

Chem. 540  
Instructor: Nancy Makri

### Math Problem 8

Consider the vectors

$$\mathbf{s} = \begin{pmatrix} 4 \\ -2 \\ 3 \end{pmatrix}, \quad \mathbf{v} = \begin{pmatrix} 1 \\ 3 \\ -1 \end{pmatrix}, \quad \mathbf{w} = \begin{pmatrix} -1 \\ 8 \\ a \end{pmatrix}$$

where  $a$  is a real valued parameter.

- Calculate the norm (length) of the first two vectors.
- Calculate the dot products  $\mathbf{s}^T \cdot \mathbf{v}$ ,  $\mathbf{v}^T \cdot \mathbf{s}$ ,  $\mathbf{s}^T \cdot \mathbf{w}$ ,  $\mathbf{w}^T \cdot \mathbf{s}$ .
- Determine the value of  $a$  that makes  $\mathbf{w}$  orthogonal to  $\mathbf{s}$ .
- Calculate the products  $\mathbf{s} \cdot \mathbf{v}^T$ ,  $\mathbf{v} \cdot \mathbf{s}^T$ .