

TEACHER AND STUDENT RESOURCE

Integer Exponents and Equivalent Forms



NC Math 1 • NC.M1.N-RN.2

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.N-RN.2 | NC Math 1 mathematics

This sample contains 19 complete selected pages from the 92-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

Rewrite algebraic expressions with integer exponents using the properties of exponents.

T1 Apply product, quotient and power properties.

T2 Explain zero and negative integer exponents.

T3 Rewrite expressions while preserving their domains.

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, M03, M07, M08, M09, M11, M12, M13, M17, M18, M19, M21, M22, M23, M27, M28, M29

T2: M04, M05, M06, M10, M14, M15, M16, M20, M24, M25, M26, M30, O03, O04, O05, O06, O13, O14, O15, O16, O23, O24, O25, O26

T3: O01, O02, O07, O08, O09, O10, O11, O12, O17, O18, O19, O20, O21, O22, O27, O28, O29, O30

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 signed-integer addition/subtraction, repeated multiplication, fractions and grouping symbols.

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

All exponents in this bank are integers. Preserve every original nonzero restriction; 0^0 is not assigned a value.

TEACHER MODEL

Simplify without losing the domain

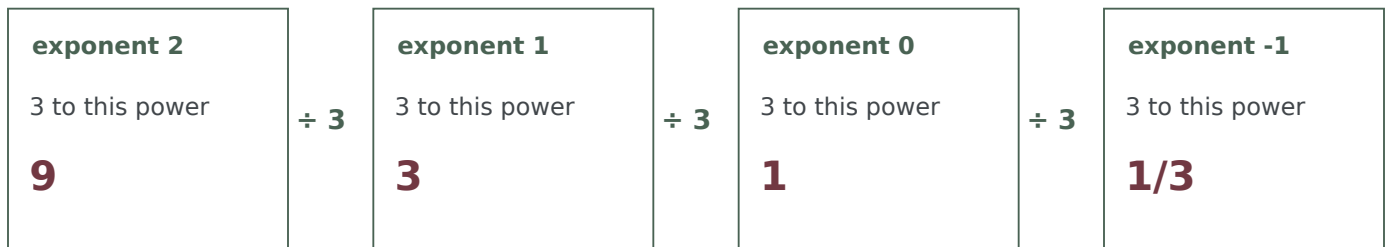
Rewrite $(3x^{-2}y)^2 / (3xy^{-1})$ with positive exponents.

The numerator is $9x^{-4}y^2$. Divide coefficients: $9/3 = 3$. Subtract exponents: x: $-4-1=-5$; y: $2-(-1)=3$. Thus $3y^3/x^5$. Original $x \neq 0$ and $y \neq 0$; keep both restrictions. At $x = y = 1$ both forms equal 3.

VISUAL ANCHOR

See the structure

Decreasing an exponent by 1 divides by the nonzero base.



General nonzero base x : $x^2 \rightarrow x \rightarrow 1 \rightarrow 1/x$.

Each arrow divides by x . This explains $x^0 = 1$ and $x^{-1} = 1/x$.

The base-zero case cannot use these division steps.

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 • T3: Rewrite expressions while preserving their domains.

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

Rewrite $(x^2y^{-3})(x^{-3}y^4)$ using only positive exponents. State the original restrictions and show separate exponent calculations.

Teacher solution and discussion

For $x \neq 0$ and $y \neq 0$, x exponent = $2-3 = -1$; y exponent = $4-3 = 1$. Result y/x . Keep both original restrictions, even though $y = 0$ would fit the simplified formula.

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 • T2: Explain zero and negative integer exponents.

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

Use an exponent pattern to justify why $2^0 = 1$ and $2^{-1} = 1/2$. Make a four-row table for exponents 2, 1, 0 and -1; explain each transition.

Teacher solution and discussion

Rows: (2,4), (1,2), (0,1), (-1,1/2). Decreasing exponent by 1 divides the value by 2; this preserves the exponent pattern. Zero exponent is not multiplication by zero.

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 • T3: Rewrite expressions while preserving their domains.

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

Rewrite $(2x^{-2}y^3)^2 / (2xy^{-1})$ using positive exponents. Annotate the power rule, quotient rule and coefficient calculation.

Teacher solution and discussion

Numerator = $4x^{-4}y^6$. Divide coefficients $4/2 = 2$; subtract exponents: $x: -4-1=-5$; $y: 6-(-1)=7$. Result $2y^7/x^5$ for $x \neq 0$ and $y \neq 0$.

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 • T2: Explain zero and negative integer exponents.

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

Create two different expressions with integer exponents equivalent to x^{-3} for $x \neq 0$: one quotient of positive powers and one power of a power. Verify both.

Teacher solution and discussion

Examples: x^2/x^5 has exponent $2-(5) = -3$; $(x^{-1})^3$ has exponent $(-1)(3) = -3$. Accept any two expressions of the specified distinct forms with valid exponent calculations.

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 • T3: Rewrite expressions while preserving their domains.

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

Rewrite $(3x^{-2}y^3)^2 / (3xy^{-1})$ using positive exponents. Annotate the power rule, quotient rule and coefficient calculation.

Teacher solution and discussion

Numerator = $9x^{-4}y^6$. Divide coefficients $9/3 = 3$; subtract exponents: $x: -4-1=-5$; $y: 6-(-1)=7$. Result $3y^7/x^5$ for $x \neq 0$ and $y \neq 0$.

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 • T2: Explain zero and negative integer exponents.

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

Create two different expressions with integer exponents equivalent to x^{-4} for $x \neq 0$: one quotient of positive powers and one power of a power. Verify both.

Teacher solution and discussion

Examples: x^2/x^6 has exponent $2-(6) = -4$; $(x^{-1})^4$ has exponent $(-1)(4) = -4$. Accept any two expressions of the specified distinct forms with valid exponent calculations.

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: 028 • T3: Rewrite expressions while preserving their domains.

Optional bank: M28–M30; 028–030. 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 028, 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

A symbolic model gives ratio $R = (4x^3)^2 / (16x^6)$. Rewrite it and explain whether the original model allows $x = 0$. Check one permitted value.

Teacher solution and discussion

Numerator = $16x^6$, so $R = 1$ for $x \neq 0$. At $x = 1$ numerator and denominator both equal 16; ratio 1. At $x = 0$ the original has division by zero; simplification does not extend the original domain.

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****For $x \neq 0$, $x^2 \cdot x^4 = x^n$. What is n ?**

- A. 16
- B. -2
- C. 6
- D. 8

Reasoning: _____

M02 | Warm-up | T1**For $x \neq 0$, $x^2 / x^4 = x^n$. What is n ?**

- A. 8
- B. 6
- C. 2
- D. -2

Reasoning: _____

WARM-UP

001 • Show your reasoning

T3: Rewrite expressions while preserving their domains.

Rewrite $(x^2y^{-3})(x^{-3}y^4)$ using only positive exponents. State the original restrictions and show separate exponent calculations.

Representation / calculation

Explanation / check

WARM-UP

002 • Show your reasoning

T3: Rewrite expressions while preserving their domains.

Rewrite $(2x^2y^{-1})^{-2}$ using positive exponents. Explain what happens to every factor and state restrictions.

Representation / calculation

Explanation / check

WORKED TEACHER KEYS

M01 / M02**M01 • T1: Apply product, quotient and power properties.****Answer: C. 6**

Equal-base multiplication adds exponents: $n = 2 + 4 = 6$.

Check each alternative

- A. $2^4 = 16$. This raises one exponent to the other instead of adding.
- B. $2 \cdot 4 = 8$. This uses the product rule for a product.
- C. Correct: Equal-base multiplication adds exponents: $n = 2 + 4 = 6$.
- D. $2 \cdot 4 = 8$. This multiplies exponents; equal-base multiplication adds them.

M02 • T1: Apply product, quotient and power properties.**Answer: D. -2**

Division subtracts denominator exponent: $n = 2 - 4 = -2$. The original denominator excludes zero.

Check each alternative

- A. $2 \cdot 4 = 8$. This multiplies exponents instead of subtracting.
- B. $2 + 4 = 6$. This adds exponents as if the expression were a product.
- C. $4 - 2 = 2$. This subtracts in the reverse order.
- D. Correct: Division subtracts denominator exponent: $n = 2 - 4 = -2$. The original denominator excludes zero.

WORKED TEACHER KEYS

001 / 002**001 • T3: Rewrite expressions while preserving their domains.**

For $x \neq 0$ and $y \neq 0$, x exponent = $2-3 = -1$; y exponent = $4-3 = 1$. Result y/x . Keep both original restrictions, even though $y = 0$ would fit the simplified formula.

002 • T3: Rewrite expressions while preserving their domains.

Reciprocate then square: $y^2/(4x^4)$. Coefficient 2 becomes $1/4$; x exponent -4 and y exponent 2 . Original restrictions: $x \neq 0$, $y \neq 0$.