Why Are We Studying Matrices?

Matrices have plenty of uses in Computer Science. E.g.:

- Representation . . .
  - . . . of the graph data structure (see CSc 345)
  - . . . of functions and relations (see Topics 8 and 9)
- Affine transformations in Computer Graphics
Matrix Fundamentals (1 / 3)

**Definition: Matrix**

Notation:

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**Definition: Square Matrices**

**Definition: Matrix Equality**
Matrix Fundamentals (3 / 3)

Definition: Transposition

Definition: Matrix Symmetry

Example(s):

Matrix Operations (1 / 5)

1. Matrix Addition

Definition: Matrix Addition (a.k.a. Matrix Sum)

Example(s):
2. Scalar Multiplication

**Definition: Scalar**

**Definition: Scalar Multiplication**

**Example(s):**

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3. Matrix Multiplication

**Definition: Matrix Multiplication (a.k.a. Matrix Product)**

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Identity Matrices

Remember the concept of Multiplicative Identity?

Definition: Identity Matrices

Matrix Powers

Definition: $n^{th}$ Matrix Power

Example(s):
Example: Affine Transformations (1 / 3)

Used to ‘move’ objects in computer graphics.

Background:

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Example: Affine Transformations (2 / 3)

Task:

\[
\begin{bmatrix}
0 & 2 & 4 \\
2 & 4 & \end{bmatrix} \Rightarrow
\begin{bmatrix}
0 & 2 & 4 \\
2 & 4 & \end{bmatrix}
\]
Zero-One Matrices (1 / 3)

Three Operations:
1. ‘Join’:
2. ‘Meet’:

Example(s):
3. Logical Matrix Product (a.k.a. Boolean Product):

Example(s):

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**Definition:** $r^{th}$ Logical Matrix Power (a.k.a. Boolean Power)