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# Common Core Georgia Performance Standards

## Coordinate Algebra

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Secondary Mathematics Specialists



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Thank you for being here today.



You will need the following materials  
during today's broadcast:

- Coordinate Algebra handouts
- Note-taking materials

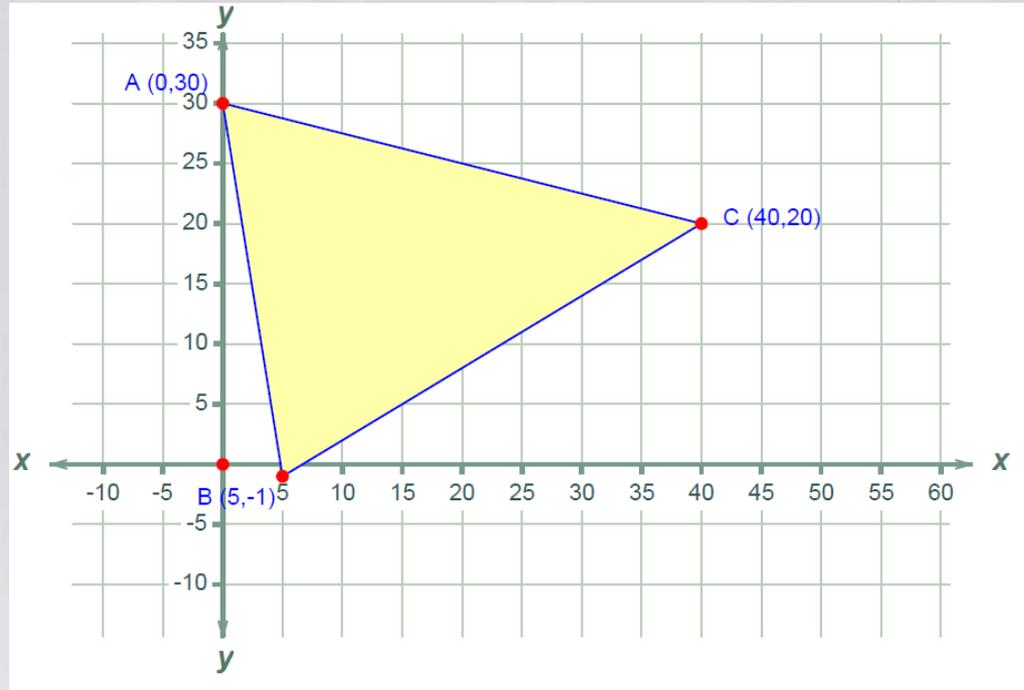


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Activate your brain

Use coordinates to prove simple geometric theorems algebraically.



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# Why Common Core Standards?



- Preparation: The standards are college- and career-ready. They will help prepare students with the knowledge and skills they need to succeed in education and training after high school.
- Competition: The standards are internationally benchmarked. Common standards will help ensure our students are globally competitive.
- Equity: Expectations are consistent for all – and not dependent on a student’s zip code.



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# Why Common Core Standards?



- **Clarity:** The standards are focused, coherent, and clear. Clearer standards help students (and parents and teachers) understand what is expected of them.
- **Collaboration:** The standards create a foundation to work collaboratively across states and districts, pooling resources and expertise, to create curricular tools, professional development, common assessments and other materials.



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# Common Core State Standards



Building on the strength of current state standards, the CCSS are designed to be:

- Focused, coherent, clear and rigorous
- Internationally benchmarked
- Anchored in college and career readiness
- Evidence and research based



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# Common Core State Standards in Mathematics



K 1 2 3 4 5 6 7 8 9 - 12

Measurement and Data

Statistics and Probability

CC

Number and Operations  
Fractions

Ratios &  
Proportional  
Relationships

Functions

Number and Operations in Base Ten

The Number System

Number and  
Quantity

Operations and Algebraic Thinking

Expressions and  
Equations

Algebra

Geometry

Modeling



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# Standards for Mathematical Practice



1. Make sense of problems and persevere in solving them.
6. Attend to precision.

2. Reason abstractly and quantitatively.
3. Construct viable arguments and critique the reasoning of others

4. Model with mathematics.
5. Use appropriate tools strategically.

7. Look for and make use of structure.
8. Look for and express regularity in repeated reasoning.

Reasoning and explaining

Modeling and using tools

Seeing structure and generalizing



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(McCallum, 2011)



Algebra



Conceptual Category



Creating Equations★

A.CED



Domain

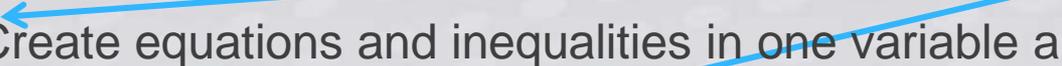
Create equations that describe numbers or relationships.

Standards  
CLUSTER Heading

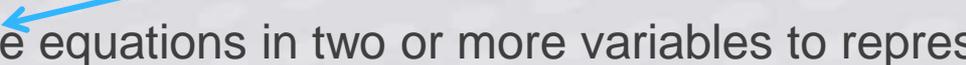


Standards

**MCC9-12.A.CED.1** Create equations and inequalities in one variable and use them to solve problems. Include equations arising from linear and quadratic functions, and simple rational and exponential functions.★



**MCC9-12.A.CED.2** Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.★



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While the standards focus on what is most essential, they do not describe all that can or should be taught. A great deal is left to the discretion of teachers and curriculum developers. The aim of the standards is to articulate the fundamentals, not to set out an exhaustive list or a set of restrictions that limits what can be taught beyond what is specified.

[corestandards.org](http://corestandards.org)



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# What's a Coordinate Algebra Teacher to do?



- Read your grade level standards
- Use the CCGPS Teaching Guide found on Georgia Standards.org and Learning Village
- Discuss the standards with your colleagues



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**Coordinate Algebra** is the first in a sequence of three high school courses designed to ensure career and college readiness. The course represents a discrete study of algebra with correlated statistics applications and a bridge to the second course through coordinate geometric topics.



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<b>Algebra</b>	<b>Geometry</b>	<b>Probability/Statistics</b>
Algebraic Expressions Solving Equations & Inequalities in One Variable Linear Equations & Inequalities Exponential Relationships (integer exponents only) Functions & Function Notation Models of Exponential & Linear Functions Arithmetic & Geometric Sequences	Slope & Distance on the Coordinate Plane Transformations in the Coordinate Plane	Interpret/Represent/ Compare Data Summarize Data Fit Functions to Data (limit to linear & exponential) Interpret Linear Models for Data



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## Common Core Georgia Performance Standards: Curriculum Map

1<sup>st</sup> Semester

2<sup>nd</sup> Semester

Unit 1	Unit 2	Unit 3	Unit 4	Unit 5	Unit 6
<b>Relationships Between Quantities</b>	<b>Reasoning with Equations and Inequalities</b>	<b>Linear and Exponential Functions</b>	<b>Describing Data</b>	<b>Transformations in the Coordinate Plane</b>	<b>Connecting Algebra and Geometry Through Coordinates</b>
MCC9-12.N.Q.1 MCC9-12.N.Q.2 MCC9-12.N.Q.3 MCC9-12.A.SSE.1a,b MCC9-12.A.CED.1 MCC9-12.A.CED.2 MCC9-12.A.CED.3 MCC9-12.A.CED.4	MCC9-12.A.REI.1 MCC9-12.A.REI.3 MCC9-12.A.REI.5 MCC9-12.A.REI.6 MCC9-12.A.REI.12	MCC9-12.A.REI.10 MCC9-12.A.REI.11 MCC9-12.F.IF.1 MCC9-12.F.IF.2 MCC9-12.F.IF.3 MCC9-12.F.IF.4 MCC9-12.F.IF.5 MCC9-12.F.IF.6 MCC9-12.F.IF.7a,e MCC9-12.F.IF.9 MCC9-12.F.BF.1a,b MCC9-12.F.BF.2 MCC9-12.F.BF.3 MCC9-12.F.LE.1a,b,c MCC9-12.F.LE.2 MCC9-12.F.LE.3 MCC9-12.F.LE.5	MCC9-12.S.ID.1 MCC9-12.S.ID.2 MCC9-12.S.ID.3 MCC9-12.S.ID.5 MCC9-12.S.ID.6a,b,c MCC9-12.S.ID.7 MCC9-12.S.ID.8 MCC9-12.S.ID.9	MCC9-12.G.CO.1 MCC9-12.G.CO.2 MCC9-12.G.CO.3 MCC9-12.G.CO.4 MCC9-12.G.CO.5	MCC9-12.G.GPE.4 MCC9-12.G.GPE.5 MCC9-12.G.GPE.6 MCC9-12.G.GPE.7

These units were written to build upon concepts from prior units, so later units contain tasks that depend upon the concepts addressed in earlier units.  
 All units will include the Mathematical Practices and indicate skills to maintain.

**NOTE:** Mathematical standards are interwoven and should be addressed throughout the year in as many different units and tasks as possible in order to stress the natural connections that exist among mathematical topics.



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# Coordinate Algebra Overview



## Unit 1: Relationships Between Quantities

### Number and Quantity - Quantities

- Reason quantitatively and use units to solve problems.

### Algebra – Seeing Structure in Expressions

- Interpret the structure of expressions.

### Algebra – Creating Equations

- Create equations that describe numbers or relationships.



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# Coordinate Algebra Overview



## Unit 2: Reasoning with Equations and Inequalities

### Algebra – Reasoning with Equations and Inequalities

- Understand solving equations as a process of reasoning and explain the reasoning.
- Solve equations and inequalities in one variable
- Solve systems of equations.
- Represent and solve equations and inequalities graphically



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# Coordinate Algebra Overview



## Unit 3: Linear and Exponential Functions

### Algebra – Reasoning with Equations and Inequalities

- ✓ Represent and solve equations and inequalities graphically.

### Functions – Interpreting Functions

- ✓ Understand the concept of a function and use function notation.
- ✓ Interpret functions that arise in applications in terms of the context.
- ✓ Analyze functions using different representations.

### Functions – Building Functions

- ✓ Build a function that models a relationship between two quantities.
- ✓ Build new functions from existing functions.

### Functions – Linear, Quadratic, and Exponential Models (Note: Quadratic functions are addressed in CCGPS Analytic Geometry.)

- Construct and compare linear, ~~quadratic~~, and exponential models and solve problems.
- Interpret expressions for functions in terms of the situation they model.



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# Coordinate Algebra Overview



## Unit 4: Describing Data

### Statistics and Probability – Interpreting Categorical and Quantitative Data

- Summarize, represent, and interpret data on a single count or measurement variable.
- Summarize, represent, and interpret data on two categorical and quantitative variables.
- Interpret linear models.



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# Coordinate Algebra Overview



## Unit 5: Transformations in the Coordinate Plane Geometry - Congruence

- Experiment with transformations in the plane.



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# Coordinate Algebra Overview



## Unit 6: Connecting Algebra and Geometry Through Coordinates

### Geometry – Expressing Geometric Properties with Equations

- Use coordinates to prove simple geometric theorems algebraically.



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Focus  
Coherence  
Fluency  
Deep Understanding  
Applications  
Balanced Approach



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# Focus

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Fluency

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Applications

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# Focus



## The student...

- spends more time thinking and working on priority concepts.
- is able to understand concepts and their connections to processes (algorithms).



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# Focus



## The teacher...

- builds knowledge, fluency and understanding of why and how certain mathematics concepts are done.
- thinks about how the concepts connect to one another.
- pays more attention to priority content and invests the appropriate time for all students to learn before moving onto the next topic.



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# Focus



The mile-wide inch-deep problem looks different in high school. In earlier grades its a matter of having too many topics. In high school its a matter of having too many separately memorized techniques, with no overall understanding of the structure to tie them altogether. So narrowing and deepening the curriculum is not so much a matter of eliminating topics, as seeing the structure that ties them together. For example, if students see that the distance formula and the trig identity  $\sin^2(t) + \cos^2(t) = 1$  are both manifestations of the Pythagorean theorem, they have an understanding that helps them reconstruct these formulas rather than memorize them...

Bill McCallum – CCSS author



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Grade	Priorities in Support of Rich Instruction and Expectations of Fluency and Conceptual Understanding
K–2	Addition and subtraction, measurement using whole number quantities
3-5	Multiplication and division of whole numbers and fractions
6	Ratios and proportional reasoning; early expressions and equations
7	Ratios and proportional reasoning; arithmetic of rational numbers
8	Linear algebra
9-12	Modeling



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# Modeling in Coordinate Algebra



What distinguishes modeling from other forms of applications of mathematics are (1) *explicit* attention at the beginning to the *process* of getting from the problem outside of mathematics to its mathematical formulation and (2) an explicit reconciliation between the mathematics and the real-world situation at the end. Throughout the modeling process, consideration is given to both the external world and the mathematics, and the results have to be both mathematically correct and reasonable in the real-world context.

“The Definition of Modeling” Henry O. Pollak



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# FAL Structure

- Pre-Assessment / opening
- Collaborative activity
- Whole-class discussion
- Return to the pre-assessment / opening



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# Focus task

Create equations that describe numbers or relationships.

Solving Linear Equations in Two Variables

Student Materials

Beta Version

## Notebooks and Pens

A store sells pens at \$2 and notebooks at \$5.

$n$  = number of notebooks sold.

$p$  = number of pens sold.

The following equations are true:

$$4n = p$$

$$5n + 2p = 39$$



Here is what Dan and Emma think the equations mean:

I think the first equation means that the store sells four times as many notebooks as pens.



**Dan**



**Emma**

I think the second equation means that the store sold 5 notebooks and 2 pens.



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# Coherence



## The student...

- builds on knowledge from year to year, in a coherent learning progression.



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# Coherence

## The teacher...

- connects mathematical ideas across grade levels.
- thinks deeply about what is being focused on.
- thinks how those ideas connect to how it was taught the years before and the years after.



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# What do Coordinate Algebra students bring?



## What are they connecting to later?

Build a function that models a relationship between two quantities.

Kimi and Jordan are each working during the summer to earn money in addition to their weekly allowance. Kimi earns \$9 per hour at her job, and her allowance is \$8 per week. Jordan earns \$7.50 per hour, and his allowance is \$16 per week.

1. Jordan wonders who will have more income in a week if they both work the same number of hours. Kimi says, "It depends." Explain what she means.
2. Is there a number of hours worked for which they will have the same income? If so, find that number of hours. If not, why not?
3. What would happen to your answer to part (b) if Kimi were to get a raise in her hourly rate? Explain.
4. What would happen to your answer to part (b) if Jordan were no longer to get an allowance? Explain.



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# Linear Overview

## 6<sup>th</sup> Grade

- Describe quantitative relationships between dependent and independent variables

## 7<sup>th</sup> Grade

- Solve problems using proportional reasoning and equations



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# Linear Overview

## 8<sup>th</sup> Grade

- Analyze and solve linear equations and systems

## Analytic Geometry

- Compare quadratic function characteristics to linear functions



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# Fluency

## The student...

- spends time practicing skills with intensity and frequency.



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# Fluency

## The teacher...

- pushes students to know skills at a greater level of fluency based on understanding.
- focuses on the listed fluencies by grade level.



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Grade	Required Fluency
K	Add/subtract within 5
1	Add/subtract within 10
2	Add/subtract within 20 & Add/subtract within 100 (pencil and paper)
3	Multiply/divide within 100 & Add/subtract within 1000
4	Add/subtract within 1,000,000
5	Multi-digit multiplication
6	Multi-digit division & Multi-digit decimal operations
7	Solve $px + q = r$ , $p(x + q) = r$
8	Solve simple $2 \times 2$ systems by inspection
9-12	Algebraic manipulation in which to understand structure. Writing a rule to represent a relationship between two quantities. Seeing mathematics as a tool to model real-world situations. Understanding quantities and their relationships.

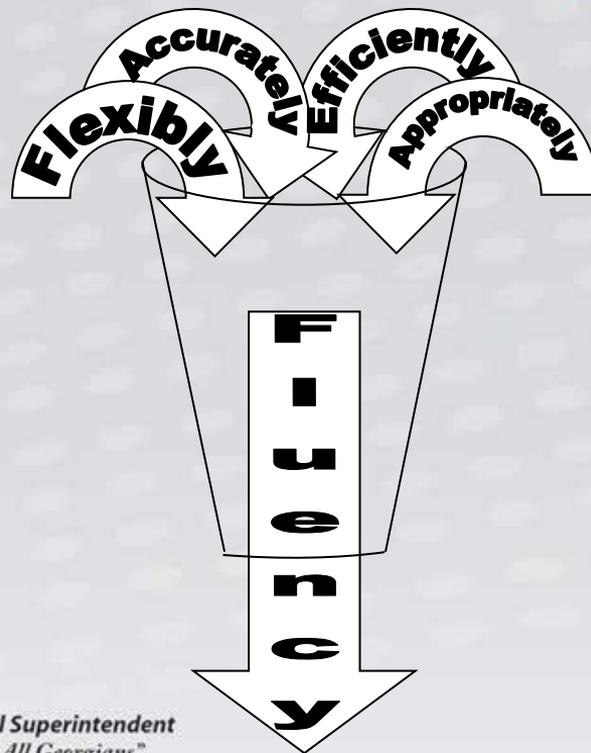


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# What does Fluency Look Like in Coordinate Algebra?



- **FLEXIBLY**
- **ACCURATELY**
- **EFFICIENTLY**
- **APPROPRIATELY**



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# Deep Understanding



## The student...

- shows mastery of material at a deep level in numerous ways.
- uses mathematical practices to demonstrate understanding of different material and concepts.



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# Deep Understanding



## The teacher...

- asks what mastery/proficiency really looks like and means.
- plans for progression of levels of understanding.
- spends the time to gain the depth of the understanding.
- becomes flexible and comfortable in own depth of content knowledge.



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# What does depth mean in Coordinate Algebra?



Experiment with transformations in the plane.

Use the translation  $(x, y) \rightarrow (x + 5, y - 9)$  for questions 1-7.

1. What is the image of  $A(-6, 3)$ ?
2. What is the image of  $B(4, 8)$ ?
3. What is the image of  $C(5, -3)$ ?
4. What is the image of  $A'$ ?
5. What is the preimage of  $D'(12, 7)$ ?
6. What is the image of  $A''$ ?
7. Plot  $A, A', A''$  and  $A'''$  from the questions above. What do you notice?



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# Application



## The student...

- applies mathematics in other content areas and situations.
- chooses the right mathematics concept to solve a problem when not necessarily prompted to do so.



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# Application



## The teacher...

- contextualizes mathematics.
- creates real world experiences in which students use what they know, and in which they are not necessarily prompted to use mathematics.



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# Mathematizing Coordinate Algebra



Summarize,  
represent, and  
interpret data on a  
single count or  
measurement  
variable

The batting averages for the Atlanta Braves for the past two years according to ESPN are listed below. Assuming all things equal, compare the 2011 BA to the 2010 BA. Justify your choices for comparisons.

2011

.500, .333, .333, .303, .286, .282, .278, .275, .270, .263, .260, .241, .240, .233, .233, .231, .220, .213, .212, .208, .173, .136, .116, .111, .106, .070, .051, .048, .000, .000, .000

2010

.321, .310, .307, .289, .287, .277, .269, .265, .256, .255, .250, .250, .250, .240, .240, .238, .210, .200, .195, .190, .185, .167, .151, .128, .125, .111, .097, .000, .000, .000, .000, .000, .000, .000, .000



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# Balanced Approach



## The student...

- practices mathematics skills to achieve fluency.
- practices mathematics concepts to ensure application in novel situations.



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# Balanced Approach



## The teacher...

- finds the balance between understanding and practice.
- normalizes the productive struggle.
- ritualizes skills practice.



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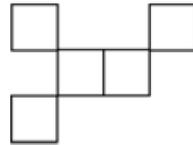


# Balanced Approach

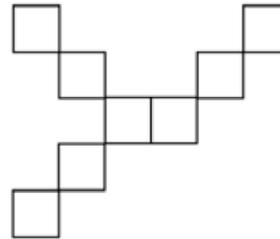
Build a function  
that models a  
relationship  
between two  
quantities.

## Mosaics

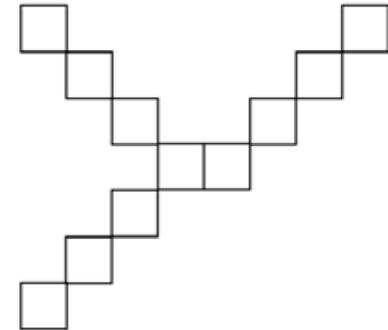
Mosaic 1



Mosaic 2



Mosaic 3



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# What's in Coordinate Algebra / Analytic Geometry A



- **Similarity, Congruence, and Proofs**
  - Understand similarity in terms of similarity transformations
  - Prove theorems involving similarity
  - Understand congruence in terms of rigid motions
  - Prove geometric theorems
  - Make geometric constructions
- **Right Triangle Trigonometry**
  - Define trigonometric ratios and solve problems involving right triangles
- **Circles and Volume**
  - Understand and apply theorems about circles
  - Find arc lengths and areas of sectors of circles
  - Explain volume formulas and use them to solve problems



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# CCGPS Suggestions:



1. Review the CCGPS. The teaching guide, curriculum map, and standards can all be found in Learning Village, on the Mathematics Program Page and on Georgia Standards.org
2. View the Fall 2011 Grade Level Webinar if you haven't already seen it.
3. Review this broadcast with your team to identify key areas of focus.



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# CCGPS Suggestions:



4. Participate in the unit-by-unit webinars beginning in May.  
**Coordinate Algebra Unit 1: May 10, 2012, 4:00pm**
5. Structure time for grade level/content areas to use framework units as a guide for planning.
6. Plan to get together with your colleagues at the end of each CCGPS unit to analyze student work samples and compare how student learning and performance look.



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# Coordinate Algebra Support:



Now-

- Fall 2011 Grade Level Webinar
- Standards Document
- Teaching Guide
- Curriculum Map

Coming soon-

- Framework Units (posting April 2012)
- Unit-by-unit webinars:

**Coordinate Algebra Unit 1 May 10, 2012, 4:00pm**



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# Takeaways

## 3 Things-

1. What's new?
2. What's different?
3. What resources and support are available for CCGPS mathematics?



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“The resources we need in order to grow as teachers are abundant within the community of colleagues. Good talk about good teaching is what we need...”

Parker Palmer  
*Courage to Teach*



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**THANK YOU**

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Thank you for participating in this CCGPS Professional Learning Session. We value your feedback. Please go to the following website, take the anonymous feedback survey, and complete the participation log to receive a certificate of participation:



<http://survey.sedl.org/efm/wsb.dll/s/1g10a>

If you have questions, feel free to contact any of the English/Language Arts or Mathematics staff at the following email addresses:

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