

## *Matrices*

The matrices **A**, **B**, and **C** in questions 1-3 are

$$\mathbf{A} = \begin{pmatrix} 2 & 3 \\ 4 & 6 \end{pmatrix} \quad \mathbf{B} = \begin{pmatrix} 2 & -1 \\ 5 & 4 \end{pmatrix} \quad \mathbf{C} = \begin{pmatrix} -4 & 2 \\ 0 & 1 \end{pmatrix}$$

1. Find the matrices given by (a)  $3\mathbf{A}$  (b)  $\mathbf{A} + \mathbf{B}$  (c)  $3\mathbf{B} - 2\mathbf{C}$ .

2. If the vector  $\mathbf{r}_0 = \begin{pmatrix} 3 \\ 4 \end{pmatrix}$ ,

find (a)  $\mathbf{r}_1 = \mathbf{A}\mathbf{r}_0$  (b)  $\mathbf{r}_2 = \mathbf{B}\mathbf{r}_0$  (c)  $\mathbf{r}_3 = \mathbf{r}_1 + \mathbf{r}_2$  (d)  $\mathbf{r}_4 = (\mathbf{A} + \mathbf{B})\mathbf{r}_0$

Think about the answers to parts (c) and (d).

3. Find the matrices

(a)  $\mathbf{AB}$  (b)  $\mathbf{BC}$  (c)  $\mathbf{CB}$  (d)  $\mathbf{AC}$  (e)  $(\mathbf{AB})\mathbf{C}$  (f)  $\mathbf{A}(\mathbf{BC})$  (g)  $(\mathbf{A} + \mathbf{B})\mathbf{C}$  (h)  $\mathbf{AC} + \mathbf{BC}$

4. If  $\mathbf{D} = \begin{pmatrix} 2 & 3 & 1 & -4 \\ 2 & 1 & 0 & 5 \end{pmatrix}$   $\mathbf{E} = \begin{pmatrix} 2 & 4 \\ 1 & -1 \\ 3 & -1 \end{pmatrix}$   $\mathbf{F} = \begin{pmatrix} 2 & 1 & 3 \\ 4 & -1 & -2 \\ -1 & 0 & 1 \end{pmatrix}$ , either calculate or discard

as meaningless all six products of two of the matrices.

5. Find the inverse of  $\begin{pmatrix} 9 & 6 \\ 5 & 3 \end{pmatrix}$ . No sophistication is needed; just slog it out!

6. Find the vector resulting from the counter-clockwise rotation of  $\mathbf{r}_0$  in question 2 by  $60^\circ$ .