Curriculum: College Algebra

Curricular Unit: Fundamental Concepts of Algebra

Instructional Unit: A. Apply basic algebraic concepts

**Standard Alignments (Section 2)**

<table>
<thead>
<tr>
<th>GLE/CLE: N/A</th>
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<tbody>
<tr>
<td>Knowledge: (MA) 1</td>
</tr>
<tr>
<td>CCSS: N-RN.1; N-RN.2; N-CN.1; N-CN.2; N-CN.3; A-APR.1; A-CED.1</td>
</tr>
<tr>
<td>NETS: 3b-d</td>
</tr>
<tr>
<td>Performance: 3.2</td>
</tr>
</tbody>
</table>

**Unit (Section 3)**

Learning Targets:

- Review properties of real numbers
- Perform basic operations on fractions
- Simplify expressions involving absolute value
- Find the distance between 2 points on the number line
- Express numbers in scientific notation and decimal notation
- Perform basic operations on polynomial expressions
- Factor polynomials
- Simplify expressions using the laws of exponents
- Simplify expressions using the laws of radicals
- Simplify complex fractions
- Rationalize a denominator
- Solve equations
- Solve application problems
- Graph linear equations
- Use trigonometric properties to simplify expressions
- Use trigonometric properties to solve equations

Board Approved 8-3-15
### Instructional Strategies:

- Lecture enhanced with:
  - SMART Notebook
  - PowerPoint
  - the Internet
- Drill and guided practice
- Demonstrations: The teacher will use examples to reinforce concepts to be reviewed
- Reflective discussion
- Class discussion
- Computer assisted instruction

### Assessments/Evaluations:

- Students will be assessed on the concepts taught using a variety of modalities:
  - Direct teacher observations
  - Formative assessments
  - Homework assignments
  - Formal common assessment

Mastery: 80%

### Sample Assessment Questions:

- **Simplify** and rationalize the denominator where appropriate.
  \[ \sqrt[5]{\frac{4x^{10}y^3}{6x^2}} \]

- **Simplify** the expression.
  \[ \frac{3}{x-1} - \frac{3}{y-1} \]

### Instructional Resources/Tools:

- Graphing calculator
- Website: [www.khanacademy.org](http://www.khanacademy.org)

### Cross Curricular Connections:

- N/A

**Depth of Knowledge (Section 5)**

DOK: 2
Curriculum: College Algebra

Curricular Unit: Solving Equations and Inequalities

Instructional Unit: B. Use various appropriate techniques to solve basic equations and inequalities

Description Section in Schoolnet:
CAHE.7-12, 19
7. Understand the meaning of solutions to linear and rational equations and be able to solve such equations whenever appropriate
8. Apply the acquired understanding and knowledge of functions to model appropriate real-world situations and draw mathematical conclusions
9. Understand the concept of complex numbers and be able to perform operations involving them
10. Understand the meaning of solutions to quadratic equations and be able to solve such equations
11. Understand and recognize other types of equations and be able to apply previously acquired knowledge to solve such equations whenever appropriate
12. Understand the meaning of solutions to linear and absolute value inequalities and be able to solve such inequalities whenever appropriate
13. Understand the meaning of solutions to polynomial and rational inequalities and be able to solve such inequalities whenever appropriate

Standard Alignments (Section 2)

| GLE/CLE: N/A |
| Knowledge: (MA) 5 |
| CCSS: N/A |
| CAHE: CA.7-12, 19 |
| NETS: 1d; 2d; 3b |
| Performance: 1.10, 3.2, 3.3 |

Unit (Section 3)

Learning Targets:
- Solve linear equations
- Solve equations containing rational expressions
- Solve for a specific variable in a formula
- Solve applied problems involving linear equations and rational equations

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• Solve quadratic equations by factoring, completing the square, and using the quadratic formula
• Solve applied problems involving quadratic equations
• Simplify expressions containing complex numbers
• Solve equations having complex roots
• Solve equations containing absolute value
• Solve equations using grouping
• Solve equations containing radicals
• Solve equations of quadratic type
• Solve linear and absolute value inequalities
• Solve higher power and rational inequalities
• Solve applied problems involving inequalities

Instructional Strategies:
• Lecture enhanced with:
  • SMART Notebook
  • PowerPoint
  • the Internet
• Drill and guided practice
• Demonstrations: e.g., The teacher will use TI-SmartView to introduce students to complete graphs and problem situation graphs on the graphing calculator
• Problem solving: Students will use the problem situation graphing calculator
• Reflective discussion
• Class discussion
• Computer assisted instruction

Assessments/Evaluations:
• Students will be assessed on the concepts taught using a variety of modalities:
  • Direct teacher observations
  • Formative assessments
  • Homework assignments
  • Formal common assessment

Mastery: 80%

Sample Assessment Questions:
• Solve: \( \sqrt{7x + 2} + x = 6 \)
A chemist has 20 milliliters of a solution that contains a 25% concentration of acid. How many milliliters of pure acid must be added in order to increase the concentration to 50%?

<table>
<thead>
<tr>
<th>Solution</th>
<th>Amount of Solution</th>
<th>Percent</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Solution A</td>
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<tr>
<td>Solution B</td>
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<tr>
<td>Mixture</td>
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Instructional Resources/Tools:

- Graphing calculator
- Website: [www.khanacademy.org](http://www.khanacademy.org)

Cross Curricular Connections:

- N/A

**Depth of Knowledge (Section 5)**

DOK: 2
Curriculum: College Algebra

Curricular Unit: Functions and Graphs

Instructional Unit: C. Analyze the relationship between equations and graphs

Description Section in Schoolnet:
CAHE.1-5, 13
1. Understand the concepts of functions and be able to apply the properties of functions and their graphs
2. Understand the relationship between linear functions and straight lines and be able to apply such knowledge
3. Understand the concept of piecewise-defined functions and be able to translate this knowledge to their properties and graphs
4. Understand the concept of transformations (e.g. shifting, reflecting, stretching, shrinking) of functions and be able to recognize and apply such knowledge when graphing functions
5. Understand the concept of combining functions and be able to perform these operations and recognize the resulted functions and their properties
13. Understand the relationship between quadratic functions and parabolas, and be able to connect such knowledge to quadratics equations

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<tr>
<td>Knowledge: (MA) 4</td>
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<tr>
<td>CCSS: N/A</td>
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<tr>
<td>CAHE: CA.1-5,13</td>
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<tr>
<td>NETS: 2d; 3b,d</td>
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<tr>
<td>Performance: 1.6, 1.10, 3.2</td>
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<table>
<thead>
<tr>
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<tbody>
<tr>
<td>Learning Targets:</td>
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<tr>
<td>• Use the distance and midpoint formulas in the plane</td>
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<tr>
<td>• Find the slope of a line and interpret it</td>
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<tr>
<td>• Write equations of lines given appropriate information</td>
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<tr>
<td>• Use function notation</td>
</tr>
<tr>
<td>• Review Parent Functions</td>
</tr>
<tr>
<td>• Find x- and y-intercepts of a function</td>
</tr>
<tr>
<td>• Find the domain and range of a function</td>
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</tbody>
</table>
• Find intervals where a function is increasing, decreasing, or constant
• Determine the graph of a function using and analyzing transformations
• Understand the effect of absolute value on the graph of a function
• Graph piecewise defined functions
• Graph the greatest integer function
• Put quadratic equations in standard form, sketch, and analyze their graphs
• Analyze linear and quadratic data
• Perform basic operations and compositions of functions

Instructional Strategies:
• Lecture enhanced with:
  • SMART Notebook
  • PowerPoint
  • the Internet
• Drill and guided practice
• Demonstrations: The teacher will use interactive lessons to introduce students to:
  • parent functions
  • piece-wise functions
  • data analysis
• Problem solving: Students will use the piece-wise functions to make predictions on real-life situations
• Reflective discussion
• Class discussion
• Computer assisted instruction

Assessments/Evaluations:
• Students will be assessed on the concepts taught using a variety of modalities:
  • Direct teacher observations
  • Formative assessments
  • Homework assignments
  • Formal common assessment
  • “Putting the Pieces Together” piecewise function project

Mastery: 80%
Sample Assessment Questions:

- Graph the piece-wise function:
  \[ f(x) = \begin{cases} 
  -2x + 1 & x \leq 2 \\
  5x - 4 & x > 2 
  \end{cases} \]

- Find the equation of the line in slope-intercept form that contains point A(3,5) and is perpendicular to \(6x + 2y = -5\).

Instructional Resources/Tools:

- Graphing calculator
- Websites:
  - [www.khanacademy.org](http://www.khanacademy.org)
  - [www.youtube.com/watch?v=RNPojGFg9-8](http://www.youtube.com/watch?v=RNPojGFg9-8)

Cross Curricular Connections:

- N/A

**Depth of Knowledge (Section 5)**

DOK: 4
Curriculum: College Algebra

Curricular Unit: Polynomial Functions

Instructional Unit: D. Analyze the relationship between equations and graphs

Description Section in Schoolnet:
CAHE.14-18
14. Understand the properties and graphs of polynomial functions and be able to perform basic operations involving polynomials
15. Understand the meaning of the Remainder Theorem and its application to evaluating polynomial functions. Understand the meaning of the Factor Theorem and its application to solving polynomial equations
16. Understand the meaning of zeros of polynomial functions and their connection to the graphs of these functions
17. Understand the importance of the Fundamental Theorem of Algebra, its application to polynomial equations, and its connection to complex numbers
18. Understand the properties and graphs of rational functions and be able to generate appropriate information, including asymptotes

Standard Alignments (Section 2)

| GLE/CLE: N/A |
| Knowledge: (MA) 4 |
| CCSS: N/A |
| CAHE: CA.14-18 |
| NETS: 1d; 3b; 4b |
| Performance: 1.6, 3.2 |

Unit (Section 3)

Learning Targets:

- Graph and analyze polynomials of degree higher than two
- Find a polynomial from the graph or with prescribed zeros
- Find the zeros and their multiplicity of a polynomial
- Perform polynomial long division and synthetic division
- Use the factor and remainder theorem
- Find polynomials if the roots are known
- Use the rational root theorem

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• Find the zeros of a polynomial

• Find the horizontal and vertical asymptotes, the intercepts, and the functional values as x approaches the left and right sides of the vertical asymptotes before sketching it

• Find the oblique asymptotes (as \( x \to \infty \) or \( x \to -\infty \)), vertical asymptotes, the intercepts, and the functional values as x approaches the left and right sides of the vertical asymptotes before sketching it

Instructional Strategies:

• Lecture enhanced with:
  • SMART Notebook
  • PowerPoint
  • the Internet

• Drill and guided practice

• Demonstrations: e.g., The teacher will use TI-SmartView to introduce students to complete graphs and problem situation graphs on the graphing calculator

• Problem solving: Students will use the problem situation graphing calculator

• Reflective discussion

• Class discussion

• Computer assisted instruction

Assessments/Evaluations:

• Students will be assessed on the concepts taught using a variety of modalities:
  • Direct teacher observations
  • Formative assessments
  • Homework assignments
  • Formal common assessment
  • Roller Coaster project

Mastery: 80%

Sample Assessment Questions:

• Show that \( f(x) = x^4 - 9x^3 + 22x^2 - 32 \) has a zero at 4 with multiplicity 2. Express \( f(x) \) as a product of linear factors.

• From a rectangular piece of cardboard having dimensions 40 inches by 50 inches, an open box is to be made by cutting out identical squares of area \( x^2 \) from each corner and turning up the sides.

Find an equation that represents the volume of the box:

EQ: _____________________

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Instructional Resources/Tools:

- Graphing calculator
- Website: [www.khanacademy.org](http://www.khanacademy.org)

Cross Curricular Connections:

- N/A

**Depth of Knowledge (Section 5)**

DOK: 4
Curriculum: College Algebra

Curricular Unit: Inverse, Exponential, and Logarithmic Functions

Instructional Unit: E. Distinguish among expressions, formulas, equations, functions and relations. Know when it is possible to simplify, solve, substitute, evaluate or graph appropriately. Solve common problems

Description Section in Schoolnet:
CAHE.6, 20-25
6. Understand the inevitability of functions and the relationship between functions inverse to each other, and be able to determine inverse functions when appropriate
20. Understand the properties and graphs of exponential functions and be able to evaluate and graph such functions
21. Understand the relationship between logarithmic functions and exponential functions and be able to evaluate and graph such functions
22. Understand the properties of logarithms and their relationship to exponentials. Be able to perform operations on logarithms
23. Understand the meaning of solutions to exponential and logarithmic equations and be able to apply the inverse relationship between exponentials and logarithms to equations involving them whenever appropriate
24. Understand the meaning of exponential growth and decay and apply the knowledge of exponential and logarithmic functions model two applications
25. Understand the meaning of compound interest and apply the knowledge of exponential functions to model this application

Standard Alignments (Section 2)

| GLE/CLE: N/A |
| Knowledge: (MA) 5 |
| CCSS: N/A |
| CAHE: CA.6, 20-25 |
| NETS: 1d; 2d; 3b |
| Performance: 1.6, 1.10, 3.2, 3.3 |

Unit (Section 3)

Learning Targets:
- Solve exponential equations using common bases
- Graph exponential functions

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• Solve verbal exponential equation problems – exponential growth, decay and compound interest
• Graph and analyze functions involving the natural exponential function
• Convert exponential equations to logarithmic form and vice versa
• Solve logarithmic equations
• Use common and natural logarithms to solve equations
• Sketch the graph of logarithmic functions
• Solve verbal problems involving logarithms
• Solve logarithmic equations using the properties of logarithms

Instructional Strategies:

• Lecture enhanced with:
  • SMART Notebook
  • PowerPoint
  • the Internet
• Drill and guided practice
• Demonstrations: The teacher will use TI-SmartView to introduce students to complete graphs and problem situation graphs on the graphing calculator
• Problem solving: Students will use the problem situation graph to make predictions on real-life situations
• Reflective discussion
• Class discussion
• Computer assisted instruction

Assessments/Evaluations:

• Students will be assessed on the concepts taught using a variety of modalities:
  • Direct teacher observations
  • Formative assessments
  • Homework assignments
  • Formal common assessment

Mastery: 80%

Sample Assessment Questions:

• Solve without using a calculator:

  \[ 4\log_5 x - \log_5 4 = \log_5 4 \]

• Twenty thousand dollars is invested in a savings fund in which interest is compounded continuously at the rate of 10% per year.
  a) When will the account contain $55,000?
  b) How long does it take for money to double in the account?
Instructional Resources/Tools:

- Graphing calculator
- Website: [www.khanacademy.org](http://www.khanacademy.org)

Cross Curricular Connections:

- N/A

**Depth of Knowledge (Section 5)**

**DOK: 3**
Curriculum: College Algebra

Curricular Unit: Systems of Equations and Inequalities

Instructional Unit: F. Analyze the meaning of solutions of linear and nonlinear equations and be able to find and express possible solutions

Description Section in Schoolnet:
CAHE: Elective 27-29
27. Understand the meaning of solutions to linear systems of equations and be able to use effective ways to find and express possible solutions
28. Understand the meaning of solutions to systems of nonlinear equations and be able to use effective ways to find and express solutions
29. Understand the concepts of matrices and their inverses (if exist), matrix operations, determinants, and be able to perform required computations. Understand how matrices are used to model and solve system of linear equations and be able to perform required appropriate computations

Standard Alignments (Section 2)

| GLE/CLE: N/A  |
| Knowledge: (MA) 6 |
| CCSS: N/A  |
| CAHE: CAE.27-29 |
| NETS: 3b-d  |
| Performance: 1.6, 3.3, 3.4 |

Unit (Section 3)

Learning Targets:

- Solve systems of equations in two variables (Substitution Method)
- Solve systems of equations in two variables (Multiplication/Addition Method)
- Solve systems of inequalities
- Find a system of inequalities from a graph
- Simplify expressions using the algebra of matrices (addition, subtraction, multiplication)
- Find the determinant of matrices (2x2, 3x3, 4x4, …)
- Find the inverse of a matrix
- Solve a system of equations using Cramer’s Rule

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**Instructional Strategies:**

- Lecture enhanced with:
  - SMART Notebook
  - PowerPoint
  - the Internet
- Drill and guided practice
- Demonstrations: The teacher will use examples to show how matrices can be used in real-life situation (i.e., stock market)
- Problem solving: Students will use matrices to make predictions on real-life situations
- Reflective discussion
- Class discussion
- Computer assisted instruction

**Assessments/Evaluations:**

- Students will be assessed on the concepts taught using a variety of modalities:
  - Direct teacher observations
  - Formative assessments
  - Homework assignments
  - Formal common assessment

**Mastery:** 80%

**Sample Assessment Questions:**

- Solve using the inverse method:
  \[x + 3y = 10\]
  \[-2x + 4y = -1\]

- Use Cramer’s Rule to solve the system:
  \[2x - 3y + 2z = -3\]
  \[-3x + 2y + z = 1\]
  \[4x + y - 3z = 4\]

**Instructional Resources/Tools:**

- Graphing calculator
- Website: [www.khanacademy.org](http://www.khanacademy.org)

**Cross Curricular Connections:**

- N/A

**Depth of Knowledge (Section 5)**

DOK: 3

Board Approved 8-3-15
Curriculum: College Algebra

Curricular Unit: Sequences and Series

Instructional Unit: G. Analyze the computations involved in sequences and series patterns

Description Section in Schoolnet:
CAHE: E31
31. Understand the concepts of sequences and series (including the arithmetic and geometric cases) and their applications. Be able to perform basic related algebraic tasks

Standard Alignments (Section 2)

<table>
<thead>
<tr>
<th>GLE/CLE: N/A</th>
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<tbody>
<tr>
<td>Knowledge: (MA) 1,4</td>
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<tr>
<td>CCSS: N/A</td>
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<tr>
<td>CAHE: CAE.31</td>
</tr>
<tr>
<td>NETS: 2b; 3b,c</td>
</tr>
<tr>
<td>Performance: 1.6, 3.5</td>
</tr>
</tbody>
</table>

Unit (Section 3)

Learning Targets:
- Find the terms of an explicitly defined sequence
- Find the terms of a recursively defined sequence
- Find the sequence of partial sums for a given sequence
- Find the sum of a sequence using summation notation
- Find the nth term and sum of n terms for a geometric sequence
- Find the sum of an infinite geometric sequence, if it exists
- Find arithmetic or geometric means for a sequence
- Express the sum in summation notation
- Perform proofs by applying the principle of mathematical induction

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Instructional Strategies:

• Lecture enhanced with:
  • SMART Notebook
  • PowerPoint
  • the Internet
• Drill and guided practice
• Demonstrations: The teacher will use TI-SmartView to introduce students to use formulas on the graphing calculator
• Problem solving: Students will find patterns to make predictions on real-life situations
• Reflective discussion
• Class discussion
• Computer assisted instruction

Assessments/Evaluations:

• Students will be assessed on the concepts taught using a variety of modalities:
  • Direct teacher observations
  • Formative assessments
  • Homework assignments
  • Formal common assessment
  • “Sequence and Series Project” PowerPoint

Mastery: 80%

Sample Assessment Questions:

• Use mathematical induction to

\[
\text{Prove: } 1 + 2 + 3 + \ldots + n = \frac{n(n + 1)}{2}
\]

• Express the sum in terms of summation notation.

Ex: \(3 + 8 + 13 + 18 + 23 + 28 + 33\)

Instructional Resources/Tools:

• Graphing calculator
• Website: [www.khanacademy.org](http://www.khanacademy.org)

Cross Curricular Connections:

• N/A

Depth of Knowledge (Section 5)

DOK: 4
Curriculum: College Algebra

Curricular Unit: Conic Sections

Instructional Unit: H. Analyze the relationship between equations and graphs

Description Section in Schoolnet:
CAHE: E30
30. Understand the properties and graphs of parabolas, ellipses, and/or hyperbolas and be able to perform basic related algebraic/graphing operations

Standard Alignments (Section 2)

| GLE/CLE: N/A |
| Knowledge: (MA) 4 |
| CCSS: N/A |
| CAHE: CAE.30 |
| NETS: 1d; 2d; 3c |
| Performance: 3.3, 3.4 |

Unit (Section 3)

Learning Targets:

- Graph circles and semicircles in the plane
- Write equations of circles that satisfy certain requirements
- Find the center and radius of a circle
- Determine the intersection of graphs on the calculator
- Sketch the graph of a parabolic equation
- Analyze the equation of a parabola to determine the vertex, focus and directrix
- Write the equations of a parabola given appropriate information
- Solve verbal problems involving the use of the parabola
- Sketch an ellipse with center at the origin
- Analyze the equation of an ellipse to determine the vertices, foci, and minor axis points
- Write the equation of an ellipse given appropriate information

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**Instructional Strategies:**

- Lecture enhanced with:
  - SMART Notebook
  - PowerPoint
  - the Internet
- Drill and guided practice
- Demonstrations: The teacher will use TI-SmartView to introduce students to entering conic section equations on the graphing calculator
- Problem solving: Students will use the graphing calculator to make real-life pictures or logos
- Reflective discussion
- Class discussion
- Computer assisted instruction

**Assessments/Evaluations:**

- Students will be assessed on the concepts taught using a variety of modalities:
  - Direct teacher observations
  - Formative assessments
  - Homework assignments
  - Formal common assessment
  - Graphing Calculator project

**Mastery: 80%**

**Sample Assessment Questions:**

- Find all applicable parts (center, vertices, foci, and asymptotes) of each conic, then sketch the graph:

  \[4x^2 + 9y^2 + 24x – 36y + 36 = 0\]

- Find an equation, in standard form, for the conic that satisfies the given conditions:

  Ellipse, with eccentricity \(\frac{2}{3}\) and endpoints of minor axis \((\pm5,0)\)

**Instructional Resources/Tools:**

- Graphing calculator
- Websites:
  - [www.khanacademy.org](http://www.khanacademy.org)
  - [http://bellsouthpwp.net/e/d/edwin222/enter.htm](http://bellsouthpwp.net/e/d/edwin222/enter.htm)

Board Approved 8-3-15
Cross Curricular Connections:

- N/A

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<tr>
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