CSPB 2820 - Truong - Linear Algebra with Computer Science Applications

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Started on	Thursday, 9 November 2023, 2:13 PM
State	Finished
Completed on	Thursday, 9 November 2023, 2:34 PM
Time taken	21 mins 44 secs
Marks	60.00/60.00
Grade	**10.00** out of 10.00 (**100**%)

Question **1**

Correct

Mark 5.00 out of 5.00

There is no special notation for an m × n matrix all of whose entries are one. Choose a simple expression for this matrix in terms of matrix multiplication, transpose, and the ones vectors $1_m, 1_n$ (where the subscripts denote the dimension).

a. $1_n 1_m{}^T$

b. $1_m{}^T 1_n$

c. $1_n 1_m$

d. $1_m 1_n$

e. $1_m 1_n{}^T$ ✔

Your answer is correct.

The matrix is given by $1_m 1_n{}^T$. This matrix is a product of an $m \times 1$ matrix and a $1 \times n$ matrix, so it has dimension $m \times n$. Its i, j entry is $1 \cdot 1 = 1$.

Correct

Marks for this submission: 5.00/5.00.

Question **2**

Correct

Mark 5.00 out of 5.00

Consider the block matrix

$$A = \begin{bmatrix} I & B & 0_a \\ B^T & 0_b & 0_c \\ 0_d & 0_e & BB^T \end{bmatrix}$$

Where B is 10×5 and $0_a, 0_b, 0_c, 0_d, 0_e$ are zero blocks in the matrix. What are the dimensions of the five zero matrices and the Identity matrix in the definition of A?

0_a : 10 ✔ by 10 ✔

0_b : 5 ✔ by 5 ✔

0_c : 5 ✔ by 10 ✔

0_d : 10 ✔ by 10 ✔

0_e : 10 ✔ by 5 ✔

and Dimention of A is : 25 ✔ by 25 ✔

Correct

Marks for this submission: 5.00/5.00.

Question **3**

Correct

Mark 5.00 out of 5.00

Let $A = \begin{bmatrix} 5 & 5 & 8 \\ 8 & 3 & 8 \\ 4 & 5 & 3 \end{bmatrix}$ and $B = \begin{bmatrix} 1 & 5 & 8 \\ 9 & 2 & 7 \\ 3 & 8 & 1 \end{bmatrix}$.

Calculate $A + B$, $5B$ and AB.

$A + B =$

6	10	16
17	5	15
7	13	4

Your last answer was interpreted as follows: $\begin{bmatrix} 6 & 10 & 16 \\ 17 & 5 & 15 \\ 7 & 13 & 4 \end{bmatrix}$

$5B =$

5	25	40
45	10	35
15	40	5

Your last answer was interpreted as follows: $\begin{bmatrix} 5 & 25 & 40 \\ 45 & 10 & 35 \\ 15 & 40 & 5 \end{bmatrix}$

$AB =$

74	99	83
59	110	93
58	54	70

Your last answer was interpreted as follows: $\begin{bmatrix} 74 & 99 & 83 \\ 59 & 110 & 93 \\ 58 & 54 & 70 \end{bmatrix}$

Your answer is correct!

Your answer is correct!

The matrix sum is correct. $A + B$.

Marks for this submission: 1.67/1.67.

Your answer is correct!

Your answer to $5B$ is correct.

Marks for this submission: 1.67/1.67.

Your answer is correct!

Your answer to AB is correct.

Marks for this submission: 1.67/1.67.

Worked solution:

$$A + B = \begin{bmatrix} 5+1 & 2\cdot 5 & 2\cdot 8 \\ 9+8 & 3+2 & 8+7 \\ 4+3 & 8+5 & 3+1 \end{bmatrix} = \begin{bmatrix} 6 & 10 & 16 \\ 17 & 5 & 15 \\ 7 & 13 & 4 \end{bmatrix}. \; 5B = 5\begin{bmatrix} 1 & 5 & 8 \\ 9 & 2 & 7 \\ 3 & 8 & 1 \end{bmatrix} = \begin{bmatrix} 5\cdot 1 & 5\cdot 5 & 5\cdot 8 \\ 5\cdot 9 & 5\cdot 2 & 5\cdot 7 \\ 5\cdot 3 & 5\cdot 8 & 5\cdot 1 \end{bmatrix} = \begin{bmatrix} 5 & 25 & 40 \\ 45 & 10 & 35 \\ 15 & 40 & 5 \end{bmatrix}.$$

$$AB = \begin{bmatrix} 5 & 5 & 8 \\ 8 & 3 & 8 \\ 4 & 5 & 3 \end{bmatrix}\begin{bmatrix} 1 & 5 & 8 \\ 9 & 2 & 7 \\ 3 & 8 & 1 \end{bmatrix} = \begin{bmatrix} 5\cdot(1) + 5\cdot(9) + 8\cdot(3) & 5\cdot(5) + 5\cdot(2) + 8\cdot(8) & 5\cdot(8) + 5\cdot(7) + 8\cdot(1) \\ 8\cdot(1) + 3\cdot(9) + 8\cdot(3) & 8\cdot(5) + 3\cdot(2) + 8\cdot(8) & 8\cdot(8) + 3\cdot(7) + 8\cdot(1) \\ 4\cdot(1) + 5\cdot(9) + 3\cdot(3) & 4\cdot(5) + 5\cdot(2) + 3\cdot(8) & 4\cdot(8) + 5\cdot(7) + 3\cdot(1) \end{bmatrix} = \begin{bmatrix} 74 & 99 \\ 59 & 110 \\ 58 & 54 \end{bmatrix}$$

Question **4**

Correct

Mark 5.00 out of 5.00

Let $A = \begin{bmatrix} 3 & 0 & 2 \\ 2 & 1 & 1 \\ 3 & 2 & 1 \end{bmatrix}$ and $B = \begin{bmatrix} 4 & 3 & 2 \\ 2 & 2 & 1 \\ 0 & 4 & 1 \end{bmatrix}$. Calculate $AB - BA$. What can we deduce if $AB - BA = 0$?

Answer:

-12	10	-5
-3	8	-1
5	11	4

Your last answer was interpreted as follows: $\begin{bmatrix} -12 & 10 & -5 \\ -3 & 8 & -1 \\ 5 & 11 & 4 \end{bmatrix}$

Your answer is correct!
Marks for this submission: 5.00/5.00.

Worked solution:

$$\begin{aligned} AB &= \begin{bmatrix} 3 & 0 & 2 \\ 2 & 1 & 1 \\ 3 & 2 & 1 \end{bmatrix} \cdot \begin{bmatrix} 4 & 3 & 2 \\ 2 & 2 & 1 \\ 0 & 4 & 1 \end{bmatrix} \\ &= \begin{bmatrix} 3\cdot4+0\cdot2+2\cdot0 & 3\cdot3+0\cdot2+2\cdot4 & 3\cdot2+0\cdot1+2\cdot1 \\ 2\cdot4+1\cdot2+1\cdot0 & 2\cdot3+1\cdot2+1\cdot4 & 2\cdot2+1\cdot1+1\cdot1 \\ 3\cdot4+2\cdot2+1\cdot0 & 3\cdot3+2\cdot2+1\cdot4 & 3\cdot2+2\cdot1+1\cdot1 \end{bmatrix} \\ &= \begin{bmatrix} 12 & 17 & 8 \\ 10 & 12 & 6 \\ 16 & 17 & 9 \end{bmatrix} \end{aligned}$$

$$\begin{aligned} BA &= \begin{bmatrix} 4 & 3 & 2 \\ 2 & 2 & 1 \\ 0 & 4 & 1 \end{bmatrix} \cdot \begin{bmatrix} 3 & 0 & 2 \\ 2 & 1 & 1 \\ 3 & 2 & 1 \end{bmatrix} \\ &= \begin{bmatrix} 4\cdot3+3\cdot2+2\cdot3 & 4\cdot0+3\cdot1+2\cdot2 & 4\cdot2+3\cdot1+2\cdot1 \\ 2\cdot3+2\cdot2+1\cdot3 & 2\cdot0+2\cdot1+1\cdot2 & 2\cdot2+2\cdot1+1\cdot1 \\ 0\cdot3+4\cdot2+1\cdot3 & 0\cdot0+4\cdot1+1\cdot2 & 0\cdot2+4\cdot1+1\cdot1 \end{bmatrix} \\ &= \begin{bmatrix} 24 & 7 & 13 \\ 13 & 4 & 7 \\ 11 & 6 & 5 \end{bmatrix} \end{aligned}$$

$$\begin{aligned} AB - BA &= \begin{bmatrix} 12 & 17 & 8 \\ 10 & 12 & 6 \\ 16 & 17 & 9 \end{bmatrix} - \begin{bmatrix} 24 & 7 & 13 \\ 13 & 4 & 7 \\ 11 & 6 & 5 \end{bmatrix} \\ &= \begin{bmatrix} 12-24 & 17-7 & 8-13 \\ 10-13 & 12-4 & 6-7 \\ 16-11 & 17-6 & 9-5 \end{bmatrix} \\ &= \begin{bmatrix} -12 & 10 & -5 \\ -3 & 8 & -1 \\ 5 & 11 & 4 \end{bmatrix}. \end{aligned}$$

Matrix $AB - BA$ is called the commutator of A and B. If the commutator equals zero the product of the matrices commutes and if it is nonzero the matrices do not commute. In other words $AB = BA$ iff $AB - BA = 0$.

Question **5**

Correct

Mark 5.00 out of 5.00

Let

$$A = \begin{bmatrix} 6 & 3 \\ 3 & 0 \end{bmatrix} \quad \text{and} \quad B = \begin{bmatrix} 1 & 4 & 7 \\ 0 & 1 & 7 \end{bmatrix}.$$

Calculate the product $A^T B$.

$$A^T B = \begin{vmatrix} 6 & 27 & 63 \\ 3 & 12 & 21 \end{vmatrix}$$

Your last answer was interpreted as follows: $\begin{bmatrix} 6 & 27 & 63 \\ 3 & 12 & 21 \end{bmatrix}$

Your answer is correct!

Marks for this submission: 5.00/5.00.

Worked solution:

The transpose of matrix A can be formed by switching the rows and columns of the matrix together.

$$A^T = \begin{bmatrix} 6 & 3 \\ 3 & 0 \end{bmatrix}$$

Note that the product would not be defined without the transpose. The left matrix must have the same amount of columns as the right matrix has rows.

Example:

$$A = \begin{bmatrix} A_{11} & A_{12} & A_{13} \\ A_{21} & A_{22} & A_{23} \end{bmatrix}, \quad B = \begin{bmatrix} B_{11} & B_{12} \\ B_{21} & B_{22} \\ B_{31} & B_{32} \end{bmatrix}$$

A is a 2×3 matrix and B is a 3×2 matrix. The product will then be the following 2×2:

$$AB = \begin{bmatrix} A_{11} \cdot B_{11} + A_{12} \cdot B_{21} + A_{13} \cdot B_{31} & A_{11} \cdot B_{12} + A_{12} \cdot B_{22} + A_{13} \cdot B_{32} \\ A_{21} \cdot B_{11} + A_{22} \cdot B_{21} + A_{23} \cdot B_{31} & A_{21} \cdot B_{12} + A_{22} \cdot B_{22} + A_{23} \cdot B_{32} \end{bmatrix}$$

Question **6**

Correct

Mark 5.00 out of 5.00

Let

$$A = \begin{bmatrix} 1 & 2 & 5 \\ 1 & 5 & 2 \\ 2 & 3 & 1 \end{bmatrix} \quad \text{and} \quad B = \begin{bmatrix} 5 & 3 & 5 \\ 2 & 1 & 2 \\ 3 & 4 & 4 \end{bmatrix}.$$

Calculate the products $C_1 = AB$ and $C_2 = BA$.

$C_1 =$

24	25	29
21	16	23
19	13	20

Your last answer was interpreted as follows: $\begin{bmatrix} 24 & 25 & 29 \\ 21 & 16 & 23 \\ 19 & 13 & 20 \end{bmatrix}$

$C_2 =$

18	40	36
7	15	14
15	38	27

Your last answer was interpreted as follows: $\begin{bmatrix} 18 & 40 & 36 \\ 7 & 15 & 14 \\ 15 & 38 & 27 \end{bmatrix}$

Your answer is correct!

Your answer is correct!

C_1 is correct.

Marks for this submission: 2.50/2.50.

Your answer is correct!

C_2 is correct.

Marks for this submission: 2.50/2.50.

Worked solution:

$$
\begin{aligned}
C_1 &= AB \\
&= \begin{bmatrix} 1 & 2 & 5 \\ 1 & 5 & 2 \\ 2 & 3 & 1 \end{bmatrix} \cdot \begin{bmatrix} 5 & 3 & 5 \\ 2 & 1 & 2 \\ 3 & 4 & 4 \end{bmatrix} \\
&= \begin{bmatrix} 1\cdot5+2\cdot2+5\cdot3 & 1\cdot3+2\cdot1+5\cdot4 & 1\cdot5+2\cdot2+5\cdot4 \\ 1\cdot5+5\cdot2+2\cdot3 & 1\cdot3+5\cdot1+2\cdot4 & 1\cdot5+5\cdot2+2\cdot4 \\ 2\cdot5+3\cdot2+1\cdot3 & 2\cdot3+3\cdot1+1\cdot4 & 2\cdot5+3\cdot2+1\cdot4 \end{bmatrix} \\
&= \begin{bmatrix} 5+4+15 & 3+2+20 & 5+4+20 \\ 5+10+6 & 3+5+8 & 5+10+8 \\ 10+6+3 & 6+3+4 & 10+6+4 \end{bmatrix} \\
&= \underline{\underline{\begin{bmatrix} 24 & 25 & 29 \\ 21 & 16 & 23 \\ 19 & 13 & 20 \end{bmatrix}.}}
\end{aligned}
$$

$$
\begin{aligned}
C_2 &= BA \\
&= \begin{bmatrix} 5 & 3 & 5 \\ 2 & 1 & 2 \\ 3 & 4 & 4 \end{bmatrix} \cdot \begin{bmatrix} 1 & 2 & 5 \\ 1 & 5 & 2 \\ 2 & 3 & 1 \end{bmatrix} \\
&= \begin{bmatrix} 5\cdot1+3\cdot1+5\cdot2 & 5\cdot2+3\cdot5+5\cdot3 & 5\cdot5+3\cdot2+5\cdot1 \\ 2\cdot1+1\cdot1+2\cdot2 & 2\cdot2+1\cdot5+2\cdot3 & 2\cdot5+1\cdot2+2\cdot1 \\ 3\cdot1+4\cdot1+4\cdot2 & 3\cdot2+4\cdot5+4\cdot3 & 3\cdot5+4\cdot2+4\cdot1 \end{bmatrix} \\
&= \begin{bmatrix} 5+3+10 & 10+15+15 & 25+6+5 \\ 2+1+4 & 4+5+6 & 10+2+2 \\ 3+4+8 & 6+20+12 & 15+8+4 \end{bmatrix} \\
&= \underline{\underline{\begin{bmatrix} 18 & 40 & 36 \\ 7 & 15 & 14 \\ 15 & 38 & 27 \end{bmatrix}.}}
\end{aligned}
$$

Question 7

Correct

Mark 5.00 out of 5.00

Let

$$A = \begin{bmatrix} 3 & 4 & 3 \\ 3 & 4 & 2 \\ 4 & 3 & 2 \end{bmatrix} \quad \text{and} \quad B = \begin{bmatrix} 4 & 3 & 1 \\ 3 & 5 & 2 \\ 3 & 4 & 3 \end{bmatrix}.$$

Calculate the matrix products AB, BA and the difference $AB - BA$.

$AB =$

33	41	20
30	37	17
31	35	16

Your last answer was interpreted as follows: $\begin{bmatrix} 33 & 41 & 20 \\ 30 & 37 & 17 \\ 31 & 35 & 16 \end{bmatrix}$

$BA =$

25	31	20
32	38	23
33	37	23

Your last answer was interpreted as follows: $\begin{bmatrix} 25 & 31 & 20 \\ 32 & 38 & 23 \\ 33 & 37 & 23 \end{bmatrix}$

$AB - BA =$

8	10	0
-2	-1	-6
-2	-2	-7

Your last answer was interpreted as follows: $\begin{bmatrix} 8 & 10 & 0 \\ -2 & -1 & -6 \\ -2 & -2 & -7 \end{bmatrix}$

Your answer is correct!

Your answer is correct!

AB is correct.

Marks for this submission: 1.67/1.67.

Your answer is correct!

BA is correct.

Marks for this submission: 1.67/1.67.

Your answer is correct!

The difference $AB - BA$ is correct.

Marks for this submission: 1.67/1.67.

Worked solution:

$$AB = \begin{bmatrix} 3 & 4 & 3 \\ 3 & 4 & 2 \\ 4 & 3 & 2 \end{bmatrix} \cdot \begin{bmatrix} 4 & 3 & 1 \\ 3 & 5 & 2 \\ 3 & 4 & 3 \end{bmatrix}$$

$$= \begin{bmatrix} 3 \cdot 4 + 4 \cdot 3 + 3 \cdot 3 & 3 \cdot 3 + 4 \cdot 5 + 3 \cdot 4 & 3 \cdot 1 + 4 \cdot 2 + 3 \cdot 3 \\ 3 \cdot 4 + 4 \cdot 3 + 2 \cdot 3 & 3 \cdot 3 + 4 \cdot 5 + 2 \cdot 4 & 3 \cdot 1 + 4 \cdot 2 + 2 \cdot 3 \\ 4 \cdot 4 + 3 \cdot 3 + 2 \cdot 3 & 4 \cdot 3 + 3 \cdot 5 + 2 \cdot 4 & 4 \cdot 1 + 3 \cdot 2 + 2 \cdot 3 \end{bmatrix}$$

$$= \begin{bmatrix} 33 & 41 & 20 \\ 30 & 37 & 17 \\ 31 & 35 & 16 \end{bmatrix}$$

$$BA = \begin{bmatrix} 4 & 3 & 1 \\ 3 & 5 & 2 \\ 3 & 4 & 3 \end{bmatrix} \cdot \begin{bmatrix} 3 & 4 & 3 \\ 3 & 4 & 2 \\ 4 & 3 & 2 \end{bmatrix}$$

$$= \begin{bmatrix} 4 \cdot 3 + 3 \cdot 3 + 1 \cdot 4 & 4 \cdot 4 + 3 \cdot 4 + 1 \cdot 3 & 4 \cdot 3 + 3 \cdot 2 + 1 \cdot 2 \\ 3 \cdot 3 + 5 \cdot 3 + 2 \cdot 4 & 3 \cdot 4 + 5 \cdot 4 + 2 \cdot 3 & 3 \cdot 3 + 5 \cdot 2 + 2 \cdot 2 \\ 3 \cdot 3 + 4 \cdot 3 + 3 \cdot 4 & 3 \cdot 4 + 4 \cdot 4 + 3 \cdot 3 & 3 \cdot 3 + 4 \cdot 2 + 3 \cdot 2 \end{bmatrix}$$

$$= \begin{bmatrix} 25 & 31 & 20 \\ 32 & 38 & 23 \\ 33 & 37 & 23 \end{bmatrix}$$

$$AB - BA = \begin{bmatrix} 33-25 & 41-31 & 20-20 \\ 30-32 & 37-38 & 17-23 \\ 31-33 & 35-37 & 16-23 \end{bmatrix}$$

$$= \begin{bmatrix} 8 & 10 & 0 \\ -2 & -1 & -6 \\ -2 & -2 & -7 \end{bmatrix}$$

Question **8**

Correct

Mark 5.00 out of 5.00

Calculate the products AB and BA when the matrices are $\mathrm{A} = \begin{bmatrix} 1 & 2 & 3 & 4 \end{bmatrix}, \quad \mathrm{B} = \begin{bmatrix} 2 \\ 9 \\ 2 \\ 7 \end{bmatrix}.$

$\mathrm{AB} =$ 54

Your last answer was interpreted as follows: 54

$\mathrm{BA} =$

2	4	6	8
9	18	27	36
2	4	6	8
7	14	21	28

Your last answer was interpreted as follows: $\begin{bmatrix} 2 & 4 & 6 & 8 \\ 9 & 18 & 27 & 36 \\ 2 & 4 & 6 & 8 \\ 7 & 14 & 21 & 28 \end{bmatrix}$

Your answer is correct!

Your answer is correct!
The product AB is correct!
Marks for this submission: 2.50/2.50.

Your answer is correct!
The product BA is correct!
Marks for this submission: 2.50/2.50.

Worked solution:

$$\mathrm{AB} = 1 \cdot 2 + 2 \cdot 9 + 3 \cdot 2 + 4 \cdot 7 = 54. \ \mathrm{BA} = \begin{bmatrix} 2 \cdot 1 & 2 \cdot 2 & 2 \cdot 3 & 2 \cdot 4 \\ 9 \cdot 1 & 9 \cdot 2 & 9 \cdot 3 & 9 \cdot 4 \\ 2 \cdot 1 & 2 \cdot 2 & 2 \cdot 3 & 2 \cdot 4 \\ 7 \cdot 1 & 7 \cdot 2 & 7 \cdot 3 & 7 \cdot 4 \end{bmatrix} = \begin{bmatrix} 2 & 4 & 6 & 8 \\ 9 & 18 & 27 & 36 \\ 2 & 4 & 6 & 8 \\ 7 & 14 & 21 & 28 \end{bmatrix}.$$

Question **9**

Correct

Mark 5.00 out of 5.00

Let

$A = \begin{bmatrix} 3 & 1 & 6 \\ 2 & 3 & 1 \end{bmatrix}$ and $B = \begin{bmatrix} 6 & 3 \\ 3 & 5 \end{bmatrix}$.

Calculate $A^T B$.

24	19
15	18
39	23

Your last answer was interpreted as follows: $\begin{bmatrix} 24 & 19 \\ 15 & 18 \\ 39 & 23 \end{bmatrix}$

Your answer is correct!
Marks for this submission: 5.00/5.00.

Worked solution:

The transpose of A is $A^T = \begin{bmatrix} 3 & 2 \\ 1 & 3 \\ 6 & 1 \end{bmatrix}$. Let's compute the elements of the product next. The element on the ith row and jth column of $A^T B$ can be calculated by taking the dot product of the ith row of A^T and the jth column of B. The element in the first row and first column is then $(A^T B)_{11} = (3, 2) \cdot (6, 3) = 3 \cdot 6 + 2 \cdot 3 = 24$ and the element in the first row and second column is $(A^T B)_{12} = (3, 2) \cdot (3, 5) = 3 \cdot 3 + 2 \cdot 5 = 19$. The rest of the elements can be similarly calculated. The answer is

$A^T B = \begin{bmatrix} 24 & 19 \\ 15 & 18 \\ 39 & 23 \end{bmatrix}$.

Question **10**

Correct

Mark 5.00 out of 5.00

Let

$A = \begin{bmatrix} -2 & 1 \\ 2 & k \end{bmatrix}$ and $B = \begin{bmatrix} 4 & 4 \\ 8 & 4 \end{bmatrix}$.

Determine the parameter k such that $AB = BA$.

$k =$ -2

Your last answer was interpreted as follows: -2

Your answer is correct!

Marks for this submission: 5.00/5.00.

Worked solution:

Let's begin by computing the products AB and BA.

$$\begin{aligned} AB &= \begin{bmatrix} -2 & 1 \\ 2 & k \end{bmatrix} \cdot \begin{bmatrix} 4 & 4 \\ 8 & 4 \end{bmatrix} \\ &= \begin{bmatrix} 0 & -4 \\ 8 \cdot k + 8 & 4 \cdot k + 8 \end{bmatrix}, \\ BA &= \begin{bmatrix} 4 & 4 \\ 8 & 4 \end{bmatrix} \cdot \begin{bmatrix} -2 & 1 \\ 2 & k \end{bmatrix} \\ &= \begin{bmatrix} 0 & 4 \cdot k + 4 \\ -8 & 4 \cdot k + 8 \end{bmatrix}. \end{aligned}$$

For the matrices to be equal their corresponding elements must be equal.

We note that two elements in the products are identical. Let's therefore use for example the elements $(AB)_{21}$ and $(BA)_{21}$ to calculate k.

$$\begin{aligned} (AB)_{21} &= (BA)_{21} \\ 8 \cdot k + 8 &= -8 \\ 8 \cdot k &= -16 \\ k &= -2. \end{aligned}$$

Finally let's check that equality holds for the element in the first row and last column.

$$\begin{aligned} (BA)_{12} &= 4 \cdot k + 4 \qquad || \ k = -2 \\ &= -4 \end{aligned}$$

Question **11**

Correct

Mark 5.00 out of 5.00

Calculate the product Ax when

$$A = \begin{bmatrix} 2 & -4 & 0 \\ 5 & 1 & 5 \\ -1 & -3 & 4 \end{bmatrix} \text{ and } x = \begin{bmatrix} 2 & 3 & -2 \end{bmatrix}^T.$$

$Ax = \begin{bmatrix} -8 & 3 & -19 \end{bmatrix}^T$.

Your last answer was interpreted as follows: -8

Your last answer was interpreted as follows: 3

Your last answer was interpreted as follows: -19

Your answer is correct!

Marks for this submission: 5.00/5.00.

Worked solution:

$$\begin{aligned} Ax &= \begin{bmatrix} 2 & -4 & 0 \\ 5 & 1 & 5 \\ -1 & -3 & 4 \end{bmatrix} \begin{bmatrix} 2 \\ 3 \\ -2 \end{bmatrix} \\ &= \begin{bmatrix} 2 \cdot 2 + (-4) \cdot 3 + 0 \cdot (-2) \\ 5 \cdot 2 + 1 \cdot 3 + 5 \cdot (-2) \\ (-1) \cdot 2 + (-3) \cdot 3 + 4 \cdot (-2) \end{bmatrix} \\ &= \begin{bmatrix} -8 \\ 3 \\ -19 \end{bmatrix}. \end{aligned}$$

Question **12**

Correct

Mark 5.00 out of 5.00

Calculate the product $\mathrm{A}\mathbf{x}$ when $\mathrm{A} = \begin{bmatrix} 0 & -1 & 2 \\ 4 & 1 & 5 \\ 1 & 5 & 2 \end{bmatrix}$ and $\mathbf{x} = \begin{bmatrix} 3 & 3 & -1 \end{bmatrix}^{\mathsf{T}}$.

$\mathrm{A}\mathbf{x} =$ -5 / 10 / 16

Your last answer was interpreted as follows: $\begin{bmatrix} -5 \\ 10 \\ 16 \end{bmatrix}$

Your answer is correct!
Marks for this submission: 5.00/5.00.

Worked solution:

$$\begin{aligned} \mathrm{A}\mathbf{x} &= \begin{bmatrix} 0 & -1 & 2 \\ 4 & 1 & 5 \\ 1 & 5 & 2 \end{bmatrix}\begin{bmatrix} 3 \\ 3 \\ -1 \end{bmatrix} \\ &= \begin{bmatrix} 0 \cdot 3 + (-1) \cdot 3 + 2 \cdot (-1) \\ 4 \cdot 3 + 1 \cdot 3 + 5 \cdot (-1) \\ (1) \cdot 3 + (5) \cdot 3 + 2 \cdot (-1) \end{bmatrix} \\ &= \begin{bmatrix} -5 \\ 10 \\ 16 \end{bmatrix}. \end{aligned}$$