A2 Algebra II

Number and Quantity

The Complex Number System N-CN

Perform arithmetic operations with complex numbers.

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.
2. Use the relation $i^2 = -1$ and the commutative, associative, and distributive properties to add, subtract, and multiply complex numbers.

Use complex numbers in polynomial identities and equations. [Polynomials with real coefficients.]

7. Solve quadratic equations with real coefficients that have complex solutions.
8. (+) Extend polynomial identities to the complex numbers. For example, rewrite $x^2 + 4$ as $(x + 2i)(x - 2i)$.
9. (+) Know the Fundamental Theorem of Algebra; show that it is true for quadratic polynomials.

Algebra

Seeing Structure in Expressions A-SSE

Interpret the structure of expressions. [Polynomial and rational.]

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. For example, interpret $P(1 + r)^n$ as the product of P and a factor not depending on P.★
2. Use the structure of an expression to identify ways to rewrite it.

Write expressions in equivalent forms to solve problems.

4. Derive the formula for the sum of a finite geometric series (when the common ratio is not 1), and use the formula to solve problems. For example, calculate mortgage payments. ★

Arithmetic with Polynomials and Rational Expressions A-APR

Perform arithmetic operations on polynomials. [Beyond quadratic.]

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.

Understand the relationship between zeros and factors of polynomials.

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).
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.

Use polynomial identities to solve problems.

4. Prove polynomial identities and use them to describe numerical relationships. For example, the polynomial identity $(x^2 + y^2)^2 = (x^2 - y^2)^2 + (2xy)^2$ can be used to generate Pythagorean triples.

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5. (+) Know and apply the Binomial Theorem for the expansion of $(x + y)^n$ in powers of x and y for a positive integer n, where x and y are any numbers, with coefficients determined for example by Pascal's Triangle.[1]

Rewrite rational expressions. [Linear and quadratic denominators.]

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.
7. (+) Understand that rational expressions form a system analogous to the rational numbers, closed under addition, subtraction, multiplication, and division by a nonzero rational expression; add, subtract, multiply, and divide rational expressions.

Creating Equations A-CED

Create equations that describe numbers or relationships. [Equations using all available types of expressions, including simple root functions.]

1. Create equations and inequalities in one variable **including ones with absolute value** and use them to solve problems. Include equations arising from linear and quadratic functions, and simple rational and exponential functions. **CA** ★
2. Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales. ★
3. Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable or non-viable options in a modeling context.
4. Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations.★

Reasoning with Equations and Inequalities A-REI

Understand solving equations as a process of reasoning and explain the reasoning. [Simple radical and rational.]

1. Solve simple rational and radical equations in one variable, and give examples showing how extraneous solutions may arise.

Solve equations and inequalities in one variable.

3.1 Solve one-variable equations and inequalities involving absolute value, graphing the solutions and interpreting them in context. CA

Represent and solve equations and inequalities graphically. [Combine polynomial, rational, radical, absolute value, and exponential functions.]

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, polynomial, rational, absolute value, exponential, and logarithmic functions. ★

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[1] The Binomial Theorem can be proved by mathematical induction or by a combinatorial argument.

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Functions

Interpreting Functions F-IF

Interpret functions that arise in applications in terms of the context. [Emphasize selection of appropriate models.]

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; end behavior; and periodicity. ★
5. Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes.★
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. ★

Analyze functions using different representations. [Focus on using key features to guide selection of appropriate type of model function.]

7. Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases. ★
   b. Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions. ★
   c. Graph polynomial functions, identifying zeros when suitable factorizations are available, and showing end behavior. ★
   e. Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude. ★
8. Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function.
9. Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions).

Building Functions F-BF

Build a function that models a relationship between two quantities. [Include all types of functions studied.]

1. Write a function that describes a relationship between two quantities.★
   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.★

Build new functions from existing functions. [Include simple radical, rational, and exponential functions; emphasize common effect of each transformation across function types.]

3. Identify the effect on the graph of replacing f(x) by f(x) + k, kf(x), f(kx), and f(x + k) for specific values of k (both positive and negative); find the value of k given the graphs. Experiment with cases and illustrate an explanation of the effects on the graph using technology. Include recognizing even and odd functions from their graphs and algebraic expressions for them.
4. Find inverse functions.
   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. For example, $f(x) = 2x^3$ or $f(x) = (x + 1)/(x - 1)$ for $x \neq 1$.

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Linear, Quadratic, and Exponential Models F-LE

Construct and compare linear, quadratic, and exponential models and solve problems.

4. For exponential models, express as a logarithm the solution to $ab^{ct} = d$ where a, c, and d are numbers and the base b is 2, 10, or e; evaluate the logarithm using technology. ★ [Logarithms as solutions for exponentials.]

4.1 Prove simple laws of logarithms. CA ★

4.2 Use the definition of logarithms to translate between logarithms in any base. CA ★

4.3 Understand and use the properties of logarithms to simplify logarithmic numeric expressions and to identify their approximate values. CA ★

Trigonometric Functions F-TF

Extend the domain of trigonometric functions using the unit circle.

1. Understand radian measure of an angle as the length of the arc on the unit circle subtended by the angle.
2. Explain how the unit circle in the coordinate plane enables the extension of trigonometric functions to all real numbers, interpreted as radian measures of angles traversed counterclockwise around the unit circle.

2.1 Graph all 6 basic trigonometric functions. CA

Model periodic phenomena with trigonometric functions.

5. Choose trigonometric functions to model periodic phenomena with specified amplitude, frequency, and midline. ★

Prove and apply trigonometric identities.

8. Prove the Pythagorean identity $\sin^2(\theta) + \cos^2(\theta) = 1$ and use it to find sin(θ), cos(θ), or tan(θ) given sin(θ), cos(θ), or tan(θ) and the quadrant.

Geometry

Expressing Geometric Properties with Equations G-GPE

Translate between the geometric description and the equation for a conic section.

3.1 Given a quadratic equation of the form $ax^2 + by^2 + cx + dy + e = 0$, use the method for completing the square to put the equation into standard form; identify whether the graph of the equation is a circle, ellipse, parabola, or hyperbola, and graph the equation. [In Algebra II, this standard addresses circles and parabolas only.] **CA**

Statistics and Probability

Interpreting Categorical and Quantitative Data S-ID

Summarize, represent, and interpret data on a single count or measurement variable.

4. 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. ★

A2 Algebra II

Making Inferences and Justifying Conclusions S-IC

Understand and evaluate random processes underlying statistical experiments.

1. Understand statistics as a process for making inferences to be made about population parameters based on a random sample from that population. ★
2. Decide if a specified model is consistent with results from a given data-generating process, e.g., using simulation. For example, a model says a spinning coin falls heads up with probability 0.5. Would a result of 5 tails in a row cause you to question the model? ★

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

3. Recognize the purposes of and differences among sample surveys, experiments, and observational studies; explain how randomization relates to each. ★
4. Use data from a sample survey to estimate a population mean or proportion; develop a margin of error through the use of simulation models for random sampling. ★
5. Use data from a randomized experiment to compare two treatments; use simulations to decide if differences between parameters are significant. ★
6. Evaluate reports based on data. ★

Using Probability to Make Decisions S-MD

Use probability to evaluate outcomes of decisions. [Include more complex situations.]

6. (+) Use probabilities to make fair decisions (e.g., drawing by lots, using a random number generator). ★
7. (+) Analyze decisions and strategies using probability concepts (e.g., product testing, medical testing, pulling a hockey goalie at the end of a game). ★

Expected School-wide Learning Results

Productive Individuals who

- think critically and creatively
- collaborate and work well with others
- are self-motivated independent learners
- pursue goals with persistence and resilience

People preparing for their future who

- master and adapt to new technologies
- plan for their post-secondary career and education
- understand the importance of physical well-being

Effective Communicators who

- master a useful and dynamic vocabulary
- convey thoughts clearly both orally, and in writing
- understand and evaluate the ideas of others

People of Integrity who

- demonstrate loyalty, responsibility, and honesty
- respect others and treat them with compassion
- serve their community and their world

Knowledgeable Individuals who

- master the California Content Standards in math, language, literature, science, world languages, the arts and technology, health, and physical education
- demonstrate skillful application of this knowledge in their daily lives

Thousand Oaks High School

Design by Janine Sobers '12

INTERACTIVE NOTEBOOK

What is an interactive notebook?

Your interactive notebook will contain all your warm-ups, notes, assignments, and projects. All class work and homework will be done in this notebook. I see your notebook as an extension and reflection of you and your learning, so your best effort should go into creating a great notebook. Represent yourself well. This notebook counts for a portion of your grade, so your work should be done correctly with attention to appearance as well as content.

What is the purpose of the interactive notebook?

Your notebook will help to keep you organized. It will be your study guide, your journal, and your best friend in this class. At the end of the semester/year, your notebook will reflect what you did, what you thought, what you felt, and what you learned in this math class.

What are the requirements for the interactive notebook?

- It should be a spiral notebook, containing 120 pages or more. You can have a 1/2-inch binder to keep any loose-leaf lined paper you work on or collect in class, but all work must be put into your interactive notebook.
- You will also need the following materials: highlighters, glue sticks OR tape

Anything else I should know about the interactive notebook?

- This notebook is only for this class. I will remove notes or assignments from other classes.
- Your notebook will be needed everyday; do not forget it or lose it.
- I will collect your notebooks at the end of each chapter for grading. However, homework assignments will be collected everyday. It is your responsibility to retrieve your graded homework from the in/out folder for your class and place it in your interactive notebook.

How can I make sure that I get an A on my interactive notebook?

- Every page must be numbered in the correct order and contain a title and date.
- All handouts or other papers should be glued or taped neatly onto the correct page. The notebook should contain no staples and no loose papers.
- All work and overall appearance of the notebook should display maximum effort.

Pride in your work should be evident!

Left Page = Input	Right Page = Output
The left side in your spiral notebook is for writing information you are given. This is the side you use for: - notes/handouts from the teacher - vocabulary words - graphic organizers filled out in class Make sure **all** your work is numbered, titled, and dated.	The right side of your spiral notebook is for you to show you understand the information you wrote on the left side. This side may have: - homework - graphs - reflections - foldables Make sure **all** your work is numbered, titled, and dated.

THE CORNELL NOTE-TAKING SYSTEM

What are the advantages?

Three Advantages

1. It is a method for mastering information--not just recording facts.
2. It is efficient.
3. Each step prepares the way for the next part of the learning process.

How should notes be recorded?

During class, record notes:

1. Record notes, skipping lines to separate information logically.
2. Strive to get main ideas down. Facts, details, and examples are important, but they're meaningful only with concepts.
3. Use abbreviations for extra writing and listening time.
4. Use graphic organizers or pictures when they are helpful.

How should notes be refined?

After class, refine notes:

1. Write questions in the left about the information on the right.
2. Check or correct incomplete items.
3. Read the notes and underline key words and phrases.
4. Read underlined words and write in recall cues in the left-hand column (key words and very brief phrases that will trigger ideas/facts on the right). These are in addition to the questions.
5. Write a reflective paragraph about the notes.
6. If possible, compare notes with a study buddy.

What are the ways to recite notes?

Recite notes three ways:

1. Cover up right side page. Read the questions. Recite information as fully as possible. Uncover the sheet and verify information frequently (single, most powerful learning tool!)
2. **Reflect** on the organization of all the lectures. Overlap notes and read recall cues. Study the progression of the information. This will stimulate categories, relationships, inferences, personal opinions/experiences. Record all of these insights! **REFLECTION - KEY TO MEMORY!!!**
3. **Review** by reciting, reflecting, and reading insights.

What are the five steps of this system?

This system in brief:

1. Record lectures in the main column
2. Refine lectures with questions, corrections, underlining, recall cues, graphics and pictures
3. Recite by covering main column and expanding on recall cues--then verify
4. Reflect on organization by studying all cues
5. Review by repeating recite and reflect steps

Summary:

The Cornell System is an efficient way to take notes. There are five steps: record, refine, recite, reflect, and review.

Chapter _____: ____

Name ____ Period __________

#	Date	Section & Topic/Activity	Page

Chapter _____: _____

Name _____ Period _____

#	Date	Assignment	Page	Score

Date	Test/Project	Score