

4 Matrices – Part 2

Name: _____ Class: _____ Date: _____

Vocabulary 词汇

Write each word three times. 把每个单词抄写三遍。

English	中文	Write it 3 times (English)
matrix	矩阵	_____
determinant	行列式	_____
linear transformation	线性变换	_____

Recall

You may have seen numbers arranged in a grid (a table). A matrix is exactly that:

- A **matrix** is a rectangular grid of numbers.
- Matrices are used to store data and to move shapes around.

Each idea has a worked example before the Practice.

New ideas

■ 1 What a matrix is

A **matrix** 矩阵 is a rectangular grid of numbers, for example $\begin{bmatrix} 3 & 1 \\ 2 & 4 \end{bmatrix}$ (2 rows, 2 columns).

■ 2 The determinant

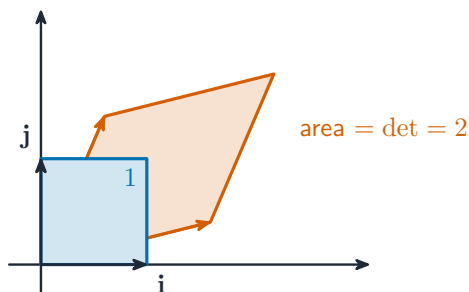
For a 2×2 matrix $\begin{bmatrix} a & b \\ c & d \end{bmatrix}$, the **determinant** 行列式 is

$$ad - bc.$$

Worked example. For $\begin{bmatrix} 3 & 1 \\ 2 & 4 \end{bmatrix}$, the determinant is $(3)(4) - (1)(2) = 12 - 2 = 10$.

■ 3 Matrices move the plane

A 2×2 matrix acts as a **linear transformation** 线性变换 of the plane – it can stretch, rotate, or reflect points.



■ 4 The determinant as area

The determinant tells you how much the transformation scales area. For example $\begin{bmatrix} 2 & 0 \\ 0 & 3 \end{bmatrix}$ stretches by 2 across and 3 up, so it multiplies every area by $2 \times 3 = 6$ – exactly its determinant.

Watch out: the determinant $ad - bc$ subtracts the off-diagonal product bc . A common slip is to compute $ad - bc$ as $ad + bc$ – remember the minus sign.

Practice

Try these in order. The methods are all above.

2.1 State what a matrix is. [1]

2.2 Find the determinant of $\begin{bmatrix} 4 & 2 \\ 1 & 3 \end{bmatrix}$. [2]

2.3 Find the determinant of $\begin{bmatrix} 5 & 0 \\ 0 & 2 \end{bmatrix}$. [2]

2.4 State by what factor the matrix in 2.3 scales area. [1]

2.5 Find the determinant of $\begin{bmatrix} 3 & 4 \\ 2 & 1 \end{bmatrix}$. [2]