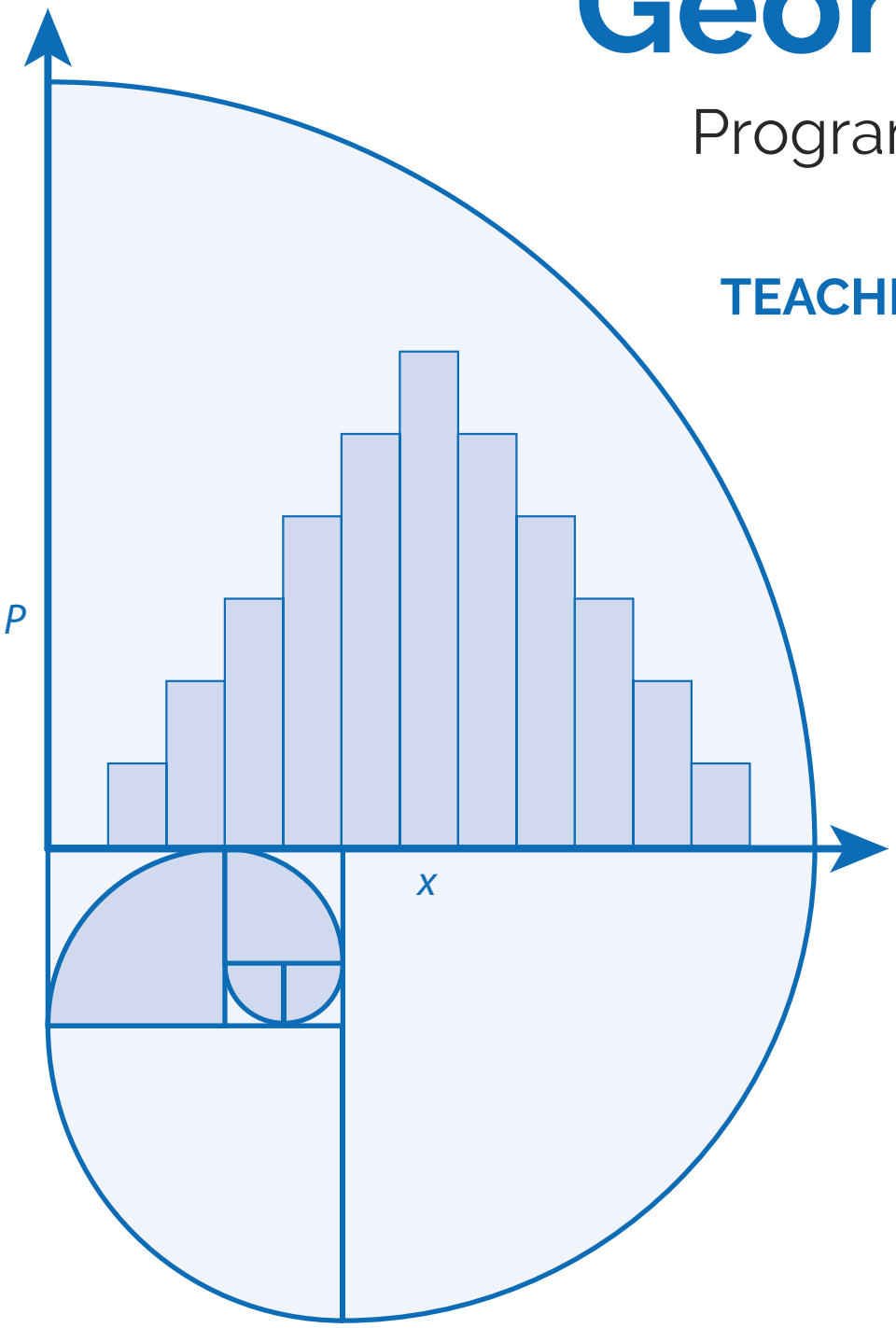
Geometry

Program Overview

TEACHER RESOURCE



Georgia Mathematics Standards

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This program was developed and reviewed by experienced math educators who have both academic and professional backgrounds in mathematics. This ensures: freedom from mathematical errors, grade level appropriateness, freedom from bias, and freedom from unnecessary language complexity.

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PROGRAM OVERVIEW

Introduction to the Program

Introduction

The *Georgia Mathematics Standards Geometry Program* is a complete set of materials developed around the Georgia Mathematics Standards and the curriculum map for High School Geometry. Topics are built around accessible core curricula, ensuring that the *Georgia Mathematics Standards Geometry Program* is useful for striving students and diverse classrooms.

This program realizes the benefits of exploratory and investigative learning and employs a variety of instructional models to meet the learning needs of students with a range of abilities.

The *Georgia Mathematics Standards Geometry Program* includes components that support problem-based learning, instruct and coach as needed, provide practice, and assess students' skills. Instructional tools and strategies are embedded throughout.

The program includes:

- More than 165 hours of lessons
- Essential Questions for each instructional topic
- Vocabulary
- Instruction and Guided Practice
- Sets of standards-based Scaffolded Practice and Practice problems
- Problem-based Tasks and Coaching questions
- Step-by-step graphing calculator instructions for the TI-Nspire and the TI-83/84
- Performance Tasks to promote collaborative learning and problem-solving skills
- Aligned open education resources that enhance procedural fluency and conceptual understanding
- Embedded Instructional Strategies to enable access for all students

Purpose of Materials

The *Georgia Mathematics Standards Geometry Program* has been organized to coordinate with the Georgia Geometry curriculum map.

Each topic includes activities that offer opportunities for exploration and investigation. These activities incorporate concept and skill development and guided practice, then move on to the application of new skills and concepts in problem-solving situations. Throughout the lessons and activities, problems are contextualized to enhance rigor and relevance.

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This program includes all the topics addressed in the Geometry content map. These include:

- Polynomial Expressions
- Geometric Foundations, Construction, and Proof
- Congruence
- Similarity
- Right Triangle Trigonometry
- Circles
- Equations and Measurements
- Probability and Statistics

The eight Mathematical Practice Standards are infused throughout:

1. Make sense of problems and persevere in solving them.
2. Reason abstractly and quantitatively.
3. Construct viable arguments and critique the reasoning of others.
4. Model with mathematics.
5. Use appropriate tools strategically.
6. Attend to precision.
7. Look for and make use of structure.
8. Look for and express regularity in repeated reasoning.

Structure of the Teacher Resource

The *Georgia Mathematics Standards Geometry Program* materials are completely reproducible. The Program Overview is the first section. This section helps you to navigate the materials, offers a collection of research-based Instructional Strategies along with their literacy connections and implementation suggestions, and shows the correlation between the Georgia Mathematics Standards and the Georgia Curriculum Map for High School Geometry.

The remaining materials focus on building math content knowledge and conceptual understanding through application of the units in the Georgia Geometry curriculum: Polynomial Expressions; Geometric Foundations, Construction, and Proof; Congruence; Similarity; Right Triangle Trigonometry; Circles; Equations and Measurements; and Probability and Statistics. The units in the *Georgia Mathematics Standards Geometry Program* are designed to be flexible so that you can mix and match activities as the needs of your students and your instructional style dictate.

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The Performance Tasks correspond to the content in selected units and provide students with the opportunity to apply concepts and skills, while you have a chance to circulate, observe, speak to individuals and small groups, and informally assess and plan.

Each topic begins with a pre-assessment and ends with a progress assessment. These allow you to assess students' progress as you move from topic to topic, enabling you to gauge how well students have understood the material and to differentiate as appropriate. Each unit culminates in a unit assessment.

Glossary

The Glossary contains vocabulary terms and formulas from throughout the program, organized alphabetically by units. Each listing provides the term and the definition in both English and Spanish.

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Unit Structure

All of the instructional units have common features. Each unit begins with a list of all the standards addressed in the topics and a list of one or more conceptual activities. Each unit also begins with a pre-assessment. Each topic begins with an overview of the standards addressed in the topic; Essential Questions; vocabulary (titled "Words to Know"); and a list of recommended websites to be used as additional resources.

Each lesson begins with a list of identified prerequisite skills that students need to have mastered in order to be successful with the new material in the upcoming lesson. This is followed by an introduction, key concepts, common errors/misconceptions, scaffolded practice problems, guided practice examples, a problem-based task with coaching questions and sample responses, a closure activity, and practice. Each topic ends with a progress assessment to evaluate students' learning.

All of the components are described below and on the following pages for your reference.

Pre-Assessment

This can be used to gauge students' prior knowledge and to inform instructional planning.

Georgia Mathematics Standards for the Topic

All standards that are addressed in the entire topic are listed.

Essential Questions

These are intended to guide students' thinking as they proceed through the topic. By the end of each topic, students should be able to respond to the questions.

Words to Know

Vocabulary terms and formulas are provided as background information for instruction or to review key concepts that are addressed in the topic.

Recommended Resources

This is a list of websites that can be used as additional resources. Some websites are games; others provide additional examples and/or explanations. (*Note*: Links will be monitored and repaired or replaced as necessary.) Each Recommended Resource is also accessible through Walch's cloud-based Curriculum Engine Learning Object Repository as a separate learning object that can be assigned to students.

Conceptual Activities

Conceptual understanding serves as the foundation on which to build deeper understanding of mathematics. In an effort to build conceptual understanding of mathematical ideas and to

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provide more than procedural fluency and application, links to interactive open education and Desmos resources are included. (*Note*: These website links will be monitored and repaired or replaced as necessary.) These and many other open educational resources (OERs) are also accessible through the Learning Object Repository as separate objects that can be assigned to students.

Warm-Up

Each warm-up takes approximately 5 minutes and addresses either prerequisite and critical-thinking skills or previously taught math concepts.

Georgia Mathematics Standards for the Lesson

When topics are broken down into lessons, the specific standard or standards that are addressed are presented at the beginning of the instructional portion of the lesson.

Warm-Up Debrief

Each debrief provides the answers to the warm-up questions, and offers suggestions for situations in which students might have difficulties. A section titled Connection to the Lesson is also included in the debrief to help answer students' questions about the relevance of the particular warm-up activity to the upcoming instruction. Warm-Ups with debriefs are also provided in PowerPoint presentations.

Identified Prerequisite Skills

This list cites the skills necessary to be successful with the new material.

Introduction

This brief paragraph gives a description of the concepts about to be presented and often contains some Words to Know.

Key Concepts

Provided in bulleted form, this instruction highlights the important ideas and/or processes for meeting the standard.

Graphing Calculator Directions

Step-by-step instructions for using a TI-Nspire and a TI-83/84 are provided whenever graphing calculators are referenced.

Common Errors/Misconceptions

This is a list of the common errors students make when applying Key Concepts. This list suggests what to watch for when students arrive at an incorrect answer or are struggling with solving the problems.

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Scaffolded Practice (Printable Practice)

This set of 10 printable practice problems provides introductory level skill practice for the lesson. This practice set can be used during instruction time.

Guided Practice

This section provides step-by-step examples of applying the Key Concepts. The three to five examples are intended to aid during initial instruction, but are also for individuals needing additional instruction and/or for use during review and test preparation.

Enhanced Instructional PowerPoint (Presentation)

Each lesson includes an instructional PowerPoint presentation with the following components: Warm-Up, Key Concepts, and Guided Practice. Selected Guided Practice examples include GeoGebra applets. These instructional PowerPoints are downloadable and editable.

Problem-Based Task

This activity can serve as the centerpiece of a problem-based lesson, or it can be used to walk students through the application of the standard, prior to traditional instruction or at the end of instruction. The task makes use of critical-thinking skills.

Optional Problem-Based Task Coaching Questions with Sample Responses

These questions scaffold the task and guide students to solving the problem(s) presented in the task. They should be used at the discretion of the teacher for students requiring additional support. The Coaching Questions are followed by answers and suggested appropriate responses to the coaching questions. In some cases answers may vary, but a sample answer is given for each question.

Recommended Closure Activity

Students are given the opportunity to synthesize and reflect on the lesson through a journal entry or discussion of one or more of the Essential Questions.

Problem-Based Task Implementation Guide

This instructional overview, found with selected Problem-Based Tasks in each unit, highlights connections between the task and the lesson's key concepts and Mathematical Practices. The Implementation Guide also offers suggestions for facilitating and monitoring, and provides alternative solutions.

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Printable Practice (Sets A and B) and Interactive Practice (Set A)

Each lesson includes two sets of practice problems to support students' achievement of the learning objectives. They can be used in any combination of teacher-led instruction, cooperative learning, or independent application of knowledge. Each Practice A is also available as an interactive Learnosity activity with Technology-Enhanced Items.

Progress Assessment

Each lesson ends with 10 multiple-choice questions, as well as one extended-response question that incorporates critical thinking and writing components. This can be used to document the extent to which students grasp the concepts and skills addressed during instruction.

Unit Assessment

Each unit ends with 12 multiple-choice questions and three extended-response questions that incorporate critical thinking and writing components. This can be used to document the extent to which students grasped the concepts and skills of each unit.

Answer Key

Answers for all of the Warm-Ups and practice problems are provided at the end of each unit.

Station Activities

Most units include a collection of station-based activities to provide students with opportunities to practice, reinforce, and apply mathematical skills and concepts. The debriefing discussions after each set of activities provide an important opportunity to help students reflect on their experiences and synthesize their thinking.

Conceptual Tasks

These engaging tasks provide opportunities for students to deepen their understanding and develop their conceptual knowledge of math concepts. These tasks provide multiple entry points and are accessible for ALL learners.

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Standards Correlations

Each lesson in this *Georgia 2021 Math Standards Geometry Program* was developed specifically to address the Georgia 2021 Mathematics Standards. Each lesson lists the standards covered in all the sub-lessons, and each lesson lists the standards addressed in that particular section. In this section, you'll find a comprehensive list mapping the lessons to the standards.

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Unit 1: Polynomial Expressions			
Topic	**Lesson**	**Title**	**Standard(s)**
Topic A	**Interpreting Polynomial Expressions**		
	1.1	Interpreting Polynomial Expressions	G.PAR.2.1
Topic B	**Operating with Polynomials**		
	1.2	Adding and Subtracting Polynomials	G.PAR.2.2 G.PAR.2.3
	1.3	Multiplying Polynomials	G.PAR.2.2 G.PAR.2.3

Unit 2: Geometric Foundations, Construction, and Proof			
Topic	**Lesson**	**Title**	**Standard(s)**
Topic A	**Proving Theorems About Parallelograms**		
	2.1	Defining Terms	G.GSR.4.1
	2.2	Proving Properties of Parallelograms	G.GSR.4.2
	2.3	Proving Properties of Special Quadrilaterals	G.GSR.4.2
Topic B	**Constructing Lines, Segments, and Angles**		
	2.4	Copying Segments and Angles	G.GSR.4.3
	2.5	Bisecting Segments and Angles	G.GSR.4.3
	2.6	Constructing Perpendicular and Parallel Lines	G.GSR.4.3
Topic C	**Constructing Polygons**		
	2.7	Constructing Equilateral Triangles Inscribed in Circles	G.GSR.4.3
	2.8	Constructing Squares Inscribed in Circles	G.GSR.4.3
	2.9	Constructing Regular Hexagons Inscribed in Circles	G.GSR.4.3
Topic D	**Proving Theorems About Lines and Angles**		
	2.10	Proving the Vertical Angles Theorem	G.GSR.4.4
	2.11	Proving Theorems About Angles in Parallel Lines Cut by a Transversal	G.GSR.4.4 G.GSR.4.5
Topic E	**Proving Theorems About Triangles**		
	2.12	Proving the Interior Angle Sum Theorem	G.GSR.4.5
	2.13	Proving Theorems About Isosceles Triangles	G.GSR.4.5
	2.14	Proving the Midsegment of a Triangle	G.GSR.4.5
	2.15	Proving Centers of Triangles	G.GSR.4.5

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Unit 3: Congruence			
Topic	**Lesson**	**Title**	**Standard(s)**
Topic A	**Introducing Transformations**		
	3.1	Transformations as Functions	G.GSR.3.1
	3.2	Applying Lines of Symmetry	G.GSR.3.1
Topic B	**Rotations, Reflections, and Translations**		
	3.3	Defining Rotations, Reflections, and Translations	G.GSR.3.1
	3.4	Applying Rotations, Reflections, and Translations	G.GSR.3.2
Topic C	Describing Rigid Motions and Determining Congruence		
	3.5	Describing Rigid Motions and Determining Congruence	G.GSR.3.2 G.GSR.3.3
Topic D	**Congruent Triangles**		
	3.6	Triangle Congruency	G.GSR.3.4
	3.7	Triangle Congruence Criteria	G.GSR.3.4

Unit 4: Similarity			
Topic	**Lesson**	**Title**	**Standard(s)**
Topic A	**Investigating Properties of Dilations**		
	4.1	Investigating Properties of Parallelism and the Center	G.GSR.5.1
	4.2	Investigating Scale Factors	G.GSR.5.1
Topic B	**Defining and Applying Similarity**		
	4.3	Defining Similarity	G.GSR.5.2
	4.4	Applying Similarity Using the Angle-Angle (AA) Criterion	G.GSR.5.3
Topic C	**Proving Similarity**		
	4.5	Proving Triangle Similarity Using Side-Angle-Side (SAS) and Side-Side-Side (SSS) Similarity	G.GSR.5.3
	4.6	Working with Ratio Segments	G.GSR.5.4
	4.7	Proving the Pythagorean Theorem Using Similarity	G.GSR.5.4
	4.8	Solving Problems Using Similarity and Congruence	G.GSR.5.4

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Unit 5: Right Triangle Trigonometry			
Topic	**Lesson**	**Title**	**Standard(s)**
Topic A	**Exploring Trigonometric Ratios**		
	5.1	Defining Trigonometric Ratios	G.GSR.6.1
	5.2	Exploring Sine and Cosine As Complements	G.GSR.6.2
Topic B	**Applying Trigonometric Ratios**		
	5.3	Calculating Sine, Cosine, and Tangent	G.GSR.6.3
	5.4	Calculating Cosecant, Secant, and Cotangent	G.GSR.6.3
	5.5	Problem Solving with the Pythagorean Theorem and Trigonometry	G.GSR.6.3

Unit 6: Circles			
Topic	**Lesson**	**Title**	**Standard(s)**
Topic A	**Introducing Circles**		
	6.1	Similar Circles and Central and Inscribed Angles	G.GSR.8.1
	6.2	Chord Central Angles Conjecture	G.GSR.8.1
	6.3	Properties of Tangents of a Circle	G.GSR.8.1
Topic B	**Finding Arc Lengths and Areas of Sectors**		
	6.4	Circumference and Area of a Circle	G.GSR.8.2
	6.5	Deriving the Formula for the Area of a Sector	G.GSR.8.2
Topic C	**The Equation of a Circle**		
	6.6	Deriving the Equation of a Circle	G.GSR.8.3
	6.7	Using Coordinates to Prove Geometric Theorems About Circles	G.GSR.8.3
Topic D	**The Unit Circle and Special Right Triangles**		
	6.8	Radians and Circles	G.GSR.7.1 G.GSR.7.2
	6.9	Special Right Triangles on the Unit Circle	G.GSR.7.3

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Unit 7: Equations and Measurements			
Topic	**Lesson**	**Title**	**Standard(s)**
Topic A	**Cross Sections and Rotated Shapes**		
	7.1	Cross Sections and Rotated Shapes	G.GSR.9.1
Topic B	**Volumes of Cylinders, Pyramids, Cones, and Spheres**		
	7.2	Volumes of Cylinders, Pyramids, Cones, and Spheres	G.GSR.9.1
Topic C	**Geometric Modeling**		
	7.3	Density	G.GSR.9.2 G.GSR.9.3
	7.4	Design	G.GSR.9.2 G.GSR.9.3

Unit 8: Probability and Statistics			
Topic	**Lesson**	**Title**	**Standard(s)**
Topic A	**Events**		
	8.1	Describing Events	G.PR.10.1
	8.2	The Addition Rule	G.PR.10.1
	8.3	Understanding Independent Events	G.PR.10.2
Topic B	**Conditional Probability**		
	8.4	Introducing Conditional Probability	G.PR.10.3
	8.5	Using Two-Way Frequency Tables	G.DSR.11.1 G.DSR.11.2
	8.6	The Multiplication Rule	G.PR.10.2
Topic C	**Combinatorics**		
	8.7	Combinations and Permutations	G.PR.10.4
	8.8	Probability with Combinatorics	G.PR.10.4
Topic D	**Probability Distributions**		
	8.9	Expected Value	G.PR.10.5 G.PR.10.7
	8.10	Developing Probability Distributions	G.PR.10.5 G.PR.10.6 G.PR.10.7
	8.11	Using Probability Distributions to Evaluate Outcomes	G.PR.10.8

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