the matrix

- A matrix is a table of numbers rather than a list as is the case for vectors
- The size of a matrix: number of rows $\times$ number of columns $= m \times n$ (read "m *by n*")
- You can think of vectors as matrices that happen to only have one column or one row

$$A = \begin{bmatrix} a_{11} & a_{12} & \cdots & a_{1n} \\ a_{21} & a_{22} & \cdots & a_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ a_{m1} & a_{m2} & \cdots & a_{mn} \end{bmatrix}$$

- A square matrix is a matrix that has an equal number of columns and rows, i.e.,$m = n$
- A zero matrix is a square matrix in which all elements are 0

the matrix

- A diagonal matrix is a square matrix with non-zero elements only on the main diagonal
- An identity matrix is a diagonal matrix in which all elements on the main diagonal are 1:

$$D_{n\times n} = \begin{bmatrix} a_{11} & 0 & 0 & 0 \\ 0 & a_{22} & 0 & 0 \\ 0 & 0 & a_{33} & 0 \\ 0 & 0 & 0 & a_{44} \end{bmatrix} \qquad I_{n\times n} = \begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

- The identity matrix is special because, when multiplied by another matrix, it produces the original matrix back again (we'll return to this later after covering matrix multiplication)
- A lower triangular matrix has non-zero elements only on or below the main diagonal
- An upper triangular matrix has non-zero elements only on or above the main diagonal
- A symmetric matrix is a square matrix with elements symmetric such that $a_{ij} = a_{ji}$