LESSON MAKER PRO

Matrix Motion Lab

Use matrices to transform vectors.

HIGH SCHOOL · HSN-VM.C.11

CCSS.Math.Content.HSN-VM.C.11 "(+) Multiply a vector (regarded as a matrix with one column) by a matrix of suitable dimensions to produce another vector. Work with matrices as transformations of vectors."

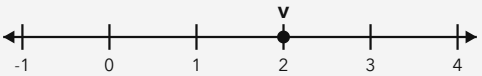
NAME _____ DATE _____

MATRIX TIMES VECTOR

To multiply a 2 x 2 matrix by a 2 x 1 vector, multiply each matrix row by the vector, then add the products. The result is a new 2 x 1 vector, which is the transformed image of the original vector.

WORKED EXAMPLE

The point V on the number line represents a one-entry vector. Apply the matrix [7] to the vector shown. What is the image vector?



1. Read the vector from V: [2].
2. Multiply: [7][2] = [7 × 2].
3. Simplify: [14].

Answer: [14]

PRACTICE 6 problems

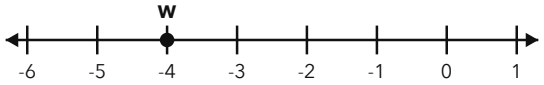
1 Find [4 -1; 6 0][1; 8].

ANSWER _____

2 Find [-4 6; 5 -3][-1; 3].

ANSWER _____

3 The point W on the number line represents a one-entry vector. Apply the matrix [-3] to the vector shown. What is the image vector?



ANSWER _____

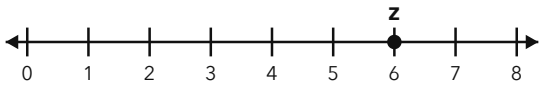
4 Find [0 1; -1 0][9; -6].

ANSWER _____

5 Find [1 1; 0 -1][-8; 4].

ANSWER _____

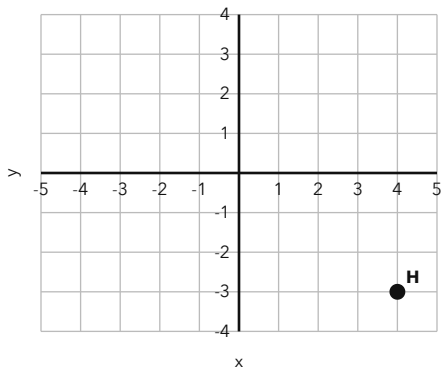
6 The point Z on the number line represents a one-entry vector. Apply the matrix [-5] to the vector shown. What is the image vector?



ANSWER _____

APPLY IT Show your work

1 At a dance club, a motion-capture app displays a dancer's hand position as a vector from the stage center. The grid shows the current endpoint H. Mirror mode applies M = [-1 0; 0 1]. What vector gives the mirrored hand position?



ANSWER _____

2 A game camera changes a character's map position v = [4; -6] using C = [3 1; -1 4]. Find Cv.

WORK SPACE

ANSWER _____

CHALLENGE One step up

Let A = [4 1; -1 3], B = [1 -5; 6 0], and v = [3; -1]. Find A(Bv) and B(Av). Then explain in one sentence why the results matter when you apply transformations.

WORK SPACE AND ANSWER

ANSWER KEY

Matrix Motion Lab

PART 1 · PRACTICE

#	PROBLEM	ANSWER
1	Find [4 -1; 6 0][1; 8].	**[-4; 6]**
2	Find [-4 6; 5 -3][-1; 3].	**[22; -14]**
3	The point W on the number line represents a one-entry vector. Apply the matrix [-3] to the vector shown. What is the image vector?	**[12]**
4	Find [0 1; -1 0][9; -6].	**[-6; -9]**
5	Find [1 1; 0 -1][-8; 4].	**[-4; -4]**
6	The point Z on the number line represents a one-entry vector. Apply the matrix [-5] to the vector shown. What is the image vector?	**[-30]**

PART 2 · APPLY IT

1. **[-4; -3]** Read the input vector as [4; -3]. Multiply M[4; -3] to reflect the horizontal coordinate while keeping the vertical coordinate unchanged.
2. **[6; -28]** Multiply the first row of C by v to get 6. Multiply the second row of C by v to get -28.

CHALLENGE

A(Bv) = [50; 46] and B(Av) = [41; 66]. The results differ, so applying B then A is not the same as applying A then B.

Accept equivalent column-vector notation, including ordered pairs when the coordinate order is clear. For the challenge, accept any accurate statement that transformation order can change the result.