Matrices

Summary

1. Matrices are 2 or more vectors in the coordinate plane.

A **matrix** is a rectangular array of numbers. It can be composed of vectors (or possibly scalars).

When listing the dimensions of a matrix, we note the number of rows, followed by the number of columns.

Matrix A below has 3 rows and 4 columns, and has dimensions 3 by 4.

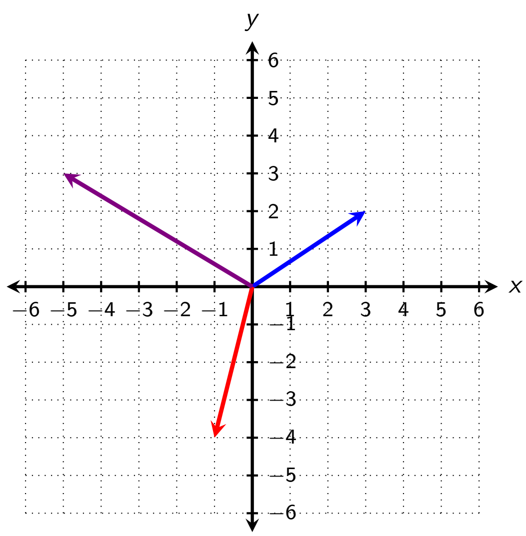
$$A = \begin{bmatrix} 8 & 6 & 7 & 5 \\ 3 & 0 & 9 & -2 \\ 0 & 1 & -10 & 7 \end{bmatrix}$$

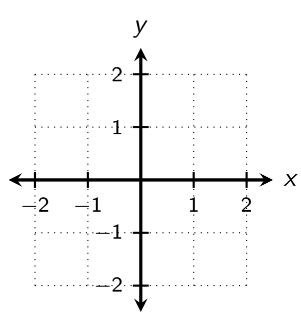
Each of the values in a matrix are called **elements**. In matrix A, the element in the 1st row, 2nd column is 6 and is denoted

$$a_{12} = 6$$

We can think of a matrix as several vectors in the coordinate plane.

$$\begin{bmatrix} 3 & -1 & -5 \\ 2 & -4 & 3 \end{bmatrix}$$





Example 1. Graph the matrix $\begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$

Matrix Addition and Subtraction

If two matrices have the same dimensions, then we can add and subtract them.

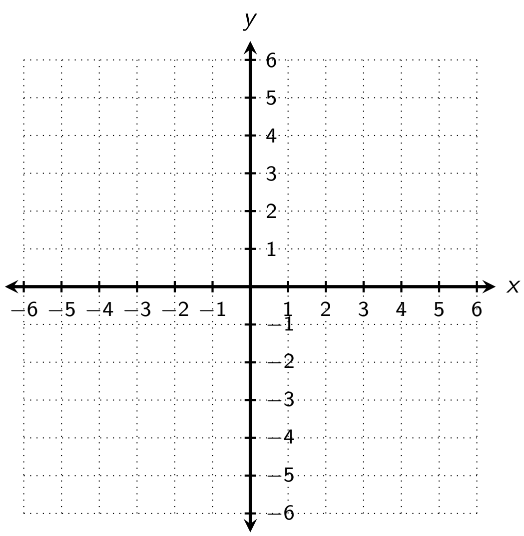
To do this, we add (or subtract) corresponding elements just like vector addition and subtraction.

Example 2. Given matrices

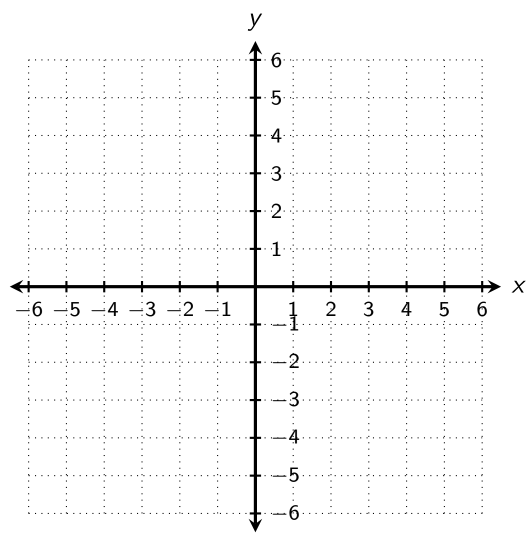
$$A = \begin{bmatrix} -2 & 3 \\ 0 & 4 \end{bmatrix} \quad B = \begin{bmatrix} 4 & -3 \\ -2 & -1 \end{bmatrix} \quad C = \begin{bmatrix} -7 & 6 & -1 \\ 0 & 4 & -4 \end{bmatrix}$$

find each and graph your answers (if possible).

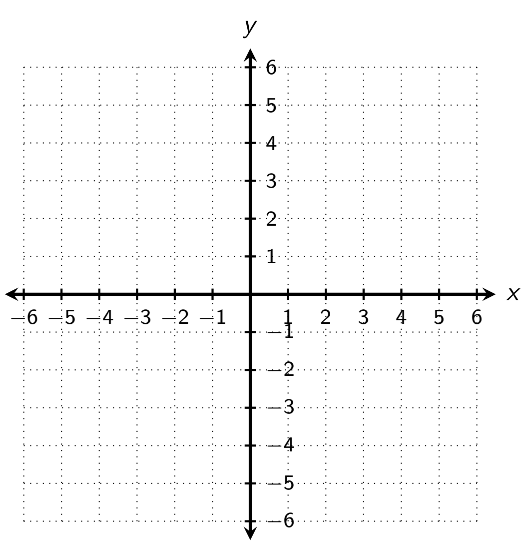
(a) $A + B$



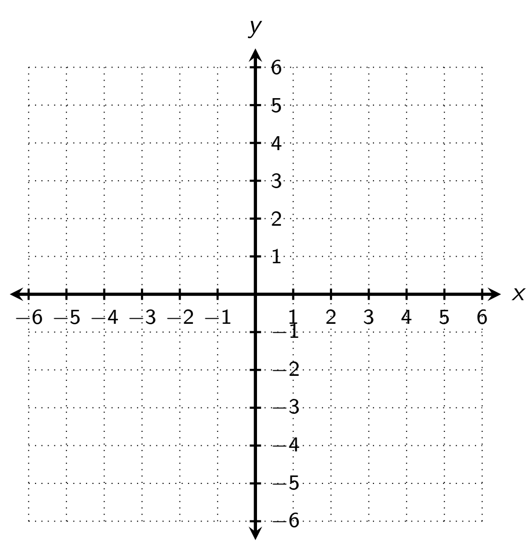
(b) $B + A$



(c) $A - B$



(d) $A + C$



Scalar Multiplication

We saw how scalars affect vectors.

Since a matrix can be thought of as an array of vectors,
multiplying a matrix by a scalar has the same effect that multiplying a vector by a scalar does:

Each element in the matrix gets multiplied by the scalar.

Example 3. Using

$$A = \begin{bmatrix} -2 & 3 \\ 0 & 5 \end{bmatrix} \quad B = \begin{bmatrix} 4 & -3 \\ -2 & -1 \end{bmatrix} \quad C = \begin{bmatrix} -7 & 6 & -1 \\ 0 & 4 & -4 \end{bmatrix}$$

find each.

(a) $5A$

(b) $-1C$

(c) $5A + 2B$