Scalar Multiplication

Multiply each entry in the matrix by the given scalar.

Example:

$$A = \begin{bmatrix} 3 & 7 \\ 9 & 10 \end{bmatrix}$$

$$2A = \begin{bmatrix} 2 \cdot 3 & 2 \cdot 7 \\ 2 \cdot 9 & 2 \cdot 10 \end{bmatrix}$$

$$= \begin{bmatrix} 6 & 14 \\ 18 & 20 \end{bmatrix}$$

How to add two matrices

3+4=7

$$\begin{bmatrix} 3 & 8 \\ 4 & 6 \end{bmatrix} + \begin{bmatrix} 4 & 0 \\ 1 & -9 \end{bmatrix} = \begin{bmatrix} 7 & 8 \\ 5 & -3 \end{bmatrix}$$

These are the calculations:

3+4=7	8+0=8
4+1=5	6-9=-3

Matrix Subtraction

$$\begin{bmatrix} -1 & 2 & 0 \\ 4 & 1 & 10 \end{bmatrix} - \begin{bmatrix} 3 & 2 & 4 \\ 0 & 8 & 16 \end{bmatrix} = \begin{bmatrix} -1-3 & 2-2 & 0-4 \\ 4-0 & 1-8 & 10-16 \end{bmatrix}$$

$$= \begin{bmatrix} -4 & 0 & -4 \\ 4 & -7 & -6 \end{bmatrix}$$

final answer

$$\begin{bmatrix} -4 & 3 \\ 1 & 9 \end{bmatrix} + \begin{bmatrix} 5 & 1 & 0 \\ 1 & 2 & 0 \\ 0 & 4 & 1 \end{bmatrix}$$

2 x 2 matrix   **3 x 3 matrix**

The addition is undefined.

You can write as your answer:

undefined

Matrix Multiplication

$$(m \times n) \cdot (n \times k) = (m \times k)$$

product is defined

Here is an example of the product of a $2x3 \; matrix \; and \; a \; 3 \; by \; 2 \; matrix, \; the \; result \; is \; a \; 2x2 \; matrix$

$$\begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \end{bmatrix} \; X \; \begin{bmatrix} 7 & 8 \\ 9 & 10 \\ 11 & 12 \end{bmatrix} = \begin{bmatrix} 58 & \end{bmatrix}$$

(1x7+2x9+3x11)

$$\begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \end{bmatrix} \; X \; \begin{bmatrix} 7 & 8 \\ 9 & 10 \\ 11 & 12 \end{bmatrix} = \begin{bmatrix} 58 & 64 \end{bmatrix}$$

(1x8+2x10+3x12)

$$\begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \end{bmatrix} \; X \; \begin{bmatrix} 7 & 8 \\ 9 & 10 \\ 11 & 12 \end{bmatrix} = \begin{bmatrix} 58 & 64 \\ 139 & \end{bmatrix}$$

(4x7+5x9+6x11)

$$\begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \end{bmatrix} \; \begin{bmatrix} 7 & 8 \\ 9 & 10 \\ 11 & 12 \end{bmatrix} \; \begin{bmatrix} 58 & 64 \\ 139 & 154 \end{bmatrix}$$

(5x8+5x10+6x12)

Here is an example of the product of a $2x2$ $matrix$ $with$ a $2x2$ $matrix, the$ $result$ is a $2x2$ $matrix$

Matrix Multiplication

$$\begin{bmatrix} 3 & 4 \\ 2 & 1 \end{bmatrix} * \begin{bmatrix} 1 & 5 \\ 3 & 7 \end{bmatrix} = \begin{bmatrix} 3 + 12 & 15 + 28 \\ 2 + 3 & 10 + 7 \end{bmatrix}$$

Matrix 1   Matrix 2

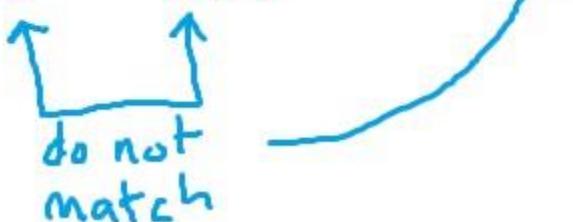$$= \begin{bmatrix} 15 & 43 \\ 5 & 17 \end{bmatrix}$$

Resultant
Matrix

If the "inner" numbers don't match, then the product is undefined.

$$\begin{bmatrix} 5 & 6 & 1 \\ 0 & 5 & 7 \\ 0 & -1 & 2 \end{bmatrix} \begin{bmatrix} -3 & -1 & 0 \\ -2 & 8 & 1 \end{bmatrix} \quad \boxed{\textbf{undefined}}$$

3 x 3   **2 x 3**   answer

do not
match

Use the following matrices to answer all the problems in this section.

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

Perform the indicated operation

1) 3A   2) 5B   3) -2F   4) -4E

5) A + B   6) C + D   7) 2A+3B   8) 2C +6D

9) 3A – 2B   10) 5C – 4D   11) A + C   12) B + D

13) D + E   14) E + F   15) AB   16) BA

17) FA   18) EF   19) CD   20) DC

21) BC   22) AD   23) FE   24) AF