the transpose of a matrix

Let A be an $m \times n$ matrix. The transpose of A, denoted A^T or A', is the $n \times m$ matrix whose columns are the respective rows of A.

- A matrix is symmetric if it doesn't change when you take its transpose

example

If you take the transpose of matrices $A = \begin{bmatrix} 1 & 2 & 3 & 4 \\ 5 & 6 & 7 & 8 \\ 9 & 10 & 11 & 12 \end{bmatrix}$ and $B = \begin{bmatrix} 1 & 2 & 3 \\ 2 & 4 & 5 \\ 3 & 5 & 6 \end{bmatrix}$

we get $A^T = \begin{bmatrix} 1 & 5 & 9 \\ 2 & 6 & 10 \\ 3 & 7 & 11 \\ 4 & 8 & 12 \end{bmatrix}$ and $B^T = \begin{bmatrix} 1 & 2 & 3 \\ 2 & 4 & 5 \\ 3 & 5 & 6 \end{bmatrix}$.

Note: matrix B is thus symmetric.

matrix arithmetic: addition and subtraction

Let A and B be $m \times n$ matrices. The sum of A and B, denoted $A + B$, is

$$\begin{bmatrix} a_{11} + b_{11} & a_{12} + b_{12} & \cdots & a_{1n} + b_{1n} \\ a_{21} + b_{22} & a_{22} + b_{23} & \cdots & a_{2n} + b_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ a_{m1} + b_{m1} & a_{m2} + b_{m2} & \cdots & a_{mn} + b_{mn} \end{bmatrix}$$

exercise 1

Let $A = \begin{bmatrix} 2 & -1 \\ 3 & 6 \end{bmatrix}$.

Find the matrix X such that $2A + 3X = -4A$