Volume & Surface Area Digital Escape Room

Real-World Solids • SpEd Visual Supports

24	4	12	71
PROBLEMS	THEMED ROOMS	TIER 3 MODIFIED	TOTAL PAGES

WHAT'S INSIDE THIS PREVIEW

- Premium cover & branding
- Teacher guide & differentiation tips
- SpEd visual supports system
- Master formula reference card
- Room-by-room worked examples
- Color-coded 3D diagrams
- CODE problems unlock each room
- Workspace & answer boxes
- Tier 3 modified problem sets
- Detailed step-by-step solutions
- Teacher answer key with codes
- Scoring rubric & IEP goals

ALIGNED STANDARDS

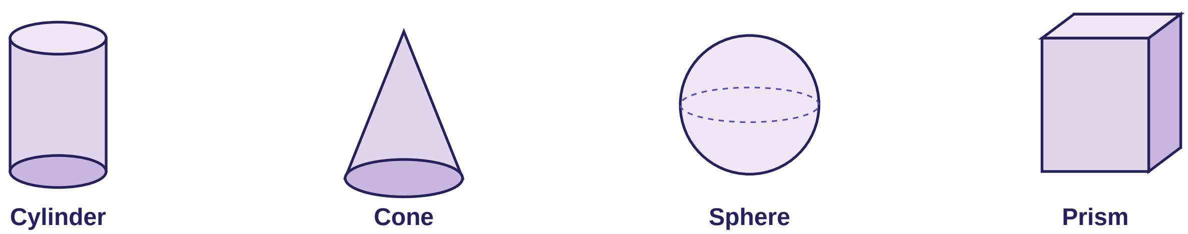
HSG.GMD.A.3 • HSG.MG.A.1 • CCSS-M

Secondary Math • Special Education / IEP • Tier 1–3 Differentiation

Volume & Surface Area Digital Escape Room

Real-World Solids • SpEd Visual Supports

24 Problems | 4 Themed Rooms | Tier 3 Modified | Color-Coded | Worked Examples | Full Solutions



Aligned Standards:

HSG.GMD.A.3 — Use volume formulas for cylinders, pyramids, cones, and spheres

HSG.MG.A.1 — Use geometric shapes, their measures, and properties to describe objects

Designed for: Secondary Math • Special Education / IEP Students • Tier 1-3 Supports

Welcome, Educator!

This premium digital escape room takes students on a four-room journey through the volume and surface area of cylinders, cones, spheres, prisms, pyramids, and composite solids. Every problem is anchored in a real-world scenario (water tanks, soup cans, basketballs, aquariums, rocket ships, pill capsules) and is supported by the explicit visual scaffolds that Special Education / IEP students need to access grade-level geometry standards. The resource is designed to meet HSG.GMD.A.3 (volume formulas) and HSG.MG.A.1 (geometric modeling) without compromising rigor for students who learn differently.

What's Inside

The escape room contains **24 standard problems** distributed across four themed rooms (six problems per room) and **12 Tier 3 modified problems** (three per room) with whole-number dimensions and formula-strip scaffolds. Each room unlocks with a 4-digit code derived from a designated CODE problem. The resource includes a master formula reference card, four worked example anchors (one per room), full step-by-step solutions for every problem, and a teacher answer key with all four unlock codes.

Room Sequence

Room	Theme	Solids Covered	Code Problem
1	Water, Soup, Pipes	Cylinders (V, SA, LA)	Problem 1 — Code 4084
2	Ice Cream, Basketball, Planets	Cones & Spheres	Problem 8 — Code 1810
3	Gifts, Tents, Aquariums	Pyramids & Prisms	Problem 15 — Code 4928
4	Rockets, Capsules, Parts	Composite Solids	Problem 20 — Code 1309

Suggested Pacing

Each room is designed for one 45-50 minute class period. The full escape room spans approximately four class periods. For block scheduling, two rooms can be completed in one 90-minute block with a brief stretch break between rooms. Tier 3 modified versions may be substituted for any standard problem set for students whose IEPs specify reduced item count or modified calculation load.

Differentiation Tips for IEP Students

Reduce cognitive load: Assign the Tier 3 modified versions (3 problems per room, whole-number dimensions, formula-strip scaffolds) for students whose IEPs specify reduced item count or simplified calculations.

Calculator-permitted versions: All standard problems are calculator-friendly. Tier 3 problems use $\pi \approx 3.14$ for clean arithmetic.

Color-code consistency: Red = length, Blue = width, Green = height, Purple = radius, Orange = slant height. Print in color to maximize the visual scaffold.

Worked-example anchors: Before each room, walk through the worked example as a whole class. Students then attempt the room's problems with the anchor as a reference.

Pair-share: Have students work in pairs to verbalize each step before writing it down — this supports language processing and executive function.

SpEd Visual Supports System

IEP-Aligned Scaffolds

Every problem in this escape room is built with explicit visual supports so that Special Education students can access grade-level geometry content without unnecessary cognitive barriers. The supports are grounded in the Universal Design for Learning (UDL) framework and align with the recommendations of the National Council of Teachers of Mathematics (NCTM) for students with learning disabilities. Each scaffold is described below.

1. Color-Coded Dimensions

Every dimension in every diagram is rendered in a consistent color: **RED = length**, **BLUE = width**, **GREEN = height**, **PURPLE = radius**, and **ORANGE = slant height**. This color system carries through every diagram, formula card, and worked solution. Research shows that consistent color-coding reduces working-memory demand for students with learning disabilities and helps them match dimensions to formula variables more reliably.

2. Labeled 3D Net Diagrams

Each problem includes a labeled 3D solid diagram showing the shape in perspective, with dimensions called out by colored arrows. Where a net (unfolded shape) is pedagogically useful — for cylinders, cones, prisms, and pyramids — a labeled net appears on the formula reference card so students can see how the 2-D face areas sum to the 3-D surface area.

3. Formula Reference Cards with Picture Icons

Each room opens with a formula reference card showing the relevant shapes and their formulas. A master formula card on page 6 collects all formulas in one place. Formulas are typeset in monospaced type with color-coded variables to match the diagrams, so students can map a formula like $V = \pi r^2 h$ directly onto a cylinder diagram with a purple radius arrow.

4. Calculator-Permitted Versions

All standard problems are designed to be calculator-permitted. Where a problem requires intermediate rounding, the convention is stated explicitly (usually 'round to the nearest whole / tenth / hundredth'). Tier 3 problems use $\pi \approx 3.14$ and whole-number dimensions so that students who are still developing calculation fluency can focus on the geometric reasoning.

5. Reduced-Item Modified Versions (Tier 3)

Each room has a Tier 3 modified version with only 3 problems (instead of 6), whole-number dimensions, and a formula-strip scaffold. The formula strip shows the formula with the values already substituted — students fill in the intermediate multiplication steps. This is the most intensive scaffold and is appropriate for students with significant learning disabilities or those at Tier 3 of an MTSS framework.

6. Step-by-Step Worked Example Anchors

Before each room's problem set, a fully worked example anchor demonstrates the problem-solving routine: (1) identify shape & formula, (2) substitute values, (3) compute step by step, (4) round to specified precision, (5) state the answer with units, (6) check for reasonableness. Students can refer back to the anchor while working the room's problems.

7. Formula-Strip Scaffolds (Tier 3)

Tier 3 problems include a formula strip that pre-substitutes the values into the formula. For example: '$V = \pi \times r \times r \times h \rightarrow V = 3.14 \times 5 \times 5 \times 10$'. Students perform the arithmetic and arrive at the answer without having to translate from

PREVIEW

Master Formula Reference Card

All Solids • All Formulas

This card collects every formula used in the escape room. Print it on a single page and provide it as a reference for all students, especially those with IEPs that specify formula cards or math reference sheets. Color-coded variables match the diagrams throughout the resource.

Color Key

■ Length	■ Width	■ Height	■ Radius	■ Slant Height

Volume & Surface Area Formulas

Solid	Volume (V)	Surface Area (SA)	Lateral Area (LA)
Cylinder	$V = \pi r^2 h$	$SA = 2\pi r^2 + 2\pi rh$	$LA = 2\pi rh$
Cone	$V = (1/3) \pi r^2 h$	$SA = \pi r^2 + \pi rl$ (l = slant)	$LA = \pi rl$
Sphere	$V = (4/3) \pi r^3$	$SA = 4 \pi r^2$	—
Hemisphere	$V = (2/3) \pi r^3$	$SA = 3 \pi r^2$	—
Rectangular Prism	$V = l \times w \times h$	$SA = 2(lw + lh + wh)$	—
Triangular Prism	$V = (½ \; b \; h_{tri}) \times L$	SA = (perimeter × L) + 2B	—
Square Pyramid	$V = (1/3) s^2 h$	$SA = s^2 + 2 \times s \times l$	$LA = 2 \times s \times l$
Triangular Pyramid	$V = (1/3) B h$	Depends on base	—
Cube	$V = s^3$	$SA = 6 s^2$	—
Half-Cylinder	$V = (1/2) \pi r^2 L$	Depends on orientation	—

Variable Definitions

Variable	Meaning	Units (typical)
r	Radius (of a circular base or sphere)	cm, m, in, ft
R	Radius of a larger sphere (used to distinguish from a smaller r)	m
h	Height of a solid (perpendicular to base)	cm, m, in, ft
h_tri	Height of a triangular BASE (within a prism)	cm, in, ft
l	Slant height (cone, pyramid) — measured along the side	cm, m
L	Length of a prism (distance the base is extruded)	cm, m, ft
s	Side length of a square or cube	cm, m, in
b	Base length (of a triangle, square, etc.)	cm, m, in
B	Area of the BASE (used in pyramid formulas)	cm^2, m^2, in^2
π	Pi ≈ 3.14159 (use 3.14 in Tier 3 problems)	— (dimensionless)

Room 1: Cylinders

Water, Soup, Pipes — Cylinders in the Real World

Mission Briefing

Welcome to Room 1 — the Cylinder Chamber. Cylinders are everywhere: water tanks, soup cans, pipes, candles, paint cans, grain silos. Your mission is to solve six cylinder problems, then use the answer to the CODE problem (Problem 1) to unlock the next room.

Learning Objectives

- Apply the formula $V = \pi r^2 h$ to find cylinder volumes.
- Apply the formula $SA = 2\pi r^2 + 2\pi rh$ for total surface area.
- Distinguish lateral area ($2\pi rh$) from total surface area.
- Practice unit conversions ($cm^3 \leftrightarrow$ liters, m $\leftrightarrow$ cm).

Formula Card for This Room

Quantity	Formula
Volume	$V = \pi r^2 h$
Total Surface Area	$SA = 2\pi r^2 + 2\pi rh$
Lateral Area (label only)	$LA = 2\pi rh$

Worked Example Anchor — Read This First

Before tackling the room's problems, walk through this fully worked example. It demonstrates the 6-step problem-solving routine: identify, substitute, compute, round, state, check. Use this routine for every problem in the room.

Example: Water Tank Filling

A county fair installs a new cylindrical water tank to supply the animal-barn wash station. The tank has a radius of 10 feet and a height of 13 feet. Before the fair opens, the maintenance crew must verify the tank's capacity for the health inspector. Compute the volume of water the tank can hold, to the nearest cubic foot. (This is the CODE problem — your rounded answer unlocks Room 1.)

Given: $r = 10$ ft, $h = 13$ ft

Find: Volume (V) in cubic feet, rounded to the nearest whole number.

Formula: $V = \pi r^2 h$

Problem 1: Water Tank Filling

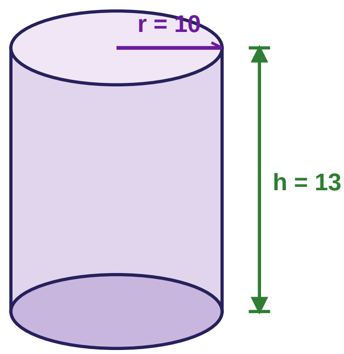
Room context CODE PROBLEM

Scenario. A county fair installs a new cylindrical water tank to supply the animal-barn wash station. The tank has a radius of 10 feet and a height of 13 feet. Before the fair opens, the maintenance crew must verify the tank's capacity for the health inspector. Compute the volume of water the tank can hold, to the nearest cubic foot. (This is the CODE problem — your rounded answer unlocks Room 1.)

Given: r = 10 ft, h = 13 ft

Find: Volume (V) in cubic feet, rounded to the nearest whole number.

Formula: $V = \pi r^2 h$



Color key: red = length, blue = width, green = height, purple = radius, orange = slant height.

Show Your Work

Final Answer (with units):

 This is the CODE problem. Round your final answer to the nearest whole number. The first four digits of that rounded answer unlock Room 1's 4-digit code. Write your code on the room's unlock page.

Room 2: Cones & Spheres

Ice Cream, Basketball, Planets — Cones & Spheres in the Real World

Mission Briefing

Welcome to Room 2 — the Cones & Spheres Chamber. Cones show up as ice cream cones, snow cones, and traffic cones. Spheres are everywhere from basketballs to balloons to entire planets. Your mission is to solve six problems, then use the answer to the CODE problem (Problem 8) to unlock the next room.

Learning Objectives

- Apply $V = (1/3)\pi r^2 h$ for cone volumes.
- Apply $V = (4/3)\pi r^3$ for sphere volumes.
- Apply $SA = 4\pi r^2$ for sphere surface areas.
- Compare volumes across shapes with shared dimensions.

Formula Card for This Room

Quantity	Formula
Cone Volume	$V = (1/3)\pi r^2 h$
Sphere Volume	$V = (4/3)\pi r^3$
Sphere Surface Area	$SA = 4\pi r^2$
Hemisphere Volume	$V = (2/3)\pi r^3$

Worked Example Anchor — Read This First

Before tackling the room's problems, walk through this fully worked example. It demonstrates the 6-step problem-solving routine: identify, substitute, compute, round, state, check. Use this routine for every problem in the room.

Example: Ice Cream Cone Optimization

An ice cream shop is choosing between two containers for a single scoop: a waffle cone with radius 3 cm and height 10 cm, or a sphere of ice cream with radius 3 cm. The shop wants the option that holds MORE ice cream. Find the volume of the cone, then compare it to the sphere's volume ($V_{sphere} \approx 113.1$ cm³). Which holds more, and by how much?

Given: Cone: r = 3 cm, h = 10 cm. Sphere: r = 3 cm ($V \approx 113.1$ cm³).

Find: Volume of the cone and the difference from the sphere.

$$\text{Formula: } V_{cone} = (1/3)\pi r^2 h$$

Problem 8: Basketball Packaging CODE

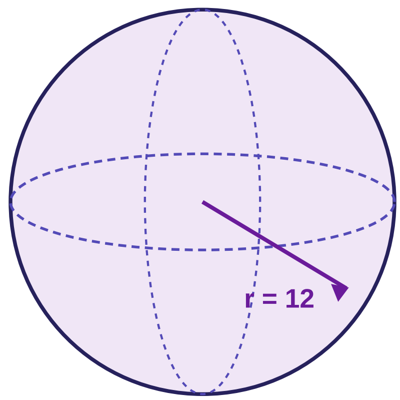
Room context □ CODE PROBLEM

Scenario. A sporting-goods manufacturer ships size-6 basketballs, each with a radius of 12 cm. The packaging team needs to know the surface area of synthetic leather required to make one basketball. Find the surface area of the sphere, to the nearest whole square centimeter. (This is the CODE problem — your rounded answer unlocks Room 2.)

Given: r = 12 cm

Find: Surface Area (SA) of a sphere.

`Formula: SA_sphere = 4 π r²`



Color key: red = length, blue = width, green = height, purple = radius, orange = slant height.

Show Your Work

Final Answer (with units):

□ **This is the CODE problem.** Round your final answer to the nearest whole number. The first four digits of that rounded answer unlock Room 2's 4-digit code. Write your code on the room's unlock page.

Mission Briefing

Welcome to Room 4 — the Composite Solids Chamber. Real-world objects often combine multiple solids: a rocket (cone + cylinder), a pill capsule (cylinder + two hemispheres), a water tower (sphere + cylinder). Your mission is to DECOMPOSE each shape, compute each piece's volume, then ADD. Solve six problems, then use the answer to the CODE problem (Problem 20) to unlock the final exit.

Learning Objectives

- Identify the basic solids that compose a composite shape.
- Compute the volume of each component separately.
- Add component volumes to find the total.
- Recognize when components share a radius or dimension.

Formula Card for This Room

Quantity	Formula
Cylinder Volume	$V = \pi r^2 h$
Cone Volume	$V = (1/3) \pi r^2 h$
Sphere Volume	$V = (4/3) \pi r^3$
Hemisphere Volume	$V = (2/3) \pi r^3$
Cube Volume	$V = s^3$
Square Pyramid Volume	$V = (1/3) \times s^2 \times h$
Half-Cylinder Volume	$V = (1/2) \times \pi r^2 \times L$

Worked Example Anchor — Read This First

Before tackling the room's problems, walk through this fully worked example. It demonstrates the 6-step problem-solving routine: identify, substitute, compute, round, state, check. Use this routine for every problem in the room.

Example: Rocket Ship

A model-rocket kit consists of a cylindrical body and a conical nose cone. The cylinder has radius 3 cm and height 12 cm. The cone has the same radius (3 cm) and height 4 cm. Find the total volume of the rocket (cylinder + cone), to the nearest cubic centimeter.

Given: Cylinder: r = 3 cm, h = 12 cm. Cone: r = 3 cm, h = 4 cm. Shared radius.

Find: Total volume (cylinder + cone).

$$\text{Formula: } V_{total} = V_{cylinder} + V_{cone} = (\pi r^2 h_{cyl}) + ((1/3) \pi r^2 h_{cone})$$

PREVIEW

Problem 20: Pill Capsule CODE

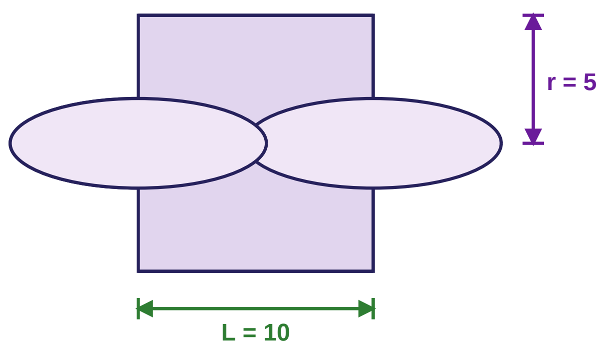
Room context □ CODE PROBLEM

Scenario. A pharmaceutical company designs a medicinal capsule shaped as a cylinder of length 10 mm and radius 5 mm, capped at both ends by hemispheres of the same radius (5 mm). Find the total volume of the capsule, using π ≈ 3.14, rounded to the nearest whole cubic millimeter. (This is the CODE problem — your answer unlocks Room 4.)

Given: Cylinder: $r = 5$ mm, $h = 10$ mm. Two hemispheres: $r = 5$ mm each. (Two hemispheres of the same radius = one full sphere.)

Find: Total volume of the capsule (use $\pi \approx 3.14$).

Formula: $V_{total} = V_{cylinder} + V_{sphere} = (\pi r^2 h) + ((4/3) \pi r^3)$



Color key: red = length, blue = width, green = height, purple = radius, orange = slant height.

Show Your Work

Final Answer (with units):

□ **This is the CODE problem.** Round your final answer to the nearest whole number. The first four digits of that rounded answer unlock Room 4's 4-digit code. Write your code on the room's unlock page.

Solutions — Room 1: Cylinders

Problems 1–6

Solution 1 — Water Tank Filling

Given: $r = 10$ ft, $h = 13$ ft

Formula: $V = \pi r^2 h$

Step 1 — Identify the shape and formula. The tank is a cylinder. The volume formula for a cylinder is $V = \pi r^2 h$, where r is the radius of the circular base and h is the height of the cylinder.

Step 2 — Substitute the known values. $V = \pi \times (10)^2 \times 13 = \pi \times 100 \times 13 = \pi \times 1{,}300$

Step 3 — Compute (using $\pi \approx 3.14159$). $V \approx 3.14159 \times 1{,}300 \approx 4{,}084.07$ ft^3

Step 4 — Round to the nearest whole number. $V \approx 4{,}084$ ft^3. The tank holds about 4,084 cubic feet of water.

Step 5 — Check for reasonableness. $10^2 = 100$ is the area of one circular base; multiplying by 13 gives 1,300; multiplying by π (a bit more than 3) gives a bit more than 3,900. Our answer of 4,084 is consistent.

Final Answer: $V \approx 4{,}084$ ft^3

Common mistake: A common error is squaring the radius incorrectly — students sometimes write $10^2 = 20$ instead of 100. Always remember: $10^2 = 10 \times 10 = 100$.

Solution 2 — Soup Can Design

Given: $r = 3.5$ cm, $h = 12$ cm

Formula: $SA = 2\pi r^2 + 2\pi rh$ (two circular bases + lateral area)

Step 1 — Identify the shape and formula. A soup can is a cylinder. Total surface area = area of the two circular ends + the lateral (curved) area: $SA = 2\pi r^2 + 2\pi rh$.

Step 2 — Compute the area of the two circular ends. $2\pi r^2 = 2 \times \pi \times (3.5)^2 = 2 \times \pi \times 12.25 = 24.5\pi$ cm^2

Step 3 — Compute the lateral area. $2\pi rh = 2 \times \pi \times 3.5 \times 12 = 84\pi$ cm^2

Step 4 — Add them together. $SA = 24.5\pi + 84\pi = 108.5\pi$ cm^2

Step 5 — Compute the decimal value. $SA \approx 108.5 \times 3.14159 \approx 340.87$ cm^2

Step 6 — Round to the nearest tenth. $SA \approx 340.9$ cm^2

Final Answer: $SA \approx 340.9$ cm^2

Common mistake: Some students forget the '2' in $2\pi r^2$ and only compute one circular base. Remember: a cylinder has TWO circular ends — top AND bottom.

Teacher Answer Key

All Codes & Answers at a Glance

Room Unlock Codes

Below are the four 4-digit codes that unlock each room. Students derive each code from the designated CODE problem in that room. Keep this page confidential — it is for teacher reference only.

Room	Theme	CODE Problem	Unlock Code
Room 1	Water, Soup, Pipes	Problem 1	**4084**
Room 2	Ice Cream, Basketball, Planets	Problem 8	**1810**
Room 3	Gifts, Tents, Aquariums	Problem 15	**4928**
Room 4	Rockets, Capsules, Parts	Problem 20	**1309**

All Problem Answers (Quick Reference)

#	Title	Answer
1	Water Tank Filling	$V \approx 4{,}084\ ft^3$
2	Soup Can Design	$SA \approx 340.9\ cm^2$
3	Pipe Flow Volume	$V \approx 251$ L
4	Grain Silo Capacity	$V \approx 1{,}696.5\ m^3$
5	Paint Can Label	$LA \approx 1{,}131\ cm^2$
6	Candle Making	$V_{wax} \approx 664\ cm^3$
7	Ice Cream Cone Optimization	$V_{cone} \approx 94.2\ cm^3$; sphere holds more by $18.8\ cm^3$
8	Basketball Packaging □ CODE	$SA \approx 1{,}810\ cm^2$
9	Planet Scale Comparison	Ratio ≈ 6.65 : 1 (Earth is about 6.65× Mars's volume)
10	Snow Cone Cone	$V \approx 201.1\ cm^3$
11	Party Balloon Helium	$V \approx 14.14$ L
12	Sports Ball — Volume & Surface Area	$V \approx 5{,}575\ cm^3$, $SA \approx 1{,}521\ cm^2$
13	Gift Box Design	$SA = 1{,}160\ cm^2$
14	Tent Volume	$V = 120\ ft^3$

What the Full PDF Contains

71-page complete resource • every feature unlocked

1
Room 1: Cylinders
Water, Soup, Pipes

- Volume ($V = \pi r^2 h$)
- Total SA ($2\pi r^2 + 2\pi rh$)
- Lateral Area ($2\pi rh$)

UNLOCK CODE **4084** | **6 PROBLEMS** + 3 Tier 3 modified

2
Room 2: Cones & Spheres
Ice Cream, Basketball, Planets

- Cone $V = \frac{1}{3}\pi r^2 h$
- Sphere $V = 4/3\ \pi r^3$
- Sphere $SA = 4\pi r^2$

UNLOCK CODE **1810** | **6 PROBLEMS** + 3 Tier 3 modified

3
Room 3: Pyramids & Prisms
Gifts, Tents, Aquariums

- Rectangular & triangular prisms
- Square pyramids
- Triangular pyramids

UNLOCK CODE **4928** | **6 PROBLEMS** + 3 Tier 3 modified

4
Room 4: Composite Solids
Rockets, Capsules, Parts

- Cylinder + cone (rocket)
- Capsule (cyl + 2 hemispheres)
- Silo & water tower

UNLOCK CODE **1309** | **6 PROBLEMS** + 3 Tier 3 modified

The Complete 71-Page Resource Includes:

- ☐ Premium cover & teacher guide
- ☐ SpEd visual supports system overview
- ☐ Master formula reference card
- ☐ 4 room introductions with worked examples
- ☐ 24 standard problems (6 per room)
- ☐ 12 Tier 3 modified problems (3 per room)
- ☐ 4 code-unlock pages with student entry boxes
- ☐ Detailed step-by-step solutions for all 24
- ☐ Step-by-step solutions for all 12 Tier 3
- ☐ Teacher answer key with all 4 unlock codes
- ☐ 6-point scoring rubric per problem
- ☐ IEP goals & CCSS-M alignment notes