

## Multiplying Matrices

<p style="text-align: center;">Multiplying Matrices</p> <p>If you are going to multiply two matrices, the number of <u>Columns</u> in the first matrix must be equal to the number of <u>Rows</u> in the second matrix</p>	<p style="text-align: center;">Is it possible to multiply the following matrices?</p> <p>Can you multiply A and B?      Can you multiply C and D?</p> <p> <math>A = \begin{bmatrix} 2 \\ 3 \end{bmatrix}</math> and <math>B = \begin{bmatrix} -5 &amp; 7 \end{bmatrix}</math>      <math>C = \begin{bmatrix} 1 &amp; 9 \\ 3 &amp; 0 \\ -8 &amp; 2 \end{bmatrix}</math> and <math>D = \begin{bmatrix} 15 &amp; 6 &amp; 7 \end{bmatrix}</math> </p> <p style="text-align: center;"> <math>2 \times 1</math>      <math>1 \times 2</math>      <math>3 \times 2</math>      <math>1 \times 3</math> </p> <p style="text-align: center;"> <span style="margin-right: 100px;">Yes</span> <span>No</span>      <span style="margin-right: 100px;">Yes</span> <span>No</span> </p> <p style="text-align: center;"> <math>2 \times 2</math>      <math>3 \times 3</math> </p>
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### Steps for Multiplying Matrices

<p>Step 1: Make sure that you can multiply the matrices. Check to make sure that the number of columns in the first matrix is the same as the number of rows in the second matrix.</p>	<p>First Matrix = <math>\begin{bmatrix} 1 &amp; 8 &amp; 0 \\ -6 &amp; 2 &amp; 5 \end{bmatrix}</math></p> <p>Second Matrix = <math>\begin{bmatrix} 3 &amp; 9 &amp; -1 \\ -4 &amp; 11 &amp; 6 \\ 7 &amp; -2 &amp; 12 \end{bmatrix}</math></p> <p>The first matrix has 3 columns and the second matrix has three rows</p>	<p>First Matrix = <math>\begin{bmatrix} 1 &amp; 8 &amp; 0 \\ -6 &amp; 2 &amp; 5 \end{bmatrix}</math></p> <p>Second Matrix = <math>\begin{bmatrix} 3 &amp; 9 &amp; -1 \\ -4 &amp; 11 &amp; 6 \\ 7 &amp; -2 &amp; 12 \end{bmatrix}</math></p> <p style="text-align: center;"><math>2 \times 3</math>      <math>3 \times 3</math></p>
<p>Step 2: Figure out what the dimensions of your new matrix will be after you multiply. The new matrix will have the same number of rows as the first matrix and the same number of columns as the second matrix.</p>	<p>Rows in the first matrix = 2 Columns in the second matrix = 3 New matrix will be a <math>2 \times 3</math></p>	<p style="text-align: center;">New Matrix = <math>\begin{bmatrix} -29 &amp; 97 &amp; 47 \\ 9 &amp; -42 &amp; 78 \end{bmatrix}</math></p> <p style="text-align: center;"><math>2 \times 3</math></p>
<p>Step 3: Find the first element of your new matrix. Each element of the new matrix will be the sum of several products. To find your first element you will complete the following steps.</p> <ol style="list-style-type: none"> <li>You will multiply the first element in the first row of your first matrix by the first element of the first column in your second matrix. This product will get added to the next two products</li> <li>You will multiply the second element in the first row of your first matrix by the second element of the first column in your second matrix. This product will get added to the product from step a and the next product</li> <li>You will multiply the third element in the first row of your first matrix by the third element of the first column in your second matrix</li> <li>Add the products from steps a, b, and c. This the first element of your matrix</li> <li>Repeat a-d for each element</li> </ol>	<p>Finding the first element (first row-matrix 1 and first column-matrix 2):</p> <p>a. <math>(1)(3) = 3</math> b. <math>(8)(-4) = -32</math> c. <math>(0)(7) = 0</math> d. <math>3 + (-32) + 0 = -29</math></p> <p>Finding the next element (first row-matrix 1 and second column-matrix 2):</p> <p>a. <math>(1)(9) = 9</math> b. <math>(8)(11) = 88</math> c. <math>(0)(-2) = 0</math> d. <math>9 + 88 + 0 = 97</math></p> <p>Finding the next element (first row-matrix 1 and third column-matrix 2):</p> <p>a. <math>(1)(-1) = -1</math> b. <math>(8)(6) = 48</math> c. <math>(0)(12) = 0</math> d. <math>-1 + 48 + 0 = 47</math></p> <p>Finding the first element (second row-matrix 1 and first column-matrix 2):</p> <p>a. <math>(-6)(3) = -18</math> b. <math>(2)(-4) = -8</math> c. <math>(5)(7) = 35</math> d. <math>-18 + (-8) + 35 = 9</math></p> <p>Finding the next element (second row-matrix 1 and second column-matrix 2):</p> <p>a. <math>(-6)(9) = -54</math> b. <math>(2)(11) = 22</math> c. <math>(5)(-2) = -10</math> d. <math>-54 + 22 + (-10) = -42</math></p> <p>Finding the next element (second row-matrix 1 and third column-matrix 2):</p> <p>a. <math>(-6)(-1) = 6</math> b. <math>(2)(6) = 12</math> c. <math>(5)(12) = 60</math> d. <math>6 + 12 + 60 = 78</math></p>	<p>First Matrix = <math>\begin{bmatrix} 1 &amp; 8 &amp; 0 \\ -6 &amp; 2 &amp; 5 \end{bmatrix}</math>      Second Matrix = <math>\begin{bmatrix} 3 &amp; 9 &amp; -1 \\ -4 &amp; 11 &amp; 6 \\ 7 &amp; -2 &amp; 12 \end{bmatrix}</math></p> <p>First Matrix = <math>\begin{bmatrix} 1 &amp; 8 &amp; 0 \\ -6 &amp; 2 &amp; 5 \end{bmatrix}</math>      Second Matrix = <math>\begin{bmatrix} 3 &amp; 9 &amp; -1 \\ -4 &amp; 11 &amp; 6 \\ 7 &amp; -2 &amp; 12 \end{bmatrix}</math></p> <p>First Matrix = <math>\begin{bmatrix} 1 &amp; 8 &amp; 0 \\ -6 &amp; 2 &amp; 5 \end{bmatrix}</math>      Second Matrix = <math>\begin{bmatrix} 3 &amp; 9 &amp; -1 \\ -4 &amp; 11 &amp; 6 \\ 7 &amp; -2 &amp; 12 \end{bmatrix}</math></p> <p>First Matrix = <math>\begin{bmatrix} 1 &amp; 8 &amp; 0 \\ -6 &amp; 2 &amp; 5 \end{bmatrix}</math>      Second Matrix = <math>\begin{bmatrix} 3 &amp; 9 &amp; -1 \\ -4 &amp; 11 &amp; 6 \\ 7 &amp; -2 &amp; 12 \end{bmatrix}</math></p> <p>First Matrix = <math>\begin{bmatrix} 1 &amp; 8 &amp; 0 \\ -6 &amp; 2 &amp; 5 \end{bmatrix}</math>      Second Matrix = <math>\begin{bmatrix} 3 &amp; 9 &amp; -1 \\ -4 &amp; 11 &amp; 6 \\ 7 &amp; -2 &amp; 12 \end{bmatrix}</math></p> <p style="text-align: center; font-size: 2em;"> <math>\begin{bmatrix} -29 &amp; 97 &amp; 47 \\ 9 &amp; -42 &amp; 78 \end{bmatrix}</math> </p>

P. 383: 1-9