# linear algebra

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March 2017

## 1 Matrix and Matrix Operations

1. Suppose A is a 3 by 4 matrix and B is a 4 by 2 matrix. Describe the dimension of AB.

   - 3 by 4
   - 4 by 2
   - 3 by 2
   - 4 by 4
   - undefined

   Answer: AB will be a 3 by 2 matrix

2. Suppose A is a 3 by 4 matrix and B is a 3 by 4 matrix. Describe the dimension of AB.

   - 3 by 4
   - 4 by 2
   - 3 by 2
   - 4 by 4
   - undefined

   Answer: AB is undefined

3. The following is a 5 by 4 matrix $A = \begin{pmatrix} \begin{bmatrix} 5 & 4 & 2 & 1 \\ 0 & 2 & 0 & 1 \\ 7 & 5 & 8 & 2 \\ 4 & 6 & 0 & 0 \\ 8 & 9 & 6 & 5 \end{bmatrix} \end{pmatrix}$ What is the second column of A?

   - $C2 = \begin{pmatrix} \begin{bmatrix} 5 \\ 0 \\ 7 \\ 4 \\ 8 \end{bmatrix} \end{pmatrix}$

- $C2 = \left( \begin{bmatrix} 4 \\ 2 \\ 5 \\ 6 \\ 9 \end{bmatrix} \right)$
- $C2 = \left( \begin{bmatrix} 2 \\ 0 \\ 8 \\ 0 \\ 6 \end{bmatrix} \right)$
- $C2 = \left( \begin{bmatrix} 1 \\ 1 \\ 2 \\ 0 \\ 5 \end{bmatrix} \right)$

Answer: the second column of matrix A is $C2 = \left( \begin{bmatrix} 4 \\ 2 \\ 5 \\ 6 \\ 9 \end{bmatrix} \right)$

4. The following are 2 by 2 matrices

   $A = \left( \begin{bmatrix} 3 & 2 \\ 6 & 1 \end{bmatrix} \right)$ $B = \left( \begin{bmatrix} 7 & 1 \\ 4 & 0 \end{bmatrix} \right)$

   Compute the sum of A + B.

   - $X = \left( \begin{bmatrix} 10 & 3 \\ 10 & 1 \end{bmatrix} \right)$
   - $Y = \left( \begin{bmatrix} 12 \\ 11 \end{bmatrix} \right)$
   - A + B is undefined

   Answer: Matrix X is the sum of A + B. when both matrices is n * n, then its sum must be a n * n matrix as well

5. The following are 2 by 2 matrices

   $A = \left( \begin{bmatrix} 3 & 2 \\ 6 & 1 \end{bmatrix} \right)$ $B = \left( \begin{bmatrix} 7 & 1 \\ 4 & 0 \end{bmatrix} \right)$

   Compute the product of AB.

   - $X = \left( \begin{bmatrix} 21 & 2 \\ 24 & 0 \end{bmatrix} \right)$
   - $Y = \left( \begin{bmatrix} 29 & 3 \\ 46 & 6 \end{bmatrix} \right)$

- $Z = \left( \begin{bmatrix} 10 & 3 \\ 10 & 1 \end{bmatrix} \right)$
- AB is undefined

Answer: matrix Y is the product of AB.

$X = \left( \begin{bmatrix} 3*7+2*4 & 3*1+2*0 \\ 6*7+1*4 & 6*1+1*0 \end{bmatrix} \right) = \left( \begin{bmatrix} 29 & 3 \\ 46 & 6 \end{bmatrix} \right)$

6. Consider the following matrices

$$A = \left( \begin{bmatrix} 5 & 4 & 2 & 1 \\ 0 & 2 & 0 & 1 \\ 7 & 5 & 8 & 2 \\ 4 & 6 & 0 & 0 \\ 8 & 9 & 6 & 5 \end{bmatrix} \right) \quad B = \left( \begin{bmatrix} 12 \\ 11 \end{bmatrix} \right)$$

Compute the product of AB.

- $X = \left( \begin{bmatrix} 3 & 100 \\ 25 & 17 \end{bmatrix} \right)$
- $Y = \left( \begin{bmatrix} 45 & 83 \\ 98 & 77 \end{bmatrix} \right)$
- $Z = \left( \begin{bmatrix} 10 & 34 \\ 11 & 24 \end{bmatrix} \right)$
- AB is undefined

Answer: the product of AB is undefined since you can not multiply a 5 by 4 matrix with a 2 by 1 matrix