

Matrix Moves

Add, scale, and multiply matrices in context.

HIGH SCHOOL • HSN-VM.C

CCSS.Math.Content.HSN-VM.C "Perform operations on matrices and use matrices in applications."

NAME _____

DATE _____

MATRIX OPERATION RULES

To add or subtract matrices, combine entries that are in the same position. To multiply a matrix by a number, multiply every entry by that number. To multiply AB , the number of columns in A must equal the number of rows in B , and each product entry uses one row of A and one column of B .

WORKED EXAMPLE

Let $A = \begin{bmatrix} 8 & -6 \\ 11 & 13 \end{bmatrix}$. Find $7A$.

1. Multiply each entry of A by 7.
2. $7A = \begin{bmatrix} 7(8) & 7(-6) \\ 7(11) & 7(13) \end{bmatrix}$.
3. $7A = \begin{bmatrix} 56 & -42 \\ 77 & 91 \end{bmatrix}$.

Answer: $\begin{bmatrix} 56 & -42 \\ 77 & 91 \end{bmatrix}$

PRACTICE 6 problems

- 1** Let $A = \begin{bmatrix} 1 & 4 \\ -2 & 3 \end{bmatrix}$ and $B = \begin{bmatrix} 3 & -1 \\ 2 & 1 \end{bmatrix}$. Find $A + B$.

ANSWER _____

- 2** Let $A = \begin{bmatrix} 5 & 1 \\ 4 & -3 \end{bmatrix}$ and $B = \begin{bmatrix} 2 & -2 \\ 1 & 2 \end{bmatrix}$. Find $A - B$.

ANSWER _____

- 3** Find $5\begin{bmatrix} 2 & -1 \\ 4 & 3 \end{bmatrix}$.

ANSWER _____

- 4** Let $A = \begin{bmatrix} 1 & 2 \\ 2 & 1 \end{bmatrix}$ and $B = \begin{bmatrix} 2 & -1 \\ 1 & 3 \end{bmatrix}$. Find AB .

ANSWER _____

- 5** Let $A = \begin{bmatrix} 1 & 0 & 2 \\ 3 & 1 & 1 \end{bmatrix}$ and $B = \begin{bmatrix} 1 & 1 \\ 1 & 1 \\ 0 & 1 \end{bmatrix}$. Find AB .

ANSWER _____

- 6** Find X if $\begin{bmatrix} 2 & -1 \\ 3 & 4 \end{bmatrix} + X = \begin{bmatrix} 5 & 2 \\ 1 & 0 \end{bmatrix}$.

ANSWER _____

APPLY IT Show your work

- 1** At two school concerts, the drama club sells hoodies and stickers. The quantity matrix $Q = \begin{bmatrix} 3 & 4 \\ 5 & 1 \end{bmatrix}$ has rows for the first and second concerts and columns for hoodies and stickers. A hoodie costs \$9 and a sticker costs \$2, so the price matrix is $P = \begin{bmatrix} 9 & 2 \end{bmatrix}$. Find QP . What does each entry mean?

WORK SPACE

ANSWER _____

- 2** A robotics club needs materials for two types of display boards. For one set of boards, the material matrix is $M = \begin{bmatrix} 2 & 1 \\ 3 & 2 \end{bmatrix}$, where rows represent the two board types and columns represent sheets of foam and paint cups. The club needs 4 identical sets. Find $4M$ and explain what the matrix represents.

WORK SPACE

ANSWER _____

CHALLENGE One step up

CHALLENGE

Let $A = \begin{bmatrix} 1 & 2 \\ 0 & 1 \end{bmatrix}$ and $B = \begin{bmatrix} 3 & 1 \\ 2 & 1 \end{bmatrix}$. Compute AB and BA . Are they equal? Explain your reasoning in one sentence.

PART 1 · PRACTICE

#	PROBLEM	ANSWER
1	Let $A = \begin{bmatrix} 1 & 4 \\ -2 & 3 \end{bmatrix}$ and $B = \begin{bmatrix} 3 & -1 \\ 2 & 1 \end{bmatrix}$. Find $A + B$.	$\begin{bmatrix} 4 & 3 \\ 0 & 4 \end{bmatrix}$
2	Let $A = \begin{bmatrix} 5 & 1 \\ 4 & -3 \end{bmatrix}$ and $B = \begin{bmatrix} 2 & -2 \\ 1 & 2 \end{bmatrix}$. Find $A - B$.	$\begin{bmatrix} 3 & 3 \\ 3 & -5 \end{bmatrix}$
3	Find $5\begin{bmatrix} 2 & -1 \\ 4 & 3 \end{bmatrix}$.	$\begin{bmatrix} 10 & -5 \\ 20 & 15 \end{bmatrix}$
4	Let $A = \begin{bmatrix} 1 & 2 \\ 2 & 1 \end{bmatrix}$ and $B = \begin{bmatrix} 2 & -1 \\ 1 & 3 \end{bmatrix}$. Find AB .	$\begin{bmatrix} 4 & 5 \\ 5 & 1 \end{bmatrix}$
5	Let $A = \begin{bmatrix} 1 & 0 & 2 \\ 3 & 1 & 1 \end{bmatrix}$ and $B = \begin{bmatrix} 1 & 1 & 1 \\ 0 & 1 \end{bmatrix}$. Find AB .	$\begin{bmatrix} 1 & 3 \\ 4 & 5 \end{bmatrix}$
6	Find X if $\begin{bmatrix} 2 & -1 \\ 3 & 4 \end{bmatrix} + X = \begin{bmatrix} 5 & 2 \\ 1 & 0 \end{bmatrix}$.	$X = \begin{bmatrix} 3 & 3 \\ -2 & -4 \end{bmatrix}$

PART 2 · APPLY IT

- $QP = \begin{bmatrix} 35 \\ 47 \end{bmatrix}$. The club earns \$35 at the first concert and \$47 at the second concert.** Multiply each row of quantities by the price column. Each resulting entry is the total revenue for one concert.
- $4M = \begin{bmatrix} 8 & 4 \\ 12 & 8 \end{bmatrix}$. The club needs 8 foam sheets and 4 paint cups for board type 1, and 12 foam sheets and 8 paint cups for board type 2.** Multiply every entry in M by 4. Each entry gives the total amount of one material needed for one board type.

CHALLENGE

$AB = \begin{bmatrix} 7 & 3 \\ 2 & 1 \end{bmatrix}$ and $BA = \begin{bmatrix} 3 & 7 \\ 2 & 5 \end{bmatrix}$. They are not equal because corresponding entries differ, such as the top-left entries.

Accept standard matrix brackets, parentheses, or clearly arranged rows and columns. For the word problems, accept equivalent descriptions that correctly connect each matrix entry to its context.