$$A\begin{bmatrix} 8 & 5 \\ -3 & 7 \end{bmatrix} B\begin{bmatrix} 10 & 3 & 9 \\ 17 & -5 & 1 \end{bmatrix} C\begin{bmatrix} 4 & 20 \\ 0 & 2 \\ -1 & 6 \end{bmatrix} D\begin{bmatrix} 7 & 13 & 8 \\ -1 & 4 & 10 \end{bmatrix}$$

- 1. Which matrices can be added? $\mathcal{B} \in \mathcal{D}$
- 2. Which can be subtracted?

In order to add and subtract matrices they must have the same dimensions.

Enter these matrices on the graphing calculator.

$$A\begin{bmatrix} 8 & 5 \\ -3 & 7 \end{bmatrix} B\begin{bmatrix} 10 & 3 & 9 \\ 17 & -5 & 1 \end{bmatrix} C\begin{bmatrix} 4 & 20 \\ 0 & 2 \\ -1 & 6 \end{bmatrix} D\begin{bmatrix} 11 & -4 & -8 \end{bmatrix}$$

4. Experimenting with the graphing calculator find which matrices can be multiplied.

see next page for answers.

5. Write down the ones that can be multiplied, with their dimensions, and the dimensions of the resulting matrix.

3. Is matrix addition and subtraction commutative?

Yes No, unless you change subtraction into adding the opposite.

$$A \begin{bmatrix} 8 & 5 \\ -3 & 7 \end{bmatrix}
B \begin{bmatrix} 10 & 3 & 9 \\ 17 & -5 & 1 \end{bmatrix}
C \begin{bmatrix} 4 & 20 \\ 0 & 2 \\ -1 & 6 \end{bmatrix}
D \begin{bmatrix} 11 & -4 & -8 \end{bmatrix}$$

$$A \cdot B = 2 \times 3$$

$$2 \times 2$$

$$X = 2 \times 3$$

$$X = 3 \times 2$$

$$X = 3$$

To Add and Subtract two matrices they must have the exact same dimensions.

To multiply two matrices

The number of columns in the first matrix must match the number of rows in the second matrix.

The middle numbers must match

$$(3 \times 2)(2 \times 3)$$

$$(2 \times 3)(3 \times 2)$$

the dimensions of the answer are the first and last numbers of the two matrices being multiplied. Or, "the outside two #'s"

$$(3 \times 2)(2 \times 3) = 3x3$$

$$(2 \times 3)(3 \times 2) = 2 \times 2$$

Is matrix multiplication commutative?

$$A\begin{bmatrix} 4 & 6 & -3 \\ 7 & 1 & 8 \end{bmatrix} B\begin{bmatrix} 6 & 5 \\ -9 & 0 \\ 6 & -1 \end{bmatrix} \quad C\begin{bmatrix} 1 & 11 \\ 2 & -3 \end{bmatrix} \quad D\begin{bmatrix} -5 & 4 \\ 2 & 19 \end{bmatrix}$$

$$\angle \times \Rightarrow \qquad \Rightarrow \times \Rightarrow$$

Is A•B the same as B•A?

These don't have the same dimensions. Therefore, AB

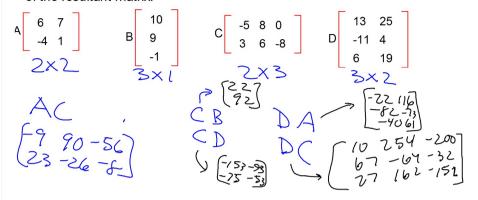
is not the same as BA.

Is C•D the same as D•C?

These have the same dimensions but not the same elements. Therefore, CD is not the same as DC.

These two examples of matrix multplication show that matrix multiplication is NOT commutative.

State all the pairs of matrices that can be multiplied. For those that can be multiplied state the dimensions of the resultant matrix.



Matrix Multiplication

If A, B, and C are $n \times n$ matrices, then

AB is an $n \times n$ matrix.

Closure Property

(AB)C = A(BC)

Associative Property of Multiplication

A(B+C) = AB + AC

(B + C)A = BA + CA

Distributive Property

OA = AO = O, where O has the same dimensions as A.

Multiplicative Property of Zero

	Lunch 1	Lunch 2	Lunch 3
Cost per Lunch	\$2.50	\$1.75	\$2.00
Number Sold	50	100	75

Find the total amount of money spent on all the lunches sold.

$$(2.50)(50) + (1.75)(100) + (2.00)(75) = $450$$

1. Write a 1x3 matrix(C) to represent the cost of the lunches.

2. Write a 3x1 matrix(N) to represent the number of lunches sold.

Multiplying matrices by hand:

Find this product: A • B

$$A \cdot B = 2x2 \cdot 2x1 = 2x1 = \begin{bmatrix} a \\ b \end{bmatrix} = \begin{bmatrix} 44 \\ -l8 \end{bmatrix}$$

Element a: Location: Row 1, Column 1.

Element b: Location: Row 2, Column 1.

	Lunch 1	Lunch 2	Lunch 3	Total \$ spent = (\$ per lunch)x(# of lunches)	
Cost per Lunch	\$2.50	\$1.75	\$2.00	(φ ρει ιαποπ)χ(π ει ιαποποσ)	
Number Sold	50	100	75	50	
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				= \$450	

3. Describe a procedure for using the matrices to find how much money will be collected from selling all three lunches. Make sure you use the words *row*, *column*, *and element*.

Multiply the elements in the first row of matrix C with the corresponding elements in the first column of matrix N, then add them together.