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
$$\left|\vec{X}\right| = \sqrt{X_1{}^2 + X_2{}^2 + \ldots + X_n{}^2}$$

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

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

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

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

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

$$\boxed{vectorprojection = \begin{bmatrix} 6/5 \\ -8/5 \\ 0 \end{bmatrix}}$$