

TEACHER AND STUDENT RESOURCE

Model and Solve in One Variable



NC Math 1 • NC.M1.A-CED.1

Creating equations

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-CED.1 | 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

Create equations and inequalities in one variable that represent linear, exponential, and quadratic relationships and use them to solve problems.

T1 Create and solve linear equations and inequalities in context.

T2 Create and solve exponential equations and inequalities in context.

T3 Create and solve quadratic equations and inequalities in context.

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, M10, M11, M12, M17, M20, M21, M22, M27, M30, O01, O02, O07, O10, O11, O12, O17, O20, O21, O22, O27, O30

T2: M03, M04, M08, M13, M14, M18, M23, M24, M28, O03, O04, O08, O13, O14, O18, O23, O24, O28

T3: M05, M06, M09, M15, M16, M19, M25, M26, M29, O05, O06, O09, O15, O16, O19, O25, O26, O29

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

Operations on equations, inequality meanings, repeated multiplication, simple integer powers, factoring monic quadratics, units and domain restrictions.

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

Define every variable and its units. Separate the mathematical model from restrictions imposed by context. For counted objects use nonnegative integers; for measurements use the stated real interval. Accept algebraically equivalent models with all original restrictions. A model is valid only under its stated assumptions.

TEACHER MODEL

The model and the allowed answers

A rectangular garden is 3 m longer than its width and has area 40 m². Find its dimensions.

Let $w > 0$ be width in meters; length is $w+3$. Area gives $w(w+3)=40$. Rearrange: $w^2+3w-40=0=(w-5)(w+8)$. Algebraic roots are 5 and -8. A negative length is inadmissible, so width 5 m and length 8 m. Check: $5 \cdot 8 = 40$ m². Say: “I translated the relation before solving, then used the context to choose a root.”

VISUAL ANCHOR

Translate, solve, filter, check

A context-to-equation map for a 40 m² rectangular garden whose length exceeds its width by 3 m.

Step	Mathematical record	Meaning
Define	$w > 0$	Width in meters
Represent	$w(w + 3) = 40$	Width $\times$ length = area
Solve	$(w - 5)(w + 8) = 0$	Roots 5 and -8
Filter	$w = 5$	Length must be positive
Check	$5 \times 8 = 40$	Square meters

The algebraic solution set and the contextual answer need not be identical. Inequalities also require domain checks: round a lower bound up for a whole-object minimum and an upper bound down for a whole-object maximum.

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: Create and solve linear equations and inequalities in context.

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

A kayak rental costs \$12 plus \$5 per hour. A customer pays \$47. Define a variable, create an equation, solve it, and check the bill with units.

Teacher solution and discussion

Let h be hours, $h \geq 0$ real. $12 + 5h = 47$; subtract 12: $5h = 35$; divide: $h = 7$ hours. Check $12 + 5(7) = 47$ dollars.

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: Create and solve quadratic equations and inequalities in context.

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

A rectangular mural is 5 meters longer than it is wide. Its area is 36 m^2 . Define the width, create a quadratic equation, solve by factoring, and explain which root fits.

Teacher solution and discussion

Let $w > 0$ be width in meters; length $w + 5$. $w(w + 5) = 36$; $w^2 + 5w - 36 = 0$; $(w - 4)(w + 9) = 0$. Roots 4, -9; only 4 m is positive. Length 9 m; product 36 m^2 .

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: Create and solve quadratic equations and inequalities in context.

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

In a motion model, distance from rest is 2 times the square of elapsed seconds. Find when distance reaches 50 meters: create an equation, solve exactly, and explain the sign of the time.

Teacher solution and discussion

Let $t \geq 0$ be elapsed seconds. $2t^2 = 50$; $t^2 = 25$; $t = \pm 5$ algebraically. Only $t = 5$ seconds fits time since start. Substitution yields $2(5)^2 = 50$ meters.

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: Create and solve exponential equations and inequalities in context.

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 digital signal model starts at strength 384 units and halves each completed interval. Create an inequality for strength at most 26 units. Determine the first qualifying integer interval and verify its predecessor.

Teacher solution and discussion

Let $n \geq 0$ integer. $384(1/2)^n \leq 26$. At $n=3$ strength is $48 > 26$; at $n=4$ it is $24 \leq 26$. Because halving decreases positive strength, all integers $n \geq 4$ qualify; first is 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 • T3: Create and solve quadratic equations and inequalities in context.

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

In a motion model, distance from rest is 3 times the square of elapsed seconds. Find when distance reaches 108 meters: create an equation, solve exactly, and explain the sign of the time.

Teacher solution and discussion

Let $t \geq 0$ be elapsed seconds. $3t^2 = 108$; $t^2 = 36$; $t = \pm 6$ algebraically. Only $t = 6$ seconds fits time since start. Substitution yields $3(6)^2 = 108$ meters.

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: Create and solve exponential equations and inequalities in context.

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

A digital signal model starts at strength 576 units and halves each completed interval. Create an inequality for strength at most 20 units. Determine the first qualifying integer interval and verify its predecessor.

Teacher solution and discussion

Let $n \geq 0$ integer. $576(1/2)^n \leq 20$. At $n=4$ strength is $36 > 20$; at $n=5$ it is $18 \leq 20$. Because halving decreases positive strength, all integers $n \geq 5$ qualify; first is 5.

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 • T2: Create and solve exponential equations and inequalities in context.

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

A simulation begins with 20 agents and multiplies their count by 4 per round. Create and solve an inequality for a count greater than 5121. Find the first whole-number round, showing adjacent counts.

Teacher solution and discussion

Let $n \geq 0$ integer; $20 \cdot 4^n > 5121$. At $n=4$, count 5120 is below 5121; at $n=5$, $20480 > 5121$. The sequence increases, so $n \geq 5$ and the first round is 5.

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**

A bicycle rental has a \$10 starting charge and costs \$3 per hour. The bill is \$22. Let h be hours. Which equation models the bill?

- A. $10h + 3h = 22$
- B. $10 + 3h = 22$
- C. $3 + 10h = 22$
- D. $10 + h/3 = 22$

Reasoning: _____

M02 | Warm-up | T1

A club has \$10 and sells n identical tickets for \$3 each. It needs at least \$22 in all. Which inequality represents this goal?

- A. $3 + 10n \geq 22$
- B. $10 + 3n \leq 22$
- C. $3 + 10n \leq 22$
- D. $10 + 3n \geq 22$

Reasoning: _____

WARM-UP

001 • Show your reasoning

T1: Create and solve linear equations and inequalities in context.

A kayak rental costs \$12 plus \$5 per hour. A customer pays \$47. Define a variable, create an equation, solve it, and check the bill with units.

Representation / calculation

Explanation / check

WARM-UP

002 • Show your reasoning

T1: Create and solve linear equations and inequalities in context.

A craft club pays \$8 for a stall and \$3 for each kit it buys. Its budget is \$36. Create and solve an inequality for the number of whole kits. Explain the greatest possible count.

Representation / calculation

Explanation / check

WORKED TEACHER KEYS

M01 / M02**M01 • T1: Create and solve linear equations and inequalities in context.****Answer: B. $10 + 3h = 22$** Fixed charge plus hourly cost: $10 + 3h = 22$. Subtract 10 and divide by 3: $h = 4$ hours.**Check each alternative**

- A. This charges both amounts for every hour.
- B. Correct: the starting charge occurs once and the hourly charge is multiplied by h .
- C. This swaps the \$10 fixed charge with the \$3 hourly rate.
- D. This uses $1/3$ dollar per hour instead of \$3 per hour.

M02 • T1: Create and solve linear equations and inequalities in context.**Answer: D. $10 + 3n \geq 22$** Total funds are $10 + 3n$. At least means $\geq$, so $n \geq (22 - 10)/3 = 4$; n is a nonnegative integer.**Check each alternative**

- A. The fixed amount and per-item rate are interchanged.
- B. The goal is a lower bound.
- C. The fixed amount and rate are interchanged. The goal is a lower bound.
- D. Correct: total and bound match the context.

WORKED TEACHER KEYS

001 / 002**001 • T1: Create and solve linear equations and inequalities in context.**

Let h be hours, $h \geq 0$ real. $12 + 5h = 47$; subtract 12: $5h = 35$; divide: $h = 7$ hours. Check $12 + 5(7) = 47$ dollars.

002 • T1: Create and solve linear equations and inequalities in context.

Let n be kit count, n a nonnegative integer. $8 + 3n \leq 36$; $n \leq 9 + 1/3$. Thus $n \leq 9$. At 9 kits cost is \$35; one more costs \$38, over budget.