

TEACHER AND STUDENT RESOURCE

Matrices and Vectors



NC Math 4 • NC.M4.N.2

Advanced Mathematics

Seven instructional sections with 30 multiple-choice and 30 open or performance tasks, teaching scripts, original mathematical visuals, generous workspaces, and worked keys.

Free sample | Contents

NC.M4.N.2 | NC Math 4 mathematics

This sample contains 19 complete selected pages from the 94-page resource, plus this sample contents page. Original printed page numbers are retained. Gaps are intentional.

Included original pages: 1-15, 30-31, 60, 75

Representative activities

M01: sample PDF page(s) 16; original page(s) 15

M02: sample PDF page(s) 16; original page(s) 15

O01: sample PDF page(s) 17; original page(s) 30

O02: sample PDF page(s) 18; original page(s) 31

Selected teacher prompts and keys: original page(s) 60, 75

Using this sample

Read the preparation and access guidance before using a selected activity.

Keep teacher keys and private preparation pages separate from student copies.

Use the original resource contents to see the scope of the complete packet.

Complete paid download

The complete resource includes the full PDF task bank and teaching materials.

ALIGNMENT

Standard and learning targets

Apply properties and operations with matrices and vectors.

T1 NC.M4.N.2.1 Add, subtract, multiply and scale matrices with valid dimensions.

T2 NC.M4.N.2.2 Add, subtract and scale vectors by components.

NC.M4.N.2.1 Execute procedures of addition, subtraction, multiplication, and scalar multiplication on matrices.

NC.M4.N.2.2 Execute procedures of addition, subtraction, and scalar multiplication on vectors.

Each item names its own target. The bank supports multiple sessions; do not assign all 60 tasks in one sitting.

NAVIGATION

Choose evidence deliberately

Warm-up: M01-M04 and O01-O04

I Do: M05-M08 and O05-O08

We Do: M09-M13 and O09-O13

Collaborative practice: M14-M18 and O14-O18

Independent practice: M19-M23 and O19-O23

Small-group reteach: M24-M27 and O24-O27

Exit ticket: M28-M30 and O28-O30

T1: M01, M02, M05, M06, M07, M09, M10, M12, M13, M15, M16, M18, M19, M21, M22, M24, M26, M28, M30, O01, O02, O05, O06, O07, O09, O10, O12, O13, O15, O16, O18, O19, O21, O22, O24, O26, O28, O30

T2: M03, M04, M08, M11, M14, M17, M20, M23, M25, M27, M29, O03, O04, O08, O11, O14, O17, O20, O23, O25, O27, O29

DAILY LEARNING TARGETS

A multi-session teaching path

Session 1 Diagnose and model

Learning target: NC.M4.N.2.1 Add, subtract, multiply and scale matrices with valid dimensions.

Learning target: NC.M4.N.2.2 Add, subtract and scale vectors by components.

Use warm-up evidence to choose explicit I Do models. Collect predictions before revealing the worked solution.

Session 2 Compare and explain

Learning target: NC.M4.N.2.2 Add, subtract and scale vectors by components.

Use selected We Do and collaborative tasks. Ask each learner for an initial representation, then compare methods and checks.

Session 3 Transfer independently

Learning target: Apply the objectives with explicit restrictions, checks and contextual interpretations.

Choose independent items across every objective. Use small-group tasks for a documented gap and a fresh exit task to test transfer.

PLANNING

Materials, access and pacing

Materials

Pencils, erasers, straightedge, student pages, and optional graph paper. A calculator may support arithmetic after a learner states the intended relationship. No device or paid software is required.

Prerequisites

Signed arithmetic, ordered pairs, dot products as sums of component products, and rectangular arrays.

Pacing

Use a short diagnostic warm-up, a model and shared task in one session; collaborative and independent reasoning in later sessions; then targeted reteaching and an exit task. Select two to four tasks at a time based on evidence. Each section's full bank is reusable, not mandatory in one lesson.

Neutral access

Read directions aloud without interpreting the graph, enlarge a page, supply a writing or pointing response method, and allow a learner to dictate an explanation. Keep axes, units, data and mathematical demand unchanged.

Separate instruction from evidence

Keep the learner's first response. Record answer-supplying cues separately from access supports. A completed teacher graph or worked key is for discussion after independent work, never a student construction template.

Review convention

Matrices are written as [row 1; row 2]. A matrix entry is indexed by row, then column. Vectors use angle brackets; horizontal is positive east and vertical positive north. A matrix product is row-by-column, not entrywise.

TEACHER MODEL

Rows meet columns

Compute $[2,-1;3,0][1,4;-2,5]$. Explain the shape before calculating.

Both factors are 2×2 , so the product is 2×2 . Each entry is a row-column sum:
 $2 \cdot 1 + (-1)(-2) = 4$; $2 \cdot 4 + (-1) \cdot 5 = 3$; $3 \cdot 1 + 0(-2) = 3$; $3 \cdot 4 + 0 \cdot 5 = 12$. The product is $[4,3;3,12]$. An entrywise product would not follow this operation.

REUSABLE REASONING GUIDE

Represent, justify, interpret

Name: _____ Date: _____

Givens, quantities and restrictions

Representation and calculation

Justification or check

Conclusion, domain and units

WARM-UP

Teaching script

Core: 001 • T1: NC.M4.N.2.1 Add, subtract, multiply and scale matrices with valid dimensions.

Optional bank: M01–M04; O01–O04. Select tasks across more than one meeting if needed.

Suggested discussion/work time: 5–8 minutes. Adjust for access and evidence; this is not a speed criterion.

Display student page O01, including its graph when present. Invite a first independent response before discussion. Ask, “What do the symbols represent? What evidence supports your claim?”

Core task

Create two matrices with six entries each that cannot be added. State their dimensions and explain why equal entry counts are insufficient.

Teacher solution and discussion

Example: $A = \begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \end{bmatrix}$ is 2×3 , and $B = \begin{bmatrix} 1 & 2 \\ 3 & 4 \\ 5 & 6 \end{bmatrix}$ is 3×2 . The rows and columns do not correspond position-by-position, so $A+B$ is undefined despite six entries in each.

Evidence and response

Look for dimension checks before operations, correctly aligned components, and a sum of products for each matrix-product entry. For vectors, compare component calculations with head-to-tail or displacement interpretations. Ask which row and column produced an entry before diagnosing an error.

Closure: Ask learners to state one feature they verified and one check they used. Use the worked key for M01 to compare all alternatives after evidence is collected.

I DO

Teaching script

Core: 005 • T1: NC.M4.N.2.1 Add, subtract, multiply and scale matrices with valid dimensions.

Optional bank: M05–M08; O05–O08. Select tasks across more than one meeting if needed.

Suggested discussion/work time: 10–12 minutes. Adjust for access and evidence; this is not a speed criterion.

Display student page O05, including its graph when present. Think aloud through the core task. Say, “I will identify the quantities first, then build a representation and check it against the stated domain.” Hide the worked key until after predictions.

Core task

Compute $-2[1, -3; 0, 4] + [5, 1; -2, 0]$. Explain which entries change sign and which stay zero during scaling.

Teacher solution and discussion

Scaling yields $[-2, 6; 0, -8]$. Adding gives $[3, 7; -2, -8]$. Every nonzero entry in the first matrix changes sign under -2 ; the zero remains zero before the second matrix is added.

Evidence and response

Look for dimension checks before operations, correctly aligned components, and a sum of products for each matrix-product entry. For vectors, compare component calculations with head-to-tail or displacement interpretations. Ask which row and column produced an entry before diagnosing an error.

Closure: Ask learners to state one feature they verified and one check they used. Use the worked key for M05 to compare all alternatives after evidence is collected.

WE DO

Teaching script

Core: 009 • T1: NC.M4.N.2.1 Add, subtract, multiply and scale matrices with valid dimensions.

Optional bank: M09–M13; O09–O13. Select tasks across more than one meeting if needed.

Suggested discussion/work time: 10–15 minutes. Adjust for access and evidence; this is not a speed criterion.

Display student page O09, including its graph when present. Have learners propose the next step, then ask a partner to verify it using the original representation. Record more than one valid explanation.

Core task

Find AB and BA for $A = \begin{bmatrix} 1 & 2 \\ 0 & 1 \end{bmatrix}$ and $B = \begin{bmatrix} 1 & 0 \\ 3 & 1 \end{bmatrix}$. Use the results to refute a claim that matrix multiplication always commutes.

Teacher solution and discussion

$AB = \begin{bmatrix} 7 & 2 \\ 3 & 1 \end{bmatrix}$, while $BA = \begin{bmatrix} 1 & 2 \\ 3 & 7 \end{bmatrix}$. Since the diagonal entries differ, $AB \neq BA$. One counterexample suffices to refute an always claim.

Evidence and response

Look for dimension checks before operations, correctly aligned components, and a sum of products for each matrix-product entry. For vectors, compare component calculations with head-to-tail or displacement interpretations. Ask which row and column produced an entry before diagnosing an error.

Closure: Ask learners to state one feature they verified and one check they used. Use the worked key for M09 to compare all alternatives after evidence is collected.

COLLABORATIVE PRACTICE

Teaching script

Core: O14 • T2: NC.M4.N.2.2 Add, subtract and scale vectors by components.

Optional bank: M14–M18; O14–O18. Select tasks across more than one meeting if needed.

Suggested discussion/work time: 15–20 minutes. Adjust for access and evidence; this is not a speed criterion.

Display student page O14, including its graph when present. Assign reader, representer, checker and explainer roles. Each learner first makes a private prediction; compare reasoning and resolve differences with the data.

Core task

A four-leg path has displacements $\langle 2, 3 \rangle$, $\langle -1, 4 \rangle$, $\langle -4, -2 \rangle$, and an unknown w . Find w that returns to the start, then show a labeled path.

Teacher solution and discussion

The known sum is $\langle -3, 5 \rangle$. Therefore $w = \langle 3, -5 \rangle$. Starting at $(0, 0)$, vertices are $(2, 3)$, $(1, 7)$, $(-3, 5)$, and $(0, 0)$, closing the path.

Evidence and response

Look for dimension checks before operations, correctly aligned components, and a sum of products for each matrix-product entry. For vectors, compare component calculations with head-to-tail or displacement interpretations. Ask which row and column produced an entry before diagnosing an error.

Closure: Ask learners to state one feature they verified and one check they used. Use the worked key for M14 to compare all alternatives after evidence is collected.

INDEPENDENT PRACTICE

Teaching script

Core: O19 • T1: NC.M4.N.2.1 Add, subtract, multiply and scale matrices with valid dimensions.

Optional bank: M19–M23; O19–O23. Select tasks across more than one meeting if needed.

Suggested discussion/work time: 15–20 minutes. Adjust for access and evidence; this is not a speed criterion.

Display student page O19, including its graph when present. Provide the printed task and neutral access supports. Preserve the first independent response; do not point to the requested answer or select a method for the learner.

Core task

Choose dimensions for A and B so AB exists but BA does not. Give explicit small matrices of those shapes and compute AB.

Teacher solution and discussion

Example $A = \begin{bmatrix} 1 & 2 & 0 \\ 0 & 1 & 1 \end{bmatrix}$ is 2×3 , $B = \begin{bmatrix} 1 & 2 & 3 \end{bmatrix}$ is 3×1 . $AB = \begin{bmatrix} 5 & 5 \end{bmatrix}$ is 2×1 . BA would require $1=2$ for the inner dimensions, so it is undefined.

Evidence and response

Look for dimension checks before operations, correctly aligned components, and a sum of products for each matrix-product entry. For vectors, compare component calculations with head-to-tail or displacement interpretations. Ask which row and column produced an entry before diagnosing an error.

Closure: Ask learners to state one feature they verified and one check they used. Use the worked key for M19 to compare all alternatives after evidence is collected.

SMALL-GROUP RETEACH

Teaching script

Core: O24 • T1: NC.M4.N.2.1 Add, subtract, multiply and scale matrices with valid dimensions.

Optional bank: M24–M27; O24–O27. Select tasks across more than one meeting if needed.

Suggested discussion/work time: 10–15 minutes. Adjust for access and evidence; this is not a speed criterion.

Display student page O24, including its graph when present. Start with the learner's prior evidence. Rebuild one representation with explicit terms and operations, then use a fresh item to check transfer without the prior cue.

Core task

Diagnose a learner's claim $2(A-B)=2A-B$. Use $A=[1,3]$ and $B=[2,-1]$, then state the correct distributive rule.

Teacher solution and discussion

$2(A-B)=2[-1,4]=[-2,8]$. But $2A-B=[2,6]-[2,-1]=[0,7]$. The correct expression is $2A-2B$, because the scalar applies to every entry of the entire difference.

Evidence and response

Look for dimension checks before operations, correctly aligned components, and a sum of products for each matrix-product entry. For vectors, compare component calculations with head-to-tail or displacement interpretations. Ask which row and column produced an entry before diagnosing an error.

Closure: Ask learners to state one feature they verified and one check they used. Use the worked key for M24 to compare all alternatives after evidence is collected.

EXIT TICKET

Teaching script

Core: O28 • T1: NC.M4.N.2.1 Add, subtract, multiply and scale matrices with valid dimensions.

Optional bank: M28–M30; O28–O30. Select tasks across more than one meeting if needed.

Suggested discussion/work time: 5–8 minutes. Adjust for access and evidence; this is not a speed criterion.

Display student page O28, including its graph when present. Ask for a concise claim supported by the representation. Collect the response before sharing a solution; use it to choose the next instructional step.

Core task

Compute AB for $A = \begin{bmatrix} 1 & 2 \\ -1 & 3 \end{bmatrix}$ and $B = \begin{bmatrix} 2 & 0 \\ 4 & -2 \end{bmatrix}$. State the operation you would use to check entry $(2,2)$ independently.

Teacher solution and discussion

$AB = \begin{bmatrix} 10 & -4 \\ 10 & -6 \end{bmatrix}$. Entry $(2,2)$ uses row 2 $[-1, 3]$ and column 2 $[0, -2]$, giving $(-1) \cdot 0 + 3(-2) = -6$.

Evidence and response

Look for dimension checks before operations, correctly aligned components, and a sum of products for each matrix-product entry. For vectors, compare component calculations with head-to-tail or displacement interpretations. Ask which row and column produced an entry before diagnosing an error.

Closure: Ask learners to state one feature they verified and one check they used. Use the worked key for M28 to compare all alternatives after evidence is collected.

MULTIPLE-CHOICE BANK

M01 / M02 • Select and justify**M01 | Warm-up | T1**

A has 2 rows and 3 columns. B has 3 rows and 2 columns. Which sum is defined?

- A. Neither $A + B$ nor $B + A$
- B. Only $A + B$
- C. Only $B + A$
- D. Both sums

Reasoning: _____

M02 | Warm-up | T1

For $A = \begin{bmatrix} 1 & -2 \\ 3 & 4 \end{bmatrix}$ and $B = \begin{bmatrix} 5 & 2 \\ -1 & 0 \end{bmatrix}$, find $A+B$.

- A. $\begin{bmatrix} 6 & 0 \\ 2 & 4 \end{bmatrix}$
- B. $\begin{bmatrix} 5 & -4 \\ -3 & 0 \end{bmatrix}$
- C. $\begin{bmatrix} 6 & 0 \\ 4 & 4 \end{bmatrix}$
- D. $\begin{bmatrix} 6 & 2 \\ 2 & 4 \end{bmatrix}$

Reasoning: _____

WARM-UP

001 • Show your reasoning

T1: NC.M4.N.2.1 Add, subtract, multiply and scale matrices with valid dimensions.

Create two matrices with six entries each that cannot be added. State their dimensions and explain why equal entry counts are insufficient.

Representation / calculation

Explanation / check

WARM-UP

002 • Show your reasoning

T1: NC.M4.N.2.1 Add, subtract, multiply and scale matrices with valid dimensions.

Compute $[2,-3;1,5]+[-4,2;0,-1]$ and then subtract the second matrix from your answer to check it.

Representation / calculation

Explanation / check

WORKED TEACHER KEYS

M01 / M02**M01 • T1: NC.M4.N.2.1 Add, subtract, multiply and scale matrices with valid dimensions.****Answer: A. Neither $A + B$ nor $B + A$**

Matrix addition requires the same number of rows and the same number of columns.

Check each alternative

- A. Correct. Matrix addition requires the same number of rows and the same number of columns.
- B. Addition requires matching dimensions in either order.
- C. Reversing order does not make dimensions match.
- D. Equal total numbers of entries do not establish matching positions.

M02 • T1: NC.M4.N.2.1 Add, subtract, multiply and scale matrices with valid dimensions.**Answer: A. [6, 0; 2, 4]**

Add corresponding entries: $1+5=6$, $-2+2=0$, $3-1=2$, and $4+0=4$.

Check each alternative

- A. Correct. Add corresponding entries: $1+5=6$, $-2+2=0$, $3-1=2$, and $4+0=4$.
- B. This multiplies entries instead of adding.
- C. The lower-left entry is $3 + (-1) = 2$.
- D. The upper-right entry is $-2 + 2 = 0$.

WORKED TEACHER KEYS

001 / 002**001 • T1: NC.M4.N.2.1 Add, subtract, multiply and scale matrices with valid dimensions.**

Example: $A=[1,2,3;4,5,6]$ is 2×3 , and $B=[1,2;3,4;5,6]$ is 3×2 . The rows and columns do not correspond position-by-position, so $A+B$ is undefined despite six entries in each.

Full evidence: Explicit arrays, distinct dimensions, and a position-matching argument. Partial credit: preserve and score a valid intermediate representation or justified step separately from the final accuracy.

002 • T1: NC.M4.N.2.1 Add, subtract, multiply and scale matrices with valid dimensions.

The sum is $[-2,-1;1,4]$. Subtracting $[-4,2;0,-1]$ gives $[2,-3;1,5]$, confirming all four entries.

Full evidence: Correct sum and a four-entry subtraction check. Partial credit: preserve and score a valid intermediate representation or justified step separately from the final accuracy.