# CSPB 2820 - Truong - Linear Algebra with Computer Science Applications



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|---|---|
| **Started on** | Wednesday, 11 October 2023, 3:57 PM |
| **State** | Finished |
| **Completed on** | Wednesday, 11 October 2023, 4:29 PM |
| **Time taken** | 32 mins 39 secs |
| **Marks** | 9.00/9.00 |
| **Grade** | **10.00** out of 10.00 (**100**%) |

Question **1**

Correct

Mark 1.00 out of 1.00

Let $A = \begin{bmatrix} 7 & 2 & 6 \\ 9 & 7 & 5 \\ 2 & 8 & 4 \end{bmatrix}$ and $B = \begin{bmatrix} 8 & 7 & 5 \\ 4 & 1 & 7 \\ 3 & 2 & 6 \end{bmatrix}$.

Calculate $A + B, 4B$ and $AB$.

$A + B =$

| | | |
|---|---|---|
| 15 | 9 | 11 |
| 13 | 8 | 12 |
| 5 | 10 | 10 |

Your last answer was interpreted as follows: $\begin{bmatrix} 15 & 9 & 11 \\ 13 & 8 & 12 \\ 5 & 10 & 10 \end{bmatrix}$

$4B =$

| | | |
|---|---|---|
| 32 | 28 | 20 |
| 16 | 4 | 28 |
| 12 | 8 | 24 |

Your last answer was interpreted as follows: $\begin{bmatrix} 32 & 28 & 20 \\ 16 & 4 & 28 \\ 12 & 8 & 24 \end{bmatrix}$

$AB =$

| | | |
|---|---|---|
| 82 | 63 | 85 |
| 115 | 80 | 124 |
| 60 | 30 | 90 |

Your last answer was interpreted as follows: $\begin{bmatrix} 82 & 63 & 85 \\ 115 & 80 & 124 \\ 60 & 30 & 90 \end{bmatrix}$

Your answer is correct!

Your answer is correct!

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

Marks for this submission: 0.33/0.33.

Your answer is correct!

Your answer to $4B$ is correct.

Marks for this submission: 0.33/0.33.

Your answer is correct!

Your answer to $AB$ is correct.

Marks for this submission: 0.33/0.33.

**Worked solution:**

$$A + B = \begin{bmatrix} 8+7 & 7+2 & 6+5 \\ 9+4 & 7+1 & 7+5 \\ 3+2 & 8+2 & 6+4 \end{bmatrix} = \begin{bmatrix} 15 & 9 & 11 \\ 13 & 8 & 12 \\ 5 & 10 & 10 \end{bmatrix}. 4B = 4\begin{bmatrix} 8 & 7 & 5 \\ 4 & 1 & 7 \\ 3 & 2 & 6 \end{bmatrix} = \begin{bmatrix} 4\cdot 8 & 4\cdot 7 & 4\cdot 5 \\ 4\cdot 4 & 4\cdot 1 & 4\cdot 7 \\ 4\cdot 3 & 4\cdot 2 & 4\cdot 6 \end{bmatrix} = \begin{bmatrix} 32 & 28 & 20 \\ 16 & 4 & 28 \\ 12 & 8 & 24 \end{bmatrix}.$$

$$AB = \begin{bmatrix} 7 & 2 & 6 \\ 9 & 7 & 5 \\ 2 & 8 & 4 \end{bmatrix}\begin{bmatrix} 8 & 7 & 5 \\ 4 & 1 & 7 \\ 3 & 2 & 6 \end{bmatrix} = \begin{bmatrix} 7\cdot(8)+2\cdot(4)+6\cdot(3) & 7\cdot(7)+2\cdot(1)+6\cdot(2) & 7\cdot(5)+2\cdot(7)+6\cdot(6) \\ 9\cdot(8)+7\cdot(4)+5\cdot(3) & 9\cdot(7)+7\cdot(1)+5\cdot(2) & 9\cdot(5)+7\cdot(7)+5\cdot(6) \\ 2\cdot(8)+8\cdot(4)+4\cdot(3) & 2\cdot(7)+8\cdot(1)+4\cdot(2) & 2\cdot(5)+8\cdot(7)+4\cdot(6) \end{bmatrix} = \begin{bmatrix} 82 & 63 \\ 115 & 80 \\ 60 & 30 \end{bmatrix}$$

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A correct answer is $\begin{bmatrix} 15 & 9 & 11 \\ 13 & 8 & 12 \\ 5 & 10 & 10 \end{bmatrix}$.

A correct answer is $\begin{bmatrix} 32 & 28 & 20 \\ 16 & 4 & 28 \\ 12 & 8 & 24 \end{bmatrix}$.

A correct answer is $\begin{bmatrix} 82 & 63 & 85 \\ 115 & 80 & 124 \\ 60 & 30 & 90 \end{bmatrix}$.

Question **2**

Correct

Mark 1.00 out of 1.00

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

Answer:

| | | |
|---|---|---|
| -4 | -4 | 0 |
| 0 | -2 | 10 |
| 0 | -2 | 6 |

Your last answer was interpreted as follows: $\begin{bmatrix} -4 & -4 & 0 \\ 0 & -2 & 10 \\ 0 & -2 & 6 \end{bmatrix}$

Your answer is correct!
Marks for this submission: 1.00/1.00.

**Worked solution:**

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

$$BA = \begin{bmatrix} 3 & 0 & 4 \\ 0 & 1 & 2 \\ 4 & 0 & 3 \end{bmatrix} \cdot \begin{bmatrix} 0 & 0 & 0 \\ 1 & 3 & 0 \\ 1 & 1 & 0 \end{bmatrix}$$
$$= \begin{bmatrix} 3\cdot0+0\cdot1+4\cdot1 & 3\cdot0+0\cdot3+4\cdot1 & 3\cdot0+0\cdot0+4\cdot0 \\ 0\cdot0+1\cdot1+2\cdot1 & 0\cdot0+1\cdot3+2\cdot1 & 0\cdot0+1\cdot0+2\cdot0 \\ 4\cdot0+0\cdot1+3\cdot1 & 4\cdot0+0\cdot3+3\cdot1 & 4\cdot0+0\cdot0+3\cdot0 \end{bmatrix}$$
$$= \begin{bmatrix} 4 & 4 & 0 \\ 3 & 5 & 0 \\ 3 & 3 & 0 \end{bmatrix}$$

$$AB - BA = \begin{bmatrix} 0 & 0 & 0 \\ 3 & 3 & 10 \\ 3 & 1 & 6 \end{bmatrix} - \begin{bmatrix} 4 & 4 & 0 \\ 3 & 5 & 0 \\ 3 & 3 & 0 \end{bmatrix}$$
$$= \begin{bmatrix} 0-4 & 0-4 & 0-0 \\ 3-3 & 3-5 & 10-0 \\ 3-3 & 1-3 & 6-0 \end{bmatrix}$$
$$= \begin{bmatrix} -4 & -4 & 0 \\ 0 & -2 & 10 \\ 0 & -2 & 6 \end{bmatrix}.$$

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 $AB - BA = 0$.

A correct answer is $\begin{bmatrix} -4 & -4 & 0 \\ 0 & -2 & 10 \\ 0 & -2 & 6 \end{bmatrix}$.

Question 3

Correct

Mark 1.00 out of 1.00

Let

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

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

$C_1 =$

| | | |
|---|---|---|
| 37 | 34 | 38 |
| 38 | 29 | 30 |
| 20 | 16 | 17 |

Your last answer was interpreted as follows: $\begin{bmatrix} 37 & 34 & 38 \\ 38 & 29 & 30 \\ 20 & 16 & 17 \end{bmatrix}$

$C_2 =$

| | | |
|---|---|---|
| 37 | 36 | 22 |
| 26 | 25 | 16 |
| 42 | 44 | 21 |

Your last answer was interpreted as follows: $\begin{bmatrix} 37 & 36 & 22 \\ 26 & 25 & 16 \\ 42 & 44 & 21 \end{bmatrix}$

Your answer is correct!

Your answer is correct!

$C_1$ is correct.

Marks for this submission: 0.50/0.50.

Your answer is correct!

$C_2$ is correct.

Marks for this submission: 0.50/0.50.

**Worked solution:**

$$
\begin{aligned}
C_1 &= AB \\
&= \begin{bmatrix} 4 & 3 & 4 \\ 5 & 5 & 1 \\ 2 & 3 & 1 \end{bmatrix} \cdot \begin{bmatrix} 4 & 3 & 3 \\ 3 & 2 & 2 \\ 3 & 4 & 5 \end{bmatrix} \\
&= \begin{bmatrix} 4 \cdot 4 + 3 \cdot 3 + 4 \cdot 3 & 4 \cdot 3 + 3 \cdot 2 + 4 \cdot 4 & 4 \cdot 3 + 3 \cdot 2 + 4 \cdot 5 \\ 5 \cdot 4 + 5 \cdot 3 + 1 \cdot 3 & 5 \cdot 3 + 5 \cdot 2 + 1 \cdot 4 & 5 \cdot 3 + 5 \cdot 2 + 1 \cdot 5 \\ 2 \cdot 4 + 3 \cdot 3 + 1 \cdot 3 & 2 \cdot 3 + 3 \cdot 2 + 1 \cdot 4 & 2 \cdot 3 + 3 \cdot 2 + 1 \cdot 5 \end{bmatrix} \\
&= \begin{bmatrix} 16 + 9 + 12 & 12 + 6 + 16 & 12 + 6 + 20 \\ 20 + 15 + 3 & 15 + 10 + 4 & 15 + 10 + 5 \\ 8 + 9 + 3 & 6 + 6 + 4 & 6 + 6 + 5 \end{bmatrix} \\
&= \underline{\underline{\begin{bmatrix} 37 & 34 & 38 \\ 38 & 29 & 30 \\ 20 & 16 & 17 \end{bmatrix}}}.
\end{aligned}
$$

$$
\begin{aligned}
C_2 &= BA \\
&= \begin{bmatrix} 4 & 3 & 3 \\ 3 & 2 & 2 \\ 3 & 4 & 5 \end{bmatrix} \cdot \begin{bmatrix} 4 & 3 & 4 \\ 5 & 5 & 1 \\ 2 & 3 & 1 \end{bmatrix} \\
&= \begin{bmatrix} 4 \cdot 4 + 3 \cdot 5 + 3 \cdot 2 & 4 \cdot 3 + 3 \cdot 5 + 3 \cdot 3 & 4 \cdot 4 + 3 \cdot 1 + 3 \cdot 1 \\ 3 \cdot 4 + 2 \cdot 5 + 2 \cdot 2 & 3 \cdot 3 + 2 \cdot 5 + 2 \cdot 3 & 3 \cdot 4 + 2 \cdot 1 + 2 \cdot 1 \\ 3 \cdot 4 + 4 \cdot 5 + 5 \cdot 2 & 3 \cdot 3 + 4 \cdot 5 + 5 \cdot 3 & 3 \cdot 4 + 4 \cdot 1 + 5 \cdot 1 \end{bmatrix} \\
&= \begin{bmatrix} 16 + 15 + 6 & 12 + 15 + 9 & 16 + 3 + 3 \\ 12 + 10 + 4 & 9 + 10 + 6 & 12 + 2 + 2 \\ 12 + 20 + 10 & 9 + 20 + 15 & 12 + 4 + 5 \end{bmatrix} \\
&= \underline{\underline{\begin{bmatrix} 37 & 36 & 22 \\ 26 & 25 & 16 \\ 42 & 44 & 21 \end{bmatrix}}}.
\end{aligned}
$$

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A correct answer is $\begin{bmatrix} 37 & 34 & 38 \\ 38 & 29 & 30 \\ 20 & 16 & 17 \end{bmatrix}$.

A correct answer is $\begin{bmatrix} 37 & 36 & 22 \\ 26 & 25 & 16 \\ 42 & 44 & 21 \end{bmatrix}$.

Question **4**

Correct

Mark 1.00 out of 1.00

Let

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

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

$AB =$

| | | |
|---|---|---|
| 18 | 34 | 39 |
| 14 | 23 | 29 |
| 16 | 31 | 37 |

Your last answer was interpreted as follows: $\begin{bmatrix} 18 & 34 & 39 \\ 14 & 23 & 29 \\ 16 & 31 & 37 \end{bmatrix}$

$BA =$

| | | |
|---|---|---|
| 28 | 28 | 27 |
| 22 | 23 | 21 |
| 32 | 29 | 27 |

Your last answer was interpreted as follows: $\begin{bmatrix} 28 & 28 & 27 \\ 22 & 23 & 21 \\ 32 & 29 & 27 \end{bmatrix}$

$AB - BA =$

| | | |
|---|---|---|
| -10 | 6 | 12 |
| -8 | 0 | 8 |
| -16 | 2 | 10 |

Your last answer was interpreted as follows: $\begin{bmatrix} -10 & 6 & 12 \\ -8 & 0 & 8 \\ -16 & 2 & 10 \end{bmatrix}$

Your answer is correct!

Your answer is correct!

$AB$ is correct.

Marks for this submission: 0.33/0.33.

Your answer is correct!

$BA$ is correct.

Marks for this submission: 0.33/0.33.

Your answer is correct!

The difference $AB - BA$ is correct.

Marks for this submission: 0.33/0.33.

**Worked solution:**

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

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

$$= \underline{\underline{\begin{bmatrix} 18 & 34 & 39 \\ 14 & 23 & 29 \\ 16 & 31 & 37 \end{bmatrix}}}$$

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

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

$$= \underline{\underline{\begin{bmatrix} 28 & 28 & 27 \\ 22 & 23 & 21 \\ 32 & 29 & 27 \end{bmatrix}}}$$

$$AB - BA = \begin{bmatrix} 18 - 28 & 34 - 28 & 39 - 27 \\ 14 - 22 & 23 - 23 & 29 - 21 \\ 16 - 32 & 31 - 29 & 37 - 27 \end{bmatrix}$$

$$= \underline{\underline{\begin{bmatrix} -10 & 6 & 12 \\ -8 & 0 & 8 \\ -16 & 2 & 10 \end{bmatrix}}}$$

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A correct answer is $\begin{bmatrix} 18 & 34 & 39 \\ 14 & 23 & 29 \\ 16 & 31 & 37 \end{bmatrix}$.

A correct answer is $\begin{bmatrix} 28 & 28 & 27 \\ 22 & 23 & 21 \\ 32 & 29 & 27 \end{bmatrix}$.

A correct answer is $\begin{bmatrix} -10 & 6 & 12 \\ -8 & 0 & 8 \\ -16 & 2 & 10 \end{bmatrix}$.

Question **5**

Correct

Mark 1.00 out of 1.00

Calculate the products $\mathrm{AB}$ and $\mathrm{BA}$ when the matrices are $\mathrm{A} = \begin{bmatrix} 1 & 2 & 3 & 4 \end{bmatrix}$, $\mathrm{B} = \begin{bmatrix} 5 \\ 8 \\ 1 \\ 1 \end{bmatrix}$.

$\mathrm{AB} =$ 28

Your last answer was interpreted as follows: $28$

$\mathrm{BA} = \begin{bmatrix} 5 & 10 & 15 & 20 \\ 8 & 16 & 24 & 32 \\ 1 & 2 & 3 & 4 \\ 1 & 2 & 3 & 4 \end{bmatrix}$

Your last answer was interpreted as follows: $\begin{bmatrix} 5 & 10 & 15 & 20 \\ 8 & 16 & 24 & 32 \\ 1 & 2 & 3 & 4 \\ 1 & 2 & 3 & 4 \end{bmatrix}$

Your answer is correct!

Your answer is correct!
The product $\mathrm{AB}$ is correct!
Marks for this submission: 0.50/0.50.

Your answer is correct!
The product $\mathrm{BA}$ is correct!
Marks for this submission: 0.50/0.50.

**Worked solution:**

$$\mathrm{AB} = 1 \cdot 5 + 2 \cdot 8 + 3 \cdot 1 + 4 \cdot 1 = 28. \ \mathrm{BA} = \begin{bmatrix} 5 \cdot 1 & 5 \cdot 2 & 5 \cdot 3 & 5 \cdot 4 \\ 8 \cdot 1 & 8 \cdot 2 & 8 \cdot 3 & 8 \cdot 4 \\ 1 \cdot 1 & 1 \cdot 2 & 1 \cdot 3 & 1 \cdot 4 \\ 1 \cdot 1 & 1 \cdot 2 & 1 \cdot 3 & 1 \cdot 4 \end{bmatrix} = \begin{bmatrix} 5 & 10 & 15 & 20 \\ 8 & 16 & 24 & 32 \\ 1 & 2 & 3 & 4 \\ 1 & 2 & 3 & 4 \end{bmatrix}.$$

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A correct answer is $28$, which can be typed in as follows: 28

A correct answer is $\begin{bmatrix} 5 & 10 & 15 & 20 \\ 8 & 16 & 24 & 32 \\ 1 & 2 & 3 & 4 \\ 1 & 2 & 3 & 4 \end{bmatrix}$.

Question **6**

Correct

Mark 1.00 out of 1.00

Let

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

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

$k =$ -6

Your last answer was interpreted as follows: $-6$

Your answer is correct!

Marks for this submission: 1.00/1.00.

**Worked solution:**

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

$$\begin{aligned} AB &= \begin{bmatrix} -3 & 1 \\ 3 & k \end{bmatrix} \cdot \begin{bmatrix} -1 & 1 \\ 3 & -4 \end{bmatrix} \\ &= \begin{bmatrix} 6 & -7 \\ 3 \cdot k - 3 & 3 - 4 \cdot k \end{bmatrix}, \\ BA &= \begin{bmatrix} -1 & 1 \\ 3 & -4 \end{bmatrix} \cdot \begin{bmatrix} -3 & 1 \\ 3 & k \end{bmatrix} \\ &= \begin{bmatrix} 6 & k - 1 \\ -21 & 3 - 4 \cdot k \end{bmatrix}. \end{aligned}$$

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 $k$.

$$\begin{aligned} (AB)_{21} &= (BA)_{21} \\ 3 \cdot k - 3 &= -21 \\ 3 \cdot k &= -18 \\ k &= -6. \end{aligned}$$

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

$$\begin{aligned} (BA)_{12} &= k - 1 \qquad || \; k = -6 \\ &= -7 \end{aligned}$$

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A correct answer is $-6$, which can be typed in as follows: -6

Question **7**

Correct

Mark 1.00 out of 1.00

Calculate the product $Ax$ when

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

$Ax = \begin{bmatrix} \text{-13} & \text{-2} & \text{-23} \end{bmatrix}^T.$

Your last answer was interpreted as follows: $-13$

Your last answer was interpreted as follows: $-2$

Your last answer was interpreted as follows: $-23$

Your answer is correct!
Marks for this submission: 1.00/1.00.

**Worked solution:**

$$\begin{aligned} Ax &= \begin{bmatrix} 5 & -4 & 2 \\ 1 & 3 & 4 \\ -2 & -2 & 5 \end{bmatrix} \begin{bmatrix} 1 \\ 3 \\ -3 \end{bmatrix} \\ &= \begin{bmatrix} 5 \cdot 1 + (-4) \cdot 3 + 2 \cdot (-3) \\ 1 \cdot 1 + 3 \cdot 3 + 4 \cdot (-3) \\ (-2) \cdot 1 + (-2) \cdot 3 + 5 \cdot (-3) \end{bmatrix} \\ &= \begin{bmatrix} -13 \\ -2 \\ -23 \end{bmatrix}. \end{aligned}$$

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A correct answer is $-13$, which can be typed in as follows: -13

A correct answer is $-2$, which can be typed in as follows: -2

A correct answer is $-23$, which can be typed in as follows: -23

Question **8**

Correct

Mark 1.00 out of 1.00

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

$\mathrm{A}\mathbf{x} =$ 

| |
|---|
| -10 |
| -2 |
| 1 |

Your last answer was interpreted as follows: $\begin{bmatrix} -10 \\ -2 \\ 1 \end{bmatrix}$

Your answer is correct!

Marks for this submission: 1.00/1.00.

**Worked solution:**

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

A correct answer is $\begin{bmatrix} -10 \\ -2 \\ 1 \end{bmatrix}$.

Question **9**

Correct

Mark 1.00 out of 1.00

Let

$$A = \begin{bmatrix} 2 & 5 & 7 \\ 6 & 6 & 4 \\ 7 & 4 & 6 \end{bmatrix}.$$

The transpose of $A$ is:

| | | |
|---|---|---|
| 2 | 6 | 7 |
| 5 | 6 | 4 |
| 7 | 4 | 6 |

Your last answer was interpreted as follows: $\begin{bmatrix} 2 & 6 & 7 \\ 5 & 6 & 4 \\ 7 & 4 & 6 \end{bmatrix}$

Your answer is correct!Vastauksesi on oikein!

Marks for this submission: 1.00/1.00.

**Worked solution:**

The transpose of $M$, denoted $M^{\intercal}$, is defined by the following equation.

$$M^{\intercal}_{ij} = M_{ji}.$$

Therefore the transpose of

$$A = \begin{bmatrix} 2 & 5 & 7 \\ 6 & 6 & 4 \\ 7 & 4 & 6 \end{bmatrix}$$

is

$$A^{\intercal} = \begin{bmatrix} 2 & 6 & 7 \\ 5 & 6 & 4 \\ 7 & 4 & 6 \end{bmatrix}.$$

**Mallivastaus:**

Matriisin $M$ transpoosi $M^{\intercal}$ määritellään seuraavasti.

$$M^{\intercal}_{ij} = M_{ji}.$$

Näin ollen matriisin

$$A = \begin{bmatrix} 2 & 5 & 7 \\ 6 & 6 & 4 \\ 7 & 4 & 6 \end{bmatrix}$$

transpoosiksi saadaan

$$A^{\intercal} = \begin{bmatrix} 2 & 6 & 7 \\ 5 & 6 & 4 \\ 7 & 4 & 6 \end{bmatrix}.$$

---

A correct answer is $\begin{bmatrix} 2 & 6 & 7 \\ 5 & 6 & 4 \\ 7 & 4 & 6 \end{bmatrix}$.