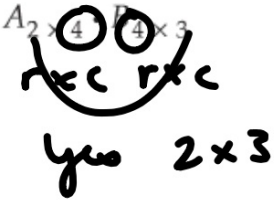
Algebra 2 3.6
Multiply matrices
Use the properties of matrix multiplication
commutative property
distributive property
dimensions (of a matrix)
whiteboards

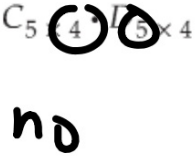
whiteboards

Determine whether each matrix product is defined. If so, state the dimensions of the product.

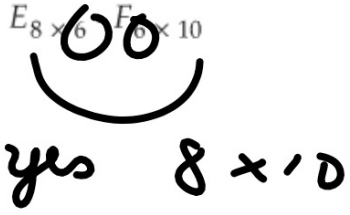
1. $A_{2\times 4}B_{4\times 3}$

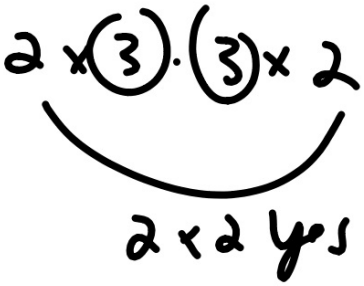


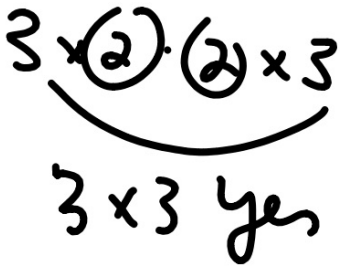
2. $C_{5\times 4}D_{5\times 4}$



3. $E_{8\times 6}F_{6\times 10}$







whiteboards

6. $\begin{bmatrix} 9 & -2 \end{bmatrix} \cdot \begin{bmatrix} -2 & 4 \\ 6 & -7 \end{bmatrix} = \begin{bmatrix} -30 & 50 \end{bmatrix}$

$1 \times (2) \quad (2) \times 2$

$-18 \quad 36$

$-12 \quad 14$

$-30 \quad 50$

8. $\begin{bmatrix} -8 & 7 & 4 \\ -5 & -3 & 8 \end{bmatrix} \cdot \begin{bmatrix} 10 & 6 \\ 8 & 4 \end{bmatrix}$

$2 \times 3 \quad 2 \times 2$

no

$2 \cdot 3 = 3 \cdot 2$

Commutative property



Example 4 Test of the Commutative Property

Find each product if $G = \begin{bmatrix} 1 & 3 & -5 \\ 4 & -2 & 0 \end{bmatrix}$ and $H = \begin{bmatrix} 2 & 3 \\ -2 & -8 \\ 1 & 7 \end{bmatrix}$.

a. GH (boys)

$$\begin{bmatrix} 1 & 3 & -5 \\ 4 & -2 & 0 \end{bmatrix} \cdot \begin{bmatrix} 2 & 3 \\ -2 & -8 \\ 1 & 7 \end{bmatrix} = \begin{bmatrix} -9 & -56 \\ 12 & 28 \end{bmatrix}$$

G H G·H

Are they the same (for these examples)?

b. HG (girls)

$$\begin{bmatrix} 2 & 3 \\ -2 & -8 \\ 1 & 7 \end{bmatrix} \begin{bmatrix} 1 & 3 & -5 \\ 4 & -2 & 0 \end{bmatrix} =$$

$$\begin{bmatrix} 14 & 0 & -10 \\ -34 & 10 & 10 \\ 29 & -11 & -5 \end{bmatrix}$$

H·G

GuidedPractice

4. Determine if $AB = BA$ is true for $A = \begin{bmatrix} 4 & -1 \\ 5 & -2 \end{bmatrix}$ and $B = \begin{bmatrix} -3 & 6 \\ -4 & 5 \end{bmatrix}$.

A B

2×2 2×2

For this pair of matrices...

(boys) AB $\begin{bmatrix} 4 & -1 \\ 5 & -2 \end{bmatrix} \cdot \begin{bmatrix} -3 & 6 \\ -4 & 5 \end{bmatrix} = \begin{bmatrix} -8 & 19 \\ -7 & 20 \end{bmatrix}$

-16
+25
4-10

(girls) BA $= \begin{bmatrix} -3 & 6 \\ -4 & 5 \end{bmatrix} \cdot \begin{bmatrix} 4 & -1 \\ 5 & -2 \end{bmatrix} = \begin{bmatrix} 18 & -9 \\ 9 & -6 \end{bmatrix}$

for this set of matrices:

GuidedPractice

5. Use the matrices $R = \begin{bmatrix} 2 & -1 \\ 1 & 3 \end{bmatrix}$, $S = \begin{bmatrix} 4 & 6 \\ -2 & 5 \end{bmatrix}$, and $T = \begin{bmatrix} -3 & 7 \\ -4 & 8 \end{bmatrix}$ to determine if $(S + T)R = SR + TR$.

(boys) (S+T)R

$$\left(\begin{bmatrix} 4 & 6 \\ -2 & 5 \end{bmatrix} + \begin{bmatrix} -3 & 7 \\ -4 & 8 \end{bmatrix}\right) \cdot \begin{bmatrix} 2 & -1 \\ 1 & 3 \end{bmatrix} \quad (S+T)\cdot R$$

$$\begin{bmatrix} 1 & 13 \\ -6 & 13 \end{bmatrix} \cdot \begin{bmatrix} 2 & -1 \\ 1 & 3 \end{bmatrix} = \begin{bmatrix} 15 & 38 \\ 1 & 45 \end{bmatrix}$$

(girls) SR + TR

$$\begin{bmatrix} 4 & 6 \\ -2 & 5 \end{bmatrix} \cdot \begin{bmatrix} 2 & -1 \\ 1 & 3 \end{bmatrix} = \begin{bmatrix} 14 & 14 \\ 1 & 17 \end{bmatrix} \quad SR$$

$$\begin{bmatrix} -3 & 7 \\ -4 & 8 \end{bmatrix} \cdot \begin{bmatrix} 2 & -1 \\ 1 & 3 \end{bmatrix} = \begin{bmatrix} 1 & 24 \\ 0 & 28 \end{bmatrix}$$

$$\begin{bmatrix} 15 & 38 \\ 1 & 45 \end{bmatrix}$$

is A*B always equal to B*A?

KeyConcept Properties of Matrix Multiplication

For any matrices A, B, and C for which the matrix product is defined and any scalar k, the following properties are true.

Associative Property of Matrix Multiplication	$(AB)C = A(BC)$
Associative Property of Scalar Multiplication	$k(AB) = (kA)B = A(kB)$
Left Distributive Property	$C(A + B) = CA + CB$
Right Distributive Property	$(A + B)C = AC + BC$

What about commutative property?...only if coincidence!

$$\begin{bmatrix} 2x & 3y \end{bmatrix} = \begin{bmatrix} 4 & 12 \end{bmatrix}$$

$1 \times 2 \qquad\qquad 1 \times 2$

$\frac{2x}{2} = \frac{4}{2} \qquad \frac{3y}{3} = \frac{12}{3}$

$x = 2 \qquad y = 4$