

## Question 1

What is the size of vector  $s = \begin{bmatrix} 1 \\ 3 \\ 4 \\ 2 \end{bmatrix}$  ?

## Answer

To calculate the size of a vector

$$|\vec{X}| = \sqrt{X_1^2 + X_2^2 + \dots + X_n^2}$$

So we now fill in the values

$$|\vec{s}| = \sqrt{1^2 + 3^2 + 4^2 + 2^2}$$

$$\boxed{|\vec{s}| = \sqrt{30}}$$

## Question 2

What is the dot product of the vectors  $r = \begin{bmatrix} -5 \\ 3 \\ 2 \\ 8 \end{bmatrix}$  and  $s = \begin{bmatrix} 1 \\ 2 \\ -1 \\ 0 \end{bmatrix}$  ?

## Answer

To get the dot product we multiply the vectors and add

$$\vec{r} \cdot \vec{s} = \begin{bmatrix} -5 \\ 6 \\ -2 \\ 0 \end{bmatrix}$$

$$\boxed{\vec{r} \cdot \vec{s} = -1}$$

### Question 3

Consider two vectors with three components,  $r = \begin{bmatrix} 3 \\ -4 \\ 0 \end{bmatrix}$

and  $s = \begin{bmatrix} 10 \\ 5 \\ -6 \end{bmatrix}$ .

What is the scalar projection of  $s$  onto  $r$ ?

**Answer**

$$\text{scalar projection} = \frac{r \cdot s}{|r|}$$

$$\boxed{\text{scalar projection} = 2}$$

### Question 4

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

What is the vector projection of  $s$  onto  $r$ ?

**Answer**

$$\text{vector projection} = r * \frac{r \cdot s}{|r|^2}$$

$$\boxed{\text{vector projection} = \begin{bmatrix} 6/5 \\ -8/5 \\ 0 \end{bmatrix}}$$