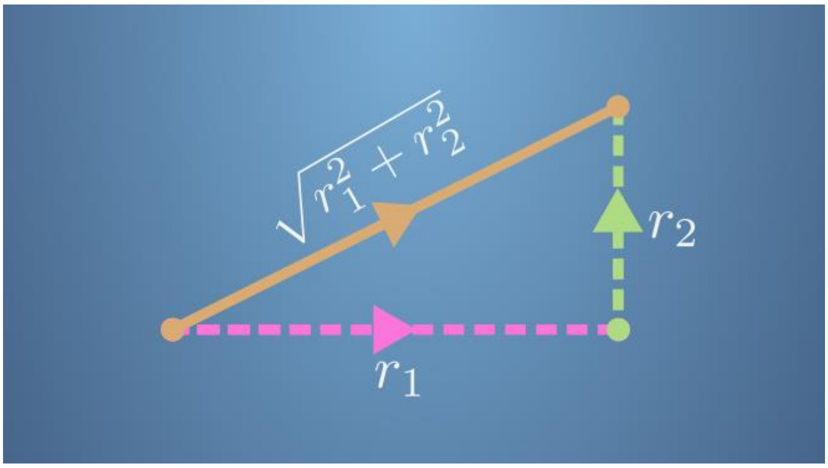
Dot product of vectors

TOTAL POINTS 6

1.Question 1

As we have seen in the lecture videos, the dot product of vectors has a lot of applications. Here, you will complete some exercises involving the dot product.

We have seen that the size of a vector with two components is calculated using Pythagoras' theorem, for example the following diagram shows how we calculate the size of the orange vector $\mathbf{r}=[r_1\ r_2]$:



In fact, this definition can be extended to any number of dimensions; the size of a vector is the square root of the sum of the squares of its components. Using this information, what is the size of the vector

s=⎣⎢⎢⎢⎡1342⎦⎥⎥⎥⎤?

- |**s**|=sqrt(10)
- |**s**|=30
- |**s**|=10
- (selected) |**s**|=sqrt(30)

1 / 1 point

2.Question 2

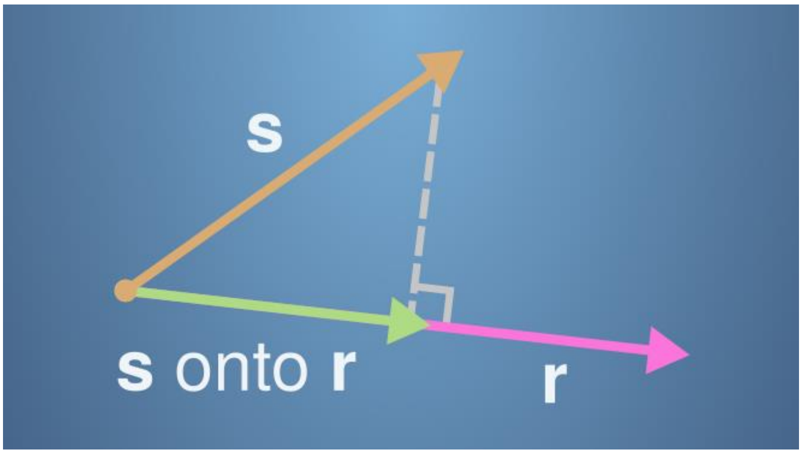
Remember the definition of the dot product from the videos. For two n component vectors, $\mathbf{a}\cdot\mathbf{b}=a_1b_1+a_2b_2+\cdots+a_nb_n$.What is the dot product of the vectors r=⎣⎢⎢⎢⎡−5328⎦⎥⎥⎥⎤ and s=⎣⎢⎢⎢⎡12−10⎦⎥⎥⎥⎤?

- r·s=⎣⎢⎢⎢⎡−56 −20⎦⎥⎥⎥⎤
- r·s=1
- ◉ r·s=−1
- r·s=⎣⎢⎢⎢⎡−4519⎦⎥⎥⎥⎤

1 / 1 point

3.Question 3

The lectures introduced the idea of projecting one vector onto another. The following diagram shows the projection of s onto r when the vectors are in two dimensions:



Remember that the scalar projection is the *size* of the green vector. If the angle betweens and r is greater than $\pi/2$, the projection will also have a minus sign.

We can do projection in any number of dimensions. Consider two vectors with three components, r=⎣⎢⎡3−40⎦⎥⎤ and s=⎣⎢⎡105−6⎦⎥⎤.

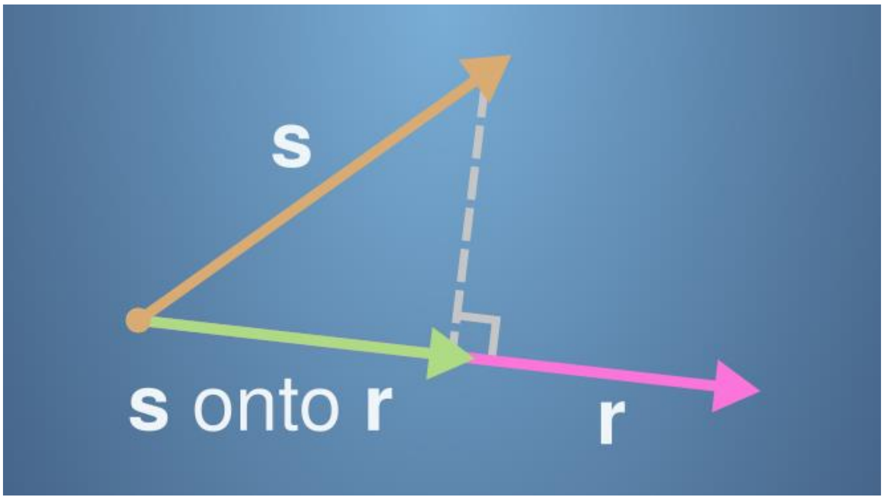
What is the scalar projection of s onto r?

- ◉ 2
- -1/2
- -2
- 1/2

1 / 1 point

4.Question 4

Remember that in the projection diagram, the vector projection *is* the green vector:



Let $r=\begin{bmatrix}3\\-4\\0\end{bmatrix}$ and let $s=\begin{bmatrix}10\\5\\-6\end{bmatrix}$.

What is the vector projection of s onto r?

- (•) $\begin{bmatrix}6/5\\-8/5\\0\end{bmatrix}$
- ( ) $\begin{bmatrix}30\\-20\\0\end{bmatrix}$
- ( ) $\begin{bmatrix}6\\-8\\0\end{bmatrix}$
- ( ) $\begin{bmatrix}6\\4\\0\end{bmatrix}$

1 / 1 point

5.Question 5

Let $a=\begin{bmatrix}3\\0\\4\end{bmatrix}$ and $b=\begin{bmatrix}0\\5\\12\end{bmatrix}$.

Which is larger, $|a+b|$ or $|a|+|b|$?

- (•) $|a+b|<|a|+|b|$
- ( ) $|a+b|=|a|+|b|$
- ( ) $|a+b|>|a|+|b|$

1 / 1 point

6.Question 6

Which of the following statements about dot products are correct?

- [x] We can find the angle between two vectors using the dot product.
- [x] The size of a vector is equal to the square root of the dot product of the vector with itself.
- [x] The vector projection of **s** onto **r** is equal to the scalar projection of **s** onto **r** multiplied by a vector of unit length that points in the same direction as **r**.
- [ ] The scalar projection of **s** onto **r** is always the same as the scalar projection of **r** onto **s**.
- [ ] The order of vectors in the dot product is important, so that **s·r ≠ r·s**