

Advanced Algebra Curriculum Description

Students will revisit and deepen their understanding of many of the topics learned in algebra I and II. Specifically, this course will delve into linear, quadratic, polynomial, exponential functions, logarithmic functions, systems of equations, and matrices. Additionally students will be introduced to basic statistics. This course was designed for a student who desires a fourth year of mathematics and its focus is to better prepare our students so that they easily transition into a regular math class in college. To that aim, the course emphasizes modeling situations and solving equations.

Unit 1 standards will focus on properties and applications of linear, quadratic, and polynomial equations. The work in unit 2 will continue to explore polynomial function. Additionally, in Unit 2 students will work on the properties and applications of absolute value, rational, radical, exponential, and logarithmic functions.

The unit 3 standards will focus the students work on Systems of Equations and Inequalities and Matrices. Unit 4 will standards focus on statistics and probability. Specifically, students will learn about the many measures of center and spread, when each is appropriate, about probability (dependent, independent, compound, and conditional) and the counting principle.

Advanced Algebra Curriculum - Standards

| Unit 1 | Unit 2 | Unit 3 | Unit 4 |
|-------------|------------|------------|------------|
| (A-REI.12) | (A-CED.2) | (A-REI.5) | (S-ID.1) |
| (A-SSE.3.b) | (A-APR.2) | (A-REI.6) | (S-ID.2) |
| (F-IF.1) | (A-APR.3) | (A-REI.7) | (S-ID.3) |
| (F-IF.2) | (A-APR.6) | (A-REI.9) | (S-CP.A.1) |
| (F-BF.4.a) | (A-REI.4b) | (A-REI.12) | (S-CP.A.2) |
| (F-BF.1.b) | (F-IF.5) | (N-VM.6) | (S-CP.A.3) |
| (F-BF.1.c) | (F-IF.8.a) | (N-VM.7) | (S-CP.A.4) |
| (F-IF.4) | (F-LE.1.c) | (N-VM.8) | (S-CP.A.5) |
| (F-IF.7a) | (F-IF.7.e) | (N-VM.12) | (S-CP.B.6) |
| (F-IF.7b) | (N-CN.3) | | (S-CP.B.7) |
| (F-LE.1) | (N-CN.7) | | (S-CP.B.8) |
| (G-GPE.1) | (N-CN.9) | | (S-CP.B.9) |
| (G-GPE.5) | (S-ID.6) | | |
| (N-CN.1) | | | |
| (N-CN.2) | | | |
| (N-CN.3) | | | |
| (N-CN.7) | | | |

PCTI MATHEMATICS DEPARTMENT

ADVANCED ALGEBRA

UNIT 1

EQUATIONS AND INEQUALITIES and FUNCTIONS AND THEIR GRAPHS

| TECHNOLOGY STANDARDS | KEY VOCABULARY | |
|--|---|--|
| <p>Use Geogebra to:</p> <ul style="list-style-type: none"> Graph equations and inequalities. https://www.youtube.com/results?search_query=geogebra+graph+equations+%26+inequalities Use Geogebra to explore Rigid and non-rigid transformations https://www.youtube.com/results?search_query=rigid+transformations+using+geogebra Use Geogebra to explore average rate of change https://www.youtube.com/watch?v=F-7Poa3i1ZU Understanding the domain and range of a function using Nspire. http://www.youtube.com/watch?v=U7BbqQFwWaE | <p>Equation, inequality Equation in two variables Solution of an equation or inequality Graph of an equation, function Intercepts Symmetry Standard form of the equation of a circle Equivalent equations Extraneous solution Mathematical modeling Quadratic equations Extracting square roots Completing the square Quadratic Formula Discriminant Imaginary unit Complex numbers Complex conjugates Polynomial equations Interval</p> | <p>Identity Literal equation Point slope form Parallel, perpendicular Relation Function Domain (implied), range Vertical line test Increasing, decreasing, constant functions Average rate of change Even, odd functions Rigid, non-rigid transformations Vertical, Horizontal Shift Vertical shrink/stretch Horizontal shrink/stretch Arithmetic combinations of functions Composing functions Inverse functions Horizontal line test One-to-one functions</p> |

| # | TOPICS (textbook reference; # of days for instruction) | # | STUDENT LEARNING OBJECTIVES | CCSS code |
|---|--|----|--|---------------------|
| I | I. EQUATIONS AND INEQUALITIES (1.1-1.6 ; 17 days) | | | |
| | 1.1 (3 day) | 1 | Evaluate Expressions Sketch graphs of equations by point plotting. | (A-REI.10) |
| | | 2 | Find the x- and y-intercepts of graphs of equations. | (F-IF.7.a) |
| | | 3 | Find equations and sketch graphs of circles. | (G-GPE.A.1) |
| | 1.2 (1 day) | 4 | Solve linear equations in one variable. | (A-REI.3) |
| | 1.3 (2 days) | 5 | Write and use linear models to solve real-life problems. | (A.CED.2) |
| | 1.4 (3 days) | 6 | Solve quadratic functions by factoring, extracting square roots, completing the square, and the Quadratic Formula. | (A-REI.4, N-CN.C.7) |
| | | 7 | Use quadratic equations to model and solve real-life problems. | (N-CN.A.1) |
| | 1.5 (3 days) | 8 | Use the imaginary unit i to write complex numbers. | |
| | | 9 | Write, add, subtract, and multiply complex numbers. | (N-CN.A.2) |
| | | 10 | Use complex conjugates to divide complex numbers. | (N-CN.A.3) |
| | 1.6 (3 days) | 11 | Solve polynomial equations of degree three or higher. | (A-APR.3) |
| | | 12 | Solve equations involving radicals, fractions, and absolute values. | (A-REI.2) |
| | | 13 | Use polynomial and radical equations to model and solve real-life problems. | (A-CED.1) |
| | 1.7 (2 days) | 14 | Solve and sketch the solutions of linear, absolute values, polynomial, and rational inequalities in one variable. | (A-REI.3, A-REI.12) |

| II | FUNCTIONS AND THEIR GRAPHS (2.2-2.8 ; 20 days) | | | |
|-----------|---|-----------|---|------------------------------|
| | * (2 days) | 1 | Write Slope-Intercept and Point-Slope forms of lines. | (A-CED.2) |
| | | 2 | Use slope to identify parallel and perpendicular lines. | (G-GPE.5) |
| | * (4 days) | 3 | Determine if a relation is a function by definition and using the Vertical Line Test. | (F-IF.A.1) |
| | | 4 | Use functional notation and evaluate functions. | (F-IF.A.2) |
| | | 5 | Find domain and range of functions. | (F-IF.A.1) |
| | | 6 | Evaluate difference quotients. | (F-BF.1.c) |
| | | 7 | Use functions to model and solve real-life problems. | (F-LE.1) |
| | | 8 | Find the zeros graphically of a function. | (F-IF.7.a) |
| | | 9 | Determine intervals on which functions are increasing, decreasing and constant. | (F-IF.4) |
| | | 10 | Determine graphically the relative minimum and relative maximum values of functions. | (A-SSE.3b, F-IF.4, F-IF.7.a) |
| | | 11 | Identify even and odd functions. | (F-BF.3) |
| | (1 day) | 12 | Identify and graph parent functions. | (F-IF.7.a, F-IF.7.b) |
| | (2 days) | 13 | Use vertical and horizontal shifts, reflections, and non-rigid transformations to sketch the graphs of functions. | (F-BF.3) |
| | (2 days) | 14 | Add, subtract, multiply and divide functions. | (F-BF.1.b) |
| | | 15 | Find compositions of functions. | (F-BF.1.c) |
| | * (3 days) | 16 | Find inverse functions. | (F-BF.4.a) |
| | | 17 | Use the Horizontal Line Test to determine if a function is one-to-one. | (F-BF.4.a) |
| | | 18 | Verify algebraically and graphically that functions are inverses of one another. | (F-BF.4.b, F-BF.4.c) |

| Selected Opportunities for Connections to Mathematical Practices | Unit 1-Link to Illustrative Mathematics And Open Ended Problems Related to the Standards |
|---|--|
| <ol style="list-style-type: none"> 1. Make sense of problems and persevere in solving them. 2. Reason abstractly and quantitatively. 3. Construct viable arguments and critique the reasoning of others. 4. Model with mathematics. 5. Use appropriate tools strategically. 6. Attend to precision. 7. Look for and make use of structure. 8. Look for and express regularity in repeated reasoning. | <p style="text-align: center;">https://www.illustrativemathematics.org/standards/hs</p> |

| Code # | Common Core State Standards |
|------------|---|
| (A-APR.3) | Identify zeros of polynomials when suitable factorizations are available, and use the zeros to construct a rough graph of the function defined by the polynomial |
| (A-CED.1) | Create equations and inequalities in one variable and use them to solve problems. Include equations arising from linear and quadratic functions, and simple rational and exponential functions. |
| (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-REI.2) | Solve simple rational and radical equations in one variable, and give examples showing how extraneous solutions may arise. |
| (A-REI.3) | Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters |

| Code # | Common Core State Standards |
|-------------|---|
| (A-REI.4.a) | Use the method of completing the square to transform any quadratic equation in x into an equation of the form $(x-p)^2=q$ that has the same solutions. Derive the quadratic formula from this form. |
| (A-REI.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). |
| (A-REI.12) | Graph the solutions to a linear inequality in two variables as a half-plane (excluding the boundary in the case of a strict inequality), and graph the solution set to a system of linear inequalities in two variables as the intersection of the corresponding half-planes. |
| (A-SSE.3.b) | Complete the square in a quadratic expression to reveal the maximum or minimum value of the function it defines. |
| (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. Illustrations. |
| (F-BF.4.a) | Solve an equation of the form $f(x)=c$ for a simple function f that has an inverse and write an expression for the inverse. |
| (F-BF.1.b) | Combine standard function types using arithmetic operations. For example, build a function that models the temperature of a cooling body by adding a constant function to a decaying exponential, and relate these functions to the model. |
| (F-BF.1.c) | Compose functions |
| (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. |
| (F-IF.7a) | Graph linear and quadratic functions and show intercepts, maxima, and minima. |
| (F-IF.7b) | Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions. |
| (F-LE.1) | Prove that linear functions grow by equal differences over equal intervals, and that exponential functions grow by equal factors over equal intervals. |
| (G-GPE.1) | Derive the equation of a circle of given center and radius using the Pythagorean Theorem; complete the square to find the center and radius of a circle given by an equation. |

| Code # | Common Core State Standards |
|-----------|---|
| (G-GPE.5) | Prove the slope criteria for parallel and perpendicular lines and use them to solve geometric problems (e.g., find the equation of a line parallel or perpendicular to a given line that passes through a given point). |
| (N-CN.1) | Know there is a complex number i such that $i^2 = -1$, and every complex number has the form $a+bi$ with a and b real. |
| (N-CN.2) | Use the relation $i^2 = -1$ and the commutative, associative, and distributive properties to add, subtract, and multiply complex numbers. |
| (N-CN.3) | Find the conjugate of a complex number; use conjugates to find moduli and quotients of complex numbers. |
| (N-CN.7) | Solve quadratic equations with real coefficients that have complex solutions. |

PCTI MATHEMATICS DEPARTMENT

ADVANCED ALGEBRA

UNIT 2

**POLYNOMIAL EQUATIONS, EXPONENTIAL AND LOGARITHMIC FUNCTIONS,
AND SYSTEMS OF EQUATIONS AND INEQUALITIES**

| TECHNOLOGY STANDARDS | KEY VOCABULARY | |
|---|---|---|
| <p>Using NSPIRE:</p> <ul style="list-style-type: none"> Finding the Vertex, Min, Max of a function https://www.youtube.com/watch?v=f828hKs4lhM Finding Vertex, Axis of Symmetry, Intercepts https://www.youtube.com/watch?v=SJiwd6dQjgq Explore Exponential and Logarithmic Functions https://www.youtube.com/watch?v=MoqEnjCuqMU https://www.youtube.com/watch?v=6frwsRg4aAs Finding the Least Squares Regression line https://www.youtube.com/watch?v=i7Hc4sLgc_Q | <p>Axis of symmetry Vertex Parabola, Quadratic Function Standard Form of a Quadratic Function Minimum, Maximum of Quadratic Function Continuous Power functions Leading Coefficient Test Standard Form of Polynomial Function Repeated Zeros, Multiplicity Intermediate Value Theorem Long Division of Polynomials Division Algorithm Synthetic Division of Polynomials The Remainder Theorem</p> | <p>The Factor Theorem The Fundamental Theorem of Algebra Linear Factorization Theorem Rational Zero Test Conjugate Pairs Descartes Rule of Signs Upper & Lower Bound Rules Least Squares Regression line Direct, Inverse, and Joint Variation Transcendental Functions Exponential Function with base a Compound Interest Logarithmic Function with base a Natural Logarithmic Function Change of base formula Exponential growth and decay models Logarithmic models</p> |

| # | TOPICS (textbook reference; # days for instruction) | # | STUDENT LEARNING OBJECTIVES | CCSS code |
|-----|--|----|---|----------------------------|
| III | POLYNOMIAL EQUATIONS (17 DAYS) | | | |
| | 3.1 (3 days) | 1 | Write quadratic function in standard form. | (A-REI.4.a) |
| | | 2 | Find the minimum and maximum algebraically of a quadratic function. | (A-REI.4.a) |
| | 3.2 (3 days) | 3 | Use vertical and horizontal shifts , reflections, and nonrigid transformations to sketch the graphs of functions. | (F-BF.3) |
| | | 4 | Use the Leading Coefficient Test to determine end behavior of a polynomial function. | (F-BF.3) |
| | 3.3 (3 days) | 5 | Use long division and synthetic division to divide polynomials. | (A-APR.6) |
| | | 6 | Use the Remainder and Factor Theorems. | (A-APR.2) |
| | 3.4 (5 days) | 7 | Use the Fundamental Theorem of Algebra to determine the number of zeros of polynomial functions. | (N-CN.7, N-CN.9, A-REI.4b) |
| | | 8 | Use the Rational Zero Test to determine possible zeros of polynomial functions. (F-IF8a) | (F-IF.8.a) |
| | | 9 | Find conjugate pairs of complex zeros. | (N-CN.3) |
| | | 10 | Find zeros of polynomials by factoring. | (A-APR.3) |
| | | 11 | Use Descartes’s Rule of Signs and Upper and Lower Bound Rules to find zeros of polynomials. | (F-IF.5) |
| | 3.5 (3 days) | 12 | Construct scatter plots from data points. | (S-ID.6) |
| | | 13 | Write mathematical models for direct, inverse, and joint variation. | (A-CED.2) |
| | | | | |

| IV | EXPONENTIAL AND LOGARITHMIC EQUATIONS (16-19 days) | | | |
|----|--|---|--|----------------------|
| | 5.1 (3-4 days) | 1 | Recognize, evaluate and graph exponential functions with base a and e. | (F-LE.1.c, F-IF.7.e) |
| | 5.2 (4-5 days) | 2 | Recognize, evaluate and graph logarithmic functions with base a and e. | (F-LE.1.c, F-IF.7.e) |
| | 5.3 (3-4 days) | 3 | Rewrite logarithms with different bases. | (F-LE.4) |
| | | 4 | Use properties of logarithms to evaluate or rewrite logarithmic expressions. | (F-IF.8.b) |
| | | 5 | Use properties of logarithms to expand or condense logarithmic expressions. | (F-IF.8.b) |
| | 5.4 (4 days) | 6 | Solve exponential and logarithmic equations. | (F-BF.5) |
| | 5.5 (2 days) | | Recognize and use exponential growth, exponential decay, and logarithmic models to solve real - life problems. | (F-LE.1.c , F-LE.4) |

| Selected Opportunities for Connections to Mathematical Practices | Unit 2-Link to Illustrative Mathematics And Open Ended Problems Related to the Standards |
|---|--|
| <ol style="list-style-type: none"> 1. Make sense of problems and persevere in solving them. 2. Reason abstractly and quantitatively. 3. Construct viable arguments and critique the reasoning of others. 4. Model with mathematics. 5. Use appropriate tools strategically. 6. Attend to precision. 7. Look for and make use of structure. 8. Look for and express regularity in repeated reasoning. | <p style="text-align: center;"> https://www.illustrativemathematics.org/standards/hs </p> |

| Code # | Common Core State Standards |
|------------|--|
| (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-APR.2) | Know and apply the Remainder Theorem: For a polynomial $p(x)$ and a number a , the remainder on division by $x-a$ is $p(a)$, so $p(a)=0$ if and only if $(x-a)$ is a factor of $p(x)$. |
| (A-APR.3) | Identify zeros of polynomials when suitable factorizations are available, and use the zeros to construct a rough graph of the function defined by the polynomial. |
| (A-APR.6) | Rewrite simple rational expressions in different forms; write $a(x)/b(x)$ in the form $q(x)+r(x)/b(x)$, where $a(x)$, $b(x)$, $q(x)$, and $r(x)$ are polynomials with the degree of $r(x)$ less than the degree of $b(x)$, using inspection, long division, or, for the more complicated examples, a computer algebra system. |
| (A-REI.4b) | Solve quadratic equations by inspection (e.g., for $x^2=49$), taking square roots, completing the square, the quadratic formula and factoring, as appropriate to the initial form of the equation. Recognize when the quadratic formula gives complex solutions and write them as $a±bi$ for real numbers a and b . |
| (F-IF.5) | Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes. |
| (F-IF.8.a) | Use the process of factoring and completing the square in a quadratic function to show zeros, extreme values, and symmetry of the graph, and interpret these in terms of a context. |
| (F-LE.1.c) | Recognize situations in which a quantity grows or decays by a constant percent rate per unit interval relative to another. |
| (F-IF.7.e) | Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude. |
| (N-CN.3) | Find the conjugate of a complex number; use conjugates to find moduli and quotients of complex numbers. |
| (N-CN.7) | Solve quadratic equations with real coefficients that have complex solutions. |
| (N-CN.9) | Know the Fundamental Theorem of Algebra; show that it is true for quadratic polynomials. |
| (S-ID.6) | Represent data on two quantitative variables on a scatter plot, and describe how the variables are related. |

PCTI MATHEMATICS DEPARTMENT

Advanced Algebra

UNIT 3

LINEAR AND NONLINEAR SYSTEMS OF EQUATIONS, AND MATRICES AND SYSTEMS OF EQUATIONS

TECHNOLOGY STANDARDS

Use a NSPIRE to:

- Verify solution to system of linear and nonlinear equations

<https://www.youtube.com/watch?v=u4eAzOgtE4Y>

<https://www.youtube.com/watch?v=e4r5hT2Dsk0>

- Solve system of equations using inverse matrices

<https://www.youtube.com/watch?v=xA9LxS7UilI>

<https://www.youtube.com/watch?v=rPeYd23jwrl>

KEY VOCABULARY

Solution
System of Equations
Solve by Substitution
Solve by Graphing
Point of Intersection
Solve by Elimination
Equilibrium Point

Consistent System
Inconsistent System
Row Echelon Form
Back Substitution
Gaussian Elimination
Row Operations

| # | TOPICS (textbook reference ; # of days for instruction) | # | STUDENT LEARNING OBJECTIVES | CCSS code |
|-----------|---|----------|---|--------------------|
| V | LINEAR AND NONLINEAR SYSTEMS OF EQUATIONS (16-18 days) | | | |
| | 1.1 Types of Data. (S-IC.3) 1.2 Critical Thinking. (S-IC.3) 1.3 Design of Experiments. (S-IC.3) | 1 | Solve systems of linear and nonlinear equations using the method of substitution and graphing methods. | (S-IC.3) |
| | 9.2 (4 days) | 2 | Solve systems of linear equations in two or more variables using the substitution, elimination, and graphing methods. | (A-REI.6) |
| | 9.3 (4-5 days) | 3 | Solve linear system using back substitution in row echelon form and Gaussian Elimination. | (A-REI.5, A-REI.6) |
| | 9.5 (4-5 days) | 4 | Solve and graph systems of inequalities. | (A-REI.12) |
| | | 5 | Use systems of linear equations and inequalities to model and solve real-life problems. | (A-REI.6) |
| VI | MATRICES AND SYSTEMS OF EQUATIONS (20 – 21 days) | | | |
| | 10.1 (5 days) | 1 | Write and perform elementary row operations on matrices. | (N-VM.6) |
| | | 2 | Use matrices to solve systems of linear equations. | (A-REI.9) |
| | 10.2 (6 days) | 3 | Add, subtract, and multiply matrices. | (N-VM.7, N-VM.8) |
| | 10.3 (3 days) | 4 | Find the inverse of a matrix. | (A-REI.9) |
| | 10.4 (2-3 days) | 5 | Find the determinant of a matrix. | (N-VM.12) |
| | 10.5 (4 days) | 6 | Use matrices to solve real-life problems. | (N-VM.6) |

| Selected Opportunities for Connections to Mathematical Practices | Unit 2-Link to Illustrative Mathematics And Open Ended Problems Related to the Standards |
|---|--|
| <ol style="list-style-type: none"> 1. Make sense of problems and persevere in solving them. 2. Reason abstractly and quantitatively. 3. Construct viable arguments and critique the reasoning of others. 4. Model with mathematics. 5. Use appropriate tools strategically. 6. Attend to precision. 7. Look for and make use of structure. 8. Look for and express regularity in repeated reasoning. | <p style="text-align: center;">https://www.illustrativemathematics.org/standards/hs</p> |

| Code # | Common Core State Standards |
|------------|---|
| (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.7) | Solve a simple system consisting of a linear equation and a quadratic equation in two variables algebraically and graphically. |
| (A-REI.9) | Find the inverse of a matrix if it exists and use it to solve systems of linear equations (using technology for matrices of dimension 3×3 or greater). |
| (A-REI.12) | Graph the solutions to a linear inequality in two variables as a half-plane (excluding the boundary in the case of a strict inequality), and graph the solution set to a system of linear inequalities in two variables as the intersection of the corresponding half-planes. |
| (N-VM.6) | Use matrices to represent and manipulate data, e.g., to represent payoffs or incidence relationships in a network. |
| (N-VM.7) | Multiply matrices by scalars to produce new matrices, e.g., as when all of the payoffs in a game are doubled. Illustrations. |
| (N-VM.8) | Add, subtract, and multiply matrices of appropriate dimensions. |
| (N-VM.12) | Work with 2×2 matrices as a transformations of the plane, and interpret the absolute value of the determinant in terms of area. |

PCTI MATHEMATICS DEPARTMENT

Advanced Algebra

UNIT 4

**INTRODUCTION TO STATISTICS, DESCRIBING, EXPLORING, AND
COMPARING DATA, PROBABILITY**

| TECHNOLOGY STANDARDS | KEY VOCABULARY | |
|---|--|---|
| <p>Use a NSPIRE to:</p> <ul style="list-style-type: none"> • Create and explore dot plots, box plots, and histograms: https://www.youtube.com/watch?v=d5vnbVauemY https://www.youtube.com/watch?v=bgnlBNbdddA • Reinforcing and verifying measures of center: https://www.youtube.com/watch?v=F6zcGSY15Vw https://www.youtube.com/watch?v=DQkeXkQPAM4 | <p>Data Statistics Population Census Sample Quantitative Data Qualitative Data Discrete Data Continuous Data Nominal level of measurement Ordinal level of measurement Interval level of measurement Ration level of measurement Voluntary Response Sample Observational Study Experiment Cross-sectional Study Retrospective Study Prospective Study Confounding Random Sample Probability Sample Systematic Sampling Convenience Sampling Stratified Sampling Cluster Sampling Sampling error Non-sampling error</p> | <p>Frequency Distribution Lower/Upper class limits Class boundaries Class midpoints Class width Histogram Measure of center Mean, median, mode, midrange Distribution (skewed/symmetric) Standard deviation Variance Coefficient of variation Z-score Outlier 5 number summary Box plot Law of Large Numbers Complement Odds (against, in-favor, payoff) Sample Space Simple & Compound Event Addition Rule Disjoint Multiplication Rule Conditional Probabilities Simulations Counting</p> |

| # | TOPICS (textbook reference ; # of days for instruction) | # | STUDENT LEARNING OBJECTIVES | CCSS code |
|-------------|--|----------|--|------------------------------|
| VII | INTRODUCTION TO STATISTICS (10-11 days) | | | |
| | 1.2 (3 day) | 1 | Types of Data. | (S-IC.3) |
| | 1.3 (3-4 days) | 2 | Critical Thinking | (S-IC.3) |
| | 1.4 (4 days) | 3 | Design of Experiments. | (S-IC.3) |
| VIII | SUMMARIZING AND GRAPHING DATA (9 days) | | | |
| | 2.2 (3 days) | 1 | Frequency Distributions. | (S.ID.1, S.ID.5) |
| | 2.3 – 2.4 (6 days) | 2 | Visualizing Data. | (S-ID1, S-ID2) |
| IX | DESCRIBING, EXPLORING, AND COMPARING DATA (13-15 days) | | | |
| | 3.2 (4 days) | 3 | Measures of Center. | (S-ID2, S-ID3) |
| | 3.3 (5 days) | 4 | Measures of Variation. | (S-ID2, S-ID3) |
| | 3.4 (2-3 days) | 5 | Measures of Relative Standing. | (S-ID4) |
| | 3.5 (2-3 days) | 6 | Exploratory Data Analysis. | (S-ID6) |
| | | | | |
| X | PROBABILITY (Time Permitting) (16-18 days) | | | |
| | 4.2 (4-5 day) | 1 | <i>Fundamentals.</i> | <i>(S-CP1, S-MD6, S-MD5)</i> |
| | 4.3 (3 day) | 2 | <i>Addition Rule. (S-CP1, S-CP7, S-MD4)</i> | <i>(S-CP1, S-CP7, S-MD4)</i> |
| | 4.4 (3 day) | 3 | <i>Multiplication Rule: Basics</i> | <i>(S-CP2, S-CP6)</i> |
| | 4.5 (2 day) | 4 | <i>Multiplication Rule: Complements and Conditional Probability.</i> | <i>(S-CP3, S-CP6, S-CP8)</i> |
| | 4.6 (1-2 day) | 5 | <i>Probabilities through Simulations.</i> | <i>(S-CP4, S-CP5)</i> |
| | 4.7 (3 day) | 6 | <i>Counting</i> | <i>(S-CP9)</i> |
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| Selected Opportunities for Connections to Mathematical Practices | Unit 2-Link to Illustrative Mathematics And Open Ended Problems Related to the Standards |
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| <ol style="list-style-type: none"> 1. Make sense of problems and persevere in solving them. 2. Reason abstractly and quantitatively. 3. Construct viable arguments and critique the reasoning of others. 4. Model with mathematics. 5. Use appropriate tools strategically. 6. Attend to precision. 7. Look for and make use of structure. 8. Look for and express regularity in repeated reasoning. | <p style="text-align: center;">https://www.illustrativemathematics.org/standards/hs</p> |

| Code # | Common Core State Standards |
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| (S-CP1) | Describe events as subsets of a sample space (the set of outcomes) using characteristics (or categories) of the outcomes, or as unions, intersections, or complements of other events (“or,” “and,” “not”). |
| (S-CP2) | Understand that two events A and B are independent if the probability of A and B occurring together is the product of their probabilities, and use this characterization to determine if they are independent. |
| (S-CP3) | Understand the conditional probability of A given B as $P(A \text{ and } B)/P(B)$, and interpret independence of A and B as saying that the conditional probability of A given B is the same as the probability of A, and the conditional probability of B given A is the same as the probability of B. |
| (S-CP4) | Construct and interpret two-way frequency tables of data when two categories are associated with each object being classified. Use the two-way table as a sample space to decide if events are independent and to approximate conditional probabilities. |
| (S-CP5) | Recognize and explain the concepts of conditional probability and independence in everyday language and everyday situations. |
| (S-CP6) | Find the conditional probability of A given B as the fraction of B's outcomes that also belong to A, and interpret the answer in terms of the model. |
| (S-CP7) | Apply the Addition Rule, $P(A \text{ or } B)=P(A)+P(B)-P(A \text{ and } B)$, and interpret the answer in terms of the model. |
| (S-CP8) | Apply the general Multiplication Rule in a uniform probability model, $P(A \text{ and } B)=P(A)P(B A)=P(B)P(A B)$, and interpret the |

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| | answer in terms of the model. |
| (S-CP9) | Use permutations and combinations to compute probabilities of compound events and solve problems. |
| (S-IC.3) | Recognize the purposes of and differences among sample surveys, experiments, and observational studies; explain how randomization relates to each. |
| (S-ID1) | Represent data with plots on the real number line (dot plots, histograms, and box plots). |
| (S-ID2) | Use statistics appropriate to the shape of the data distribution to compare center (median, mean) and spread (interquartile range, standard deviation) of two or more different data sets. |
| (S-ID3) | Interpret differences in shape, center, and spread in the context of the data sets, accounting for possible effects of extreme data points (outliers). |
| (S-ID4) | Use the mean and standard deviation of a data set to fit it to a normal distribution and to estimate population percentages. Recognize that there are data sets for which such a procedure is not appropriate. Use calculators, spreadsheets, and tables to estimate areas under the normal curve |
| (S-ID.5) | Summarize categorical data for two categories in two-way frequency tables. Interpret relative frequencies in the context of the data (including joint, marginal, and conditional relative frequencies). Recognize possible associations and trends in the data. |
| (S-ID6) | Represent data on two quantitative variables on a scatter plot, and describe how the variables are related. |
| (S-MD4) | Develop a probability distribution for a random variable defined for a sample space in which probabilities are assigned empirically; find the expected value. |
| (S-MD5) | Weigh the possible outcomes of a decision by assigning probabilities to payoff values and finding expected values. |
| (S-MD6) | Use probabilities to make fair decisions (e.g., drawing by lots, using a random number generator). |