GVC Companion Guide: Geometry

<u>COURSE FOCUS</u>: THE STUDY OF RELATIONSHIPS WITHIN SHAPES AND LOGICAL REASONING



- Set classroom norms and excitement for a great year of mathematics ahead! Start the school year with growth mindset work doing Week of Inspirational Math(s) youcubed. Consider using these tasks throughout the year with a big kick off week one using parts of any of the "weeks" provided. Work with your PLC to collaborate together on which to use when.
- Use number talks/sense making routines and mini-lessons to bring back past math knowledge. Things to think about including:
 - o "My Favorite No" My favorite wrong answer/Error Analysis
 - o Which one doesn't belong? (WODB)
 - o Which would you rather?
 - o Silent Board Game (How To)
 - o Graphing Stories: Blog-why-how-samples; Desmos Stories; STEMlearning; sample search
 - o Open Middle (open-ended questions)
 - o Estimation 180
 - o Number-Math Talks | Same but Different
 - o Always, Sometimes, or Never | True-False ... and why? | Give example(s) and/or counter-example(s) nrich.maths-ASN | true/false routine
 - o Academic Talk protocol (English learners) | Partner A/Partner B (Academic Talk protocol)
 - o Claims-Evidence Writing (graphic organizer support) | Problem-Evidence-Reasoning-Claim (PERC)
 - o Mathematical Mindsets by Jo Boaler (Appendix A pgs. 217-268) Appendix A

Math Core 8 Milestones as background content knowledge and expectations with which students enter Algebra I

- <u>Algebra Warm Ups</u> for Geometry Teachers ~ Keeping it Fresh!
- OpenUp Resources

Guiding Philosophy, CGI, Cognitively Guided Instruction:

- We invite you to consider the following:
 - Students need space and time to make sense of mathematics.
 - Students need time to explain their thinking.
 - Take time to notice, strategically share, and celebrate diverse student thinking.
 - Use questioning to elicit, support, and extend thinking.
 - Facilitate student-centered discussions to deepen understanding and create spaces for sense-making.

Seven Guiding Principles of Cognitively Guided Instruction, CGI:

We tie these principles to the Social Justice Standards, learning for justice anti-bias framework - <u>Learning</u> for Justice Website

- 1. Every student comes to math class knowing some mathematics
- 2. Every student is capable of extending their mathematical ideas
- 3. Knowing the development of children's thinking helps you know how to support learning– "What am I working toward?"
- 4. Details of children's thinking support instructional decision making
- 5. Must challenge our assumptions about what students know and are able to do
- 6. Must create space for the participation of each and honor the different ways in which students are participating



7. Identity shapes participation, so want to position students competently

SEMESTER 1 Fall FIAB Equations and Reasoning



Unit 1 Aug-Sept	Unit 2 Sept-Oct	Unit 3 Oct-Nov	Unit 4 Dec
Reasoning and Foundations	Lines and Angles	Transformations and Congruent Triangles	Properties of Triangles and
	OpenUp Units 2, 7		Parallelograms
OpenUp Unit 1		OpenUp Units 1,2,3	
			OpenUp Units 2-3

SEMESTER 1

Students should build on prior knowledge of	Students should master	Students should be developing and will continue to work on
Basic geometric terms.	Finding angle measurements (formed by lines and/or	Structuring and writing a formal proof.
Area of triangles, rectangles, and circles.	triangles)	Rigid and non-rigid
Pythagorean Theorem.	Recognizing and executing transformations on a coordinate plan.	transformations. Recognizing, stating and
Solving multi-step equations.	Defining congruency and	justifying congruent parts.
Graphing and writing linear equations.	being congruent.	
	Naming geometric terms using	
	correct notation.	

District FIAB in October will be Equations and Reasoning

Changes to look out for:

• Reasoning is joined with Foundations Unit 1



- Rationale:
 - Inductive and Deductive activities work well as community building to set the tone in the classroom -- working together, perseverance, participation, productive struggle, etc.
 - Not start year with vocab they have had some exposure to
 - Given the focus, start from the beginning emphasizing justifying and reasoning.
 - Do Algebraic Proof Format on Segment Addition Problems (and other similar types) from the beginning
- In Lines and Angles, unit 2 (chapter 3), the relationship between slopes of parallel and perpendicular lines is officially part of the geometry course for the first time in this unit; however, the concept has been discussed in algebra I. It is a concept for mastery in Geometry.
- Transformations are joined with Triangle Congruency in unit 3
 - Rationale:
 - Standards stress using transformations for congruency
 - Combining the units will force us to make more connections between rigid transformations and congruent figures
 - Mindset is to cause a change in the emphasis for our transformation unit
- OpenUp Resources

SEMESTER 2 Winter IAB Geometry Congruence				
Unit 5 January	Unit 6 February	Unit 7 March-April	Unit 8 Apr-May	Unit 9 May-June
Similarity and Special Right Triangles	Trigonometry OpenUp Unit 4	Circles OpenUp Units	Area and Volume OpenUp Units	Probability OpenUp Unit 12
OpenUp Unit 4		5, 6, 7	5, 8 SM	

SEMESTER 2

Students should build on prior knowledge of	Students should master	Students should be developing and will continue to work on
Proportions.	Solving right triangles using trigonometry, including real	Recognizing and applying transformations
Solving multi-step equations.	world applications.	(transformations of functions).
Area of triangles, rectangles, and circles.	Understanding and applying concepts of similarity, including real world applications.	Recognizing when and knowing how to complete the square.
Recognizing, stating and justifying congruent parts.	Understanding and applying theorems about circles.	Applying trigonometry and special right triangles to find missing measurements (unit circle).
	Applying volume formulas to solve problems.	

District IAB in February will be Geometry Congruence

Changes to look out for:

- Unit 5 brings together Special Right Triangles and Similarity
 - Rationale:
 - Use the idea of similarity as lens for special right triangle
- In Probability, unit 9, include the study of factorials since it may be the only time some students see and use this concept.

For the Geometry course, instructional time should focus on six critical areas:



- (1) Establish criteria for congruence of triangles based on rigid motions.
- (2) Establish criteria for similarity of triangles based on dilations and proportional reasoning.
- (3) Informally develop explanations of circumference, area, and volume formulas.
- (4) Apply the Pythagorean Theorem to the coordinate plane

(5) Prove basic geometric theorems.

(6) Extend work with probability.

Algebra Warm Ups for Geometry Teachers ~ Keeping it Fresh!

<u>Math Core 8 Milestones</u> as background content knowledge and expectations with which students enter Algebra I

Equity

Curiosity . En

GITY

Standards for Mathematical Practices = the how-to of the content

standards

MP1: Make sense of problems and persevere in solving them

MP2: Reason abstractly and quantitatively

- MP3: Construct viable arguments and critique the reasoning of others
- MP4: Model with mathematics
- MP5: Use appropriate tools
- MP6: Attend to precision
- MP7: Look for and make use of structure

MP8: Look for and express regularity in repeated reasoning

Mathematical Practices 1-3-6 = connections to EL/ELD and NGSS standards: See <u>Critical Areas</u> for details of grade expectations



GEOMETRY BIG IDEAS from 2023 CA MATH FRAMEWORK chapter 8



The graphic illustrates the connections and relationships of some high school geometry mathematics concepts. Direct connections include the following:

- · Probability Modeling directly connects to: Fairness in Data
- · Fairness in Data directly connects to: Probability Modeling

Trig Explorations directly connects to: Triangle Congruence, Geometric Models, Triangle
 Problems, Geospatial Data, Circle Relationships, Points & Shapes

Triangle Congruence directly connects to: Geometric Models, Triangle Problems,
 Transformations, Geospatial Data, Circle Relationships, Points & Shapes, Trig Explorations

• Geometric Models directly connects to: Triangle Problems, Transformations, Circle Relationships, Points & Shapes, Trig Explorations, Triangle Congruence

Triangle Problems directly connects to: Geometric Models, Triangle Congruence,
 Transformations, Geospatial Data, Circle Relationships, Points & Shapes, Trig Explorations

• Transformations directly connects to: Geometric Models, Triangle Problems, Triangle Congruence, Geospatial Data, Circle Relationships, Points & Shapes

Circle Relationships directly connects to: Geometric Models, Triangle Problems,
 Transformations, Geospatial Data, Triangle Congruence, Points & Shapes, Trig Explorations

· Points & Shapes directly connects to: Geometric Models, Triangle Problems,

Transformations, Geospatial Data, Circle Relationships, Triangle Congruence, Trig

Explorations

Geospatial Data: Triangle Problems, Transformations, Triangle Congruence, Circle
 Relationships, Points & Shapes, Trig Explorations

CONTENT CONNECTIONS ~ BIG IDEAS ~ CONTENT STANDARDS

CC1~reasoning with data CC2~exploring changing quantities CC3~taking wholes apart, putting parts together CC4~discovering shape and space

Big Idea	Content Connection	Geometry Content Standards
Probability Modeling	Reasoning with Data	S-CP.1, S-CP.2, S-CP.3, S-CP.4, S-CP.5, S-IC.1, S- IC.2, S-IC.3, S-MD.6, S-MD.7: Explore and compare independent and conditional probabilities, interpreting the output in terms of the model. Construct and interpret two-way frequency tables of data as a sample space to determine if the events are independent and use the data to approximate conditional probabilities. Examples of topics include product and medical testing, and player statistics in sports.
Fairness in Data	Reasoning with Data	S-MD.6, S-MD.7: Determine fairness and make decisions based on evaluation of outcomes. Allow students to explore fairness by researching topics of interest, analyzing data from two-way tables. Provide opportunities for students to make meaningful inference, and communicate their findings to community or other stakeholders.
Geospatial Data	Reasoning with Data	G-MG.1, G-MG.2, G-MG.3, F-LE.6, G-GPE.4, G-GPE.6, G-SRT.5, G-CO.1, G-CO.2, G-CO.12, G-C.2, G-C.5: Explore geospatial data that represent either locations (e.g., maps) or objects (e.g., patterns of people's faces, road objects for driverless cars), and connect to geometric equations and properties of common shapes. Demonstrate how a computer can measure the distance between two points using geometry, and then account for constraints (e.g., distance and then roads for directions) and multiple points with triangulation. Model what shapes and geometric relationships are most appropriate for different situations.
Trig Explorations	Exploring Changing Quantities	G-SRT.1, G-SRT.2, G-SRT.3, G-SRT.5, G-SRT.9, G- SRT.10, G-SRT.11, G-GPE.7. G-C.2, G-C.4: Investigate properties of right triangle similarity and congruence and the relationships between sine, cosine, and tangent; explore the relationship between sine and cosine of complementary angles, and apply that knowledge to problem solving situations. Students recognize the role similarity plays in establishing trigonometric functions, and they use trigonometric functions to investigate situations. Using dynamic geometric software students investigate similarity and trigonometric identities to derive the Laws of Sines and Cosines and use the laws to solve problems.



Big Idea	Content Connection	Geometry Content Standards
Triangle Problems	Exploring Changing Quantities	G-SRT.4, G-SRT.5, G-SRT.6, G-SRT.8, G-C.2, G-C.4, G-CO.12: Understand and use congruence and similarity when solving problems involving triangles, including trigonometric ratios. Use trigonometric ratios and the Pythagorean Theorem to solve right triangles in applied problems using dynamic geometric software.
Points and Shapes	Exploring Changing Quantities	G-GPE.1, G-GPE.2, G-GPE.4, G-GPE.5, G-GPE.6, G- GPE.7, G-CO.1, G-CO.12, G-C.2, G-C.4: Solve problems involving geometric shapes in the coordinate plane using dynamic geometric software to apply the distance formula, Pythagorean Theorem, slope, and similarity rules in solving problems.
		 Investigate equations of circles and how coefficients in the equations correspond to the location and radius of the circles.
		Find areas and perimeters of triangles and rectangles in the coordinate plane.
Transformations	Taking Wholes Apart, Putting Parts Together and Discovering Shape and Space	G-CO.1, G-CO.3, G-CO.4, G-CO.5, G-CO.12: Understand rotations, reflections, and translations of regular polygons, quadrilaterals, angels, circles, and line segments. Identify transformations, through investigation, that move a figure back onto itself, using that process to prove congruence.
Triangle Congruence	Discovering Shape and Space and Exploring Changing Quantities and Taking Wholes Apart, Putting Parts Together	G-CO.1, G-CO.2, G-CO.7, G-CO.8, G-CO.9, G-CO.10, G-CO.11, G-CO.12, G-CO.13, G-SRT.5: Investigate triangles and their congruence over rigid transformations verifying findings using triangle congruence theorems (ASA, SSS, SAS, AAS, and HL) and other geometric properties, including vertical angles, angles created by transversals across parallel lines, and bisectors.
Circle Relationships	Exploring Changing Quantities and Discovering Shape and Space	G-C.1, G-C.2, G-C.3, G-C.4, G-CO.1, G-CO.12, G- CO.13, G-GPE.1: Investigate similarity in circles and relationships between angle measures and segments, including inscribed angles, radii, chords, central angles, inscribed angles, circumscribed angles, and tangent lines using dynamic geometric software.
Geometric Models	Discovering Shape and Space	 G-GMD.1, G-GMD.3, G-GMD.4, G-GMD.5, G-MG.1, G-MG.2, G-MG.3, G-SRT.5, G-CO.12, G-C.2, G-C.4: Apply geometric concepts in modeling situations to solve design problems using dynamic geometric software. Investigate 3-D shapes and their cross sections. Use volume, area, circumference, and perimeter formulas. Understand and apply Cavalieri's principle. Investigate and apply scale factors for length, area, and volume.



Drivers of Investigation. Unifying reasons that both elicit curiosity and provide the motivation for deeply engaging with authentic mathematics.

D1~make sense of the world (understand and explain)

D2~predict what could happen (predict)

D3~impact the future (affect)

