y \geq -x + 1
&
y \geq x

y \geq x

y \geq -x + 1

Secondary Mathematics
Instructional Guide
2008-2009
ALGEBRA 1 AB  
(Annual Course – Grade 8 or 9)  
Prerequisite: Mathematics 7AB

310301 Algebra 1A  
310302 Algebra 1B

COURSE DESCRIPTION

The purpose of this course is to serve as the vehicle by which students make the transition from arithmetic to symbolic mathematical reasoning. It is an opportunity for students to extend and practice logical reasoning in the context of understanding, writing, solving, and graphing problems involving linear and quadratic equations (including systems of two linear equations in two unknowns).

In this course, students are expected to demonstrate their ability to extend specific problems and conditions to general assertions about mathematical situations. Additionally, they are expected to justify steps in an algebraic procedure and check algebraic arguments for validity.

COURSE SYLLABUS

The following are recurring standards in the course:

Algebra I 24.0 Students use and know simple aspects of a logical argument.
Algebra I 25.0 Students use properties of the number system to judge the validity of results, to justify each step of a procedure, and to prove or disprove statements.

Unit I

Recommended Focus Standards

Algebra I 2.0 Students understand and use such operations as taking the opposite, finding the reciprocal, taking a root, and raising to a fractional power. They understand and use the rules of exponents.
Algebra I 4.0 Students simplify expressions before solving linear equations and inequalities in one variable.
Algebra I 5.0 Students solve multistep problems, including word problems, involving linear equations and linear inequalities in one variable and provide justification for each step.

Scope and Sequence

This unit sets the stage for success in Algebra by providing time to review arithmetic (whole numbers, fractions, decimals, and percents) and proceeds on to cover foundational algebra skills necessary to solve equations. Subsequent to this review, students will proceed to solving equations in one variable (including equations with absolute value).
Unit 2

Recommended Focus Standards

Algebra I 6.0 Students graph a linear equation and compute the x- and y- intercepts. (e.g., graph $2x + 6y = 4$). They are also able to sketch the region defined by linear inequalities (e.g., they sketch the region defined by $2x + 6y < 4$).

Algebra I 7.0 Students verify that a point lies on a line, given an equation of the line. Students are able to derive linear equations by using the point-slope formula.

Scope and Sequence

The focus of this unit is graphing and deriving linear equations using a variety of techniques. The unit also addresses solving inequalities (including absolute value) in one variable.

Unit 3

Recommended Focus Standards

Algebra I 9.0 Students solve a system of two linear equations in two variables algebraically and are able to interpret the answer graphically. Students are able to solve a system of two linear inequalities in two variables and to sketch the solution sets.

Algebra I 15.0 Students apply algebraic techniques to solve rate problems, work problems, and percent mixture problems.

Algebra I 19.0 Students know the quadratic formula and are familiar with its proof by completing the square.

Algebra I 20.0 Students use the quadratic formula to find the roots of a second-degree polynomial and to solve quadratic equations.

Algebra I 21.0 Students graph quadratic functions and know that their roots are the x-intercepts.

Algebra I 23.0 Students apply quadratic equations to physical problems, such as the motion of an object under the force of gravity.

Scope and Sequence

This unit includes two main foci. Linear relationships are concluded with solving systems of linear equations and inequalities. The students will then learn how to solve quadratic equations and how to interpret the graphs of quadratic functions.

Unit 4

Recommended Focus Standards

Algebra I 10.0 Students add, subtract, multiply, and divide monomials and polynomials. Students solve multistep problems, including word problems, by using these techniques.

Algebra I 12.0 Students simplify fractions with polynomials in the numerator and denominator by factoring both and reducing them to the lowest terms.

Algebra I 13.0 Students add, subtract, multiply, and divide rational expressions and functions. Students solve both computationally and conceptually challenging problems by using these techniques.

Algebra I 14.0 Students solve a quadratic equation by factoring or completing the square.
**Scope and Sequence**

It is important that students learn how to perform polynomial arithmetic (including factoring) and apply factoring as a technique to solve simple quadratics prior to the CST. After the CST, students will learn the arithmetic of rational expressions and will solve rational equations in one variable.

**REPRESENTATIVE PERFORMANCE OUTCOMES AND SKILLS**

In this course, students will know and be able to:

- Interpret the meaning of variables and variable expressions
- Solve linear equations (including proportions) in one variable
- Apply the concept of absolute value to simple equations
- Graph a linear function by plotting points, using intercepts, and using the slope and y-intercept
- Sketch the region defined by a linear inequality
- Derive the equation of a line when given a variety of parameters for that line
- Solve inequalities in one variable (including those with absolute value)
- Solve systems of linear equations by graphing, using substitution, and using elimination
- Solve systems of linear inequalities by graphing
- Solve quadratic equations by graphing, finding square roots, using the quadratic formula, and factoring
- Simplify and perform arithmetic operations on and with rational expressions
- Solve rational equations
- Solve application problems using the above techniques

**ASSESSMENTS** will include:

- Teacher designed standards-based quizzes and tests
- Projects and group tasks
- Teacher designed formative assessments
- Periodic Assessments

**TEXTS/MATERIALS**

- LAUSD Secondary Mathematics Instructional Guide
- Textbook: District approved materials
- Supplemental materials and resources
Linear Equations and Functions

1. Understand the language of algebra
   - 1.0, 1.1, 2.0, 16.0, 17.0, 24.0, 25.1

2. Understand and solve linear equations
   - 4.0, 5.0
   - Translate between verbal sentences and equations
   - Solve multi-step linear equations in one variable (involving addition, subtraction, multiplication and division)
   - Solve equations for a given variable
   - Solve problems using proportions
   - Solve application problems using all of these techniques

3. Understand and graph linear equations, functions and patterns
   - 6.0, 7.0, 16.0, 17.0, 18.0
   - Identify the domain and range of functions and relations
   - Determine whether a relation is a function
   - Graph linear equations
   - Compute the x and y-intercepts of a linear equation
   - Verify that a point lies on a line

<table>
<thead>
<tr>
<th>KEY Standards - #CST Questions</th>
<th>Other Standards - #CST Questions * 1/2 : 1 question every 2 years</th>
<th>NA</th>
<th>1/2*</th>
<th>4</th>
<th>3</th>
<th>6</th>
<th>4</th>
<th>4</th>
<th>1/2*</th>
<th>1</th>
<th>1/2*</th>
<th>1</th>
<th>1 1/2*</th>
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<tr>
<td>CONCEPT LESSON:</td>
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<td>TT</td>
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<tr>
<td>TOMMY'S T-Shirts</td>
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<td>TT</td>
<td>SP</td>
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<td>SURROUND THE POOL</td>
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<tr>
<td>STACK OF CUPS</td>
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<td>SC</td>
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</table>
Tommy’s T-Shirts

This past summer you were hired to work as a consultant for Tommy’s T-Shirts, a company that produces custom t-shirts using their customer’s own designs. They want you to help them decide how much they should charge for their shirts. Their major competitor is Custom T-Shirts. When a customer places an order for a special design, Custom T-Shirts charges a one-time fee of $15 to set up the design plus $8 for each t-shirt printed.

1. Create a plan for Tommy’s T-Shirts that has a lower base fee than Custom T-Shirts but will charge the same for an order of 8 shirts. Explain how you arrived at your plan.

2. Create a new plan that will always cost a customer less than either of the other two plans. Explain your reasoning.
Surround the Pool

Hot tubs and in-ground swimming pools are sometimes surrounded by borders of tiles. This drawing shows a square swimming pool surrounded by a border of square tiles. Each tile measures 1 foot on each side.

1. Write an expression describing the total number of 1-foot square tiles needed for the border of the pool. Show how your expression can be seen in the drawing.

2. Solve the problem again using a different expression and explain how the second expression can be seen in the drawing.
A Stack of Cups

Your task is to represent the relationship between the size of the cups and the height of the stack of cups using a formula and a graph. Then answer the questions below about the stack of cups.

The paper cups shown below are identical and drawn full size:

a) By making measurements, represent the relationship between the number of cups and the height of the stack using a formula and a graph.

b) The graph can be drawn as a set of discrete points on a coordinate system. These points lie along a line and can be connected by a straight line.

• Why is the line straight?
• What are the slope and intercept of this line?
• Interpret the meaning of the slope and intercept with regard to the number and size of the cups, or parts of the cups.
**Secondary Mathematics:** Stack of Cups Concept Task

<table>
<thead>
<tr>
<th># Cups</th>
<th>Height</th>
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<tbody>
<tr>
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</tr>
</tbody>
</table>

**Formula:** _____________________

![Graph with X and Y axes labeled as Height and Number of Cups]
### UNIT 1

#### The Language of Algebra

<table>
<thead>
<tr>
<th>Topic</th>
<th>Standards</th>
<th>Textbook Sections</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.1</td>
<td>Students use properties of numbers to demonstrate whether assertions are true or false.</td>
<td>1.1 Variables and Expressions</td>
</tr>
<tr>
<td>2.0</td>
<td>Students understand and use such operations as taking the opposite, finding the reciprocal, taking a root, and raising to a fractional power. They understand and use the rules of exponents.</td>
<td>1.2 Order of Operations</td>
</tr>
<tr>
<td>4.0</td>
<td>Students simplify expressions prior to solving linear equations and inequalities in one variable, such as $3(2x-5) + 4(x-2) = 12$.</td>
<td>1.3 Open Sentences</td>
</tr>
<tr>
<td>5.0</td>
<td>Students solve multistep problems, including word problems, involving linear equations and linear inequalities in one variable, and provide justification for each step.</td>
<td>1.4 Identity and Equality Properties</td>
</tr>
<tr>
<td>6.0</td>
<td>Students graph a linear equation and compute the x and y-intercepts (e.g., graph $2x + 6y = 4$). They are also able to sketch the region defined by linear inequality (e.g., they sketch the region defined by $2x + 6y &lt; 4$).</td>
<td>1.5 The Distributive Property</td>
</tr>
<tr>
<td>7.0</td>
<td>Students verify that a point lies on a line, given an equation of the line. Students are able to derive linear equations using the point slope formula.</td>
<td>1.6 Commutative and Associative Properties</td>
</tr>
</tbody>
</table>

#### Solve Linear Equations

<table>
<thead>
<tr>
<th>Topic</th>
<th>Standards</th>
<th>Textbook Sections</th>
</tr>
</thead>
<tbody>
<tr>
<td>16.0</td>
<td>Students understand the concepts of a relation and a function, determine whether a given relation defines a function, and give pertinent information about given relations and functions.</td>
<td>1.7 Logical Reasoning and Counterexamples</td>
</tr>
<tr>
<td>17.0</td>
<td>Students determine the domain of independent variables defined by a graph, a set of ordered pairs, or a symbolic expression.</td>
<td>1.8 Number Systems</td>
</tr>
<tr>
<td>18.0</td>
<td>Students determine whether a relation defined by a graph, a set of ordered pairs, or a symbolic expression is a function and justify the conclusion.</td>
<td>1.9 Functions and Graphs</td>
</tr>
</tbody>
</table>

#### Graph Linear Equations, Functions and Patterns

<table>
<thead>
<tr>
<th>Topic</th>
<th>Standards</th>
<th>Textbook Sections</th>
</tr>
</thead>
<tbody>
<tr>
<td>24.0</td>
<td>Students know and use simple aspects of a logical argument</td>
<td>2.1 Writing Equations</td>
</tr>
<tr>
<td>25.0</td>
<td>Students use properties of the number system to judge the validity of results, to justify each step of a procedure, and to prove or disprove statements.</td>
<td>2.2 Solving Equations by Using Addition and Subtraction</td>
</tr>
</tbody>
</table>

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*Standards in bold are key standards as defined by the Mathematics Framework for California Public Schools. To be covered as time permits. While this material is not necessary for CA Algebra 1, it may be very useful in preparing students for the CAHSEE examination, and/or previewing topics in to be covered in Geometry and Algebra 2.*
### Algebra 1: Assessment 1 Blueprint

<table>
<thead>
<tr>
<th>Standard</th>
<th>Description</th>
<th>Number of Items on the CST</th>
<th>Number of Multiple Choice Questions on the Assessment</th>
<th>Number of Constructed Response Questions on the Assessment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.1</td>
<td>Students use properties of numbers to demonstrate whether assertions are true or false.</td>
<td>½*</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>2.0</td>
<td>Students understand and use such operations as taking the opposite, finding the reciprocal, taking a root, and raising to a fractional power. They understand and use the rules of exponents.</td>
<td>4</td>
<td>2</td>
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<td>4.0</td>
<td>Students simplify expressions prior to solving linear equations and inequalities in one variable, such as (3(2x-5) + 4(x-2) = 12).</td>
<td>3</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>5.0</td>
<td>Students solve multistep problems, including word problems, involving linear equations and linear inequalities in one variable, and provide justification for each step.</td>
<td>6</td>
<td>6</td>
<td>CR</td>
</tr>
<tr>
<td>6.0</td>
<td>Students graph a linear equation and compute the x and y-intercepts (e.g., graph (2x + 6y = 4)). They are also able to sketch the region defined by linear inequality (e.g., they sketch the region defined by (2x + 6y &lt; 4)).</td>
<td>4</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>7.0</td>
<td>Students verify that a point lies on a line, given an equation of the line. Students are able to derive linear equations using the point slope formula.</td>
<td>4</td>
<td>1</td>
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<tr>
<td>16.0</td>
<td>Students understand the concepts of a relation and a function, determine whether a given relation defines a function, and give pertinent information about given relations and functions.</td>
<td>½*</td>
<td>1</td>
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<td>17.0</td>
<td>Students determine the domain of independent variables defined by a graph, a set of ordered pairs, or a symbolic expression.</td>
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<tr>
<td>18.0</td>
<td>Students determine whether a relation defined by a graph, a set of ordered pairs, or a symbolic expression is a function and justify the conclusion.</td>
<td>½*</td>
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<tr>
<td>24.0</td>
<td>Students know and use simple aspects of a logical argument.</td>
<td>1</td>
<td>1</td>
<td></td>
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<tr>
<td>25.0</td>
<td>Students use properties of the number system to judge the validity of results, to justify each step of a procedure, and to prove or disprove statements.</td>
<td>1 ½*</td>
<td>1</td>
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</tbody>
</table>

*Fractional Values indicate rotated standards (e.g., 1/3 = rotated every three years)

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Systems of Linear Equations and Inequalities

Understand, Analyze, and Graph Linear Equations
6.0, 7.0, 8.0

- Evaluate the slope of a line
- Use rate of change to solve problems
- Write and graph different forms of linear functions
- Identify characteristics of parallel and perpendicular lines
- Derive the equation of a line:
  o Given the slope and a point on a line
  o Given 2 points on the line
  o Parallel or perpendicular to a given line through a given point

Understand and Solve Systems of Linear Equations
9.0, 15.0

- Solve systems of equations by graphing
- Solve systems of linear inequalities by graphing
- Solve systems of two linear equations using substitution and elimination
- Solve application problems using the above techniques

Understand, Solve, and Graph linear inequalities
3.0, 4.0, 5.0, 9.0

- Sketch the region defined by a linear inequality
- Solve inequalities in one and two variables
- Solve linear absolute value inequalities
- Graph inequality solutions (including absolute value)

<table>
<thead>
<tr>
<th>3.0</th>
<th>4.0</th>
<th>5.0</th>
<th>6.0</th>
<th>7.0</th>
<th>8.0</th>
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<td>1</td>
<td>5</td>
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CONCEPT LESSON:
MF - Making the Final
ST - Storage Tanks
CP - Calling Plans
TK - Tying the Knot
MF CP TK ST CP TK ST CP
Making the Final (Part I)

To qualify for the finals of the X-Games Skateboarding competition, skateboarders must complete one 45 second run. They earn points in two ways:

- A score out of 100 for the Skill of the tricks performed
- A score out of 100 for the Amplitude (air) the skateboarder gets

40% of the Skill score and 60% of the Amplitude score are added together to produce the Weighted Score. To make the final, the skater’s Weighted Score must be at least 60. (All Weighted Scores are rounded to the nearest tenth.)

1. You score 80 points for Skill and 50 points for Amplitude. What is your Weighted Score?

2. Make a table that shows some possible performance scores for Skill and Amplitude and the Corresponding Weighted Score. Be sure to choose a range of high and low scores for both programs in your table.

*Note: The table is drawn for you on the next page

Materials adapted from the PRISMA project, developed by the IFL and LAUSD
### Note: The first skateboarder’s scores are given to you. You need to decide what the other skateboarders scored for both Skill and Amplitude and then calculate their Weighted Scores.

<table>
<thead>
<tr>
<th>Skill Score</th>
<th>Amplitude Score</th>
<th>Weighted Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>80</td>
<td>50</td>
<td></td>
</tr>
</tbody>
</table>

3. Make a group graph (four tables per graph) to represent the situation.

   The x-axis represents the Skill score (S).

   The y-axis represents the Amplitude score (A).

   a. Use a **BLACK MARKER** to plot the points in the tables you and your group members created.

   b. Use a **GREEN MARKER** to circle the points that represent a Weighted Score that qualifies for the team.

   c. Now add a **BLUE STAR** to those points where the Weighted score is EXACTLY 60.

What patterns do you notice in your group graph?
Making the Final (Part II)

A new rule has been introduced to the qualifying process. It states that if a skater scores less than 50 points for either Skill or Amplitude then that skateboarder cannot make the X-Games final.

1. On your group graph from Part I, use a **RED MARKER** to circle all the points that represent a score that will not make the final because of the new rule.

What new patterns do you notice in your group graph?

2. Develop a System of Inequalities to algebraically describe the situation.
   
   Only use the variables $S$ (Skill score) and $A$ (Amplitude score).

3. Shade the region of the graph that contains the points that make the X-Games skateboarding final.

**Extension Questions**

4. What is the minimum Skill score a skateboarder can receive and still make the final?

5. What score is required for Amplitude to make the final with the minimum Skill score?

6. A skater has a particular Skill score. How can she/he figure out the minimum Amplitude score needed to make the team?

*Materials adapted from the PRISMA project, developed by the IFL and LAUSD*
Making the Final (Group Graph)

Materials adapted from the PRISMA project, developed by the IFL and LAUSD
Two Storage Tanks

Two large storage tanks, T and W, contain water. T starts losing water at the same time additional water starts flowing into W. The graph below shows the amount of water in each tank over a period of time.

1. Assume that the rates of water loss and water gain continue as shown. When will the two tanks contain the same amount of water? Explain how you found your answer and interpret your solution in terms of the problem.

2. Write an equation for each storage tank that can be used to determine the amount of water in the tank at any given number of hours. How many different coordinate pairs (x and y pairs) will satisfy both equations? Explain.

3. How are the two equations the same and how are they different? Interpret each equation in terms of its corresponding graph.

4. Suppose Tank Z contains 550 gallons of water and is not gaining or losing water. When will Tank Z contain the same amount of water as Tank T? as Tank W? Will all 3 tanks ever contain the same amount of water at the same time? Explain.
Long-distance Company A charges a base rate of $5 per month, plus 4 cents per minute that you are on the phone. Long-distance Company B charges a base rate of only $2 per month, but they charge you 10 cents per minute used.

How much time per month you would have to talk on the phone before subscribing to Company A would save you money?
Tying the knot

Your task is to explore the relationship between the length of a rope and the number of knots tied in the rope.

a) By measuring the length of the rope after you tie each knot, investigate the relationship between the number of knots and the length of the rope.

b) Express this relationship in a table, a graph, a written description, and an algebraic formula.

c) The graph can be drawn as a set of discrete points on a coordinate system. These points lie along a line of best fit and can be connected by a straight line.

• What are the slope and intercept of this line?

• Interpret the meaning of the slope and intercept with regard to the rope and the knots.

• Predict the length of a rope with 10 knots

• What is the maximum number of knots that you can tie with your piece of rope?
## Algebra 1 Unit 2: Tying the knot

<table>
<thead>
<tr>
<th>Number of knots tied</th>
<th>Length of rope (cm)</th>
<th>Graph your relationship and draw the line of best fit</th>
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</thead>
<tbody>
<tr>
<td>0</td>
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<td>6</td>
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</tbody>
</table>

Describe in words the approximate relationship between the number of knots tied in the rope and the length of the rope.

Write an algebraic formula that describes your line of best fit.
## Standards

<table>
<thead>
<tr>
<th>Topic</th>
<th>Standards</th>
</tr>
</thead>
<tbody>
<tr>
<td>Analyze and Graph Linear Equations</td>
<td>3.0 Students solve equations and inequalities involving absolute values 4.0 Students simplify expressions prior to solving linear equations and inequalities in one variable, such as $3(2x-5) + 4(x-2) = 12$. 5.0 Students solve multistep problems, including word problems, involving linear equations and linear inequalities in one variable, and provide justification for each step. 6.0 Students graph a linear equation and compute the x and y-intercepts (e.g., graph $2x + 6y = 4$). They are also able to sketch the region defined by linear inequality (e.g., they sketch the region defined by $2x + 6y &lt; 4$). 7.0 Students verify that a point lies on a line, given an equation of the line. Students are able to derive linear equations using the point slope formula. 8.0 Students understand the concepts of a relation and a function, determine whether a given relation defines a function, and give pertinent information about given relations and functions. 9.0 Students determine the domain of independent variables defined by a graph, a set of ordered pairs, or a symbolic expression. 15.0 Students determine whether a relation defined by a graph, a set of ordered pairs, or a symbolic expression is a function and justify the conclusion</td>
</tr>
<tr>
<td>Solve Systems of Linear Equations</td>
<td>4.1 Rate of Change and Slope 4.2 Slope and Direct Variation 4.3 Graphing Equations in Slope-Intercept Form 4.4 Writing Equations in Slope-Intercept Form 4.5 Writing Equations in Point-Slope Form 4.6 Scatter Plots and Lines of Best Fit 4.7 Parallel and Perpendicular Lines 5.1 Graphing Systems of Equations 5.2 Substitution 5.3 Elimination Using Addition and Subtraction 5.4 Elimination Using Multiplication 5.5 Applying Systems of Linear Equations 2.9 Weighted Averages 6.1 Solving Inequalities by Addition and Subtraction 6.2 Solving Inequalities by Multiplication and Division 6.3 Solving Multi-Step inequalities 6.4 Solving Compound Inequalities 6.5 Solving Open Sentences Involving Absolute Value 6.6 Solving Inequalities involving Absolute value 6.7 Graphing Inequalities in Two Variables 6.8 Graphing Systems of Inequalities</td>
</tr>
<tr>
<td>Solve and Graph Linear Inequalities</td>
<td></td>
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</tbody>
</table>

Standards in bold are key standards as defined by the Mathematics Framework for California Public Schools

*To be covered as time permits. While this material is not necessary for CA Algebra 1, it may be very useful in preparing students for the CAHSEE examination, and/or previewing topics in to be covered in Geometry and Algebra 2
3.0 Students solve equations and inequalities involving absolute values

4.0 Students simplify expressions prior to solving linear equations and inequalities in one variable, such as $3(2x-5) + 4(x-2) = 12$.

5.0 Students solve multistep problems, including word problems, involving linear equations and linear inequalities in one variable, and provide justification for each step.

6.0 Students graph a linear equation and compute the x and y-intercepts (e.g., graph $2x + 6y = 4$). They are also able to sketch the region defined by linear inequality (e.g., they sketch the region defined by $2x + 6y < 4$).

7.0 Students verify that a point lies on a line, given an equation of the line. Students are able to derive linear equations using the point slope formula.

8.0 Students understand the concepts of parallel lines and perpendicular lines and how those slopes are related. Students are able to find the equation of a line perpendicular to a given line that passes through a given point.

9.0 Students solve a system of two linear equations in two variables algebraically and are able to interpret the answer graphically. Students are able to solve a system of two linear inequalities in two variables and to sketch the solution sets.

15.0 Students apply algebraic techniques to solve rate problems, work problems, and percent mixture problems.

*Fractional Values indicate rotated standards (e.g., $1/3 =$ rotated every three years)

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Polynomials and Quadratic Functions

- Understand Operations on Polynomials
  - 2.0, 10.0
  - Perform operations on monomials and polynomials

- Understand factoring of Polynomials
  - 11.0, 14.0
  - Factor 2nd degree polynomials over the integers
  - Use the zero-product rule and factoring as well as completing the square to solve simple quadratics

- Understand and use quadratic functions
  - 14.0, 19.0, 20.0, 21.0, 22.0, 23.0
  - Solve quadratic equations by:
    - Graphing (x-intercepts)
    - Finding square roots
    - Using the quadratic formula
  - Relate the graph of a quadratic function to its related quadratic equation
  - Solve application problems using the above techniques

- Key Standards - #CST Questions
  - 1 / 3 : means 1 question every 3 years

- Other Standards - #CST Questions

- Concept Lesson:
  - BB-Bend it Like Beckham
  - MM-Martian Math
  - SP-S Pattern
  - QQ-Quadratic Quandry
  - TL-Trading Land

- Table:

<table>
<thead>
<tr>
<th></th>
<th>2.0</th>
<th>10.0</th>
<th>11.0</th>
<th>14.0</th>
<th>19.0</th>
<th>20.0</th>
<th>21.0</th>
<th>22.0</th>
<th>23.0</th>
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<td>4</td>
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<td>2</td>
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<td>CONCEPT LESSON:</td>
<td>MM TL</td>
<td>MM TL</td>
<td></td>
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<tr>
<td>BB-Bend it Like Beckham</td>
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<td>MM-Martian Math</td>
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<tr>
<td>SP-S Pattern</td>
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<td></td>
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<tr>
<td>QQ-Quadratic Quandry</td>
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<td></td>
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</tr>
<tr>
<td>TL-Trading Land</td>
<td></td>
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</tr>
</tbody>
</table>
Andre, Juana, Kevin and Emiko go to a soccer day at the L.A. Galaxy’s training field at the Home Depot Center. The coach has a computer and video system that can track the height and distance of their kicks. All four soccer players are practicing up-field kicks, away from the goal.

Andre goes first and takes a kick starting 12 yards out from goal. His kick reaches a maximum height of 17 yards and lands 48 yards from the goal.

Juana goes next and the computer gives the equation of the path of her kick as $y = -x^2 + 14x - 24$, where $y$ is the height of the ball in yards and $x$ is the horizontal distance of the ball from the goal line in yards.

After Kevin takes his kick, the coach gives him a printout of the path of the ball:

Finally Emiko takes her kick but the computer has a problem and can only give her a partial table of data points of the ball’s trajectory.

<table>
<thead>
<tr>
<th>Distance from the goal line in yards</th>
<th>10</th>
<th>11</th>
<th>12</th>
<th>13</th>
<th>14</th>
<th>15</th>
<th>16</th>
<th>17</th>
<th>18</th>
<th>19</th>
<th>20</th>
</tr>
</thead>
<tbody>
<tr>
<td>Height in yards</td>
<td>0</td>
<td>4.7</td>
<td>8.75</td>
<td>12.2</td>
<td>15</td>
<td>17.2</td>
<td>18.75</td>
<td>19.7</td>
<td>20</td>
<td>19.7</td>
<td>18.75</td>
</tr>
</tbody>
</table>

The computer is still not working but Andre, Juana, Kevin and Emiko want to know who made the best kick.

Help them decide by using what you know to find: (a) Whose kick went the highest? (b) Whose kick went the longest? Be prepared to explain your answer and support your reasoning.
Martian Math: Distributing

Part A: Zeb is a Martian visiting Earth. Scientists have deciphered some of the Martian symbols and we know that:

<table>
<thead>
<tr>
<th>Martian Number</th>
<th>Earth Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>One</td>
<td>One</td>
</tr>
<tr>
<td>Ten</td>
<td></td>
</tr>
<tr>
<td>One hundred</td>
<td></td>
</tr>
</tbody>
</table>

You and your team must figure out how the Martians use their number system to do multiplication.

1. Explore the multiplication

*Note: You must use the Martian symbols for every part of your process, including your answer.

Exploration: (Use extra paper if necessary)

2. Write up a detailed step-by-step explanation of the multiplication process you developed with your team in part 1.

Explanation: (Use extra paper if necessary)
Martian Math: Distributing

3. Now only using the step-by-step process you described in question 2 do the multiplication 12 times 13 using our earth numbers.

4. Does your process work in this case? Why, or why not?

5. Now using the same step-by-step process, multiply \(x + 2\) times \(x + 3\)
Part B: Zeb is trying to figure out how we do math. He needs your help to discover how we multiply binomials like the one below.

1. Multiply \(x + a\) times \(x + b\) and explain each step of the process you use.

   **Your Math:**

   **Your Explanation:**

   **Answer:** \(x^2 + (\underline{\quad})x + \underline{\quad}\)

2. Without performing the full multiplication, complete the equation below.

   \((x + 4) \cdot (x + 3) = x^2 + (\underline{\quad})x + \underline{\quad}\)

3. In your own words, write a general rule for multiplying binomials like \((x + a)\cdot(x + b)\)

   **General Rule:**

---

CA 10.0 Students add, subtract, multiply, and divide monomials and polynomials. Students solve multistep problems, including word problems, by using these techniques.

CA 11.0 Students apply basic factoring techniques to second- and simple third-degree polynomials. These techniques include finding a common factor for all terms in a polynomial, recognizing the difference of two squares, and recognizing perfect squares of binomials.

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Part C: Zeb is a little confused. He has been trying to understand factoring but he needs your help.

You and your team need to clearly explain each step of the following factorization:

<table>
<thead>
<tr>
<th>Mathematics</th>
<th>Your Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. (x^2 + 7x + 10)</td>
<td>Describe how the 7 and the 10 are related to each other</td>
</tr>
<tr>
<td>2. (x^2 + 5x + 2x + 10)</td>
<td>Explain how to get from Step 1 to Step 2</td>
</tr>
<tr>
<td>3. (x(x + 5) + 2(x + 5))</td>
<td>Explain how to get from Step 2 to Step 3</td>
</tr>
<tr>
<td>4. ((x + 5)(x + 2))</td>
<td>Explain how to get from Step 3 to Step 4</td>
</tr>
</tbody>
</table>

CA 10.0 Students add, subtract, multiply, and divide monomials and polynomials. Students solve multistep problems, including word problems, by using these techniques.

CA 11.0 Students apply basic factoring techniques to second- and simple third-degree polynomials. These techniques include finding a common factor for all terms in a polynomial, recognizing the difference of two squares, and recognizing perfect squares of binomials.

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1. Describe the development of this pattern?

2. How many square tiles are in step 7? Write a description that could be used to determine the shape of and total number of square tiles in step 7. Your description should be clear enough so that another person could read it and use it to think about another figure.

3. Determine an expression for the total number of squares in any figure. Explain your rule and show how it relates to the visual diagram shown above.
Follow-up

- Find another way to describe the development of the pattern and write the expression that matches that description. Compare the two expressions and show algebraically how one expression is equivalent to the other.

- A figure has 9802 squares tiles in it. Show how you can determine the step number of this figure.

- Does the pattern describe a linear relationship between the step number and the total number of squares? Why or why not?
Two friends, Adam and Alyssa, are members of model rocket clubs at their schools. Each of their schools is having a competition to see whose model rocket can stay in the air the longest. The science teachers in each school have helped the students construct equations that describe the height of the rocket from the ground when it has been launched from the roof of the school.

Following are Adam’s and Alyssa’s equations:

**Adam:**  \( h = -16t^2 + 40t + 56 \) where \( t \) is measured in seconds and \( h \) is measured in feet.

**Alyssa:**  \( h = -5t^2 + 15t + 18 \) where \( t \) is measured in seconds and \( h \) is measured in meters.

- Use a graph to determine whose rocket stays in the air the longest. Explain how you used the graph to answer the question.

- Explain how to find the x-intercepts of any quadratic function by graphing. In general, what do the x-intercepts of a quadratic function mean? How many x-intercepts can a quadratic function have?
**Quadratic Expressions: Trading Land**

*Your task: In this problem you will explore whether the trade offered will always be fair, sometimes be fair, or never be fair. Read the situation and develop a way to evaluate whether the proposed trade is a fair trade for any side length.*

If you gave a friend two $1 dollar bills, and your friend gave you eight quarters, you would consider it a fair trade. If you left you job an hour early one day and worked an hour later the next day, your boss would probably consider it a fair trade. Sometimes, it is not easy to determine whether a trade is fair.

Think about this!
U.S. Mall, Incorporated, wants to build a new shopping center. The mall developer has bought all the land on the proposed site except for one square lot that measures 125 meters on each side. The family that owns the lot is reluctant to sell it. In exchange for the lot, the developer has offered to give the family a rectangular lot that is 100 meters longer on one side and 100 meters shorter on another side than the square lot. Do you think this is a fair trade? Why or why not?

*Adapted from Connected Mathematics: Grade 8. Frogs, Fleas, and Painted Cubes; 2.1 Trading Land*
Concept Task

Suppose you own a square piece of land with sides $n$ meters long. You trade your land for a rectangular lot. The length of your new lot is 2 meters longer than the side length of your original lot, and the width of your new lot is 2 meters shorter than the side length of the original lot.

A. For which side lengths, if any, is this a fair trade? Use pictures, tables, graphs, symbols, and/or words to show how you know whether this is a fair trade for any side length.

B. Copy and complete the table below.

<table>
<thead>
<tr>
<th>Original square</th>
<th>New rectangle</th>
<th>Difference in areas (m$^2$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Side length (m)</td>
<td>Area (m$^2$)</td>
<td>Length (m)</td>
</tr>
<tr>
<td>3</td>
<td>9</td>
<td>5</td>
</tr>
<tr>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

C. For each side length in the table, tell how the area of your new lot compares with the area of the original lot.

D. The side length of the original square lot was $n$ meters. For each column in the table, write an expression for the values in the column in terms of $n$. For example, the expression for the area of the original square is $n^2$. 
### UNIT 3

#### Topic | Standards | Textbook Sections
--- | --- | ---
**Operations on Polynomials** | 2.0 Students understand and use such operations as taking the opposite, finding the reciprocal, taking a root, and raising to a fractional power. They understand and use the rules of exponents. 10.0 Students add, subtract, multiply, and divide monomials and polynomials. Students solve multistep problems, including word problems, by using these techniques. 11.0 Students apply basic factoring techniques to second-and third degree polynomials. These techniques include finding a common factor for all terms in a polynomial, recognizing the difference of two squares, and recognizing perfect squares of binomials. 14.0 Students solve a quadratic equation by factoring or completing the square. 19.0 Students know the quadratic formula and are familiar with its proof by completing the square. 20.0 Students use the quadratic formula to find the roots of a second-degree polynomial and to solve quadratic equations. 21.0 Students graph quadratic functions and know that their roots are the x-intercepts. 22.0 Students use the quadratic formula or factoring techniques or both to determine whether the graph of a quadratic function will intersect the x-axis in zero, one, or two points. 23.0 Students apply quadratic equations to physical problems such as the motion of an object under the force of gravity. | 7.1 Multiplying Monomials 7.2 Dividing Monomials 7.3 Polynomials 7.4 Adding and Subtracting Polynomials 7.5 Multiplying a Polynomial by a Monomial 7.6 Multiplying Polynomials 7.7 Special Products
--- | --- | ---
**Factoring of Polynomials** | 8.1 Monomials and Factoring 8.2 Factoring Using the Distributive Property 8.3 Factoring Trinomials: \( x^2 + bx + c \) 8.4 Factoring Trinomials: \( ax^2 + bx + c \) 8.5 Factoring Differences of Squares 8.6 Perfect Squares and Factoring | 9.1 Graphing Quadratic Functions 9.2 Solving Quadratic Equations by Graphing 9.3 Solving Quadratic Equations by Completing the Square 9.4 Solving Quadratic Equations by Using the Quadratic Formula 9.5 Exponential Functions 9.6 Growth and Decay
--- | --- | ---
**Quadratic Functions** | \( *9.5 \) Exponential Functions \( *9.6 \) Growth and Decay | |
### Algebra 1: Assessment 3 Blueprint

<table>
<thead>
<tr>
<th>Standard</th>
<th>Description</th>
<th>CST</th>
<th>Multiple Choice</th>
<th>Constructed Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.0</td>
<td>Students understand and use such operations as taking the opposite, finding the reciprocal, taking a root, and raising to a fractional power.</td>
<td>4</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>10.0</td>
<td>Students add, subtract, multiply, and divide monomials and polynomials. Students solve multistep problems, including word problems, by using these techniques.</td>
<td>4</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>11.0</td>
<td>Students apply basic factoring techniques to second-and-third degree polynomials. These techniques include finding a common factor for all terms in a polynomial, recognizing the difference of two squares, and recognizing perfect squares of binomials.</td>
<td>2</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>14.0</td>
<td>Students solve a quadratic equation by factoring or completing the square.</td>
<td>3</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>19.0</td>
<td>Students know the quadratic formula and are familiar with its proof by completing the square.</td>
<td>2</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>20.0</td>
<td>Students use the quadratic formula to find the roots of a second-degree polynomial and to solve quadratic equations.</td>
<td>3</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>21.0</td>
<td>Students graph quadratic functions and know that their roots are the x-intercepts.</td>
<td>3</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>22.0</td>
<td>Students use the quadratic formula or factoring techniques or both to determine whether the graph of a quadratic function will intersect the x-axis in zero, one, or two points.</td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>23.0</td>
<td>Students apply quadratic equations to physical problems such as the motion of an object under the force of gravity.</td>
<td>3</td>
<td>2</td>
<td>CR</td>
</tr>
</tbody>
</table>

*Fractional Values indicate rotated standards (e.g., 1/3 = rotated every three years)
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Rational Expressions and Equations

Understand Rational Expressions and Equations
2.0, 10.0, 12.0, 13.0, 15.0

- Simplify rational expressions
- Perform arithmetic operations on and with rational expressions
- Solve rational equations
- Solve applications problems using the above techniques

Understand Radical Expressions
2.0, 17.0, 19.0

- Simplify radical expressions
- Use the rules of exponents to simplify expressions

### KEY Standards - #CST Questions

<table>
<thead>
<tr>
<th>2.0</th>
<th>10.0</th>
<th>12.0</th>
<th>13.0</th>
<th>15.0</th>
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<td>3</td>
<td>4</td>
<td>4</td>
<td>1</td>
<td>2</td>
</tr>
</tbody>
</table>

Other Standards - #CST Questions
* 1/2 means 1 question every 2 years

CONCEPT LESSON:
Music Mania

Maria, Ben, and Patrice all received MP3 players as gifts and want to download music from the Internet. They want to find the best possible deal available.

Following are two of the plans they found:

1. Super Songs charges 20 cents per minute for the first 100 minutes of downloaded music and then 10 cents per minute for any additional minutes. (You can download fractional parts of a minute.)

2. Terrific Tunes charges by the number of songs downloaded. The first song costs $10 and each successive song is ¾ of the cost of the previous song.

Represent each of the plans using a table and a graph.

- Do either of the music plans represent a function? Explain why or why not.
- For each plan, what information would you need to know if you wanted to determine the cost?
- For each plan, what are the possible values for the cost?
- Choose the plan that you think is the best deal and justify to Maria, Ben, and Patrice why you chose that plan.

EXTENSION: Represent each plan by writing an equation. Use the equation to determine the domain and range of each.
# Algebra 1: Textbook Connections

*Glencoe McGraw-Hill: Algebra 1 Concepts, Skills, and Problem Solving*

## UNIT 4

<table>
<thead>
<tr>
<th>Topic</th>
<th>Standards</th>
<th>Textbook Sections</th>
</tr>
</thead>
</table>
| Rational Expressions and Equations | 2.0 Students understand and use such operations as taking the opposite, finding the reciprocal, taking a root, and raising to a fractional power. They understand and use the rules of exponents.  
10.0 Students add, subtract, multiply, and divide monomials and polynomials. Students solve multistep problems, including word problems, by using these techniques.  
12.0 Students simplify fractions with polynomials in the numerator and denominator by factoring both and reducing them to the lowest terms.  
13.0 Students add, subtract, multiply, and divide rational expressions and functions. Students solve both computationally and conceptually challenging problems by using these techniques.  
15.0 Students determine whether a relation defined by a graph, a set of ordered pairs, or a symbolic expression is a function and justify the conclusion  
17.0 Students determine the domain of independent variables defined by a graph, a set of ordered pairs, or a symbolic expression.  
19.0 Students know the quadratic formula and are familiar with its proof by completing the square | 11.1 Inverse Variation  
11.2 Rational Expressions  
11.3 Multiply Rational Expressions  
11.4 Dividing Rational Expressions  
11.5 Dividing Polynomials  
11.6 Rational Expressions with Like Denominators  
11.7 Rational Expressions with Unlike Denominators  
11.8 Mixed Expressions and Complex Fractions  
11.9 Rational Equations and Functions  
10.1 Simplifying Radical Expressions  
10.2 Operations with Radical Expressions  
*10.3 Radical Equations  
*10.4 The Pythagorean Theorem  
*10.5 The Distance Formula  
*10.6 Similar Triangles  
*12.1 Sampling Bias  
*12.2 Counting Outcomes  
*12.3 Permutations and Combinations  
*12.4 Probability of Compound Events  
*12.5 Probability Distributions  
*12.6 Probability Simulations |
| Radical Expressions          |                                                                           |                                                        |
| Statistics and Probability   |                                                                           |                                                        |

Standards in bold are key standards as defined by the Mathematics Framework for California Public Schools  
*To be covered as time permits. While this material is not necessary for CA Algebra 1, it may be very useful in preparing students for the CAHSEE examination, and/or previewing topics in to be covered in Geometry and Algebra 2*