PRINTABLES
PREMIUM EDUCATIONAL RESOURCES

Geometry EOC & Regents Test Prep Mega Bundle

Organized by CCSS Standard Cluster

P1	P2	P3	P4	P5	P6
Congruence	Similarity	Circles	GPE	GMD	Modeling

Premium Educational Resource

6 Packets • 235+ Problems • Full Worked Solutions

A comprehensive End-of-Course and Regents test-prep bundle organized by Common Core Standard Cluster — the structure teachers actually need to target reteach where data shows weaknesses.

Premium Educational Resources

Table of Contents

This bundle is organized into six cluster-aligned packets. Each packet contains a CCSS alignment chart, multiple-choice problem sets, constructed-response questions with rubrics, a most-missed-concepts summary, a mixed-cluster practice Regents exam, and complete worked solutions.

PACKET 1 • HSG.CO

Packet 1 — Congruence

Transformations, Congruence Criteria, and Proofs

This packet targets the Congruence cluster of the Common Core State Standards for high-school Geometry. Students master the language of rigid motions, develop the SSS, SAS, ASA, AAS, and HL criteria for triangle congruence, and use those criteria to write formal two-column and paragraph proofs. The packet concludes with a mixed-cluster mini-Regents that integrates CO skills with light SRT and GPE applications, mirroring the format of the New York State Geometry Regents Examination.

What's Inside

- CCSS Cluster Alignment Chart & Problem-to-Standard Map
- Concept Review with 5 labeled diagrams
- 25 Multiple-Choice Regents Problems across 3 sets
- 10 Constructed-Response Questions with Rubrics
- Most-Missed Concepts Summary (5 common errors)
- Mixed-Cluster Practice Regents Exam (10 problems)
- Complete Worked Solutions for Every Problem

Problem	Section	Standard
1.2	MC Set A	HSG.CO.A.5
1.3	MC Set A	HSG.CO.A.5
1.4	MC Set A	HSG.CO.A.5
1.5	MC Set A	HSG.CO.A.5
1.6	MC Set A	HSG.CO.A.5
1.7	MC Set A	HSG.CO.A.3
1.8	MC Set A	HSG.CO.A.2
1.9	MC Set A	HSG.CO.B.6
1.10	MC Set A	HSG.CO.A.4
1.11	MC Set B	HSG.CO.B.8
1.12	MC Set B	HSG.CO.B.8
1.13	MC Set B	HSG.CO.B.8
1.14	MC Set B	HSG.CO.B.8
1.15	MC Set B	HSG.CO.C.10
1.16	MC Set B	HSG.CO.C.9
1.17	MC Set B	HSG.CO.C.9
1.18	MC Set B	HSG.CO.C.11
1.19	MC Set B	HSG.CO.C.11
1.20	MC Set B	HSG.CO.C.10
1.21	MC Set C	HSG.CO.D.12
1.22	MC Set C	HSG.CO.D.13
1.23	MC Set C	HSG.CO.C.9
1.24	MC Set C	HSG.CO.C.10
1.25	MC Set C	HSG.CO.C.11
1.26	Constructed Response	HSG.CO.A.5
1.27	Constructed Response	HSG.CO.B.8
1.28	Constructed Response	HSG.CO.C.10
1.29	Constructed Response	HSG.CO.C.11

Dilations are *not* rigid motions because they scale distances.

Coordinate Rules You Must Memorize

On the coordinate plane, the four most-tested transformation rules are: **Translation** by <a, b>: (x, y) → (x + a, y + b). **Reflection across the y-axis**: (x, y) → (−x, y). **Reflection across the x-axis**: (x, y) → (x, −y). **Reflection across y = x**: (x, y) → (y, x). **Rotation 90° CCW about the origin**: (x, y) → (−y, x). **Rotation 180° about the origin**: (x, y) → (−x, −y). **Rotation 270° CCW (or 90° CW)**: (x, y) → (y, −x). Memorize the 90° CCW rule — every other rotation can be derived by applying it twice (for 180°) or three times (for 270°).

Congruence Criteria — When Each Applies

Two triangles are congruent if and only if a rigid motion maps one exactly onto the other. To prove congruence without constructing the motion, use the shortcut criteria: **SSS** (three pairs of sides equal), **SAS** (two sides and the *included* angle), **ASA** (two angles and the *included* side), **AAS** (two angles and a non-included side), and **HL** (the hypotenuse and a leg of two *right* triangles). Beware the invalid combinations: SSA is generally not valid (the ambiguous case), and AAA only guarantees similarity, not congruence.

Anatomy of a Two-Column Proof

Every proof has the same skeleton: (1) a **Given** statement handed to you by the problem, (2) a **Prove** statement — the destination you must reach, (3) a chain of **statements** with corresponding **reasons**. Acceptable reasons include: Given, Definition of Congruence, Reflexive / Symmetric / Transitive Properties, Vertical Angles Theorem, Alternate Interior Angles Theorem, CPCTC (Corresponding Parts of Congruent Triangles are Congruent), and the triangle-congruence criteria themselves. CPCTC is *only* usable *after* you have established a pair of congruent triangles — never before.

Constructions on the Regents

The Regents references constructions in multiple-choice and constructed-response items. You must know: **copying a segment** (compass set to segment length, swing arc from new endpoint), **copying an angle** (compass arc from vertex, transfer chord length), **perpendicular bisector** (two arcs from each endpoint, connect intersections), **angle bisector** (arc from vertex, then arcs from each intersection), **perpendicular from a point to a line**, and **constructing an equilateral triangle** or **regular hexagon inscribed in a circle** (use the radius as the chord length — six arcs fit perfectly).

Key Diagrams

1.24. *Standard: HSG.CO.C.10*

The midsegment of a triangle is:

- Triangle Midsegment Theorem: the segment connecting the midpoints of two sides of a triangle is parallel to the third side and is half its length.
- Answer: **B — Half the length of the third side**.

ANSWER

B

1.25. *Standard: HSG.CO.C.11*

*Which condition alone is **sufficient** to prove a parallelogram is a rectangle?*

- A parallelogram with one right angle has all right angles (consecutive angles are supplementary), so it is a rectangle. (Diagonals perpendicular would give a rhombus; all sides congruent also gives a rhombus; diagonals bisecting each other just confirms it's a parallelogram.)
- Answer: **C**.

ANSWER

C

Worked Solutions — Constructed Response

1.26. *Standard: HSG.CO.A.5 [2 pts]*

Triangle ABC has vertices A(−2, 1), B(2, 1), and C(0, 5).
a) State the coordinates of A′B′C′ after the translation T<4, −3>.
b) State the coordinates of A″B″C″ after A′B′C′ is reflected ...

- **Part (a):** Apply T<4, −3> to each vertex: (x, y) → (x + 4, y − 3).
- A′ = (−2 + 4, 1 − 3) = (2, −2). B′ = (2 + 4, 1 − 3) = (6, −2). C′ = (0 + 4, 5 − 3) = (4, 2).
- **Part (b):** Reflect A′B′C′ across the x-axis: (x, y) → (x, −y).
- A″ = (2, 2). B″ = (6, 2). C″ = (4, −2).

ANSWER

A′(2, −2), B′(6, −2), C′(4, 2); A″(2, 2), B″(6, 2), C″(4, −2)

1.27. *Standard: HSG.CO.B.8 [4 pts]*

In the diagram, AB ≅ DB, AC ≅ DC, and ∠BAC ≅ ∠BDC. Prove ΔABC ≅ ΔDBC. Provide a two-column proof.

- **Statements | Reasons**
- 1. AB ≅ DB; AC ≅ DC; ∠BAC ≅ ∠BDC | 1. Given
- 2. BC ≅ BC | 2. Reflexive Property
- 3. ΔABC ≅ ΔDBC | 3. SSS (or SAS — since ∠BAC is included between AB and AC, and ∠BDC is included between DB and DC; SAS also works).
- *Either SSS (using all three pairs of sides) or SAS (using two sides and the included angle) is acceptable.*

ANSWER

ΔABC ≅ ΔDBC by SSS (or SAS)

Dilations and the Definition of Similarity

A **dilation** with center O and scale factor k maps every point P to a point P′ on ray OP such that OP′ = |k| · OP. When $k > 1$ the image is an enlargement; when $0 < k < 1$ it is a reduction; when $k = 1$ the image coincides with the original (the identity). Two figures are **similar** if a composition of rigid motions and dilations maps one exactly onto the other. For triangles specifically, similarity is equivalent to having all three pairs of corresponding angles congruent *and* all three pairs of corresponding sides proportional.

Similarity Criteria: AA, SSS~, SAS~

Proving all six correspondences is rarely necessary. The three shortcut criteria are: **AA** (two pairs of angles congruent — the third is automatic by the angle-sum theorem), **SSS~** (all three pairs of sides proportional), and **SAS~** (two pairs of sides proportional and the included angles congruent). Note the parallel to the congruence criteria: the "~" (similar) versions replace "≅" with "proportional".

Pythagorean Theorem and Its Converse

In a right triangle with legs a and b and hypotenuse c: $\mathbf{a^2 + b^2 = c^2}$. The converse is just as important: if a triangle has sides satisfying $a^2 + b^2 = c^2$, then the angle opposite c is a right angle. Common Pythagorean triples to recognize on sight are 3-4-5, 5-12-13, 8-15-17, 7-24-25, and their multiples (e.g., 6-8-10 = 2·(3-4-5)). Recognizing a triple saves time on multiple-choice items.

Special Right Triangles

45°-45°-90°: legs are equal (call them x); the hypotenuse is $x\sqrt{2}$. Reason: an isosceles right triangle is half of a square cut along its diagonal; the diagonal of a unit square is $\sqrt{2}$. **30°-60°-90°**: short leg (opposite 30°) = x; hypotenuse = 2x; long leg (opposite 60°) = $x\sqrt{3}$. Reason: drop the altitude of an equilateral triangle to split it into two 30-60-90 triangles. Memorize these two patterns — they appear in over a dozen Regents problems per exam cycle.

The Three Trig Ratios and Complementary Angles

In a right triangle, for an acute angle θ: **sin θ = opposite/hypotenuse**, **cos θ = adjacent/hypotenuse**, **tan θ = opposite/adjacent**. The mnemonic SOH-CAH-TOA encodes this. Because the two acute angles in a right triangle are complementary, $\sin\theta = \cos(90° - \theta)$ and $\cos\theta = \sin(90° - \theta)$. This is why, for example, $\sin 30° = \cos 60° = \frac{1}{2}$. To find a missing angle, use the inverse: $\theta = \sin^{-1}(\text{ratio})$ or $\cos^{-1}(\text{ratio})$ or $\tan^{-1}(\text{ratio})$.

Key Diagrams

Mixed-Cluster Practice Regents Exam

Directions: This mini-exam integrates the current cluster with light applications from the others, mirroring the format of the New York State Geometry Regents Examination. Show all work. Multiple-choice problems are worth 2 points each; constructed-response problems are worth the points shown. The exam is timed for 30 minutes.

Part I — Multiple Choice (2 points each)

3.R1. A circle has radius 9. Find the area of a 120° sector.

(A) 3π **(B)** 9π
(C) 27π **(D)** 81π

3.R2. A central angle of 100° intercepts arc AB. An inscribed angle that intercepts the same arc measures:

(A) 50° **(B)** 100°
(C) 200° **(D)** 25°

3.R3. What is the center of the circle $(x + 4)^2 + (y - 1)^2 = 25$?

(A) (4, −1) **(B)** (−4, 1)
(C) (4, 1) **(D)** (−4, −1)

3.R4. Two chords intersect inside a circle. The segments of one chord are 8 and 3; one segment of the other chord is 6. The other segment is:

(A) 2 **(B)** 4
(C) 5 **(D)** 9

3.R5. From an external point, a tangent of length 6 and a secant with external part 4 are drawn. The internal segment of the secant has length:

(A) 3 **(B)** 5
(C) 9 **(D)** 13

Part II — Constructed Response

3.R6. [4 pts] A circular pizza with radius 8 inches is cut into 8 equal slices. (a) What is the area of one slice? (b) What is the perimeter of one slice (to the nearest tenth of an inch)?

Rubric:

- *4 pts: Both parts correct.*
- *3 pts: One part correct with full work.*
- *2 pts: One part correct.*
- *1 pt: Identifies 360/8 = 45° per slice.*
- *0 pts: No valid work.*

Most-Missed Concepts Summary

Based on years of Regents exam data, the following five errors are the most common mistakes students make on this cluster. Review these before exam day — being aware of these traps is half the battle.

1. Arc length vs. sector area

Arc length uses $2\pi r$ as the "full" quantity: arc = $(\theta/360)\cdot 2\pi r$. Sector area uses πr^2: area = $(\theta/360)\cdot \pi r^2$. Students mix these up because both have the $(\theta/360)$ prefix. Memory aid: length is one-dimensional (uses circumference), area is two-dimensional (uses area formula).

2. Forgetting that inscribed = ½ · central

An inscribed angle intercepting the same arc as a central angle is **half** the central angle. This is the single most-tested circle theorem on the Regents. If a problem says 'inscribed angle x°' and asks for the arc, the arc is 2x° (not x°).

3. Power of a point — getting the formula right

For intersecting chords: $a \cdot b = c \cdot d$ (product of segments of one chord = product of segments of the other). For two secants from an external point: (external part) · (whole secant) is constant. For tangent-secant: tangent^2 = (external secant) · (whole secant). Memorize all three forms.

4. Equation of a circle — completing the square correctly

When completing the square in $x^2 + ax$, add $(a/2)^2$ to both sides. Many students forget to add it to the right side as well, leading to wrong r^2. Always add the same quantity to BOTH sides.

5. Cyclic quadrilateral — opposite, not adjacent

Opposite angles of a cyclic quadrilateral are supplementary. Adjacent angles are NOT supplementary (they would be only in a degenerate case). Always identify which angles are opposite — they are separated by exactly one vertex in the cyclic order.

Slope Criteria: Parallel and Perpendicular

Parallel lines have equal slopes: $m_1 = m_2$. **Perpendicular lines** have slopes that are negative reciprocals: $m_1 \cdot m_2 = -1$ (equivalently, $m_2 = -1/m_1$). The only exception is a horizontal line (slope 0) and a vertical line (undefined slope), which are perpendicular but don't fit the formula. To find a parallel/perpendicular line through a given point, identify the needed slope and then apply point-slope form: $y - y_1 = m(x - x_1)$.

Partitioning a Directed Segment

To find the point P that divides segment AB in ratio m : n (i.e., AP : PB = m : n), use the section formula: **P = ((n·x_A + m·x_B)/(m+n), (n·y_A + m·y_B)/(m+n))**. The trick: the weights are the *opposite* ratio — for AP : PB = m : n, the weights on A and B are n and m, respectively. A common special case is the *midpoint* (ratio 1 : 1), which gives the midpoint formula. Another common case is ratio 1 : 2 or 2 : 1, giving the trisection points.

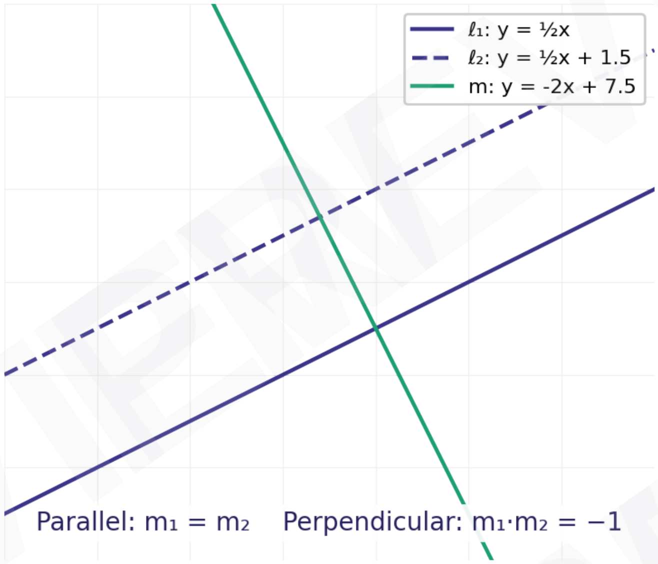
Coordinate Proofs — Strategy

Coordinate proofs assign coordinates to the vertices of a figure, then use algebra (distance, slope, midpoint) to verify geometric properties. Conventions for clean coordinates: place one vertex at the origin, one side along an axis, and use variables for the 'moving' parts. For example, to prove a property of a generic triangle, place A at (0, 0), B at (b, 0), and C at (c_1, c_2). Use distance to prove congruence/lengths, slope to prove perpendicularity/parallelism, and midpoint to prove bisection.

Equation of a Circle (Recap from Packet 3)

Standard form: $\mathbf{(x - h)^2 + (y - k)^2 = r^2}$, center (h, k), radius r. If given an expanded equation, complete the square in both x and y to recover the standard form. The converse of completing the square — going from standard form to expanded form — is also occasionally tested: $(x - 2)^2 + (y + 5)^2 = 9$ expands to $x^2 + y^2 - 4x + 10y + 20 = 0$.

Key Diagrams



Constructed Response Questions

Directions: Show all work. Each question is scored using the rubric provided. Partial credit is awarded according to the rubric — even if your final answer is wrong, you can earn points for correct setup, valid reasoning, and clear communication.

5.21. [4 pts] A cylindrical water tank has radius 5 feet and height 12 feet. (a) Find the volume of the tank in cubic feet. (b) How many gallons does the tank hold, to the nearest gallon? (1 $ft^3 \approx 7.48$ gallons.)

Rubric:

- *4 pts: Both parts correct with work.*
- *3 pts: One part correct with full work, other partial.*
- *2 pts: One part correct.*
- *1 pt: Identifies volume formula.*
- *0 pts: No valid work.*

5.22. [4 pts] A cone has radius 6 cm, height 8 cm, and slant height 10 cm. Find the total surface area of the cone.

Rubric:

- *4 pts: Correct SA with reasoning.*
- *3 pts: Forgets base or has minor arithmetic error.*
- *2 pts: Identifies both parts of SA but arithmetic wrong.*
- *1 pt: Identifies lateral SA formula.*
- *0 pts: No valid work.*

5.23. [2 pts] A sphere has volume 288π. Find its radius.

Rubric:

- *2 pts: Correct radius with work.*
- *1 pt: Sets up equation.*
- *0 pts: No valid work.*

5.24. [4 pts] A square pyramid has base side 10 and slant height 13. Find its total surface area.

Rubric:

- *4 pts: Correct SA with work.*
- *3 pts: Correct setup, minor arithmetic error.*
- *2 pts: Identifies lateral + base but wrong component.*
- *1 pt: Identifies slant height use.*
- *0 pts: No valid work.*

Density: Mass per Unit

Density = mass / volume (or mass / area for surface density, or mass / length for linear density). The Regents commonly tests population density (people per square mile), packing density (objects per unit area), and weight density (weight per unit volume). The key trick: compute the volume (or area) first, then multiply by density to get total mass (or count).

Optimization: Maximum / Minimum

Optimization problems ask for the maximum or minimum of some quantity (often area, volume, or cost) subject to a constraint (often perimeter, fencing, or material). Strategy: identify the quantity to maximize/minimize; write it as a function of one variable; use the constraint to eliminate one variable; find the maximum/minimum of the resulting function (usually by setting the derivative to zero in calculus, but on the Regents it's often solvable by AM-GM inequality, vertex of a parabola, or by testing integer cases).

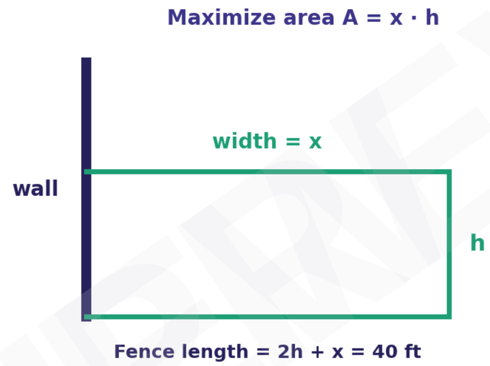
Scale Models and Drawings

Scale drawings preserve angles but scale lengths by a constant factor. A scale of 1 : 50 means every 1 inch on the drawing represents 50 inches in reality. Areas scale by the square of the scale factor (1 : 2500 for area), and volumes scale by the cube (1 : 125000 for volume). Read the scale carefully — a common Regents trap is to apply the linear scale to an area or volume calculation.

Sight Lines and Indirect Measurement

Many modeling problems use angles of elevation/depression to find unknown heights. The strategy: identify the right triangle (formed by the observer, the object's base, and the object's top), label the known angle and side, and apply the appropriate trig ratio. When two observers at different distances measure angles to the same object, you can set up a system of two equations in two unknowns (often solvable by the tangent of a sum or difference).

Key Diagrams



Rectangular fence against a wall — optimization.

6.14. *Standard: HSG.MG.A.1 [4 pts]*

A person who is 5.5 ft tall stands 18 ft from a lamppost. Her shadow is 6 ft long. How tall is the lamppost?

- The person and the lamppost form similar triangles (both vertical, both share the sun's angle).
- Proportion: (lamppost height) / (lamppost-to-shadow-tip distance) = (person height) / (person-to-shadow-tip distance).
- Lamppost shadow tip is 18 + 6 = 24 ft from base. Person shadow tip is 6 ft from base of person.
- $h/24 = 5.5/6 \to h = 24 \cdot 5.5/6 = 22$ ft.

ANSWER

22 ft

6.15. *Standard: HSG.MG.A.3 [6 pts]*

A 12-oz soda can is to be designed as a cylinder. The can must have a volume of 355 cm³. (a) Express the height h in terms of the radius r. (b) Find the radius and height that minimize the surface are...

- **(a)** $V = \pi r^2 h = 355 \to h = 355/(\pi r^2)$.
- **(b)** $SA = 2\pi r^2 + 2\pi rh = 2\pi r^2 + 2\pi r \cdot 355/(\pi r^2) = 2\pi r^2 + 710/r$.
- Minimize: $dSA/dr = 4\pi r - 710/r^2 = 0 \to r^3 = 710/(4\pi) \approx 56.5 \to r \approx 3.84$ cm.
- $h = 355/(\pi \cdot 14.7) \approx 7.68$ cm. (Note: $h \approx 2r$, a classic result for minimal-SA cylinders.)
- **(c)** $SA = 2\pi(14.7) + 2\pi(3.84)(7.68) \approx 92.4 + 185.3 \approx 277.7$ cm^2.

ANSWER

(a) $h = 355/(\pi r^2)$; (b) $r \approx 3.84$ cm, $h \approx 7.68$ cm; (c) ≈ 277.7 cm^2

6.16. *Standard: HSG.MG.A.2 [4 pts]*

A rectangular field 200 m by 150 m is to be planted with corn. If the recommended density is 6 plants per square meter, how many corn plants are needed for the field?

- Area = $200 \cdot 150 = 30{,}000$ m^2.
- Plants = $30{,}000 \cdot 6 = 180{,}000$ plants.

ANSWER

180,000 plants

6.17. *Standard: HSG.MG.A.3 [4 pts]*

A shipping company wants to fit identical cylindrical cans of radius 4 cm into a rectangular box that is 40 cm long, 24 cm wide, and 20 cm tall. What is the maximum number of cans that fit?

- Each can has diameter 8 cm.
- Cans per row along 40 cm: $40/8 = 5$ cans.
- Cans per column along 24 cm: $24/8 = 3$ cans.
- Cans per layer: $5 \cdot 3 = 15$ cans.
- Layers along 20 cm height: $20/8 = 2.5 \to 2$ layers (can't fit partial).
- Total: $15 \cdot 2 = 30$ cans.

ANSWER

30 cans

WHAT'S INSIDE

the Full 168-Page Mega Bundle

6 cluster-aligned packets • 235+ problems • complete worked solutions

Congruence
1

HSG.CO

45 problems

Transformations • Congruence criteria • Proofs • Constructions

Similarity, RT & Trig
2

HSG.SRT

50 problems

Dilations • AA/SSS~/SAS~ • Pythagorean • Special right triangles • Trig ratios

Circles
3

HSG.C

35 problems

Arc length • Sector area • Inscribed angles • Chord/tangent • Circle equations

Geometric Properties
4

HSG.GPE

40 problems

Distance • Midpoint • Slope • Partitioning • Coordinate proofs • Circle equations

Measurement & Dimension
5

HSG.GMD

35 problems

Volume • Surface area • Cross-sections • Cavalieri • Solids of revolution

Modeling with Geometry
6

HSG.MG

30 problems

Real-world applications • Density • Optimization • Scale models • Sight lines

CCSS ALIGNED | RUBRICS | WORKED SOLUTIONS | MOST-MISSED TIPS | PRACTICE REGENTS