

TRUMBULL PUBLIC SCHOOLS

Trumbull, Connecticut

Advanced College Prep Algebra I Grade 9

2024

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ACP Algebra I Grade

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The Trumbull Board of Education promotes non-discrimination in all of its programs, including educational opportunities and services provided to students, student assignment to schools and classes, and educational offerings and materials.

CORE VALUES AND BELIEFS

The Trumbull High School community engages in an environment conducive to learning that believes that all students will **read and write effectively**, therefore communicating in an articulate and coherent manner. All students will participate in activities that present **problem-solving through critical thinking**. Students will **use technology as a tool applying it to decision making**. We believe that by fostering self-confidence, self-directed and student-centered activities, we will promote **independent thinkers and learners**. We believe **ethical conduct** to be paramount in sustaining the welcoming school climate that we presently enjoy.

Approved 8/26/2011

INTRODUCTION & PHILOSOPHY

Advanced College Preparatory Algebra I is a prerequisite for all high school and college mathematics and thus provides a necessary foundation for higher-level mathematics. Students develop abstract reasoning and critical thinking skills, develop a better understanding of the world in which they live, and become better able to correctly apply mathematical knowledge when required. The focus areas of Algebra 1 help students gain strong foundations, including a solid understanding of concepts, a high degree of procedural skill and fluency, and the ability to apply the math they know to solve problems inside and outside the classroom.

COURSE GOALS

The following course goals are from the 2010 Connecticut Common Core State Standards for Mathematics and apply to all units:

N-RN The Real Number System

Extend the properties of exponents to radical exponents. Use properties of rational and irrational numbers.

N-Q Quantities

Reason quantitatively and use units to solve problems.

A-SSE Seeing Structure in Expressions

Interpret the structure of expressions. Write expressions in equivalent forms to solve problems.

A-APR Arithmetic with Polynomials and Rational Expressions

Perform arithmetic operations on polynomials. Understand the relationship between zeros and factors of polynomials.

A-CED Creating Equations

Create equations that describe numbers or relationships.

A-REI Reasoning with Equations and Inequalities

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

F-IF Interpreting Functions

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

F-BF Building Functions

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

F-LE Linear, Quadratic, and Exponential Models

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

S-ID Interpreting Categorical and Quantitative Data

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

S-IC Making Inferences and Justifying Conclusions

Make inferences and justify conclusions from sample surveys, experiments, and observational studies.

S-CP Conditional Probability and the Rules of Probability

Understand independence and conditional probability and use them to interpret data.

COURSE ENDURING UNDERSTANDINGS

Students will understand that...

- linear, exponential, and quadratic equations can be used to model real-life situations.
- technology can help them analyze, organize, and display data to support their conclusions.
- make sense of problems and persevere in solving them.
- reason abstractly and quantitatively.
- model with mathematics.
- use appropriate tools strategically.
- attend to precision.

COURSE ESSENTIAL QUESTIONS

- What is an expression?
- What is an equation?
- What is a sequence?
- How can patterns be represented?
- What are arithmetic and geometric sequences?
- What does equality mean?
- What is an inequality?
- How can we use linear equations and linear inequalities to solve real-world problems?
- What is a solution set for a linear equation or linear inequality?
- What is a function?
- What are the different ways in which functions may be represented?
- How can functions be used to model real-world situations, make predictions, and solve problems?
- What is a linear function?
- What are the different ways that linear functions may be represented?
- What is the significance of a linear function's slope and y -intercept?
- How do linear functions model real-world situations?
- How are parallel and perpendicular lines related?
- How do we make predictions and informed decisions based on current numerical information?
- What are the advantages and disadvantages of analyzing data by hand versus by using technology?
- What is the potential impact of deciding data that contains one or more outliers?
- What does the number of solutions (none, one, or infinite) of a system of linear equations represent?
- What are the advantages and disadvantages of solving a system of linear equations graphically versus algebraically?
- What characterizes exponential growth and decay?
- What are real-world models of exponential growth and decay?
- What are the limitations of exponential growth models?
- How can one differentiate an exponential model from a linear model?
- How is the factoring of polynomials related to the multiplication of polynomials?
- What is the best method for solving a quadratic equation?

COURSE KNOWLEDGE & SKILLS

Students will:

- examine patterns to determine whether the pattern is arithmetic or geometric
- use recursive and explicit forms of sequences
- determine if sequences represent linear or exponential functions
- solve multistep linear equations and inequalities
- determine what causes a linear equation to have no solution or infinite solution
- determine if relations are functions
- identify parent functions
- use function notation
- graph linear functions
- write equations of lines in slope intercept form, point-slope form, and standard form
- explore parallel and perpendicular lines
- find trend lines, lines of best fit, and regression equations
- solve systems of linear equations using graphing, substitution, and elimination
- solve systems of linear inequalities using graphing
- simplify expressions using properties of exponents
- identify and write equations involving exponential growth and decay
- explore real-life applications of functions
- simplify polynomial expressions
- factor polynomial expressions with a focus on quadratic expressions
- solve quadratic equations

COURSE SYLLABUS

Course Name

Advanced College Prep Algebra I

Level

Advanced College Prep

General Description of the Course

In this curriculum, students will learn function notation and develop the concepts of domain and range. They explore many examples of functions, including sequences; they interpret functions given graphically, numerically, symbolically, and verbally, translate between representations, and understand the limitations of various representations. Students build on and informally extend their understanding of integer exponents to consider exponential functions. Students explore systems of equations and inequalities, and they find and interpret their solutions. They interpret arithmetic sequences as linear functions and geometric sequences as exponential functions.

Students build on prior experiences with data, which provides a more formal means of assessing how a model fits data. Students use regression techniques to describe approximately linear relationships between quantities. They use graphical representations and knowledge of the context to make judgments about the appropriateness of linear models. With linear models, they look at residuals to analyze the goodness of fit.

Students consider quadratic functions, comparing the key characteristics of quadratic functions to those of linear and exponential functions. They select from among these functions to model phenomena. Students learn to anticipate the graph of a quadratic function by interpreting various forms of quadratic expressions. In particular, they identify the real solutions of a quadratic equation as the zeros of a related quadratic function.

Assured Assessments

Formative assessments can include, but are not limited to:

- Warm-up problems
- Individual and group activities
- Homework
- Exit tickets

Summative assessments can include, but are not limited to::

- Individual and group assessments
- Common end-of-unit assessments
- Common end-of-semester examination

Core Texts & Resources

- CSDE CCSS
<https://portal.ct.gov/sde/ct-core-standards/materials-for-teachers/mathematics/connecticut-model-curriculum/algebra-1>
- TI 84, or 84+ Graphing Calculator

Unit P

Prerequisite Material

Unit Goals

At the completion of this unit, students will be able to:

- Simplify expressions using order of operations
- Combine like terms
- Solve one and two-step equations
- Proportions

2010 Connecticut Common Core State Standards for Mathematics

Standards (Priority Standards in Bold)

8EE 7. Solve linear equations in one variable.

- a. Give examples of linear equations in one variable with one solution, infinitely many solutions, or no solutions. Show which of these possibilities is the case by successively transforming the given equation into simpler forms, until an equivalent equation of the form $x = a$, $a = a$, or $a = b$ results (where a and b are different numbers).
- b. Solve linear equations with rational number coefficients, including equations whose solutions require expanding expressions using the distributive property and collecting like terms.

A-SSE 1. Interpret expressions that represent a quantity in terms of its context.

- a. Interpret parts of an expression, such as terms, factors, and coefficients.**
- b. Interpret complicated expressions by viewing one or more of their parts as a single entity...

A-SSE 3. (part) Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression.

A-CED 1. (part) Create equations and inequalities in one variable and use them to solve problems. Include equations arising from linear functions.

A-CED 4. Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations. *For example, rearrange Ohm's law $V = IR$ to highlight resistance R .*

A-REI 1. Explain each step in solving a simple equation as following from the equality of numbers asserted at the previous step, starting from the assumption that the original equation has a solution. Construct a viable argument to justify a solution method.

A-REI 3. Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters.

Unit Essential Questions

- What is an expression?
- What is an equation?

Unit Essential Vocabulary

Equation

Expression

Like Terms

Order of Operations

Proportion

Simplify

Solve

Scope and Sequence

1. Students will simplify numerical expressions using order of operations.
2. Students will simplify algebraic expressions by combining like terms.
3. Students will solve one-step equations and two-step equations.
4. Students will solve proportions.

Assured Assessments

Formative assessments can include, but are not limited to:

- Warm-up problems
- Individual and group activities
- Homework
- Exit tickets

Summative assessments:

- Individual and group assessments
- Common end-of-unit assessments
- Common end-of-semester examination

Resources

- CSDE CCSS
<https://portal.ct.gov/sde/ct-core-standards/materials-for-teachers/mathematics/connecticut-model-curriculum/algebra-1>
- TI 84, or 84+ Graphing Calculator

Time Allotment

- 7 days

Unit 1

Patterns

Unit Goals

At the completion of this unit, students will be able to:

- Recognize patterns that are linear and exponential
- Build a function that models a relationship between two quantities

2010 Connecticut Common Core State Standards for Mathematics

Standards (Priority Standards in Bold)

F-IF 3. Recognize that sequences are functions, sometimes defined recursively, whose domain is a subset of the integers.

F-BF 1. Write a function that describes a relationship between two quantities.*

- a. Determine an explicit expression, a recursive process, or steps for calculation from a context.

F-BF 2. Write arithmetic and geometric sequences both recursively and with an explicit formula, use them to model situations, and translate between the two forms.*

Unit Essential Questions

- What is a sequence?
- How can patterns be represented?
- What are arithmetic and geometric sequences?

Unit Essential Vocabulary

Arithmetic Sequence	Explicit Rule	Geometric Sequence	Integer
N^{th} term	Recursive Rule	Symbolic Algebraic Expression	

Scope and Sequence

1. Students will represent patterns with tables, graphs, and symbolic rules.
2. Students will understand the difference between recursive rule versus explicit rule.
3. Students will recognize and analyze arithmetic sequences.
4. Students will recognize and analyze geometric sequences.

Assured Assessments

Formative assessments can include, but are not limited to:

- Warm-up problems
- Individual and group activities
- Homework
- Exit tickets

Summative assessments:

- Individual and group assessments
- Common end-of-unit assessments
- Common end-of-semester examination

Resources

- CSDE CCSS
<https://portal.ct.gov/sde/ct-core-standards/materials-for-teachers/mathematics/connecticut-model-curriculum/algebra-1>
- TI 84, or 84+ Graphing Calculator

Time Allotment

- 9 days

UNIT 2

Linear Equations and Inequalities

Unit Goals

At the completion of this unit, students will be able to:

- Solve linear equations involving multi-steps and variables on both sides
- Solve equations involving coefficients that are real numbers
- Solve linear inequalities involving multi-steps and variables on both sides
- Graph the solution to linear inequalities

2010 Connecticut Common Core State Standards for Mathematics

Standards (Priority Standards in Bold)

8EE 7. Solve linear equations in one variable.

- a. Give examples of linear equations in one variable with one solution, infinitely many solutions, or no solutions. Show which of these possibilities is the case by successively transforming the given equation into simpler forms, until an equivalent equation of the form $x = a$, $a = a$, or $a = b$ results (where a and b are different numbers).
- b. Solve linear equations with rational number coefficients, including equations whose solutions require expanding expressions using the distributive property and collecting like terms.

A-SSE 1. Interpret expressions that represent a quantity in terms of its context.

a. Interpret parts of an expression, such as terms, factors, and coefficients.

b. Interpret complicated expressions by viewing one or more of their parts as a single entity...

A-SSE 3. (part) Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression.

A-CED 1. (part) Create equations and inequalities in one variable and use them to solve problems. Include equations arising from linear functions.

A-CED 4. Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations. *For example, rearrange Ohm's law $V = IR$ to highlight resistance R .*

A-REI 1. Explain each step in solving a simple equation as following from the equality of numbers asserted at the previous step, starting from the assumption that the original equation has a solution. Construct a viable argument to justify a solution method.

A-REI 3. Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters.

N-Q 1 Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas....

N-Q 2 Define appropriate quantities for the purpose of descriptive modeling.

N-Q 3 Choose a level of accuracy appropriate to limitations on measurements when reporting quantities.

Unit Essential Questions

- What does equality mean?
- What is an inequality?
- How can we use linear equations and linear inequalities to solve real-world problems?
- What is a solution set for a linear equation or linear inequality?

Unit Essential Vocabulary

Algebraic expression	All Real Numbers	Coefficient	Constant
Commutative property	Distributive property	Equation	Evaluate
Inequality	Integers	Inverse operations	Linear inequalities
Order of operations	Properties of equality	Real numbers	Simplify
Solve	Variable		

Scope and Sequence

1. Students will write, simplify, and model situations involving linear equations.
2. Students will use the commutative, associative, and distributive properties to solve multi-step equations.
3. Students will write, simplify, and model situations involving linear inequalities.

Assured Assessments

Formative assessments can include, but are not limited to:

- Warm-up problems
- Individual and group activities
- Homework
- Exit tickets

Summative assessments:

- Individual and group assessments
- Common end-of-unit assessments
- Common end-of-semester examination

Resources

- CSDE CCSS
<https://portal.ct.gov/sde/ct-core-standards/materials-for-teachers/mathematics/connecticut-model-curriculum/algebra-1>
- TI 84, or 84+ Graphing Calculator

Time Allotment

- 13 days

UNIT 3

Functions

Unit Goals

At the completion of this unit, students will be able to:

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

2010 Connecticut Common Core State Standards for Mathematics

Standards (Priority Standards in Bold)

- 8F 1. Understand that a function is a rule that assigns to each input exactly one output. The graph of a function is the set of ordered pairs consisting of an input and the corresponding output.
- 8F 2. Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). *For example, given a linear function represented by a table of values and a linear function represented by an algebraic expression, determine which function has the greater rate of change.*
- 8F 5. Describe qualitatively the functional relationship between two quantities by analyzing a graph (e.g., where the function is increasing or decreasing, linear or nonlinear). Sketch a graph that exhibits the qualitative features of a function that has been described verbally.
- A-CED 2. Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.**
- A-CED 10. Understand that the graph of an equation in two variables is the set of all its solutions plotted in the coordinate plane, often forming a curve (which could be a line).
- F-IF 1. Understand that a function from one set (called the domain) to another set (called the range) assigns to each element of the domain exactly one element of the range. If f is a function and x is an element of its domain, then $f(x)$ denotes the output of f corresponding to the input x . The graph of f is the graph of the equation $y = f(x)$.
- F-IF 2. Use function notation, evaluate functions for inputs in their domains, and interpret statements that use function notation in terms of a context.**
- F-IF 4. For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities and sketch graphs showing key features given a verbal description of the relationship. *Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative....****
- F-IF 5. Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes. *For example, if the function $h(n)$ gives the number of person-hours it takes to assemble n engines in a factory, then the positive integers would be an appropriate domain for the function.**
- F-IF 9. Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions).

Unit Essential Questions

- What is a function?
- What are the different ways in which functions may be represented?
- How can functions be used to model real-world situations, make predictions, and solve problems?

Unit Essential Vocabulary

Absolute Value Function	Continuous	Cubic Function	Dependent Variable
Discrete	Domain	Evaluating a Function	Exponential Function
Function	Function Notation	Independent Variable	Input
Interval Notation	Linear Function	Mapping Diagram	Ordered Pair
Output	Parabola	Quadratic Function	Range
Relation	Reciprocal Function	Set-Builder Notation	Square Root Function
Step Function	Table	Vertical Line Test	

Scope and Sequence

1. Students will be introduced to the concept of a function.
2. Students will be able to identify relationships that are functions
3. Students will learn how to define the domain and range of discrete and continuous functions.
4. Students will organize and analyze data in tables and graphs and use the information to describe relationships.
5. Students will be introduced to function notation and will evaluate functions.
6. Students will be exposed to parent functions, with an emphasis on linear, exponential, and quadratic functions.

Assured Assessments

Formative assessments can include, but are not limited to:

- Warm-up problems
- Individual and group activities
- Homework
- Exit tickets

Summative assessments:

- Individual and group assessments
- Common end-of-unit assessments
- Common end-of-semester examination

Resources

- CSDE CCSS
<https://portal.ct.gov/sde/ct-core-standards/materials-for-teachers/mathematics/connecticut-model-curriculum/algebra-1>
- TI 84, or 84+ Graphing Calculator

Time Allotment

- 14 days

UNIT 4

Linear Functions

Unit Goals

At the completion of this unit, students will be able to:

- Write linear functions in slope-intercept form, point-slope form, and standard form
- Calculate and interpret the slope of a line
- Understand the graph of linear functions
- Apply linear functions to real-world applications

2010 Connecticut Common Core State Standards for Mathematics

Standards (Priority Standards in Bold)

- F-IF 6. Calculate and interpret the average rate of change of a function (presented symbolically or as a table) over a specified interval. Estimate the rate of change from a graph.*
- F-IF 7. Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.*
- a. Graph linear ...functions and show intercepts...
- F-IF 8. Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function.
- F-LE 1.** Distinguish between situations that can be modeled with linear functions [and with exponential functions].
- a. Prove that linear functions grow by equal differences over equal intervals...
- b. Recognize situations in which one quantity changes at a constant rate per unit interval relative to another....
- F-LE 2. Construct linear ... functions, including arithmetic ... sequences, given a graph, a description of a relationship, or two input-output pairs (include reading these from a table).
- F-LE 5. Interpret the parameters in a linear ... function in terms of a context.**

Unit Essential Questions

- What is a linear function?
- What are the different ways that linear functions may be represented?
- What is the significance of a linear function's slope and y -intercept?
- How do linear functions model real-world situations?
- How are parallel and perpendicular lines related?

Unit Essential Vocabulary

Dependent Variable	Independent Variable	Initial Value	Linear Function
Linear Inequality	Linear Models	Nonlinear Function	Parallel
Parameters	Perpendicular	Point-Slope Form	Rate of Change
Slope	Slope-Intercept Form	Standard Form	Unit Rate
Velocity	x -intercept	y -intercept	

Scope and Sequence

1. Students will graph linear functions.
2. Students will write linear equations in slope-intercept form and point-slope form.
3. Students will interpret the meaning of slope and y -intercept.
4. Students will understand the relationship between parallel and perpendicular lines.

Assured Assessments

Formative assessments can include, but are not limited to:

- Warm-up problems
- Individual and group activities
- Homework
- Exit tickets

Summative assessments:

- Individual and group assessments
- Common end-of-unit assessments
- Common end-of-semester examination

Resources

- CSDE CCSS
<https://portal.ct.gov/sde/ct-core-standards/materials-for-teachers/mathematics/connecticut-model-curriculum/algebra-1>
- TI 84, or 84+ Graphing Calculator

Time Allotment

- 19 days

UNIT 5

Scatter Plots & Trend Lines

Unit Goals

At the completion of this unit, students will be able to:

- Summarize and interpret data using one variable statistics
- Represent data using linear models
- Interpret linear models

2010 Connecticut Common Core State Standards for Mathematics

Standards (Priority Standards in Bold)

- 8-SP 1. Construct and interpret scatter plots for bivariate measurement data to investigate patterns of association between two quantities. Describe patterns such as clustering, outliers, positive or negative association, linear association, and nonlinear association.
- 8-SP 2. Know that straight lines are widely used to model relationships between two quantitative variables. For scatter plots that suggest a linear association, informally fit a straight line, and informally assess the model fit by judging the closeness of the data points to the line.
- 8-SP 3. Use the equation of a linear model to solve problems in the context of bivariate measurement data, interpreting the slope and intercept. *For example, in a linear model for a biology experiment, interpret a slope of 1.5 cm/hr as meaning that an additional hour of sunlight each day is associated with an additional 1.5 cm in mature plant height.*
- S-ID 2. Use statistics appropriate to the shape of the data distribution to compare center (median, mean) and spread (interquartile range) of two or more different data sets.**
- S-ID 3. Interpret differences in shape, center, and spread in the context of the data sets, accounting for possible effects of extreme data points (outliers).**
- S-ID 6. Represent data on two quantitative variables on a scatter plot, and describe how the variables are related.
- a. **Fit a function to the data; use functions fitted to data to solve problems in the context of the data.**
- c. Fit a linear function for a scatter plot that suggests a linear association.
- S-ID 7. Interpret the slope (rate of change) and the intercept (constant term) of a linear model in the context of the data.**
- S-ID 8. Compute (using technology) and interpret the correlation coefficient of a linear fit.
- S-ID 9. Distinguish between correlation and causation.

Unit Essential Questions

- How do we make predictions and informed decisions based on current numerical information?
- What are the advantages and disadvantages of analyzing data by hand versus by using technology?
- What is the potential impact of deciding data that contains one or more outliers?

Unit Essential Vocabulary

Boxplot	Causation	Correlation	Correlation coefficient
Data	Dependent variable	Distribution	Graphical representation
Independent variable	Interquartile range (IQR)	Line of best fit	Linear regression
Linear relationship/model	Mean (average)	Median	Measures of central tendency
Mode	Nonlinear relationship/model	Outlier	Prediction
Regression equation	Scale	Scatter plot	Skewed distribution
Slope	Trend line	Variable	

Scope and Sequence

1. Use five number summaries to create box and whisker plots
2. Fit trend lines to a scatter plot
3. Make predictions from trend lines
4. Calculate linear regression equations and find the correlation coefficient

Assured Assessments

Formative assessments can include, but are not limited to:

- Warm-up problems
- Individual and group activities
- Homework
- Exit tickets

Summative assessments:

- Individual and group assessments
- Common end-of-unit assessments
- Common end-of-semester examination

Resources

- CSDE CCSS
<https://portal.ct.gov/sde/ct-core-standards/materials-for-teachers/mathematics/connecticut-model-curriculum/algebra-1>
- TI 84, or 84+ Graphing Calculator

Time Allotment

- 10 days

UNIT 6

Systems of Linear Equations

Unit Goals

At the completion of this unit, students will be able to:

- Solve systems of linear equations graphically
- Solve systems of linear equations using algebraic methods
- Identify if systems of linear equations are consistent or inconsistent

2010 Connecticut Common Core State Standards for Mathematics

Standards (Priority Standards in Bold)

A-CED 3. Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable or nonviable options in a modeling context.

A-REI 5. Prove that, given a system of two equations in two variables, replacing one equation by the sum of that equation and a multiple of the other produces a system with the same solutions.

A-REI 6. Solve systems of linear equations exactly and approximately (e.g., with graphs), focusing on pairs of linear equations in two variables.

A-REI 11. Explain why the x -coordinates of the points where the graphs of the equations $y = f(x)$ and $y = g(x)$ intersect are the solutions of the equation $f(x) = g(x)$; find the solutions approximately, e.g., using technology to graph the functions, make tables of values, or find successive approximations. Include cases where $f(x)$ and/or $g(x)$ are linear functions.*

Unit Essential Questions

- What does the number of solutions (none, one, or infinite) of a system of linear equations represent?
- What are the advantages and disadvantages of solving a system of linear equations graphically versus algebraically?

Unit Essential Vocabulary

Breakeven Point	Consistent	Elimination Method
Inconsistent	Infinite Solution	Parallel
Solution	Substitution Method	System of Linear Equations

Scope and Sequence

1. Students will represent, compare, and analyze two linear equations, look for common solutions, and use this information to make choices between competing situations in real-world contexts.
2. Students will solve systems of equations graphically and algebraically.
3. Students will explain what the solution of a system of linear equations represents in the contexts of various applications.
4. Students will explore the special cases of parallel lines (no solution) and identical lines (infinite solutions).

Assured Assessments

Formative assessments can include, but are not limited to:

- Warm-up problems
- Individual and group activities
- Homework
- Exit tickets

Summative assessments:

- Individual and group assessments
- Common end-of-unit assessments
- Common end-of-semester examination

Resources

- CSDE CCSS
<https://portal.ct.gov/sde/ct-core-standards/materials-for-teachers/mathematics/connecticut-model-curriculum/algebra-1>
- TI 84, or 84+ Graphing Calculator

Time Allotment

- 11 days

UNIT 7

Introduction to Exponential Functions

Unit Goals

At the completion of this unit, students will be able to:

- Simplify expressions using the properties of exponents
- Graph and write exponential functions

2010 Connecticut Common Core State Standards for Mathematics

Standards (Priority Standards in Bold)

A-SSE 1b. Interpret complicated expressions by viewing one or more of their parts as a single entity.
For example, interpret $P(1+r)^n$ as the product of P and a factor not depending on P .

A-SSE 3c. Use the properties of exponents to transform expressions for exponential functions. For example the expression 1.15^t can be rewritten as $[1.15^{(1/12)}]^{(12t)} \approx 1.012^{(12t)}$ to reveal the approximate equivalent monthly interest rate if the annual rate is 15%.

F-IF 7. Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.*

- e. Graph exponential ... functions, showing intercepts and end behavior... F-IF 8b. Use the properties of exponents to interpret expressions for exponential functions. For example, identify percent rate of change in functions such as $y = (1.02)^t$, $y = (0.97)^t$, $y = (1.01)^{12t}$, $y = (1.2)^{t/10}$, and classify them as representing exponential functions.

F-BF 2. Write ... geometric sequences both recursively and with an explicit formula, use them to model situations, and translate between the two forms.*

F-LE 1. Distinguish between situations that can be modeled with linear functions and with exponential functions.

a. Prove ... that exponential functions grow by equal factors over equal intervals....

c. Recognize situations in which a quantity grows or decays by a constant percent rate per unit interval relative to another.

F-LE 2. Construct linear and exponential functions, including arithmetic and geometric sequences, given a graph, a description of a relationship, or two input-output pairs (include reading these from a table).

F-LE 3. Observe using graphs and tables that a quantity increasing exponentially eventually exceeds a quantity increasing linearly...

F-LE 5. Interpret the parameters in a ... exponential function in terms of a context.

Unit Essential Questions

- What characterizes exponential growth and decay?
- What are real-world models of exponential growth and decay?
- What are the limitations of exponential growth models?
- How can one differentiate an exponential model from a linear model?

Unit Essential Vocabulary

Decay Factor	Decay Rate	Doubling
Exponential Decay	Exponential Function	Exponential Growth
Growth Factor	Growth Rate	Half-Life
Percent	Quadrupling	Tripling

Scope and Sequence

1. Students will investigate the properties of exponents.
2. Students will write equations of exponential functions.
3. Students will graph exponential functions.
4. Students will identify the real-world meaning of the initial value and the growth/decay factor.

Assured Assessments

Formative assessments can include, but are not limited to:

- Warm-up problems
- Individual and group activities
- Homework
- Exit tickets

Summative assessments:

- Individual and group assessments
- Common end-of-unit assessments
- Common end-of-semester examination

Resources

- CSDE CCSS
<https://portal.ct.gov/sde/ct-core-standards/materials-for-teachers/mathematics/connecticut-model-curriculum/algebra-1>
- TI 84, or 84+ Graphing Calculator

Time Allotment

- 11 days

UNIT 8

Quadratic Functions and Equations

Unit Goals

At the completion of this unit, students will be able to:

- Add, subtract, and multiply polynomial expressions
- Factor polynomial expressions with a focus on quadratic functions
- Solve quadratic equations

2010 Connecticut Common Core State Standards for Mathematics

Standards (Priority Standards in Bold)

8EE 2. Use square root and cube root symbols to represent solutions to equations of the form $x^2 = p$ and $x^3 = p$, where p is a positive rational number. Evaluate square roots of small perfect squares and cube roots of small perfect cubes. Know that $\sqrt{2}$ is irrational.

A-SSE 3. a Factor a quadratic expression to reveal the zeros of the function it defines. b. Complete the square in a quadratic expression to reveal the maximum or minimum value of the function it defines.

A-APR 1. Understand that polynomials form a system analogous to the integers, namely, they are closed under the operations of addition, subtraction, and multiplication; add, subtract, and multiply polynomials.

A-CED 1. Create equations and inequalities in one variable and use them to solve problems. *Include equations arising from ...quadratic functions ...*

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

F-IF 4. For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries... *

Unit Essential Questions

- How is the factoring of polynomials related to the multiplication of polynomials?
- What is the best method for solving a quadratic equation?

Unit Essential Vocabulary

Binomial	Coefficient	Constant Term	Cubic
Decreasing	Expanded Form	Factored Form	Increasing
Leading Coefficient	Monomial	Quadratic Formula	Quadratic Function
Quadratic Equation	Quadratic	Parabola	Parameter
Polynomial	Quadratic	Standard Form	Trinomial
Vertex	x-intercepts	y-intercept	Zero Product Property

Scope and Sequence

1. Students will perform operations with polynomial expressions
2. Students will factor using the Greatest Common Factor
3. Students will factor quadratic expressions
4. Students will factor by grouping
5. Students will solve quadratic equations using the square root method, factoring, and the quadratic formula

Assured Assessments

Formative assessments can include, but are not limited to:

- Warm-up problems
- Individual and group activities
- Homework
- Exit tickets

Summative assessments:

- Individual and group assessments
- Common end-of-unit assessments
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- TI 84, or 84+ Graphing Calculator

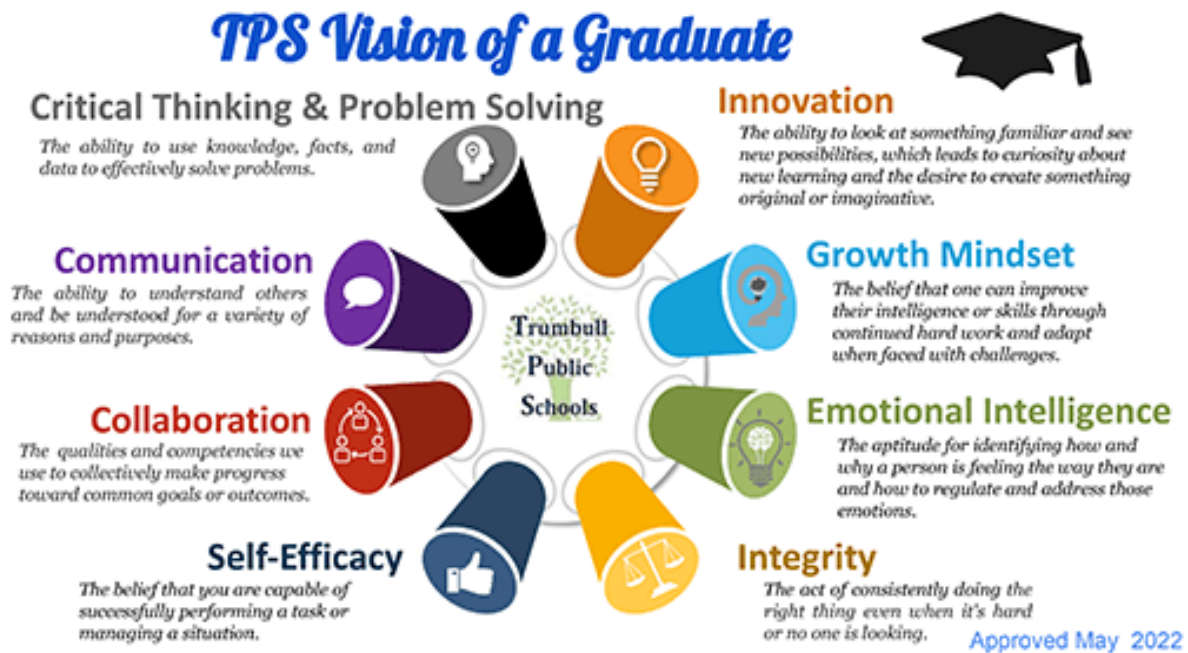
Time Allotment

- 27 days

COURSE CREDIT

1.0 credits in mathematics
One class period for one year

TPS VISION OF THE GRADUATE SKILLS AND DISPOSITIONS



ASSURED STUDENT PERFORMANCE RUBRICS

- Trumbull High School School-Wide Writing Rubric
- Trumbull High School School-Wide Problem-Solving Rubric
- Trumbull High School School-Wide Independent Learning and Thinking Rubric

Trumbull High School School-Wide Problem Solving Through Critical Thinking Rubric

Category/ Weight	Exemplary 4	Goal 3	Working Toward Goal 2	Needs Support 1-0
Understanding X _____	<ul style="list-style-type: none"> Student demonstrates clear understanding of the problem and the complexities of the task 	<ul style="list-style-type: none"> Student demonstrates sufficient understanding of the problem and most of the complexities of the task 	<ul style="list-style-type: none"> Student demonstrates some understanding of the problem but requires assistance to complete the task 	<ul style="list-style-type: none"> Student demonstrates limited or no understanding of the fundamental problem after assistance with the task
Research X _____	<ul style="list-style-type: none"> Student gathers compelling information from multiple sources including digital, print, and interpersonal 	<ul style="list-style-type: none"> Student gathers sufficient information from multiple sources including digital, print, and interpersonal 	<ul style="list-style-type: none"> Student gathers some information from few sources including digital, print, and interpersonal 	<ul style="list-style-type: none"> Student gathers limited or no information
Reasoning and Strategies X _____	<ul style="list-style-type: none"> Student demonstrates strong critical thinking skills to develop a comprehensive plan integrating multiple strategies 	<ul style="list-style-type: none"> Student demonstrates sufficient critical thinking skills to develop a cohesive plan integrating strategies 	<ul style="list-style-type: none"> Student demonstrates some critical thinking skills to develop a plan integrating some strategies 	<ul style="list-style-type: none"> Student demonstrates limited or no critical thinking skills and no plan
Final Product and/or Presentation X _____	<ul style="list-style-type: none"> Solution shows deep understanding of the problem and its components Solution shows extensive use of 21st-century technology skills 	<ul style="list-style-type: none"> Solution shows sufficient understanding of the problem and its components Solution shows sufficient use of 21st-century technology skills 	<ul style="list-style-type: none"> Solution shows some understanding of the problem and its components Solution shows some use of 21st-century technology skills 	<ul style="list-style-type: none"> Solution shows limited or no understanding of the problem and its components Solution shows limited or no use of 21st-century technology skills

Trumbull High School School-Wide Writing Rubric

Category/ Weight	Exemplary 4 Student work:	Goal 3 Student work:	Working Toward Goal 2 Student work:	Needs Support 1-0 Student work:
Purpose X_____	<ul style="list-style-type: none"> • Establishes and maintains a clear purpose • Demonstrates an insightful understanding of audience and task 	<ul style="list-style-type: none"> • Establishes and maintains a purpose • Demonstrates an accurate awareness of audience and task 	<ul style="list-style-type: none"> • Establishes a purpose • Demonstrates an awareness of audience and task 	<ul style="list-style-type: none"> • Does not establish a clear purpose • Demonstrates limited/no awareness of audience and task
Organization X_____	<ul style="list-style-type: none"> • Reflects sophisticated organization throughout • Demonstrates logical progression of ideas • Maintains a clear focus • Utilizes effective transitions 	<ul style="list-style-type: none"> • Reflects organization throughout • Demonstrates logical progression of ideas • Maintains a focus • Utilizes transitions 	<ul style="list-style-type: none"> • Reflects some organization throughout • Demonstrates logical progression of ideas at times • Maintains a vague focus • May utilize some ineffective transitions 	<ul style="list-style-type: none"> • Reflects little/no organization • Lacks logical progression of ideas • Maintains little/no focus • Utilizes ineffective or no transitions
Content X_____	<ul style="list-style-type: none"> • Is accurate, explicit, and vivid • Exhibits ideas that are highly developed and enhanced by specific details and examples 	<ul style="list-style-type: none"> • Is accurate and relevant • Exhibits ideas that are developed and supported by details and examples 	<ul style="list-style-type: none"> • May contain some inaccuracies • Exhibits ideas that are partially supported by details and examples 	<ul style="list-style-type: none"> • Is inaccurate and unclear • Exhibits limited/no ideas supported by specific details and examples
Use of Language X_____	<ul style="list-style-type: none"> • Demonstrates excellent use of language • Demonstrates a highly effective use of standard writing that enhances communication • Contains few or no errors. Errors do not detract from meaning 	<ul style="list-style-type: none"> • Demonstrates competent use of language • Demonstrates effective use of standard writing conventions • Contains few errors. Most errors do not detract from meaning 	<ul style="list-style-type: none"> • Demonstrates use of language • Demonstrates use of standard writing conventions • Contains errors that detract from meaning 	<ul style="list-style-type: none"> • Demonstrates limited competency in use of language • Demonstrates limited use of standard writing conventions • Contains errors that make it difficult to determine meaning

Trumbull High School School-Wide Independent Learning and Thinking Rubric

Category/ Weight	Exemplary 4	Goal 3	Working Toward Goal 2	Needs Support 1-0
Proposal X_____	<ul style="list-style-type: none"> • Student demonstrates a strong sense of initiative by generating compelling questions, creating uniquely original projects/work 	<ul style="list-style-type: none"> • Student demonstrates initiative by generating appropriate questions, creating original projects/work 	<ul style="list-style-type: none"> • Student demonstrates some initiative by generating questions, creating appropriate projects/work 	<ul style="list-style-type: none"> • Student demonstrates limited or no initiative by generating few questions and creating projects/work
Independent Research & Development X_____	<ul style="list-style-type: none"> • Student is analytical, insightful, and works independently to reach a solution 	<ul style="list-style-type: none"> • Student is analytical, and works productively to reach a solution 	<ul style="list-style-type: none"> • Student reaches a solution with direction 	<ul style="list-style-type: none"> • Student is unable to reach a solution without consistent assistance
Presentation of Final Product X_____	<ul style="list-style-type: none"> • Presentation shows compelling evidence of an independent learner and thinker • Solution shows deep understanding of the problem and its components • Solution shows extensive and appropriate application of 21st-century skills 	<ul style="list-style-type: none"> • Presentation shows clear evidence of an independent learner and thinker • Solution shows adequate understanding of the problem and its components • Solution shows adequate application of 21st-century skills 	<ul style="list-style-type: none"> • Presentation shows some evidence of an independent learner and thinker • Solution shows some understanding of the problem and its components • Solution shows some application of 21st-century skills 	<ul style="list-style-type: none"> • Presentation shows limited or no evidence of an independent learner and thinker • Solution shows limited or no understanding of the problem and its components • Solution shows limited or no application of 21st-century skills

ACP Algebra I Pacing Guide

P. Prerequisites: 7 Days

<i>Days</i>	<i>Topics</i>
1	Simplify expressions using order of operations
1	Combine like terms
2	Solving One-Step and Two-Step Equations
1	Proportions
1	Review
1	Assessment

1. Patterns: 9 Days

<i>Days</i>	<i>Topics</i>
1	Representing patterns
1	Patterns with integers
2	Arithmetic sequences
2	Geometric sequences
1	Patterns with Fractals
1	Review
1	Assessment

2. Linear Equations and Inequalities: 13 Days

<i>Days</i>	<i>Topics</i>
1	Solving equations variables both sides
2	Solving equations using the distributive property
2	Fraction busting and solving with noninteger coefficients
1	Review
1	Assessment
4	Linear inequalities
1	Review
1	Assessment

3. Functions: 14 Days

<i>Days</i>	<i>Topics</i>
1	Representing Relations and Functions
1	What is a Function?
1	Parent Functions
3	Function Notation
1	Assessment
1	Graphing Functions
3	Domain and Range of Functions
1	Review
1	Test

4. Linear Functions: 19 Days

<i>Days</i>	<i>Topics</i>
2	Rate of Change and Slope
2	Slope-Intercept Form
3	Point-Slope Form
2	Standard Form
1	Review
1	Assessment
3	Parallel and Perpendicular Lines
1	Review
1	Assessment
2	Linear Inequalities
1	Assessment

Midterm Exam Review (3 Days)

-----END of SEMESTER 1-----

5. Scatter Plots & Trend Lines: 10 days

<i>Days</i>	<i>Topics</i>
2	Five-number summary/Box and whisker
2	Scatterplots and Trend Lines
2	Linear Regression
4	Project

6. Systems of Linear Equations: 11 days

<i>Days</i>	<i>Topics</i>
1	Solving by graphing
2	Solving using substitution
2	Solving using elimination
1	Review
1	Assessment
2	Applications of linear systems
1	Review
1	Assessment

7. Introduction to Exponential Functions: 11 days

<i>Days</i>	<i>Topics</i>
4	Exponent properties
1	Review
1	Assessment
1	Exponential Functions
2	Percents
2	Exponential Growth and Decay
1	Review
1	Assessment

8. Quadratic Functions and Equations: 27 days

<i>Days</i>	<i>Topics</i>
2	Adding and subtracting polynomials
3	Multiplying polynomials
1	Review
1	Assessment
5	Factoring Polynomials
1	Review
1	Assessment
2	Simplifying square roots
1	Solving square root property
1	Solving zero product property
4	Solving by factoring
3	Solving using the quadratic formula
1	Review
1	Assessment

Final Exam Review (3 Days)

-----END of SEMESTER 2-----