

TEACHER AND STUDENT RESOURCE

Creating One Variable Equations and Inequalities



NC Math 2 • NC.M2.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.M2.A-CED.1 | NC Math 2 mathematics

This sample contains 22 complete selected pages from the 123-page resource, plus this sample contents page. Original printed page numbers are retained. Gaps are intentional.

Included original pages: 1-16, 31-32, 61-62, 91-92

Representative activities

M01: sample PDF page(s) 17; original page(s) 16

M02: sample PDF page(s) 17; original page(s) 16

O01: sample PDF page(s) 18; original page(s) 31

O02: sample PDF page(s) 19; original page(s) 32

Selected teacher prompts and keys: original page(s) 61-62, 91-92

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 quadratic, square root, inverse variation, and right triangle trigonometric relationships and use them to solve problems.

T1 Create and solve quadratic equations and inequalities from contextual quantities.

T2 Create and solve square-root and inverse-variation equations and inequalities with valid domains.

T3 Create and solve right-triangle trigonometric equations and inequalities using labeled side roles.

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, O01, M02, O02, M06, O06, M10, O10, M14, O14, M16, O16, M20, O20, M22, O22, M24, O24, M28, O28

T2: M03, O03, M04, O04, M07, O07, M08, O08, M11, O11, M12, O12, M13, O13, M17, O17, M18, O18, M21, O21, M25, O25, M26, O26, M29, O29

T3: M05, O05, M09, O09, M15, O15, M19, O19, M23, O23, M27, O27, M30, O30

DAILY LEARNING TARGETS

A multi-session teaching path

Session 1 Identify and represent

Learning target: Create and solve quadratic equations and inequalities from contextual quantities.

Learning target: Create and solve square-root and inverse-variation equations and inequalities with valid domains.

Use Warm-up, I Do, and early We Do tasks. Ask for a first response before showing the model.

Session 2 Explain and connect

Learning target: Create and solve square-root and inverse-variation equations and inequalities with valid domains.

Learning target: Create and solve right-triangle trigonometric equations and inequalities using labeled side roles.

Use We Do and collaborative tasks. Compare approaches and justify each step with the original conditions.

Session 3 Transfer independently

Learning target: Create and solve quadratic equations and inequalities from contextual quantities.

Learning target: Create and solve square-root and inverse-variation equations and inequalities with valid domains.

Learning target: Create and solve right-triangle trigonometric equations and inequalities using labeled side roles.

Select independent items spanning the targets, reteach an evidenced gap, and use an unrehearsed exit item.

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

Area and perimeter formulas, solving simple equations and inequalities, square roots and domains, inverse variation, and sine/cosine/tangent ratios for acute right-triangle angles.

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.

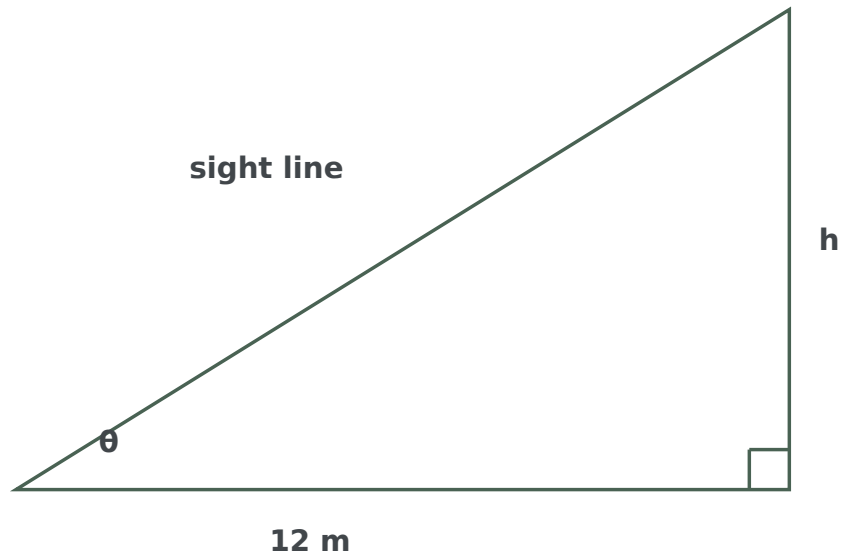
Review convention

Define the unknown and its units before writing a model. Use physical domains such as positive lengths, nonnegative time, and integer counts. Multiply inequalities by a variable only after establishing its sign. Check square-root candidates in the original equation. Use degree mode for angle calculations; exact given ratios need no angle lookup.

TEACHER MODEL

Model the side ratio before solving

An observer at ground level is 12 m from a pole. The angle of elevation θ has $\tan \theta = 2/3$. Create and solve an equation for height h .



Schematic diagram; lengths are represented by labels.

Relative to θ , h is opposite and 12 is adjacent. Tangent gives $h/12 = 2/3$. Multiply by 12 to obtain $h = 8$ m. Check $8/12 = 2/3$. This model assumes level ground and a ground-level eye; a nonzero eye height would be added to the triangle's rise.

VISUAL ANCHOR

Match the relationship to a model

The unknown can represent a length, time, rate, count, or angle. Units and domain are part of the model.

Relationship	Example equation	A necessary restriction
Quadratic area	$x(x+3)=40$	$x>0$ for a width
Square-root output	$2\sqrt{t}=10$	$t\geq 0$
Inverse sharing	$120/n\leq 15$	n is a positive integer
Right-triangle ratio	$h/12=\tan \theta$	θ acute; lengths positive

After solving, return to the original equation or inequality and the contextual domain. Algebra may produce negative lengths, fractional people, or candidates that arose only after squaring.

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 quadratic equations and inequalities from contextual quantities.

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 visual when present. Ask learners to define the unknown and name the measured quantity before choosing an operation. Contrast area, perimeter, rate, and side ratio.

Core task

A square display has area 81 cm^2 . Define its side variable, create an equation, solve it, and explain why only one of the algebraic square roots represents a side length.

Teacher solution and discussion

Let s be the side in centimeters. The equation is $s^2=81$. Its real algebraic solutions are ± 9 , but a side length is positive, so $s=9 \text{ cm}$. Substitution gives $9^2=81 \text{ cm}^2$.

Evidence and response

Look for a relationship justified from the quantities, not a memorized equation shape. Check radical scope, fixed versus per-person fees, reference-angle side roles, inequality language, and contextual rejection of algebraic candidates. A numerical answer without a defensible model is incomplete.

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 right-triangle trigonometric equations and inequalities using labeled side roles.

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 visual when present. Build the equation from labeled quantities aloud. State the domain before manipulating a variable denominator or squaring a root. Check the solution in the original relationship.

Core task

A pole is observed from 12 m away on level ground at angle θ with $\tan \theta = 2/3$. Assuming the observer's eye is at ground level, create an equation for pole height h and solve it. Explain the reference-angle side roles.

Teacher solution and discussion

The pole height is opposite θ and 12 m is adjacent. Thus $h/12 = \tan \theta = 2/3$, so $h = 8$ m. The ground-level eye assumption means no additional eye-height term is needed.

Evidence and response

Look for a relationship justified from the quantities, not a memorized equation shape. Check radical scope, fixed versus per-person fees, reference-angle side roles, inequality language, and contextual rejection of algebraic candidates. A numerical answer without a defensible model is incomplete.

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 right-triangle trigonometric equations and inequalities using labeled side roles.

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 visual when present. Have learners propose the modeling step and justify its units. For inequalities, translate at most, at least, and strictly less before solving, then intersect with the contextual domain.

Core task

A ramp makes a 30° angle to the ground and rises 3 m. Use $\sin 30^\circ = 1/2$ to model and find its sloping length. Explain why 6 m is plausible compared with the 3 m rise.

Teacher solution and discussion

Let $L > 0$ be sloping length. Since rise is opposite and L hypotenuse, $3/L = 1/2$, so $L = 6$ m. A right-triangle hypotenuse must exceed its vertical leg, and $6 > 3$ meets that requirement.

Evidence and response

Look for a relationship justified from the quantities, not a memorized equation shape. Check radical scope, fixed versus per-person fees, reference-angle side roles, inequality language, and contextual rejection of algebraic candidates. A numerical answer without a defensible model is incomplete.

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 • T1: Create and solve quadratic equations and inequalities from contextual quantities.

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 visual when present. Assign partners to model, solve, and challenge the restrictions. Compare algebraic candidates with physical or integer feasibility; ask for a boundary check in inequality tasks.

Core task

A rectangle is 3 m longer than its width $w > 0$ and must have area at least 28 m^2 . Create and solve an inequality, giving a reason for excluding the negative branch.

Teacher solution and discussion

$w(w+3) \geq 28$ gives $(w+7)(w-4) \geq 0$. The product is nonnegative for $w \leq -7$ or $w \geq 4$. Width must be positive, so $w \geq 4 \text{ m}$. At the boundary, $4 \times 7 = 28 \text{ m}^2$. Negative algebraic branches do not represent valid side lengths.

Evidence and response

Look for a relationship justified from the quantities, not a memorized equation shape. Check radical scope, fixed versus per-person fees, reference-angle side roles, inequality language, and contextual rejection of algebraic candidates. A numerical answer without a defensible model is incomplete.

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 right-triangle trigonometric equations and inequalities using labeled side roles.

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 visual when present. Preserve first responses. Require the equation or inequality and variable definition, not only the final number. Do not identify a trig ratio or radical restriction for the learner during assessment.

Core task

A height above eye level is modeled by $h = d \tan \theta$, with $\tan \theta = 2/5$ and positive d . Find all d that produce $h \geq 6$ m. Create an inequality, solve it, and verify the boundary distance.

Teacher solution and discussion

$(2/5)d \geq 6$. Multiply by positive $5/2$ to get $d \geq 15$ m. At $d = 15$, the modeled height is 6 m; larger positive distances give larger heights for the fixed angle.

Evidence and response

Look for a relationship justified from the quantities, not a memorized equation shape. Check radical scope, fixed versus per-person fees, reference-angle side roles, inequality language, and contextual rejection of algebraic candidates. A numerical answer without a defensible model is incomplete.

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: Create and solve quadratic equations and inequalities from contextual quantities.

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 visual when present. Use the observed gap: wrong operation, radical scope, reciprocal ratio, inequality direction, or missing domain. Rebuild that one feature and collect a fresh item.

Core task

A square has side $x+2$ cm, with $x \geq 0$, and area 49 cm^2 . Create the equation, solve it, and distinguish the parameter x from the actual side length.

Teacher solution and discussion

$(x+2)^2=49$ gives $x=5$ or -9 . Only $x=5$ satisfies $x \geq 0$. The actual side is $x+2=7$ cm; x is the parameter, not the side itself. Check $7^2=49$.

Evidence and response

Look for a relationship justified from the quantities, not a memorized equation shape. Check radical scope, fixed versus per-person fees, reference-angle side roles, inequality language, and contextual rejection of algebraic candidates. A numerical answer without a defensible model is incomplete.

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: Create and solve quadratic equations and inequalities from contextual quantities.

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 visual when present. Ask for a new contextual model or feasibility decision. Require a valid solution set, original-model check, and a reason for accepting or rejecting each candidate.

Core task

A rectangular banner has length 3 times its positive width w . Its area must be between 48 and 108 m^2 inclusive. Create and solve a compound inequality for w , then give the corresponding length range.

Teacher solution and discussion

$48 \leq 3w^2 \leq 108$ gives $16 \leq w^2 \leq 36$. With $w > 0$, $4 \leq w \leq 6$ m. Since length $= 3w$, it ranges from 12 to 18 m. Endpoints produce areas 48 and 108 m^2 .

Evidence and response

Look for a relationship justified from the quantities, not a memorized equation shape. Check radical scope, fixed versus per-person fees, reference-angle side roles, inequality language, and contextual rejection of algebraic candidates. A numerical answer without a defensible model is incomplete.

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 square has area 49 m^2 and positive side x . Which equation models its side length?

- A. $4x=49$
- B. $x^2=49$
- C. $2x=49$
- D. $x+2=49$

Reasoning: _____

M02 | Warm-up | T1

A rectangle is $x \text{ m}$ wide and $x+3 \text{ m}$ long, with area 40 m^2 . Which equation models it?

- A. $2x(x+3)=40$
- B. $x(x+3)=40$
- C. $2x+3=40$
- D. $x^2+3=40$

Reasoning: _____

WARM-UP

001 • Show your reasoning

T1: Create and solve quadratic equations and inequalities from contextual quantities.

A square display has area 81 cm^2 . Define its side variable, create an equation, solve it, and explain why only one of the algebraic square roots represents a side length.

Representation / calculation

Explanation / check

WARM-UP

002 • Show your reasoning

T1: Create and solve quadratic equations and inequalities from contextual quantities.

A rectangle has length 4 m more than its width and area 45 m². Create and solve a one-variable equation. State both dimensions and check their area.

Representation / calculation

Explanation / check

WORKED TEACHER KEYS

M01

M01 • T1: Create and solve quadratic equations and inequalities from contextual quantities.

Answer: B. $x^2=49$

Square area is side times side, so $x^2=49$. The positive geometric solution is $x=7$ m.

Check each alternative

A. $4x$ gives perimeter, not area.

B. Square area is side times side, so $x^2=49$. The positive geometric solution is $x=7$ m.

C. $2x$ doubles the side but does not give area.

D. Adding 2 to a length does not produce square area.

Evidence to assess

Assess accurate representation, a valid justification, and a conclusion consistent with the domain and units. Accept equivalent reasoning or another construction meeting every condition. An answer alone does not establish a unique misconception.

WORKED TEACHER KEYS

M02

M02 • T1: Create and solve quadratic equations and inequalities from contextual quantities.

Answer: B. $x(x+3)=40$

Multiply the two side lengths to obtain area: $x(x+3)=40$. Equivalently $x^2+3x-40=0=(x+8)(x-5)$, so the positive width is 5 m.

Check each alternative

- A. The area does not have the extra factor 2 used in some perimeter formulas.
- B. Multiply the two side lengths to obtain area: $x(x+3)=40$. Equivalently $x^2+3x-40=0=(x+8)(x-5)$, so the positive width is 5 m.
- C. This adds lengths rather than multiplying them.
- D. The extra length 3 must multiply the width x .

Evidence to assess

Assess accurate representation, a valid justification, and a conclusion consistent with the domain and units. Accept equivalent reasoning or another construction meeting every condition. An answer alone does not establish a unique misconception.

WORKED TEACHER KEYS

001**001 • T1: Create and solve quadratic equations and inequalities from contextual quantities.**

Let s be the side in centimeters. The equation is $s^2=81$. Its real algebraic solutions are ± 9 , but a side length is positive, so $s=9$ cm. Substitution gives $9^2=81$ cm².

Evidence to assess

Require a defined variable and units, the area equation, both algebraic signs, and the geometric rejection of the negative length.

WORKED TEACHER KEYS

002**002 • T1: Create and solve quadratic equations and inequalities from contextual quantities.**

Let $w > 0$ be width. Then $w(w+4)=45$, so $w^2+4w-45=(w+9)(w-5)=0$. Reject $w=-9$; $w=5$ m and length 9 m. Their product is 45 m².

Evidence to assess

Require the product model, complete algebraic roots, valid dimensions, and an area check.