Section 1: Introduction to matrices

Section test

1. What is the order of the matrix $\begin{pmatrix} 3 & 8 & 6 & 2 & 0 \\ -2 & 4 & -1 & 0 & 2 \\ 3 & 0 & 0 & 2 & -4 \end{pmatrix}$?

2. **A** is the matrix $\begin{pmatrix} -1 & 2 \\ 1 & 3 \end{pmatrix}$ and **B** is the matrix $\begin{pmatrix} 2 & 4 \\ 0 & -1 \end{pmatrix}$.

   Find:
   (i) $\mathbf{A} + \mathbf{B}$
   (ii) $\mathbf{A} - \mathbf{B}$
   (iii) $3\mathbf{A} - 2\mathbf{B}$

In the following questions,

A is the matrix $\begin{pmatrix} 2 & 3 \\ 1 & 3 \end{pmatrix}$ **B** is the matrix $\begin{pmatrix} 2 & 3 \\ 4 & 6 \\ 1 & 2 \end{pmatrix}$

C is the matrix $\begin{pmatrix} -1 & 0 & 4 \\ 3 & 1 & -2 \end{pmatrix}$ **D** is the matrix $\begin{pmatrix} 3 & 0 & 4 \\ -2 & 1 & 0 \\ 2 & 3 & -1 \end{pmatrix}$

3. **BA** is the matrix

(a) $\begin{pmatrix} 7 & 15 \\ 14 & 30 \\ 4 & 9 \end{pmatrix}$ (b) $\begin{pmatrix} 7 & 14 & 4 \\ 15 & 30 & 9 \end{pmatrix}$

(c) $\begin{pmatrix} 16 & 24 \\ 14 & 21 \end{pmatrix}$ (d) Not defined

4. **AB** is the matrix

(a) $\begin{pmatrix} 7 & 15 \\ 14 & 30 \\ 4 & 9 \end{pmatrix}$ (b) $\begin{pmatrix} 7 & 14 & 4 \\ 15 & 30 & 9 \end{pmatrix}$

(c) $\begin{pmatrix} 16 & 24 \\ 14 & 21 \end{pmatrix}$ (d) Not defined

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5. **CB** is the matrix

(a) $\begin{pmatrix} 7 & 3 & 14 \\ 14 & 6 & 28 \end{pmatrix}$

(b) $\begin{pmatrix} 7 & 3 & 14 \\ 14 & 6 & 28 \\ 5 & 2 & 8 \end{pmatrix}$

(c) $\begin{pmatrix} 2 & 5 \\ 8 & 11 \end{pmatrix}$

(d) Not defined

(e) I don't know

6. **CD** is the matrix

(a) $\begin{pmatrix} 13 & 2 & 2 \\ 1 & -5 & 11 \end{pmatrix}$

(b) $\begin{pmatrix} 5 & 12 & -8 \\ 3 & -5 & 14 \end{pmatrix}$

(c) $\begin{pmatrix} 5 & 3 \\ 12 & -5 \\ -8 & 14 \end{pmatrix}$

(d) $\begin{pmatrix} 13 & 1 \\ 2 & -5 \\ 2 & 11 \end{pmatrix}$

7. **DB** is the matrix

(a) $\begin{pmatrix} 10 & 0 & 15 \\ 17 & 0 & 22 \end{pmatrix}$

(b) $\begin{pmatrix} 0 & 7 & 7 \\ 1 & 12 & 10 \end{pmatrix}$

(c) $\begin{pmatrix} 10 & 17 \\ 0 & 0 \\ 15 & 22 \end{pmatrix}$

(d) $\begin{pmatrix} 0 & 1 \\ 7 & 12 \\ 7 & 10 \end{pmatrix}$

8. **A** is a 2×2 matrix, **B** is a 2×3 matrix and **C** is a 3×2 matrix.
Which of the following calculations are possible?
   (i) **BC** + **A**
   (ii) **CA** + **B**

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Solutions to section test

1. The matrix has 3 rows and 5 columns, so it is a 3 × 5 matrix.

2. $\mathbf{A}+\mathbf{B}=\begin{pmatrix}-1 & 2\\ 1 & 3\end{pmatrix}+\begin{pmatrix}2 & 4\\ 0 & -1\end{pmatrix}=\begin{pmatrix}-1+2 & 2+4\\ 1+0 & 3+-1\end{pmatrix}=\begin{pmatrix}1 & 6\\ 1 & 2\end{pmatrix}$

$\mathbf{A}-\mathbf{B}=\begin{pmatrix}-1 & 2\\ 1 & 3\end{pmatrix}-\begin{pmatrix}2 & 4\\ 0 & -1\end{pmatrix}=\begin{pmatrix}-1-2 & 2-4\\ 1-0 & 3-(-1)\end{pmatrix}=\begin{pmatrix}-3 & -2\\ 1 & 4\end{pmatrix}$

$$\begin{aligned}3\mathbf{A}-2\mathbf{B}&=3\begin{pmatrix}-1 & 2\\ 1 & 3\end{pmatrix}-2\begin{pmatrix}2 & 4\\ 0 & -1\end{pmatrix}\\ &=\begin{pmatrix}-3 & 6\\ 3 & 9\end{pmatrix}-\begin{pmatrix}4 & 8\\ 0 & -2\end{pmatrix}\\ &=\begin{pmatrix}-7 & -2\\ 3 & 11\end{pmatrix}\end{aligned}$$

3. $\mathbf{BA}=\begin{pmatrix}2 & 3\\ 4 & 6\\ 1 & 2\end{pmatrix}\begin{pmatrix}2 & 3\\ 1 & 3\end{pmatrix}=\begin{pmatrix}7 & 15\\ 14 & 30\\ 4 & 9\end{pmatrix}$

4. A is a 2 × 2 matrix, and B is a 3 × 2 matrix, so AB is not defined.

5. $\mathbf{CB}=\begin{pmatrix}-1 & 0 & 4\\ 3 & 1 & -2\end{pmatrix}\begin{pmatrix}2 & 3\\ 4 & 6\\ 1 & 2\end{pmatrix}=\begin{pmatrix}2 & 5\\ 8 & 11\end{pmatrix}$

6. $\mathbf{CD}=\begin{pmatrix}-1 & 0 & 4\\ 3 & 1 & -2\end{pmatrix}\begin{pmatrix}3 & 0 & 4\\ -2 & 1 & 0\\ 2 & 3 & -1\end{pmatrix}=\begin{pmatrix}5 & 12 & -8\\ 3 & -5 & 14\end{pmatrix}$

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7. $DB = \begin{pmatrix} 3 & 0 & 4 \\ -2 & 1 & 0 \\ 2 & 3 & -1 \end{pmatrix}\begin{pmatrix} 2 & 3 \\ 4 & 6 \\ 1 & 2 \end{pmatrix} = \begin{pmatrix} 10 & 17 \\ 0 & 0 \\ 15 & 22 \end{pmatrix}$

8. (i) B is a 2 × 3 matrix and C is a 3 × 2 matrix, so BC exists and is a 2 × 2 matrix. A is also a 2 × 2 matrix, so A can be added to BC.

(ii) C is a 3 × 2 matrix, and A is a 2 × 2 matrix, so CA exists and is a 3 × 2 matrix. B is a 2 × 3 matrix, so B cannot be added to CA.

Only calculation (i) is possible.