

**Multiplying a Vector by a Matrix - Guided Lesson Explanation****Explanation #1**

You need to figure out the number of rows and columns the product will have. This is determined by the number of rows of the first matrix.

The first matrix (c) has 3 rows. The second matrix (x) has 1 column. So the product will have 3 rows and 1 column (3 x 1).

Matrix c =

$$\begin{bmatrix} c_1 & c_2 & c_3 \\ c_4 & c_5 & c_6 \\ c_7 & c_8 & c_9 \end{bmatrix}$$

Vector x =  $\begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix}$

$$C_x = \begin{bmatrix} M_1 \\ M_2 \\ M_3 \end{bmatrix}$$

The product can be determined by:

$$M_1 = c_1 (x_1) + c_2 (x_2) + c_3 (x_3)$$

$$M_2 = c_4 (x_1) + c_5 (x_2) + c_6 (x_3)$$

$$M_3 = c_7 (x_1) + c_8 (x_2) + c_9 (x_3)$$

$$M_1 = 1 (4) + 4 (-7) + -2 (-3) = -18$$

$$M_2 = 2 (4) + -5 (-7) + 7 (-3) = 22$$

$$M_3 = 6 (4) + 8 (-7) + 1 (-3) = -35$$



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$$C_x = \begin{bmatrix} -18 \\ 22 \\ -35 \end{bmatrix}$$

### Explanation#2

You need to figure out the number of rows and columns the product will have. This is determined by the number of rows of the first matrix

The first matrix (c) has 3 rows. The second matrix (x) has 1 column. The product will have 3 rows and 1 column (3 x 1).

Matrix c =

$$\begin{bmatrix} c_1 & c_2 & c_3 \\ c_4 & c_5 & c_6 \\ c_7 & c_8 & c_9 \end{bmatrix}$$

$$\text{Vector } x = \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix}$$

$$C_x = \begin{bmatrix} M_1 \\ M_2 \\ M_3 \end{bmatrix}$$

The product can be determined by:

$$M_1 = c_1 (x_1) + c_2 (x_2) + c_3 (x_3)$$

$$M_2 = c_4 (x_1) + c_5 (x_2) + c_6 (x_3)$$

$$M_3 = c_7 (x_1) + c_8 (x_2) + c_9 (x_3)$$



Name \_\_\_\_\_

Date \_\_\_\_\_

$$M1 = 3 (-3) + 4 (5) + 7 (6) = 53$$

$$M2 = 2 (-3) + 9 (5) + 2 (6) = 51$$

$$M3 = 8 (-3) + -2 (5) + -5 (6) = -64$$

$$C_x = \begin{bmatrix} 53 \\ 51 \\ -64 \end{bmatrix}$$

