Mathematics Curriculum Map

College Algebra

Chandler Unified School District #80
Revised: May 2018

Mathematics – College Algebra
College Algebra – At a Glance

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.

Curriculum Map							
Semester 1				Semester 2			Optional Units
Unit 1 **Equations and Inequalities**	**Unit 2** **Graphs and Functions**	**Unit 3** **Polynomial Functions**	**Unit 4** **Rational Functions**	**Unit 5** **Inverse, Exponential, Logarithmic Functions**	**Unit 6** **Systems**	**Unit 7** **Sequences and Series**	**Unit 8** **Conics** **Matrices** **Finance**
R.1 Sets R.2 Real numbers 1.1 Linear Equations 1.3 Complex Numbers 1.4 Quadratic Equations 1.5 Applications and Modeling with Quadratic Equations 1.6 Other Types of Equations and Applications 1.7 Inequalities 1.8 Abs Value Equations and Inequalities	2.3 Functions 2.4 Linear Functions 2.5 Equations of lines and linear models 2.6 Graphs of Basic Functions 2.7 Graphing Techniques 2.8 Function Operations and Composition	R.3 Polynomials R.4 Factoring Polynomials 3.1 Quadratic Functions and Models 3.2 Synthetic Division 3.3 Zeros of Polynomial Functions 3.4 Polynomial Functions: Graphs, Applications, and Models	R.5 Rational Expressions 3.5 Rational Functions: Graphs, Applications, and Models	R.6 Rational Exponents R.7 Radical Expressions 4.1 Inverse Functions 4.2 Exponential Functions 4.3 Logarithmic Functions 4.4 Evaluating Logarithmic and the change of base theorem 4.5 Exponential and Logarithmic Equations 4.6 Applications and models of Exponential Growth and Decay	5.1 Systems of Linear Equations 5.5 Nonlinear Systems of Equations 5.6 Systems of Inequalities and Linear Programming	7.1 Sequences and Series 7.2 Arithmetic Sequences and Series 7.3 Geometric Sequences and Series	**Choose 1 of the Optional Units**: 2.1 Rectangular Coordinates and graphs 2.2 Circles 6.1 Parabolas 6.2 Ellipses 6.3 Hyperbolas 6.4 Summary of the Conic Sections 5.7 Properties of Matrices 5.8 Matrix Inverses Finance

Mathematical Practices: All units will include the Mathematical Practices

College Algebra Overview

MCCCD Official Course Competencies

1. Define, distinguish, and interpret the relations and functions and their inverses represented verbally, graphically, numerically, or algebraically.
2. Calculate and interpret the average rate of change in varied contexts, using function notation including the difference quotient.
3. Evaluate functions and solve function equations and inequalities using multiple methods.
4. Set up, solve, and interpret the meaning of solutions of systems of linear and nonlinear equations and inequalities using multiple methods, including matrices where appropriate.
5. Identify, graph, analyze, and determine the key characteristics of the following function types and their transformations: polynomial, power, radical, rational, exponential, logarithmic, absolute value, piecewise-defined, and discrete.
6. Model real world situations using a variety of mathematical techniques (including regression) and solve real world mathematical problems using functions and function compositions.
7. Introduce sequences and series.

Standards for Mathematical Practices (MP)

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

Semester 1

Unit: 1 Equations and Inequalities
Essential Question(s):

- How do I define a set?
- How do I simplify expressions?
- How do I classify numbers in the real number system?
- How do I solve a various types of equations?
- How do I classify an equation?
- How do I solve a literal equation?
- How do I identify an imaginary number?
- How do I simplify complex numbers?
- How do I add, subtract, multiply and divide complex numbers?

- How do I use the discriminant to determine the number and type of solutions?
- How do I find the height of a projectile?
- How do I make predictions from data?
- How do I solve linear, quadratic, and rational inequalities?
- How do I solve absolute value equations and inequalities?

Topic	MCCCD Core Competencies	Mathematical Practices	Resources
R.1: Sets	MCCCD Course Competencies #1 Define, distinguish, and interpret the relations and functions represented verbally, graphically, numerically, or algebraically. MCCCD Course Competencies #3 Evaluate functions and solve function equations and inequalities using multiple methods. MCCCD Course Competencies #6 Model real world situations using a variety of mathematical techniques (including regression) and solve real world mathematical problems using functions.	MP 1 MP 2 MP 3 MP 4 MP 5 MP 6 MP 7 MP 8	Pearson Chapter 1
R.2: Real Numbers and Their Properties			
1.1 Linear Equations			
1.3 Complex Numbers			
1.4 Quadratic Equations			
1.5 Applications and Modeling with Quadratic Equations			
1.6 Other Types of Equations and Applications			
1.7 Inequalities			
1.8 Absolute Value Equations and Inequalities			

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Semester 1

Unit 2 Graphs and Functions
Essential Question(s):

- **How do identify a function vs a relation?**
- **How do I describe the characteristics of a function?**
- **How do I use function notation?**
- **How do I write a linear equation?**
- **How do I determine the average rate of change?**
- **How do I graph basic functions?**

- **How do I transform the graphs of basic functions?**
- **How do I operate on and compose functions?**

Topic	MCCCD Core Competencies	Mathematical Practices	Resources
2.3 Functions	MCCCD Course Competencies #1 Define, distinguish, and interpret the relations and functions represented verbally, graphically, numerically, or algebraically.	MP 1 MP 2 MP 3	Pearson Chapter 2
2.4 Linear Functions	MCCCD Course Competencies #2 Calculate and interpret the average rate of change in varied contexts, using function notation including the difference quotient.	MP 4 MP 5	
2.5 Equations of lines and linear models	MCCCD Course Competencies #3 Evaluate functions and solve function equations using multiple methods.	MP 6	
2.6 Graphs of Basic Functions	MCCCD Course Competencies #5 Identify, graph, analyze, and determine the key characteristics of the following function types and their transformations: power, radical, absolute value, and piecewise-defined.	MP 7 MP 8	
2.7 Graphing Techniques			
2.8 Function Operations and Composition	MCCCD Course Competencies #6 Model real world situations using a variety of mathematical techniques (including regression) and solve real world mathematical problems using functions and function compositions.		

Semester 1

Unit 3 Polynomial Functions
Essential Question(s):
- **How do I Interpret Quadratic Functions?**
- **How do I apply Synthetic Division to find zeros of polynomial functions?**
- **How do I model real world situations with polynomial functions?**

Topic	MCCCD Core Competencies	Mathematical Practices	Resources
R.3: Polynomials	MCCCD Course Competencies #1 Define, distinguish, and interpret the relations and functions represented verbally, graphically, numerically, or algebraically.	MP 1 MP 2 MP 3 MP 4 MP 5 MP 6 MP 7 MP 8	Pearson Chapter 3
R.4: Factoring Polynomials			
3.1 Quadratic Functions and Models	MCCCD Course Competencies #3 Evaluate functions and solve function equations using multiple methods.		
3.2 Synthetic Division	MCCCD Course Competencies #5 Identify, graph, analyze, and determine the key characteristics of the following function types and their transformations: power, radical, absolute value, and piecewise-defined.		
3.3 Zeros of Polynomial Functions			
3.4 Polynomial Functions: Graphs, Applications, and Model			

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Semester 1

Unit 4 Rational Functions
Essential Question(s):
- **How do I simplify rational expressions?**
- **How do I simplify expressions with rational exponents?**
- **How do I apply and model real world situations of rational functions?**

Topic	MCCCD Core Competencies	Mathematical Practices	Resources
R.5: Rational Expressions	MCCCD Course Competencies #1 Define, distinguish, and interpret the relations and functions represented verbally, graphically, numerically, or algebraically.	MP 1 MP 2 MP 3	Pearson Chapter 3
3.5 Rational Functions: Graphs, Applications, and Models	MCCCD Course Competencies #4 Set up, solve, and interpret the meaning of solutions of systems of linear and nonlinear equations and inequalities using multiple methods, including matrices where appropriate. MCCCD Course Competencies #5 Identify, graph, analyze, and determine the key characteristics of the following function types and their transformations: power, radical, absolute value, and piecewise-defined.	MP 4 MP 5 MP 6 MP 7 MP 8	

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Semester 2

Unit 5 Inverse, Exponential, and Logarithmic Functions
Essential Question(s):
- **How do I find and interpret inverse functions?**
- **How do I graph, interpret and apply exponential functions?**
- **How do I graph, interpret and apply logarithmic functions?**
- **How do I model and apply exponential and logarithmic equations and functions?**
- **How do I solve logarithmic equations?**

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Topic	MCCCD Core Competencies	Mathematical Practices	Resources
R.6: Rational Exponents R.7 Radical Expressions 4.1 Inverse Functions 4.2 Exponential Functions 4.3 Logarithmic Functions 4.4 Evaluating Logarithmic and the change of base theorem 4.5 Exponential and Logarithmic Equations 4.6 Applications and models of Exponential Growth and Decay	MCCCD Course Competencies #1 Define, distinguish, and interpret the relations and functions represented verbally, graphically, numerically, or algebraically. MCCCD Course Competencies #3 Evaluate functions and solve function equations and inequalities using multiple methods. MCCCD Course Competencies #5 Identify, graph, analyze, and determine the key characteristics of the following function types and their transformations: power, radical, absolute value, and piecewise-defined. MCCCD Course Competencies #6 Model real world situations using a variety of mathematical techniques (including regression) and solve real world mathematical problems using functions.	MP 1 MP 2 MP 3 MP 4 MP 5 MP 6 MP 7 MP 8	Pearson Chapter 4

<table>
<tr><td colspan="4" align="center">**Semester 2**</td></tr>
<tr><td colspan="4">**Unit 6 Systems**
Essential Question(s):
• **How do I setup and solve a system of linear equations?**
• **How do I setup and solve a system of nonlinear equations?**
• **How do I setup and solve systems of inequalities and linear programming?**</td></tr>
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Topic	MCCCD Core Competencies	Mathematical Practices	Resources
5.1 Systems of Linear Equations	MCCCD Course Competencies #1 Define, distinguish, and interpret the relations and functions represented verbally, graphically, numerically, or algebraically. MCCCD Course Competencies #4 Set up, solve, and interpret the meaning of solutions of systems of linear and nonlinear equations and inequalities using multiple methods, including matrices where appropriate	MP 1 MP 2 MP 3 MP 4 MP 5 MP 6 MP 7 MP 8	Pearson Chapter 5
5.5 Nonlinear Systems of Equations			
5.6 Systems of Inequalities and Linear Programming			

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<tr><td colspan="4" style="background-color:yellow"><p align="center">**Semester 2**</p>**Unit 7 Sequences**
Essential Question(s):
•   **What is a sequence?**
•   **What is a series?**
•   **What is the difference between Arithmetic and Geometric sequences?**
•   **What is the difference between Arithmetic and Geometric series?**</td></tr>
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Topic	MCCCD Core Competencies	Mathematical Practices	Resources
7.1 Sequences and Series	MCCCD Course Competencies #6 Model real world situations using a variety of mathematical techniques (including regression) and solve real world mathematical problems using functions and function compositions.	MP 1 MP 2 MP 3	Pearson Chapter 7
7.2 Arithmetic Sequences and Series	MCCCD Course Competencies #7 Introduce sequences and series.	MP 4 MP 5 MP 6	
7.3 Geometric Sequences and Series		MP 7 MP 8	

Optional Unit 8

Optional Unit 8 Choice #1 Analytic Geometry
Essential Question(s):
- **How do I graph a parabola?**
- **How do I write the equation of a parabola?**
- **How do I graph an ellipse?**
- **How do I write the equation of an ellipse?**
- **How do I graph a hyperbola?**
- **How do I write the equation of a hyperbola?**

Topic	MCCCD Core Competencies	Mathematical Practices	Resources
2.1 Rectangular Coordinates and graphs	MCCCD Course Competencies #3 Evaluate functions and solve function equations and inequalities using multiple methods.	MP 1 MP 2	Pearson Chapter 6
2.2 Circles	MCCCD Course Competencies #6 Model real world situations using a variety of mathematical techniques (including regression) and solve real world mathematical problems using functions.	MP 3 MP 4	
6.1 Parabolas		MP 5 MP 6	
6.2 Ellipses		MP 7 MP 8	
6.3 Hyperbolas			
6.4 Summary of the Conic Sections			

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Optional Unit 8

Optional Unit 8 Choice #2 Matrices
Essential Question(s):
- **What is a matrix and how do I use it?**
- **How do I create an inverse of a matrix and what is its application use?**

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<td>**Topic**</td>
<td>**MCCCD Core Competencies**</td>
<td>**Mathematical Practices**</td>
<td>**Resources**</td>
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<td>5.7 Properties of Matrices</td>
<td rowspan="2">. MCCCD Course Competencies #3
Evaluate functions and solve function equations and inequalities using multiple methods.

MCCCD Course Competencies #6
Model real world situations using a variety of mathematical techniques (including regression) and solve real world mathematical problems using functions.</td>
<td>MP 1

MP 2

MP 3

MP 4

MP 5

MP 6

MP 7

MP 8</td>
<td>Pearson Chapter 7</td>
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<td>5.8 Matrix Inverses</td>
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Optional Unit 8	
Optional Unit 8 Choice #3 Finance **Essential Question(s):** • **How do I manage money?**	
Topic	**Resources**
Finance	http://www.scholastic.com/nextgeneration/lessons&worksheets/financialplanning.htm

The Mathematical Practices: Narratives and Questions

Mathematics Practices		Narratives	Related Questions
Overarching habits of mind of a productive math thinker	**P.MP.1 Make sense of problems and persevere in solving them**	Mathematically proficient students explain to themselves the meaning of a problem, look for entry points to begin work on the problem, and plan and choose a solution pathway. While engaging in productive struggle to solve a problem, they continually ask themselves, "Does this make sense?" to monitor and evaluate their progress and change course if necessary. Once they have a solution, they look back at the problem to determine if the solution is reasonable and accurate. Mathematically proficient students check their solutions to problems using different methods, approaches, or representations. They also compare and understand different representations of problems and different solution pathways, both their own and those of others.	• How would you describe the problem in your own words? • How would you describe what you are trying to find? • What do you notice about...? • What information is given in the problem? • Describe the relationship between the quantities. • Describe what you have already tried. What might you change? • Talk me through the steps you've used to this point. • What steps in the process are you most confident about? • What are some other strategies you might try? • What are some other problems that are similar to this one? • How might you use one of your previous problems to help you begin? • How else might you organize...represent... show...?
	P.MP.6 Attend to precision	Mathematically proficient students clearly communicate to others using appropriate mathematical terminology, and craft explanations that convey their reasoning. When making mathematical arguments about a solution, strategy, or conjecture, they describe mathematical relationships and connect their words clearly to their representations. Mathematically proficient students understand meanings of symbols used in mathematics, calculate accurately and efficiently, label quantities appropriately, and record their work clearly and concisely.	• What mathematical terms apply in this situation? • How did you know your solution was reasonable? • Explain how you might show that your solution answers the problem. • What would be a more efficient strategy? • How are you showing the meaning of the quantities? • What symbols or mathematical notations are important in this problem? • What mathematical language...,definitions..., properties can you use to explain...? • How could you test your solution to see if it answers the problem?

Actions and dispositions from NCSM Summer Leadership Academy, Atlanta, GA • Draft, June 22, 2011)
Most questions from all Grades Common Core State Standards Flip Book

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The Mathematical Practices: Narratives and Questions

Mathematics Practices		Narratives	Related Questions
Reasoning and Explaining	**P.MP.2 Reason abstractly and quantitatively**	Mathematically proficient students make sense of quantities and their relationships in problem situations. Students can contextualize and decontextualize problems involving quantitative relationships. They contextualize quantities, operations, and expressions by describing a corresponding situation. They decontextualize a situation by representing it symbolically. As they manipulate the symbols, they can pause as needed to access the meaning of the numbers, the units, and the operations that the symbols represent. Mathematically proficient students know and flexibly use different properties of operations, numbers, and geometric objects and when appropriate they interpret their solution in terms of the context.	• What do the numbers used in the problem represent? • What is the relationship of the quantities? • How is _____ related to _____? • What is the relationship between _____ and _____? • What does_____ mean to you? (e.g. symbol, quantity, diagram) • What properties might we use to find a solution? • How did you decide in this task that you needed to use...? • Could we have used another operation or property to solve this task? Why or why not?
	P.MP.3 Construct viable arguments and critique the reasoning of others	Mathematically proficient students construct mathematical arguments (explain the reasoning underlying a strategy, solution, or conjecture) using concrete, pictorial, or symbolic referents. Arguments may also rely on definitions, assumptions, previously established results, properties, or structures. Mathematically proficient students make conjectures and build a logical progression of statements to explore the truth of their conjectures. They are able to analyze situations by breaking them into cases, and can recognize and use counterexamples. Mathematically proficient students present their arguments in the form of representations, actions on those representations, and explanations in words (oral or written). Students critique others by affirming or questioning the reasoning of others. They can listen to or read the reasoning of others, decide whether it makes sense, ask questions to clarify or improve the reasoning, and validate or build on it. Mathematically proficient students can communicate their arguments, compare them to others, and reconsider their own arguments in response to the critiques of others.	• What mathematical evidence would support your solution? • How can we be sure that...? / How could you prove that...? • Will it still work if...? • What were you considering when...? • How did you decide to try that strategy? • How did you test whether your approach worked? • How did you decide what the problem was asking you to find? • Did you try a method that did not work? Why didn't it work? Could it work? • What is the same and what is different about...? • How could you demonstrate a counter-example?

Actions and dispositions from NCSM Summer Leadership Academy, Atlanta, GA • Draft, June 22, 2011)
Most questions from all Grades Common Core State Standards Flip Book

Mathematics Practices		Narratives	Related Questions
Modeling and Using Tools	**P.MP.4 Model with mathematics**	Mathematically proficient students apply the mathematics they know to solve problems arising in everyday life, society, and the workplace. When given a problem in a contextual situation, they identify the mathematical elements of a situation and create a mathematical model that represents those mathematical elements and the relationships among them. Mathematically proficient students use their model to analyze the relationships and draw conclusions. They interpret their mathematical results in the context of the situation and reflect on whether the results make sense, possibly improving the model if it has not served its purpose.	• What number model could you construct to represent the problem? • What are some ways to represent the quantities? • What is an equation or expression that matches the diagram, number line, chart, table, and your actions with the manipulatives? • Where did you see one of the quantities in the task in your equation or expression? What does each number in the equation mean? • How would it help to create a diagram, graph, table...? • What are some ways to visually represent...? • What formula might apply in this situation?
	P.MP.5 Use appropriate tools strategically	Mathematically proficient students consider available tools when solving a mathematical problem. They choose tools that are relevant and useful to the problem at hand. Proficient students are sufficiently familiar with tools appropriate for their grade or course to make sound decisions about when each of these tools might be helpful; recognizing both the insight to be gained and their limitations. Students deepen their understanding of mathematical concepts when using tools to visualize, explore, compare, communicate, make and test predictions, and understand the thinking of others.	• What mathematical tools can we use to visualize and represent the situation? • Which tool is more efficient? Why do you think so? • What information do you have? • What do you know that is not stated in the problem? • What approach are you considering trying first? • What estimate did you make for the solution? • In this situation would it be helpful to use...a graph..., number line..., ruler..., diagram..., calculator..., manipulative? • Why was it helpful to use...? • What can using a _____ show us that _____ may not? • In what situations might it be more informative or helpful to use...?

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The Mathematical Practices: Narratives and Questions

Mathematics Practices		Narratives	Related Questions
Seeing structure and generalizing	**P.MP.7 Look for and make use of structure**	Mathematically proficient students use structure and patterns to assist in making connections among mathematical ideas or concepts when making sense of mathematics. Students recognize and apply general mathematical rules to complex situations. They are able to compose and decompose mathematical ideas and notations into familiar relationships. Mathematically proficient students manage their own progress, stepping back for an overview and shifting perspective when needed.	• What observations do you make about...? • What do you notice when...? • What parts of the problem might you eliminate..., simplify...? • What patterns do you find in...? • How do you know if something is a pattern? • What ideas that we have learned before were useful in solving this problem? • What are some other problems that are similar to this one? • How does this relate to...? • In what ways does this problem connect to other mathematical concepts?
	P.MP.8 Look for and express regularity in repeated reasoning	Mathematically proficient students look for and describe regularities as they solve multiple related problems. They formulate conjectures about what they notice and communicate observations with precision. While solving problems, students maintain oversight of the process and continually evaluate the reasonableness of their results. This informs and strengthens their understanding of the structure of mathematics which leads to fluency.	• Explain how this strategy works in other situations? • Is this always true, sometimes true or never true? • How would we prove that...? • What do you notice about...? • What is happening in this situation? • What would happen if...? • Is there a mathematical rule for...? • What predictions or generalizations can this pattern support? • What mathematical consistencies do you notice?

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