Matrix Operations

1. What size is this matrix?

$$\begin{bmatrix} 6 & 11 & -2 \\ 23 & 31 & 5 \end{bmatrix}$$

   (a) 2x3

   (b) 3x2

   (c) 6

   Answer: (a). This is a quick check to see if students can determine the size of a matrix.

   CC HZ MA117 S07: **100**/0/0

   by Carroll College MathQuest

   LA.00.08.010

2. Let $A = \begin{bmatrix} 4 & 6 \\ 20 & 24 \end{bmatrix}$ and $B = \begin{bmatrix} 2 & 5 \\ 3 & 7 \end{bmatrix}$

   What is $A + B$?

   (a) 71

   (b)
   $$\begin{bmatrix} 6 & 9 \\ 7 & 11 \end{bmatrix}$$

   (c)
   $$\begin{bmatrix} 6 & 11 \\ 23 & 31 \end{bmatrix}$$

   (d)
   $$\begin{bmatrix} 26 & 62 \\ 112 & 268 \end{bmatrix}$$

   (e)
   $$\begin{bmatrix} 4 & 6 & 2 & 5 \\ 20 & 24 & 3 & 7 \end{bmatrix}$$

   Answer: (c). This is a quick check to see if students know how to add matrices. This question can be used before introducing the concept to see what knowledge students bring to the course. Answer (a) comes from adding all of the entries of A and B. Answer (d) is the product AB.

   CC HZ MA117 S07: 8/0/**92**/0/0

   by Carroll College MathQuest

   LA.00.08.020

3. If $A = \begin{bmatrix} 2 & 3 & 1 \\ 0 & -1 & 3 \\ -2 & 0 & 4 \end{bmatrix}$ what is A^T?

(a) $A^T = \begin{bmatrix} 2 & 3 & 1 \\ 0 & -1 & 3 \\ -2 & 0 & 4 \end{bmatrix}$

(b) $A^T = \begin{bmatrix} 2 & 0 & -2 \\ 3 & -1 & 0 \\ 1 & 3 & 4 \end{bmatrix}$

(c) $A^T = \begin{bmatrix} -2 & 0 & 4 \\ 0 & -1 & 3 \\ 2 & 3 & 1 \end{bmatrix}$

(d) $A^T = \begin{bmatrix} 1 & 3 & 4 \\ 3 & -1 & 0 \\ 2 & 0 & -2 \end{bmatrix}$

Answer: (b). This is a quick check to see if students can find the transpose of a matrix.

CC HZ MA117 S07: 0/**92**/8/0 time 0:35

by Carroll College MathQuest

LA.00.08.030

4. If $A = \begin{bmatrix} 4 & 6 \\ 20 & 7 \end{bmatrix}$ what is $5A$?

(a) $5A = \begin{bmatrix} 9 & 6 \\ 20 & 7 \end{bmatrix}$

(b) $5A = \begin{bmatrix} 9 & 11 \\ 25 & 12 \end{bmatrix}$

(c) $5A = \begin{bmatrix} 20 & 6 \\ 20 & 7 \end{bmatrix}$

(d) $5A = \begin{bmatrix} 20 & 30 \\ 100 & 35 \end{bmatrix}$

Answer: (d). This is a quick check to see if students can multiply a matrix by a scalar.

CC HZ MA117 S07: 0/4/0/**96**

by Carroll College MathQuest

LA.00.08.040

5. If $A = \begin{bmatrix} 2 & 1 \\ 3 & 2 \end{bmatrix}$ and $B = \begin{bmatrix} 4 \\ -1 \end{bmatrix}$ then calculate the product AB.

(a) $AB = \begin{bmatrix} 5 \\ 2 \end{bmatrix}$

(b) $AB = \begin{bmatrix} 10 & 7 \end{bmatrix}$

(c) $AB = \begin{bmatrix} 8 & 4 \\ -3 & -2 \end{bmatrix}$

(d) $AB = \begin{bmatrix} 7 \\ 10 \end{bmatrix}$

(e) None of the above.

(f) This matrix multiplication is impossible.

Answer: (d). This is a quick check of the matrix multiplication process.

CC HZ MA117 S07: 0/8/40/**4**/0/48 (before intro to multiplication)

by Carroll College MathQuest

LA.00.08.050

6. If $A = \begin{bmatrix} 2 & 1 \\ 3 & 2 \end{bmatrix}$ and $B = \begin{bmatrix} 4 \\ -1 \end{bmatrix}$ then calculate the product AB.

(a) $AB = \begin{bmatrix} 5 \\ 2 \end{bmatrix}$

(b) $AB = \begin{bmatrix} 10 & 7 \end{bmatrix}$

(c) $AB = \begin{bmatrix} 8 & 4 \\ -3 & -2 \end{bmatrix}$

(d) $AB = \begin{bmatrix} 7 \\ 10 \end{bmatrix}$

(e) None of the above.

(f) This matrix multiplication is impossible.

Answer: (d). This is a quick check of the matrix multiplication process.

CC HZ MA117 S07: 0/8/40/**4**/0/48

by Carroll College MathQuest

LA.00.08.150

7. Calculate $\begin{bmatrix} 2 & 0 \\ -3 & 1 \end{bmatrix} \times \begin{bmatrix} 0 & -1 \\ 2 & 2 \end{bmatrix}$.

(a) $\begin{bmatrix} 3 & -1 \\ -2 & 2 \end{bmatrix}$

(b) $\begin{bmatrix} 0 & -2 \\ 2 & 5 \end{bmatrix}$

(c) $\begin{bmatrix} 0 & 0 \\ -6 & 2 \end{bmatrix}$

(d) None of the above.

(e) This matrix multiplication is impossible.

Answer: (b). This is a quick check of the matrix multiplication process.

CC KC MA232 S07: 0/**77**/0/24 time 2:00

CC HZ MA117 S07: 0/**80**/5/15/0 time 3:00

by Carroll College MathQuest

LA.00.08.160

8. Calculate $\begin{bmatrix} 0 & -1 \\ 2 & 2 \end{bmatrix} \times \begin{bmatrix} 2 & 0 \\ -3 & 1 \end{bmatrix}$.

(a) $\begin{bmatrix} 3 & -1 \\ -2 & 2 \end{bmatrix}$

(b) $\begin{bmatrix} 0 & -2 \\ 2 & 5 \end{bmatrix}$

(c) $\begin{bmatrix} 0 & 0 \\ -6 & 2 \end{bmatrix}$

(d) None of the above.

(e) This matrix multiplication is impossible.

Answer: (a). With the previous problem, this demonstrates the noncommutative nature of matrix multiplication.

CC KC MA232 S07: **100**/0/0/0/0 time 1:30

CC HZ MA117 S07: **95**/0/0/5/0 time 1:15

by Carroll College MathQuest

LA.00.08.170

9. **True or False** If A and B are square matrices with the same dimensions, then $(A + B) \times (A + B) = A^2 + 2AB + B^2$.

Answer: (False). When we expand this expression we get $A^2 + AB + BA + B^2$. A good follow-up question is to ask the students for an example of two matrices where the "identity" given in this question is true. They will need to choose matrices where $AB = BA$. This is done easily by choosing one of the matrices to be an identity matrix.

CC KC MA232 S07: 28/**72** time 2:00

by Carroll College MathQuest

LA.00.08.180

10. If A and B are both 2x3 matrices, then which of the following is not defined?

    (a) $A + B$

    (b) $A^T B$

    (c) BA

    (d) AB^T

    (e) More than one of the above

    (f) All of these are defined.

    Answer: (c). In order to make matrix multiplication possible the number of columns of the first matrix must equal the number of rows of the second matrix.

    CC KC MA232 S07: 0/0/**83**/0/17/0 time 1:30 CC HZ MA117 S07: 0/16/**37**/0/32/10 time 1:15

    by Carroll College MathQuest

    LA.00.08.190

11. If A is a 2x3 matrix and B is a 3x6 matrix, what size is AB?

    (a) 2x6

    (b) 6x2

    (c) 3x3

    (d) 2x3

    (e) 3x6

    (f) This matrix multiplication is impossible.

    Answer: (a). This is a quick check on final size of a matrix product. Note that this is a different concept than knowing when the multiplication is possible.

    CC HZ MA117 S07: **84**/0/0/16/0/0 time 1:00

    by Carroll College MathQuest

    LA.00.08.200

12. In order to compute the matrix product AB, what must be true about the sizes of A and B?

(a) A and B must have the same number of rows.

(b) A and B must have the same number of columns.

(c) A must have as many rows as B has columns.

(d) A must have as many columns as B has rows.

Answer: (d). This question is intended to extend students' conceptualization of matrix multiplication so that they really think of it as a row times a column. This is one level deeper than memorizing that if A is mxn and B is rxs, then we must have $n = r$.

CC HZ MA117 S07: 0/0/16/**84** time 1:10

by Carroll College MathQuest

LA.00.08.210

13. If $A = \begin{bmatrix} 2 & 3 & 1 \\ 0 & -1 & 3 \\ -2 & 0 & 4 \end{bmatrix}$ and $B = \begin{bmatrix} 3 & 0 & 2 \\ 1 & 2 & -1 \\ 3 & 1 & 0 \end{bmatrix}$ what is the (3,2)-entry of AB? (You should be able to determine this without computing the entire matrix product.)

(a) 1

(b) 3

(c) 4

(d) 8

Answer: (c). We compute -2*0 + 0*2 + 4*1 = 4. This question, as the previous one, is intended to extend students' conceptualization of matrix multiplication so that they really think of it as a row times a column.

CC HZ MA117 S07: 32/21/**47**/0 time 2:30

by Carroll College MathQuest

LA.00.08.220