

## Tutorial Sheet 6

1. For the vectors given below, evaluate the following expressions where it is possible.

$$\mathbf{u} = \begin{bmatrix} 1 \\ 2 \\ 3 \end{bmatrix}, \mathbf{v} = \begin{bmatrix} -1 \\ 0 \\ 4 \end{bmatrix}, \mathbf{x} = \begin{bmatrix} 3 \\ 4 \end{bmatrix}, \mathbf{y} = \begin{bmatrix} -4 \\ 3 \end{bmatrix}, \mathbf{w} = \begin{bmatrix} 1 \\ 0 \\ 2 \\ -5 \end{bmatrix}, \mathbf{z} = \begin{bmatrix} 2 \\ 2 \\ 2 \\ 3 \end{bmatrix}$$

- |                                 |   |  |
|---------------------------------|---|--|
| i) $2\mathbf{u} + 3\mathbf{v}$  | vi) $\mathbf{v} + \mathbf{w}$             | xi) $\mathbf{w} \cdot (\mathbf{z} + \mathbf{w})$ |
| ii) $3\mathbf{u} - \mathbf{v}$  | vii) $\mathbf{u} \cdot \mathbf{v}$        | xii) $ \mathbf{x} $                              |
| iii) $\mathbf{x} + 3\mathbf{v}$ | viii) $(2\mathbf{u}) \cdot (3\mathbf{v})$ | xiii) $ \mathbf{w} $                             |
| iv) $2\mathbf{z} - \mathbf{w}$  | ix) $\mathbf{x} \cdot \mathbf{y}$         | xiv) $ \mathbf{y}  +  \mathbf{w} $               |
| v) $\mathbf{u} + \mathbf{x}$    | x) $\mathbf{w} \cdot \mathbf{z}$          |  |

2. Calculate the angles between the pairs  $\mathbf{u}, \mathbf{v}$ ,  $\mathbf{x}, \mathbf{y}$ , and  $\mathbf{w}, \mathbf{z}$  from the previous question. Give your answers in both radians and degrees.

3. For the matrices below, evaluate the following expressions where it is possible.

$$A = \begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix}, B = \begin{bmatrix} -2 & 0 \\ 1 & -7 \end{bmatrix}, C = \begin{bmatrix} 3 & 2 & -2 \\ 4 & 8 & 2 \end{bmatrix}, D = \begin{bmatrix} 3 & 2 & -2 \\ 4 & 8 & 2 \end{bmatrix},$$

$$E = \begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 7 & 8 & 9 \end{bmatrix}, F = \begin{bmatrix} -1 & 0 & 2 \\ 3 & 4 & 1 \\ 3 & 1 & 0 \end{bmatrix},$$

$$G = \begin{bmatrix} 3 & 4 \\ 1 & 2 \\ 2 & -1 \end{bmatrix}, H = \begin{bmatrix} 3 & 4 & 3 \\ 1 & 2 & 2 \end{bmatrix}, I = \begin{bmatrix} 2 & 2 & 1 \end{bmatrix},$$

$$J = \begin{bmatrix} 3 \\ 1 \\ 1 \end{bmatrix}, K = \begin{bmatrix} 2 & 1 & 3 \\ 1 & 2 & 2 \\ 2 & 1 & 0 \end{bmatrix},$$

- |                     |                                   |                                   |
|---------------------|-----------------------------------|-----------------------------------|
| i) $2A + 3B$        | vi) $A\mathbf{x}$                 | xi) $C\mathbf{w}$                 |
| ii) $3C - D$        | vii) $B\mathbf{x}$                | xii) $E\mathbf{u}$                |
| iii) $8A + 4C$      | viii) $A\mathbf{y} + B\mathbf{x}$ | xiii) $E\mathbf{w} - F\mathbf{w}$ |
| iv) $2000A + 3000B$ | ix) $A\mathbf{u}$                 |                                   |
| v) $E - F$          | x) $C\mathbf{x}$                  |                                   |