3. <u>Matrix Multiplication</u>

Examples

1. $\begin{pmatrix} 2 & -4 \\ 3 & 8 \end{pmatrix} \begin{pmatrix} 4 \\ 6 \end{pmatrix} =$

2.

$$\begin{bmatrix} 1 & 0 & 3 & -2 \\ 2 & 8 & 4 & 3 \\ 7 & -1 & 0 & 2 \end{bmatrix} \begin{bmatrix} 5 & 1 \\ 1 & 7 \\ 0 & 3 \\ 8 & -3 \end{bmatrix} = \begin{bmatrix} \quad & \quad \\ \quad & \quad \\ \quad & \quad \end{bmatrix}$$

Matrix Multiplication Involving I:

Test Your Understanding

1. $\begin{pmatrix}1 & 2\\3 & 4\end{pmatrix}\begin{pmatrix}3\\-1\end{pmatrix}$

2. $\begin{pmatrix}1 & 2\\3 & 4\end{pmatrix}\begin{pmatrix}2 & 0 & -1\\3 & 2 & 1\end{pmatrix}$

3. $\begin{pmatrix}1 & 2\\3 & 4\end{pmatrix}^2$

4. $\begin{pmatrix}1 & a\\0 & 1\end{pmatrix}^k$

5. $\begin{pmatrix}1 & 2 & 3\end{pmatrix}\begin{pmatrix}1\\2\\3\end{pmatrix}$

6. $\begin{pmatrix}1\\2\\3\end{pmatrix}\begin{pmatrix}1 & 2 & 3\end{pmatrix}$

Matrices Grid Activity

When is Matrix Multiplication Valid?

Matrix multiplications are not always valid: the dimensions have to agree.

- For two matrices A and B, the matrix multiplication AB is valid provided A has the same number of columns as B has rows.
- If we multiply an n x m matrix by an m x k matrix we generate an n x k matrix.
- Note that only **square matrices** (i.e. same width as height) can be raised to a power.

Properties of Matrix Operations

Properties of Addition

The basic properties of addition for real numbers also hold true for matrices.

Let A, B and C be m x n matrices

A + B = B + A commutative

A + (B + C) = (A + B) + C associative

Properties of Multiplication

Let A, B and C be matrices of dimensions such that the following are defined. Then

A(BC) = (AB)C associative

A(B + C) = AB + AC distributive

(A + B)C = AC + BC distributive

But AB =/= BA non - commutative

Ex 6B pg 101