

TEACHER AND STUDENT RESOURCE

Polynomial Operations and Integer Structure



NC Math 1 • NC.M1.A-APR.1

Expressions and algebraic structure

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.M1.A-APR.1 | NC Math 1 mathematics

This sample contains 19 complete selected pages from the 95-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

Build an understanding that operations with polynomials are comparable to operations with integers by adding and subtracting quadratic expressions and by adding, subtracting, and multiplying linear expressions.

T1 Add and subtract linear expressions.

T2 Multiply linear expressions with distribution.

T3 Add and subtract quadratic expressions.

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, M07, M08, M13, M14, M19, M20, M25, M26, O01, O02, O09, O11, O12, O19, O21, O22, O29

T2: M03, M06, M09, M12, M15, M18, M21, M24, M27, M30, O03, O06, O07, O10, O13, O16, O17, O20, O23, O26, O27, O30

T3: M04, M05, M10, M11, M16, M17, M22, M23, M28, M29, O04, O05, O08, O14, O15, O18, O24, O25, O28

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

Check integer operations, additive inverses, distribution, area of rectangles, signed coefficients, like terms, and substitution.

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

Operations stay within scope: add/subtract quadratics; add/subtract/multiply linear expressions. No multiplication of two quadratics or polynomial division is required.

TEACHER MODEL

Distribution is the same operation

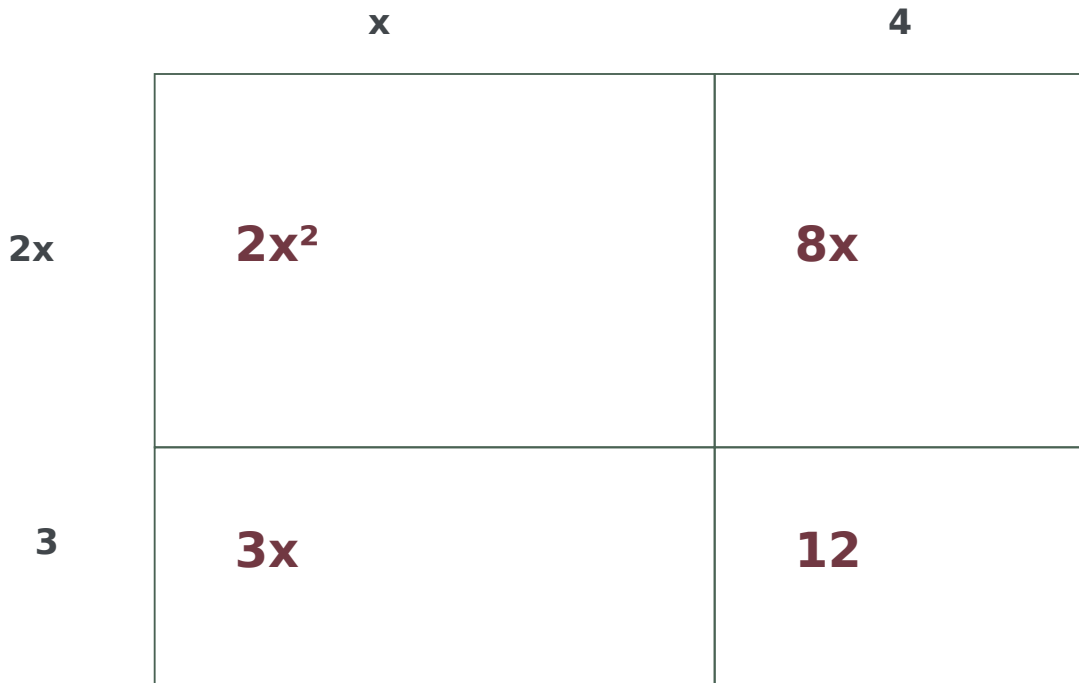
Multiply $(2x + 3)(x + 4)$. Compare the structure with $(20 + 3)(10 + 4)$.

The four polynomial products are $2x^2$, $8x$, $3x$, 12 . Combine like terms: $2x^2 + 11x + 12$. Integer distribution similarly gives $200 + 80 + 30 + 12 = 322$. At $x=10$ the polynomial yields $200 + 110 + 12 = 322$, matching $23 \cdot 14$. Unlike powers remain separate until x has a numerical value.

VISUAL ANCHOR

See the structure

Area model for $(2x + 3)(x + 4)$, with $x > 0$.



Add the four areas: $2x^2 + 8x + 3x + 12 = 2x^2 + 11x + 12$.

Like terms combine; unlike powers remain separate.

Schematic partition: lengths are labels, not measurements of this drawing.

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: Add and subtract linear expressions.

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

Add $(2x + 4) + (3x - 1)$. Group like terms explicitly and use $x = 2$ to check your identity. Explain the connection to adding integers.

Teacher solution and discussion

Coefficients add: $2+3=5$; constants add: $4-1=3$. Result $5x + 3$. At $x=2$, original $8+5=13$. Like terms behave as counts of the same unit, as in 2 units plus 3 units.

Evidence and response

Look for a claim tied to specific terms, factors, operations or graph features. If a learner only names an answer, ask which values or parts of the graph support it. If a sign or operation is mishandled, reconstruct that step with a numerical analogy, then collect a fresh response. A selected option alone does not identify a unique misconception.

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 • T3: Add and subtract quadratic expressions.

Optional bank: M05–M08; 005–008. 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 005, 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

Subtract $(x^2 + 2x - 4) - (-2x^2 + 4x + 1)$. Record the opposite of the entire second quadratic before combining. Check at $x = 1$.

Teacher solution and discussion

Opposite of second: $2x^2 - 4x - 1$. Result $3x^2 - 2x - 5$. At $x=1$, original $-1 - (3) = -4$. Every second-expression term changes sign, including its negative leading term.

Evidence and response

Look for a claim tied to specific terms, factors, operations or graph features. If a learner only names an answer, ask which values or parts of the graph support it. If a sign or operation is mishandled, reconstruct that step with a numerical analogy, then collect a fresh response. A selected option alone does not identify a unique misconception.

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: Add and subtract linear expressions.

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

Create a context in which $(2x + 4) + (3x + 1)$ is a combined quantity. Define x and units, simplify, and interpret both resulting coefficients. Keep the two component quantities separate in your explanation.

Teacher solution and discussion

Example: two independent containers hold $2x + 4$ and $3x + 1$ liters after x minutes. Combined volume $5x + 5$; 5 liters/minute is total rate and 5 liters total initial volume. Both containers are measured at the same elapsed time. Accept any coherent context with matching units.

Evidence and response

Look for a claim tied to specific terms, factors, operations or graph features. If a learner only names an answer, ask which values or parts of the graph support it. If a sign or operation is mishandled, reconstruct that step with a numerical analogy, then collect a fresh response. A selected option alone does not identify a unique misconception.

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 • T3: Add and subtract quadratic expressions.

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

Add $(3x^2 - 5x + 2) + (-x^2 + 2x + 5)$. Make separate columns for x^2 terms, x terms and constants, then explain why unlike powers cannot be combined.

Teacher solution and discussion

x^2 coefficient $3-1=2$; x coefficient $-5+2=-3$; constant $2+5=7$. Result $2x^2 - 3x + 7$. x^2 and x are different units/powers; e.g. at $x=2$, $x^2+x=6$, not $2x=4$.

Evidence and response

Look for a claim tied to specific terms, factors, operations or graph features. If a learner only names an answer, ask which values or parts of the graph support it. If a sign or operation is mishandled, reconstruct that step with a numerical analogy, then collect a fresh response. A selected option alone does not identify a unique misconception.

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: Add and subtract linear expressions.

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

Create a context in which $(3x + 5) + (4x + 2)$ is a combined quantity. Define x and units, simplify, and interpret both resulting coefficients. Keep the two component quantities separate in your explanation.

Teacher solution and discussion

Example: two independent containers hold $3x + 5$ and $4x + 2$ liters after x minutes. Combined volume $7x + 7$; 7 liters/minute is total rate and 7 liters total initial volume. Both containers are measured at the same elapsed time. Accept any coherent context with matching units.

Evidence and response

Look for a claim tied to specific terms, factors, operations or graph features. If a learner only names an answer, ask which values or parts of the graph support it. If a sign or operation is mishandled, reconstruct that step with a numerical analogy, then collect a fresh response. A selected option alone does not identify a unique misconception.

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 • T3: Add and subtract quadratic expressions.

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

Add $(4x^2 - 6x + 3) + (-x^2 + 3x + 6)$. Make separate columns for x^2 terms, x terms and constants, then explain why unlike powers cannot be combined.

Teacher solution and discussion

x^2 coefficient $4-1=3$; x coefficient $-6+3=-3$; constant $3+6=9$. Result $3x^2 - 3x + 9$. x^2 and x are different units/powers; e.g. at $x=2$, $x^2+x=6$, not $2x=4$.

Evidence and response

Look for a claim tied to specific terms, factors, operations or graph features. If a learner only names an answer, ask which values or parts of the graph support it. If a sign or operation is mishandled, reconstruct that step with a numerical analogy, then collect a fresh response. A selected option alone does not identify a unique misconception.

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 • T3: Add and subtract quadratic expressions.

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

Two areas are modeled by $A = x^2 + 4x + 6$ and $B = x^2 - 5x + 3$ square units for $x \geq 6$. Find $A - B$ and interpret it. Explain why the result can be linear even though both models are quadratic.

Teacher solution and discussion

$A - B = 9x + 3$ square units; this is how much greater area A is than B. The equal x^2 terms cancel, leaving a linear expression. At the stated domain both areas are positive, and the difference $9x + 3$ is positive.

Evidence and response

Look for a claim tied to specific terms, factors, operations or graph features. If a learner only names an answer, ask which values or parts of the graph support it. If a sign or operation is mishandled, reconstruct that step with a numerical analogy, then collect a fresh response. A selected option alone does not identify a unique misconception.

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****Perform $(2x + 3) + (x - 1)$. What is the coefficient of x in the simplified result?**

- A. 5
- B. 3
- C. 1
- D. 2

Reasoning: _____

M02 | Warm-up | T1**Perform $(2x - 3) - (3x + 1)$. What is the constant term in the simplified result?**

- A. 4
- B. -1
- C. -4
- D. -2

Reasoning: _____

WARM-UP

001 • Show your reasoning**T1: Add and subtract linear expressions.****Add $(2x + 4) + (3x - 1)$. Group like terms explicitly and use $x = 2$ to check your identity. Explain the connection to adding integers.****Representation / calculation****Explanation / check**

WARM-UP

002 • Show your reasoning**T1: Add and subtract linear expressions.****Subtract $(2x - 4) - (4x + 1)$. Show addition of the opposite and check $x = -1$. Explain why both terms of the second expression change sign.****Representation / calculation****Explanation / check**

WORKED TEACHER KEYS

M01 / M02**M01 • T1: Add and subtract linear expressions.****Answer: B. 3**

The simplified result is $3x + 2$. Requested coefficient calculation: $2+1=3$. Group terms with the same power and add their coefficients. The requested coefficient of x is 3.

Check each alternative

- A. $2+1+3-1 = 5$. This evaluates at $x=1$ and reports the whole result as a coefficient.
- B. Correct: The simplified result is $3x + 2$. Requested coefficient calculation: $2+1=3$. Group terms with the same power and add their coefficients. The requested coefficient of x is 3.
- C. $2-1 = 1$. This subtracts the linear coefficients instead of adding.
- D. $2 \cdot 1 = 2$. This multiplies the linear coefficients instead of adding.

M02 • T1: Add and subtract linear expressions.**Answer: C. -4**

The simplified result is $-x - 4$. Requested coefficient calculation: $-3-1=-4$. Distribute the subtraction to every term of the second expression, then combine like powers. The requested constant term is -4.

Check each alternative

- A. $3+1 = 4$. This adds constant magnitudes and loses both negative signs.
- B. $2-3 = -1$. This reports the x coefficient, not the constant.
- C. Correct: The simplified result is $-x - 4$. Requested coefficient calculation: $-3-1=-4$. Distribute the subtraction to every term of the second expression, then combine like powers. The requested constant term is -4.
- D. $-3+1 = -2$. This fails to negate the second constant when subtracting.

WORKED TEACHER KEYS

001 / 002**001 • T1: Add and subtract linear expressions.**

Coefficients add: $2+3=5$; constants add: $4-1=3$. Result $5x + 3$. At $x=2$, original $8+5=13$. Like terms behave as counts of the same unit, as in 2 units plus 3 units.

002 • T1: Add and subtract linear expressions.

Add $-(4x + 1) = -4x - 1$. Result $-2x - 5$. At $x=-1$, $-6 - (-3) = -3$. Subtracting a sum adds its full additive inverse, just as $8-(3+2)=8-3-2$.