Multiplying a Vector by a Matrix - Step-by-Step Lesson

a. Find the matrix product of C_x.

matrix c =

$$\begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 7 & 8 & 9 \end{bmatrix}$$

vector x =

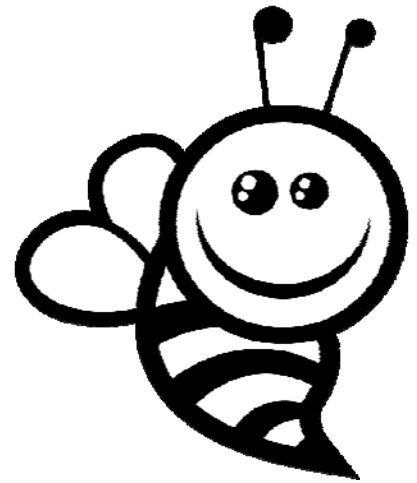$$\begin{bmatrix} 2 \\ -3 \\ 4 \end{bmatrix}$$

Explanation:

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 matrix (c) and the number of columns of the vector (x).

The matrix (c) has 3 rows. The vector (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 the:

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

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

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

Substitute in our values.

$M_1 = 1 \, (2) + 2 \, (-3) + 3 \, (4) = -25$

$M_2 = 4 \, (2) + 5 \, (-3) + 6 \, (4) = -29$

$M_3 = 7 \, (2) + 8 \, (-3) + 9 \, (4) = -33$

$$C_x = \begin{bmatrix} 8 \\ 17 \\ 26 \end{bmatrix}$$