

TEACHER AND STUDENT RESOURCE

Create and Graph Relationships



NC Math 1 • NC.M1.A-CED.2

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.2 | NC Math 1 mathematics

This sample contains 19 complete selected pages from the 106-page resource, plus this sample contents page. Original printed page numbers are retained. Gaps are intentional.

Included original pages: 1-14, 29-30, 59, 74-75

Representative activities

M01: sample PDF page(s) 15; original page(s) 14

M02: sample PDF page(s) 15; original page(s) 14

O01: sample PDF page(s) 16; original page(s) 29

O02: sample PDF page(s) 17; original page(s) 30

Selected teacher prompts and keys: original page(s) 59, 74-75

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 and graph equations in two variables to represent linear, exponential, and quadratic relationships between quantities.

T1 Create and graph linear relationships between quantities.

T2 Create and graph exponential relationships between quantities.

T3 Create and graph quadratic relationships between quantities.

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, M11, M12, M13, M21, M22, M23, O01, O02, O03, O11, O12, O13, O21, O22, O23

T2: M04, M05, M10, M14, M15, M20, M24, M25, M30, O04, O05, O10, O14, O15, O20, O24, O25, O30

T3: M06, M07, M08, M09, M16, M17, M18, M19, M26, M27, M28, M29, O06, O07, O08, O09, O16, O17, O18, O19, O26, O27, O28, 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

Read coordinate grids and scales, evaluate expressions, distinguish constant differences from constant ratios, multiply binomials, and interpret 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.

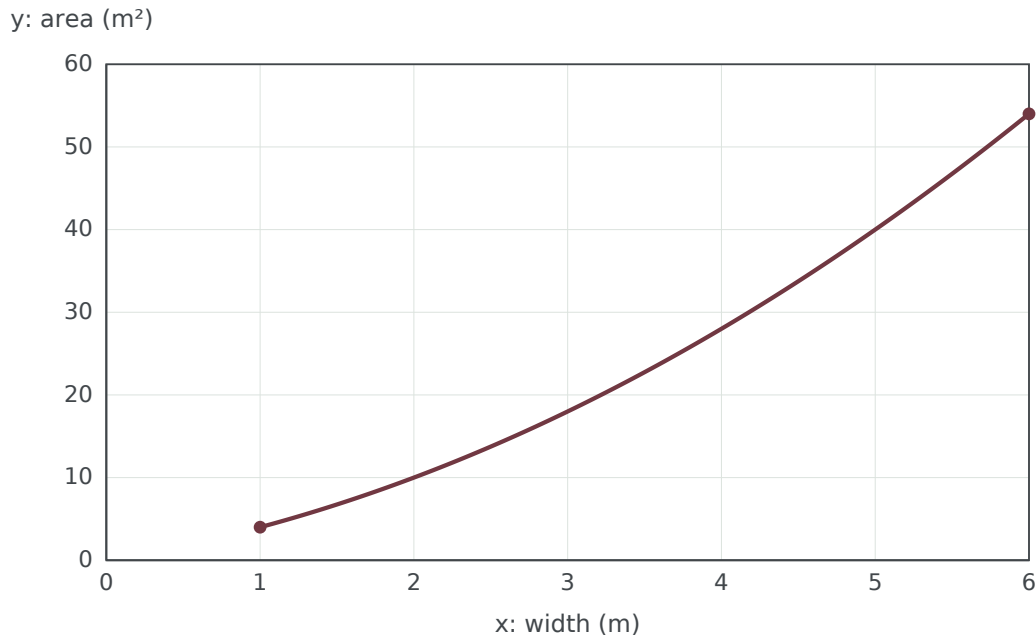
Review convention

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

From rectangle dimensions to a curve

A rectangle is 3 meters longer than its width x meters. Let y be its area in m^2 . Create an equation and graph it for $1 \leq x \leq 6$.



$y = x(x + 3)$. Length $x+3$ times width x gives x^2+3x . Both dimensions vary continuously. Points include $(1,4)$, $(2,10)$, $(3,18)$, $(4,28)$, $(5,40)$, $(6,54)$. Axes carry width in meters and area in square meters. Connect smoothly only over $1 \leq x \leq 6$; include both endpoints.

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 graph linear relationships between 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 graph when present. Invite a first independent response before discussion. Ask, “What do the symbols represent? What evidence supports your claim?”

Core task

A scooter rental costs \$20 to start and \$5 for each hour used. Let x be hours and y the cost in dollars. Use only real x from 0 through 6, including endpoints. Create an equation and graph it on the grid. Label axes with units, plot at least three exact points, and explain whether to connect them.

Teacher solution and discussion

$y = 5x + 20$. Fixed cost 20; each hour adds 5. The y -intercept is (0,20) and slope is 5 dollars/hour. Domain: real x from 0 through 6, including endpoints. Reference values (x,y) : (0, 20); (1, 25); (2, 30); (3, 35); (4, 40); (5, 45); (6, 50). Draw the curve only on the specified interval; both endpoints are included.

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: Create and graph exponential relationships between quantities.

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 computer model starts at intensity 256 units and halves after each completed cycle. Let x be cycle number and y the intensity. Use only integer x from 0 through 4. Create an equation and graph it on the grid. Label axes with units, plot at least three exact points, and explain whether to connect them.

Teacher solution and discussion

$y = 256(1/2)^x$. Initial intensity 256; each next value is half the previous. Use isolated points because only completed cycles are modeled. Domain: integer x from 0 through 4. Reference values (x,y) : (0, 256); (1, 128); (2, 64); (3, 32); (4, 16). The graph consists only of these discrete points.

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 graph quadratic relationships between quantities.

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

An arch model gives height as 24 times horizontal distance minus 4 times that distance squared. Let x be horizontal meters and y be height in meters. Use only real x from 0 through 6, including endpoints. Create an equation and graph it on the grid. Label axes with units, plot at least three exact points, and explain whether to connect them.

Teacher solution and discussion

$y = 24x - 4x^2$. The model is $4x(6-x)$; zeros are $x=0$ and $x=6$. The highest point is (3,36); a smooth concave-down curve connects the values. Domain: real x from 0 through 6, including endpoints. Reference values (x,y) : (0, 0); (1, 20); (2, 32); (3, 36); (4, 32); (5, 20); (6, 0). Draw the curve only on the specified interval; both endpoints are included.

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 graph exponential relationships between 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 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

An animation begins with 6 shapes; each completed stage doubles the count. Let x be stage number and y the number of shapes. Use only integer x from 0 through 4. Create an equation and graph it on the grid. Label axes with units, plot at least three exact points, and explain whether to connect them.

Teacher solution and discussion

$y = 6 \cdot 2^x$. Initial count 6 is at $x=0$. Each next count is twice the preceding one; plot isolated integer-stage points. Domain: integer x from 0 through 4. Reference values (x,y) : (0, 6); (1, 12); (2, 24); (3, 48); (4, 96). The graph consists only of these discrete points.

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 graph quadratic relationships between quantities.

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

An arch model gives height as 30 times horizontal distance minus 5 times that distance squared. Let x be horizontal meters and y be height in meters. Use only real x from 0 through 6, including endpoints. Create an equation and graph it on the grid. Label axes with units, plot at least three exact points, and explain whether to connect them.

Teacher solution and discussion

$y = 30x - 5x^2$. The model is $5x(6-x)$; zeros are $x=0$ and $x=6$. The highest point is (3,45); a smooth concave-down curve connects the values. Domain: real x from 0 through 6, including endpoints. Reference values (x,y) : (0, 0); (1, 25); (2, 40); (3, 45); (4, 40); (5, 25); (6, 0). Draw the curve only on the specified interval; both endpoints are included.

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 graph exponential relationships between 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 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

An animation begins with 7 shapes; each completed stage doubles the count. Let x be stage number and y the number of shapes. Use only integer x from 0 through 4. Create an equation and graph it on the grid. Label axes with units, plot at least three exact points, and explain whether to connect them.

Teacher solution and discussion

$y = 7 \cdot 2^x$. Initial count 7 is at $x=0$. Each next count is twice the preceding one; plot isolated integer-stage points. Domain: integer x from 0 through 4. Reference values (x,y) : (0, 7); (1, 14); (2, 28); (3, 56); (4, 112). The graph consists only of these discrete points.

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: Create and graph quadratic relationships between 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 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 motion model says distance from rest equals 6 times elapsed time squared. Let x be seconds and y be meters traveled. Use only real x from 0 through 6, including endpoints. Create an equation and graph it on the grid. Label axes with units, plot at least three exact points, and explain whether to connect them.

Teacher solution and discussion

$y = 6x^2$. Square elapsed time, then multiply by 6; distance starts at zero. The continuous model has increasing slope. Domain: real x from 0 through 6, including endpoints. Reference values (x,y) : (0, 0); (1, 6); (2, 24); (3, 54); (4, 96); (5, 150); (6, 216). Draw the curve only on the specified interval; both endpoints are included.

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 scooter rental costs \$8 to start and \$2 for each hour used. Let x be hours and y the cost in dollars. Which equation models the relationship?

- A. $y = 2(x + 8)$
- B. $y = 2x - 8$
- C. $y = 2x + 8$
- D. $y = 8x + 2$

Reasoning: _____

M02 | Warm-up | T1

A tank starts with 30 liters and drains at 3 liters per minute. Let x be minutes and y the liters remaining. Which equation models the relationship?

- A. $y = 30 + 3x$
- B. $y = 30 - 3x$
- C. $y = 3 - 30x$
- D. $y = (30 - 3)x$

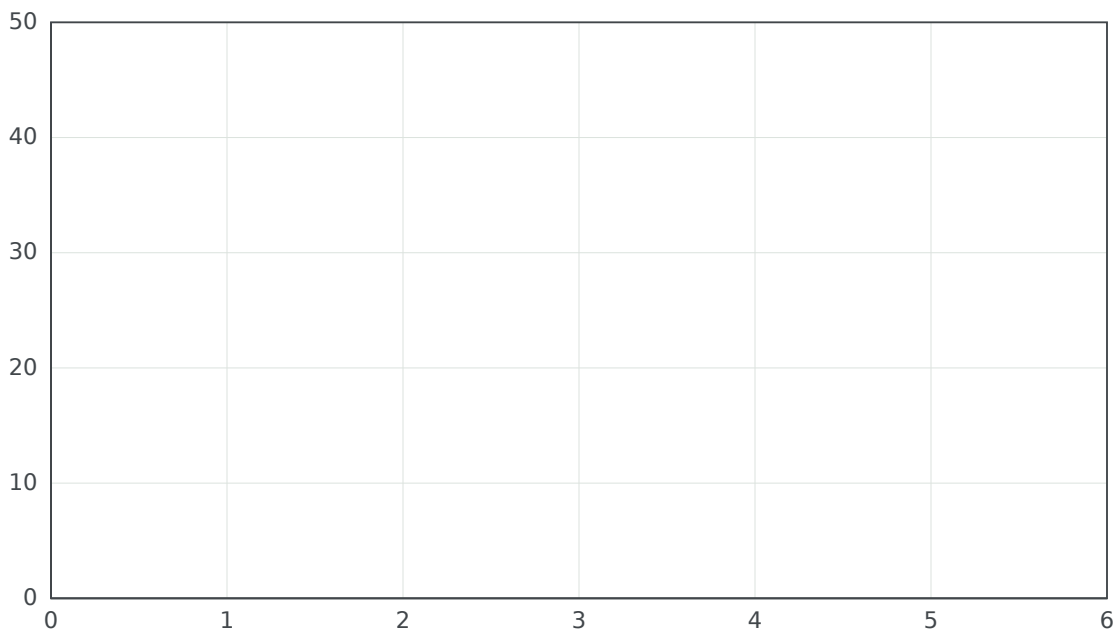
Reasoning: _____

WARM-UP

001 • Show your reasoning**T1: Create and graph linear relationships between quantities.**

A scooter rental costs \$20 to start and \$5 for each hour used. Let x be hours and y the cost in dollars. Use only real x from 0 through 6, including endpoints. Create an equation and graph it on the grid. Label axes with units, plot at least three exact points, and explain whether to connect them.

vertical axis: _____



horizontal axis: _____

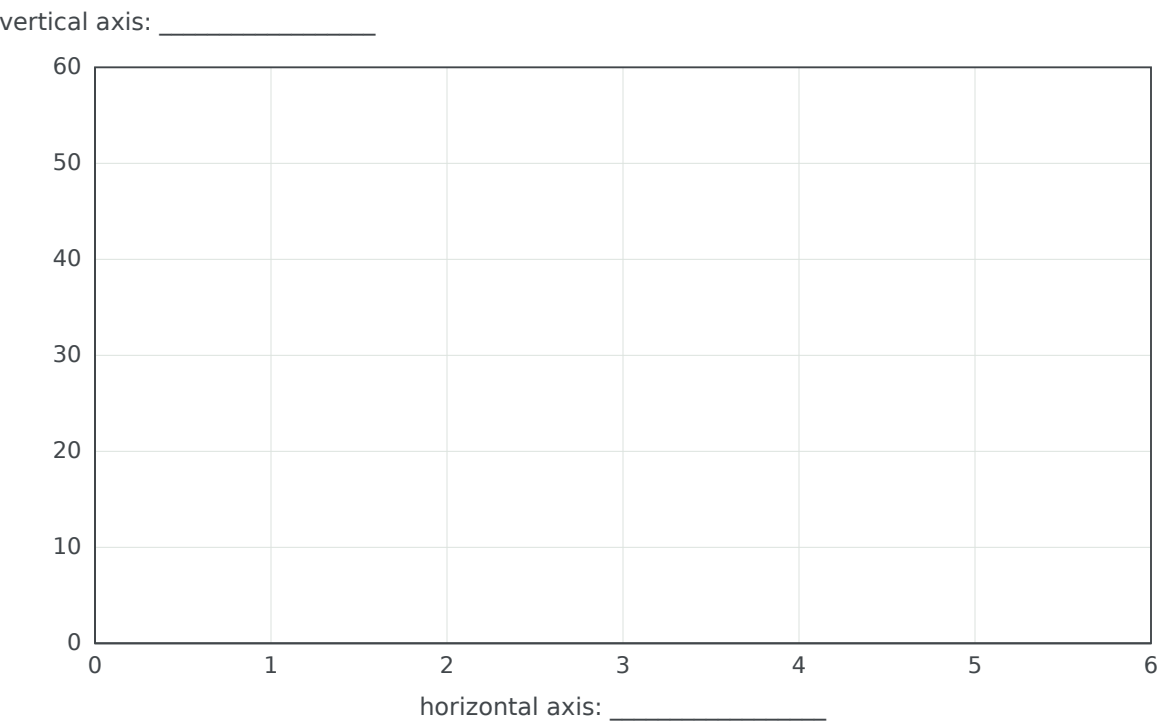
Explanation and check

WARM-UP

002 • Show your reasoning

T1: Create and graph linear relationships between quantities.

A tank starts with 60 liters and drains at 6 liters per minute. Let x be minutes and y the liters remaining. Use only real x from 0 through 6, including endpoints. Create an equation and graph it on the grid. Label axes with units, plot at least three exact points, and explain whether to connect them.



Explanation and check

WORKED TEACHER KEYS

M01 / M02**M01 • T1: Create and graph linear relationships between quantities.****Answer: C. $y = 2x + 8$**

$y = 2x + 8$. Fixed cost 8; each hour adds 2. The y-intercept is (0,8) and slope is 2 dollars/hour.

Check each alternative

- A. Distribution gives $2x+16$, so the fixed charge becomes 16, not 8.
- B. Subtracts rather than adds the starting charge.
- C. Correct: Fixed cost 8; each hour adds 2. The y-intercept is (0,8) and slope is 2 dollars/hour.
- D. Interchanges the fixed fee and hourly rate.

M02 • T1: Create and graph linear relationships between quantities.**Answer: B. $y = 30 - 3x$**

$y = 30 - 3x$. At $x=0$, $y=30$; each minute decreases volume by 3. The slope is -3 liters/minute.

Check each alternative

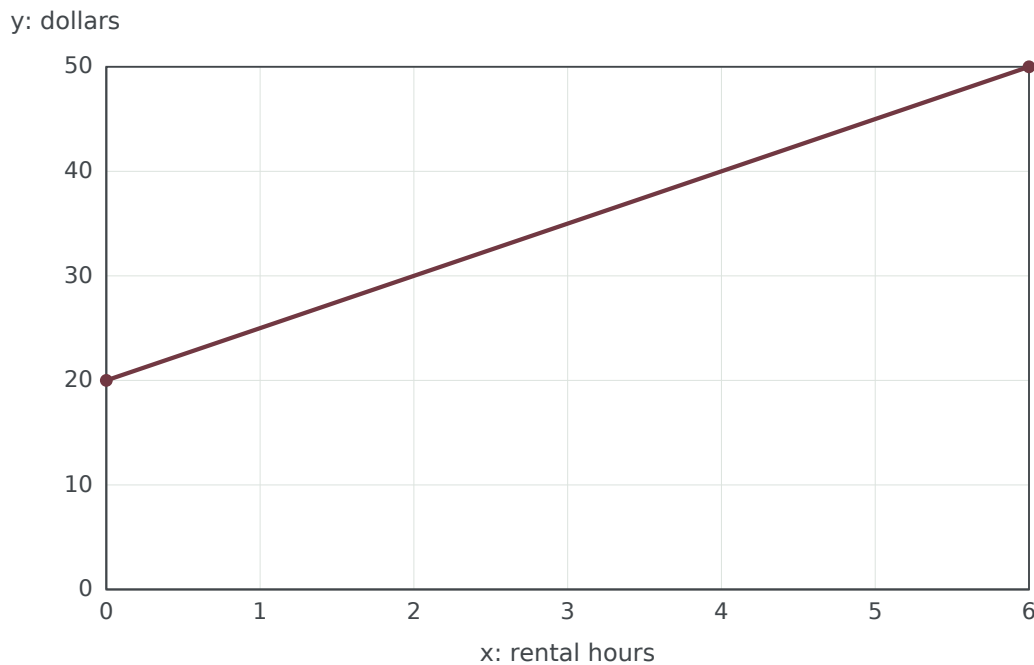
- A. Adds water instead of removing it.
- B. Correct: At $x=0$, $y=30$; each minute decreases volume by 3. The slope is -3 liters/minute.
- C. Swaps the initial volume and draining rate.
- D. Gives zero volume at time zero.

WORKED TEACHER KEYS

001

001 • T1: Create and graph linear relationships between quantities.

$y = 5x + 20$. Fixed cost 20; each hour adds 5. The y-intercept is (0,20) and slope is 5 dollars/hour. Domain: real x from 0 through 6, including endpoints. Reference values (x,y): (0, 20); (1, 25); (2, 30); (3, 35); (4, 40); (5, 45); (6, 50). Draw the curve only on the specified interval; both endpoints are included.

**Evidence to assess**

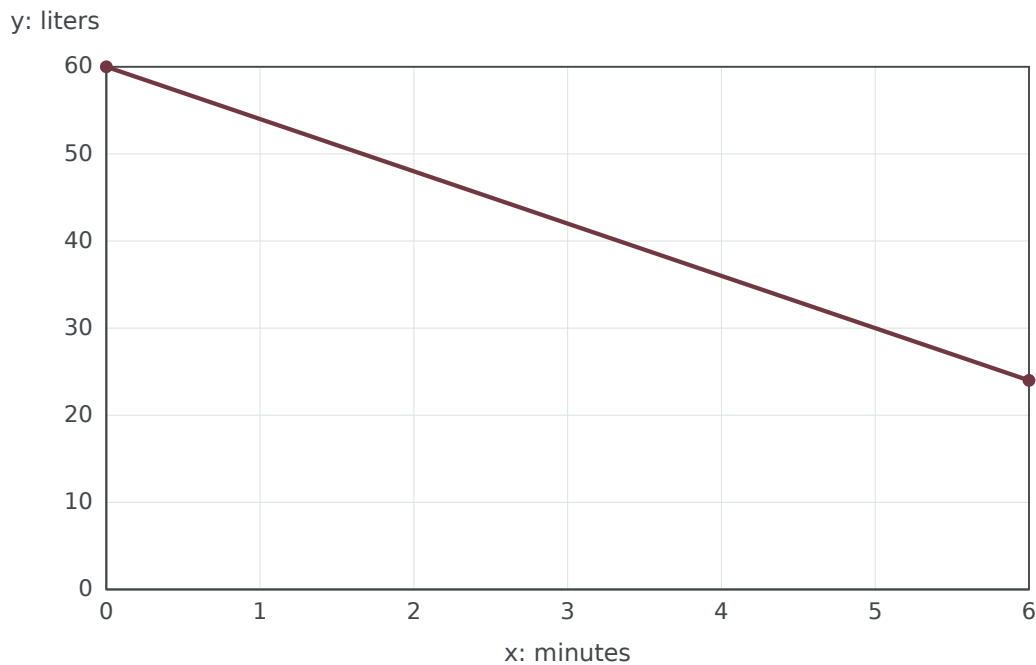
Assess a context-derived equation, all axis labels and units, at least three accurately plotted points, correct shape, interval endpoints and continuous/discrete treatment. A list of ordered pairs alone is not a completed graph.

WORKED TEACHER KEYS

002

002 • T1: Create and graph linear relationships between quantities.

$y = 60 - 6x$. At $x=0$, $y=60$; each minute decreases volume by 6. The slope is -6 liters/minute. Domain: real x from 0 through 6, including endpoints. Reference values (x,y) : (0, 60); (1, 54); (2, 48); (3, 42); (4, 36); (5, 30); (6, 24). Draw the curve only on the specified interval; both endpoints are included.

**Evidence to assess**

Assess a context-derived equation, all axis labels and units, at least three accurately plotted points, correct shape, interval endpoints and continuous/discrete treatment. A list of ordered pairs alone is not a completed graph.