Name: ______________________________ Date: _______________ Score: / 10

Learning Objectives

- Perform matrix addition, subtraction, and scalar multiplication
- Multiply matrices of compatible sizes (2×2, 2×3 × 3×2, etc.)
- Find the transpose and verify properties like (AB)■ = B■A■
- Compute the inverse of a 2×2 matrix and verify AA■¹ = I

For matrix multiplication, always verify dimensions first. A is m×n and B is n×p → AB is m×p.

1. Compute A + B. (2×2 matrices)

$$A = \begin{bmatrix} 3 & -1 \\ 2 & 5 \end{bmatrix} \quad B = \begin{bmatrix} -1 & 4 \\ 0 & -3 \end{bmatrix}$$

Answer: ________________________________

2. Compute 2A − B. (3×3 matrices)

$$A = \begin{bmatrix} 1 & 0 & 2 \\ -1 & 3 & 1 \\ 0 & 2 & -1 \end{bmatrix} \quad B = \begin{bmatrix} 2 & 1 & 0 \\ 0 & -1 & 4 \\ 3 & 0 & 2 \end{bmatrix}$$

Answer: ________________________________

3. Compute A·B. (2×2 × 2×2)

$$A = \begin{bmatrix} 2 & 1 \\ 3 & 4 \end{bmatrix} \quad B = \begin{bmatrix} 1 & -1 \\ 2 & 0 \end{bmatrix}$$

Answer: ________________________________

4. Compute A·B. State the dimensions of the result. (2×3 × 3×2)

$$A = \begin{bmatrix} 1 & 2 & 0 \\ 3 & 1 & -1 \end{bmatrix} \quad B = \begin{bmatrix} 2 & 1 \\ 0 & 3 \\ 4 & -1 \end{bmatrix}$$

Answer: ________________________________

5. Compute the matrix product. What type of result do you get? (1×3 × 3×1)

$$A = \begin{bmatrix} 2 & -1 & 3 \end{bmatrix} \quad B = \begin{bmatrix} 1 \\ 4 \\ -2 \end{bmatrix}$$

Answer: ______________________________

6. Compute A·B and state the size of the result. (3×1 × 1×3)

$$A = \begin{bmatrix} 1 \\ 2 \\ 3 \end{bmatrix} \quad B = \begin{bmatrix} 4 & -1 & 2 \end{bmatrix}$$

Answer: ______________________________

7. Find A■. State the dimensions of A and A■. (2×4 → 4×2)

$$A = \begin{bmatrix} 1 & -2 & 0 & 3 \\ 4 & 1 & -1 & 2 \end{bmatrix}$$

Answer: ______________________________

8. Compute A·B. State the size of the result. (3×2 × 2×4)

$$A = \begin{bmatrix} 1 & 0 \\ 2 & 1 \\ 0 & 3 \end{bmatrix} \quad B = \begin{bmatrix} 2 & 1 & 0 & -1 \\ 1 & -1 & 3 & 2 \end{bmatrix}$$

Answer: ______________________________

9. Find A■¹ using the 2×2 inverse formula.

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

Answer: ______________________________

10. Verify AB = I■ (confirm B = A■¹).

$$A = \begin{bmatrix} 3 & 1 \\ 5 & 2 \end{bmatrix} \quad B = \begin{bmatrix} 2 & -1 \\ -5 & 3 \end{bmatrix}$$

Answer: ______________________________

Scan to watch

Problems 3–4 cover matrix multiplication with non-square matrices. Problems 7–8 cover the 2×2 inverse formula and verification.

Solutions

1. Compute A + B. (2×2 matrices)

$$A = \begin{bmatrix} 3 & -1 \\ 2 & 5 \end{bmatrix} \quad B = \begin{bmatrix} -1 & 4 \\ 0 & -3 \end{bmatrix}$$

→ *Add corresponding entries.*
→ *Row 1: 3+(–1)=2, –1+4=3. Row 2: 2+0=2, 5+(–3)=2.*

Answer:

$$\begin{bmatrix} 2 & 3 \\ 2 & 2 \end{bmatrix}$$

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2. Compute 2A – B. (3×3 matrices)

$$A = \begin{bmatrix} 1 & 0 & 2 \\ -1 & 3 & 1 \\ 0 & 2 & -1 \end{bmatrix} \quad B = \begin{bmatrix} 2 & 1 & 0 \\ 0 & -1 & 4 \\ 3 & 0 & 2 \end{bmatrix}$$

→ *2A = [[2,0,4],[–2,6,2],[0,4,–2]].*
→ *Row 1: 2–2=0, 0–1=–1, 4–0=4.*
→ *Row 2: –2–0=–2, 6–(–1)=7, 2–4=–2.*
→ *Row 3: 0–3=–3, 4–0=4, –2–2=–4.*

Answer:

$$\begin{bmatrix} 0 & -1 & 4 \\ -2 & 7 & -2 \\ -3 & 4 & -4 \end{bmatrix}$$

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3. Compute A·B. (2×2 × 2×2)

$$A = \begin{bmatrix} 2 & 1 \\ 3 & 4 \end{bmatrix} \quad B = \begin{bmatrix} 1 & -1 \\ 2 & 0 \end{bmatrix}$$

→ *Row 1·Col 1: 2(1)+1(2)=4. Row 1·Col 2: 2(–1)+1(0)=–2.*
→ *Row 2·Col 1: 3(1)+4(2)=11. Row 2·Col 2: 3(–1)+4(0)=–3.*

Answer:

$$\begin{bmatrix} 4 & -2 \\ 11 & -3 \end{bmatrix}$$

Scan to watch

4. Compute A·B. State the dimensions of the result. (2×3 × 3×2)

$$A = \begin{bmatrix} 1 & 2 & 0 \\ 3 & 1 & -1 \end{bmatrix} \quad B = \begin{bmatrix} 2 & 1 \\ 0 & 3 \\ 4 & -1 \end{bmatrix}$$

→ A is 2×3, B is 3×2 → product AB is 2×2.
→ Row 1·Col 1: 1(2)+2(0)+0(4)=2. Row 1·Col 2: 1(1)+2(3)+0(–1)=7.
→ Row 2·Col 1: 3(2)+1(0)+(–1)(4)=2. Row 2·Col 2: 3(1)+1(3)+(–1)(–1)=7.

Answer: $$\begin{bmatrix} 2 & 7 \\ 2 & 7 \end{bmatrix}$$

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5. Compute the matrix product. What type of result do you get? (1×3 × 3×1)

$$A = \begin{bmatrix} 2 & -1 & 3 \end{bmatrix} \quad B = \begin{bmatrix} 1 \\ 4 \\ -2 \end{bmatrix}$$

→ A is 1×3, B is 3×1 → product AB is 1×1 (a scalar).
→ 2(1)+(–1)(4)+3(–2) = 2–4–6 = –8.

Answer: $AB = 2(1) + (-1)(4) + 3(-2) = -8 \quad (1imes1extscalar)$

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6. Compute A·B and state the size of the result. (3×1 × 1×3)

$$A = \begin{bmatrix} 1 \\ 2 \\ 3 \end{bmatrix} \quad B = \begin{bmatrix} 4 & -1 & 2 \end{bmatrix}$$

→ A is 3×1, B is 1×3 → product AB is 3×3 (outer product).
→ Row i, Col j of AB = A[i]·B[j].
→ Row 1: 1·[4,–1,2]=[4,–1,2]. Row 2: 2·[4,–1,2]=[8,–2,4]. Row 3: 3·[4,–1,2]=[12,–3,6].

Answer: $$\begin{bmatrix} 4 & -1 & 2 \\ 8 & -2 & 4 \\ 12 & -3 & 6 \end{bmatrix}$$

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7. Find A■. State the dimensions of A and A■. (2×4 → 4×2)

$$A = \begin{bmatrix} 1 & -2 & 0 & 3 \\ 4 & 1 & -1 & 2 \end{bmatrix}$$

→ A is 2×4 → A■ is 4×2 (rows become columns).
→ Col 1 of A■ = Row 1 of A: [1,–2,0,3]■.
→ Col 2 of A■ = Row 2 of A: [4,1,–1,2]■.

Answer:

$$\begin{bmatrix} 1 & 4 \\ -2 & 1 \\ 0 & -1 \\ 3 & 2 \end{bmatrix}$$

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8. Compute A·B. State the size of the result. (3×2 × 2×4)

$$A = \begin{bmatrix} 1 & 0 \\ 2 & 1 \\ 0 & 3 \end{bmatrix} \quad B = \begin{bmatrix} 2 & 1 & 0 & -1 \\ 1 & -1 & 3 & 2 \end{bmatrix}$$

→ A is 3×2, B is 2×4 → product is 3×4.
→ Row 1: 1·[2,1,0,–1]+0·[1,–1,3,2]=[2,1,0,–1].
→ Row 2: 2·[2,1,0,–1]+1·[1,–1,3,2]=[5,1,3,0].
→ Row 3: 0·[2,1,0,–1]+3·[1,–1,3,2]=[3,–3,9,6].

Answer:

$$\begin{bmatrix} 2 & 1 & 0 & -1 \\ 5 & 1 & 3 & 0 \\ 3 & -3 & 9 & 6 \end{bmatrix}$$

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9. Find A■¹ using the 2×2 inverse formula.

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

→ A■¹ = (1/det A)·[[d,–b],[–c,a]].
→ det A = 4(6)–7(2) = 10.
→ A■¹ = (1/10)·[[6,–7],[–2,4]] = [[3/5,–7/10],[–1/5,2/5]].

Answer:

$$\begin{bmatrix} 3/5 & -7/10 \\ -1/5 & 2/5 \end{bmatrix}$$

Scan to watch

10. Verify AB = I■ (confirm B = A■¹).

$$A = \begin{bmatrix} 3 & 1 \\ 5 & 2 \end{bmatrix} \quad B = \begin{bmatrix} 2 & -1 \\ -5 & 3 \end{bmatrix}$$

→ *Row 1·Col 1: 3(2)+1(–5)=1. Row 1·Col 2: 3(–1)+1(3)=0.*
→ *Row 2·Col 1: 5(2)+2(–5)=0. Row 2·Col 2: 5(–1)+2(3)=1.*
→ *AB = I■. ✓ B is the inverse of A.*

Answer: $\begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$

Scan to watch