# Basic Concepts List

## for All Available Subjects

### Math
- Elementary Math
- Algebra II
- Pre-Calculus
- Discrete Math
- Intermediate Statistics
- Mid-level Math
- Geometry
- Calculus
- Finite Math
- Algebra
- Trigonometry
- Calculus BC
- Statistics

### Science
- Elementary Science
- Earth Science
- Physics – Algebra Based
- Nursing
- Biology
- Anatomy & Physiology
- Physics – Calculus Based
- Chemistry
- Organic Chemistry
- Microbiology

### Humanities
- Social Studies
- College Essay Writing
- Symbolic Logic
- English
- Reading
- Essay Writing
- ESL

### Social Sciences
- Psychology
- Research Methods

### Business
- Introductory Accounting
- Intermediate Accounting
- Business Management
- Introductory Economics
- Intermediate Economics
- Finance
- Business Law

### Technology
- MS Excel
- Intro Computer Science
- MS Word
- MS PowerPoint

### Foreign Languages
- French
- German
- Italian
Elementary (Grades 4-6)

**Algebraic Skills**
- Equations
- Functions
- Patterns

**Geometry**
- Composite and Real World Shapes
- Coordinates
- Lines and Angles
- Perimeter, Area, Volume
- Position and Direction
- Similar, Congruent, Symmetric Shapes
- Sorting and Classifying
- Three Dimensional Shapes
- Transformations
- Two Dimensional Shapes

**Measurement**
- Converting Units and Measurements
- Estimates
- Measuring
- Time
- Units and Tools

**Numbers**
- Coins, Bills, and Collections of Money
- Counting
- Decimals - Read, Write, Place Value, Compare
- Equivalent Numbers - Decimals and Fractions
- Fractions - Compare and Order
- Fractions - Read, Write, Model
- Integers
- Ordinal Numbers
- Whole Number - Place Value
- Whole Numbers - Compare and Order
- Whole Numbers - Read, Write, Characteristics

**Operations and Number Relationships**
- Decimals - Operations
- Estimation
- Fractions - Operations
- Number Properties
- Number Theory: Factors, Multiples, Primes, Divisibility
- Order of Operations
- Ratios, Rates, Proportions, Percents, Squares and Roots
- Solving Real World Problems with Operations
- Understanding Addition, Subtractions, Multiplication, and Division
- Whole Number Addition and Subtraction
- Whole Number Multiplication and Division

**Statistics and Probability**
- Collect and Organize Data
- Measures and Descriptions of Data
- Probability
- Read and Interpret Data
Mid-Level (Grades 7-8)

**Algebra, Patterns and Relationships**
- Algebraic Expressions
- Formulas
- Functions
- Graphing Relationships
- Inequalities
- Linear Relationships
- Number and Geometric Patterns
- Solving Equations
- Systems of Equations
- Variables and Substitution
- Represent and Analyze Quantitative Relationships between Dependent and Independent Variables
- Use Properties of Operations to Generate Equivalent Expressions
- Work with Radicals and Integer Exponents
- Understand the Connections between Proportional Relationships, Lines and Linear Equations
- Analyze and Solve Linear Equations and Pairs of Simultaneous Linear Equations
- Define, Evaluate and Compare Functions
- Use Functions to Model Relationships between Quantities

**Data and Graphs**
- Experiments and Data Collection
- Infer, Predict, Evaluate, Compare Data
- Measures of Central Tendency and Variation
- Represent, Read, Interpret Data Displays

**Geometry**
- Circles and Pi
- Classify Two- and Three-Dimensional Figures
- Coordinate Plane
- Drawing, Modeling, and Constructing Figures and Describe the Relationships between them
- Formulas for Perimeter, Area, Surface Area, Volume
- Logic and Reasoning
- Points, Lines, and Planes
- Properties of Two-Dimensional Figures
- Understand and Apply the Pythagorean Theorem
- Similarity, Congruence, and Symmetry
- Transformations

**Measurement**
- Estimate and Measure
- Measurement Systems
- Measurement Tools
- Rates, Indirect Measurements, Proportion

**Numbers**
- Compare and Order Numbers
- Equivalent Forms of Rational Numbers
- Estimation and Rounding
- Exponents and Roots
- Number Properties
- Number Theory Concepts
- Operations to Solve Problems
- Operations with Integers and Absolute Value
Operations with Real Numbers
Order of Operations
Percents
Ratios, Rates, Proportions
Understand Ratio Concepts and Use Ratio Reasoning to Solve Problems
Real Number System

**Probability**
Develop Understanding of Statistical Variability
Summarize and Describe Distributions
Sample Space, Combinations, Permutations
Theoretical and Experimental Probability
Use Random Sampling to Draw Inferences about a Population
Draw Informal Comparative Inferences about Two Populations
Investigate Chance Processes and Develop, Use, and Evaluate Probability Models
Understand Patterns of Association in Bivariate Data
Algebra

Absolute Value Equations and Inequalities
- Graphing Absolute Value Equations and Inequalities
- Solving Absolute Value Equations and Inequalities

Algebraic Expressions
- Add, Subtract Expressions
- Multiply, Divide, Factor Expressions including Exponents
- Variables and Expressions

Linear Equations and Inequalities
- Slope, Intercepts, Points on a Line
- Solving Linear Equations
- Solving Linear Inequalities
- Solving Problems with Equations and Inequalities
- Systems of Equations and Inequalities
- Writing and Graphing Linear Equations
- Writing and Graphing Linear Inequalities

Numbers
- Exponents and Roots
- Number Properties
- Number Theory Concepts
- Operations with Real Numbers
- Ratios, Proportions, Percents and Rates

Patterns and Functions
- Composition and Operations on Functions
- Graphing Functions and Transformations
- Inverse of Function
- Patterns
- Properties of Functions - Domain and Range
- Properties of Functions - Zeros, End Behavior, Turning Points
- Relations and Functions
- Solving Problems with Functions
- Translate Between Forms

Probability
- Counting Principles and Sample Spaces
- Theoretical and Experimental Probability

Quadratic Equations, Inequalities, and Functions
- Factoring Quadratic Equations
- Graphing and Properties of Quadratic Equations
- Solving Quadratic Equations and Inequalities
- Systems of Nonlinear Equations and Inequalities

Radical, Exponential and Logarithmic Equations and Functions
- Graphing Exponential and Logarithmic Functions
- Properties of Exponents and Logarithms
- Radical Expressions, Equations and Rational Exponents
- Solving Exponential and Logarithmic Equations and Inequalities
- Solving Problems with Exponential and Logarithmic Functions

Statistics
- Data Analysis – Data Collection – Data Displays – Measures of Data
Geometry

**Measurement**
- Formulas and Measurement
- Indirect Measurements, Ratios, and Rates
- Units, Unit Conversions, and Error

**Points, Lines, Angles, Planes**
- Angle Relationships and Problems
- Coordinate Geometry - Slope, Distance, Midpoint
- Geometric Constructions

**Proofs and Logic**
- Conditional Statements
- Conjectures, Axioms, Theorems, Proofs
- Inductive and Deductive Reasoning

**Two- and Three- Dimensional Shapes**
- Congruency
- Relationship Between Plane and Solid Figures
- Right Triangles, Including Pythagorean Theorem
- Similarity
- Symmetry and Transformations
- Theorems and Problems with Circles
- Theorems and Problems with Polygons
- Theorems and Problems with Quadrilaterals
- Theorems and Problems with Triangles
- Three-Dimensional Figures
- Trigonometric Ratios in Right Triangles
Algebra II

Absolute Value Equations and Inequalities
- Graphing Absolute Value Equations and Inequalities
- Solving Absolute Value Equations and Inequalities

Conic Sections
- Properties of Conic Sections
- Solving Problems with Conic Sections

Linear Functions, Equations, and Inequalities
- Slope, Intercepts, Points on a Line
- Solving Linear Equations
- Solving Linear Inequalities
- Solving Problems with Equations and Inequalities
- Systems of Equations and Inequalities
- Writing and Graphing Linear Equations
- Writing and Graphing Linear Inequalities

Matrices
- Matrices Operations and Problems

Numbers
- Complex Numbers
- Number Properties
- Operations with Real Numbers

Patterns and Functions
- Composition and Operations on Functions
- Graphing Functions and Transformations
- Inverse of Function
- Patterns
- Properties of Functions - Domain and Range
- Properties of Functions - Zeros, End Behavior, Turning Points
- Relations and Functions
- Solving Problems with Functions
- Translate Between Forms

Polynomial, Rational Expressions, Equations and Functions
- Solving and Graphing Polynomial Equations
- Solving and Graphing Rational Equations

Probability
- Counting Principles and Sample Spaces
- Theoretical and Experimental Probability

Quadratic Equations, Inequalities, and Functions
- Complex Solutions to Quadratic Equations
- Factoring Quadratic Equations
- Graphing and Properties of Quadratic Equations
- Solving Quadratic Equations and Inequalities
- Systems of Nonlinear Equations and Inequalities

Radical, Exponential and Logarithmic Equations and Functions
- Graphing Exponential and Logarithmic Functions
- Properties of Exponents and Logarithms
- Radical Expressions, Equations and Rational Exponents
- Solving Exponential and Logarithmic Equations and inequalities
- Solving Problems with Exponential and Logarithmic Functions

Sequences and Series
Properties of Sequences and Series
Solving Problems with Sequences and Series

Statistics
Data Analysis
Data Collection
Data Displays
Measures of Data
**Trigonometry**

**Complex Numbers**
- Polar Coordinates, DeMoivre’s Theorem
- Trigonometric Form
- Complex Number

**Introduction to Trigonometry: Linear Relationships and Functions**
- Introduction to Trigonometry
- Introduction to Trigonometry: Linear Relationships and Functions
- Relations, Functions, and Graphs
- Defining and Finding Trigonometric Functions
- Slope, Linear Relations, Scatter Plots, and Piecewise Functions
- Introduction to Trigonometry: Linear Relationships and Functions Unit Review

**Trigonometric Ratios**
- Trigonometric Ratios
- Angles and Angle Measures
- Measuring angles using radian and degree measures
- Right Triangles and Trigonometric Ratios
- The Unit Circle
- Trigonometric Ratios Unit Review

**Graphing Trigonometric Functions**
- Introduction to Graphing Trigonometric Functions
- Graphing Trigonometric and Inverse Functions
- Inverse Trigonometric Functions
- Transformations of Trigonometric Functions
- Real-world Applications of Trigonometric Functions
- Vectors
- Graphing Trigonometric Functions Unit Review

**Trigonometric Laws and Identities**
- Trigonometric Laws and Identities
- Law of Sines and Law of Cosines
- Trigonometric Identities and Equations
- Area of Triangles
- Angular and Linear Velocities
- Trigonometric Laws and Identities Unit Review
- Modeling Periodic Phenomenon

**Vectors**
- Graphing and Operations with Vectors
- Solving problems with Vectors
Calculus

Limits of functions (including one-sided limits)
- Calculate limits using algebra
- Estimating limits from graphs or tables
- Limits proofs for linear functions
- Vertical asymptotes and infinite limits
- Horizontal asymptotes and limits to infinity
- L'Hospital's Rule

Continuity
- Understanding continuity in terms of limits
- Types of discontinuity (infinite, jump, removable)
- Determining continuity from a graph or rule for a function
- Intermediate Value Theorem

Derivatives
- Compute derivatives of functions: power, exponential, logarithmic, trigonometric, inverse trig
- Apply Product Rule, Quotient Rule, Chain Rule, etc.
- Understand the first and second derivative graphically
- Approximate derivative from graph or tables
- Interpretation of the derivative as a rate of change (limit of an average rate of change)
- Relationship between differentiability and continuity
- Tangent line to curve
- Linear approximation and differentials
- Relationship between increasing and decreasing behavior and the sign of the derivative
- Mean Value Theorem
- Relationship between concavity and the sign of the second derivative
- Inflection Points
- Optimization Problems
- Related Rates Problems
- Implicit differentiation
- Antiderivatives and initial value problems
- Particle motion (position, velocity, acceleration)
- Slope fields and solution curves for differential equations

Integrals
- Riemann sums
- Basic properties of definite integrals
- Applications of integrals (including areas, arc length, volumes for solids of revolution)
- Fundamental Theorem of Calculus, Parts I and II
- Definite and indefinite integrals of basic functions
- Techniques of Integration (Substitution, Parts, Partial Fractions, Trigonometric Substitution)
- Improper Integrals
- Numerical Approximation of Integrals
- Separable differential equations

Parametric and Polar Curves
- Graphs, derivatives, areas, arc length

Series and Sequences
- Sequence convergence
- Partial Sums and the definition of series convergence
- Geometric Series and their sums
- Tests for series convergence
- Test for divergence (nth term test)
- Integral test and p-Series
Alternating series
Comparison test and limit comparison test
Ratio and Root Test
Power series, radius and interval of convergence
Maclaurin and Taylor series

In addition, the concepts below are frequently seen by students in pre-Calculus courses and ones that all Calculus tutors are expected to know and be able to assist students with:

- Circle, ellipse, hyperbola, and parabola
- Perform translations for various conic sections
- Arithmetic and Geometric sequences
- Trigonometric Ratios and Identities
- Trigonometric graphs
- Law of Cosines and Law of Sines
- Functions and Graphs (Linear and Polynomial)
- Exponential and Logarithmic Functions
Calculus BC

Calculus Basics
- Combining Functions
- Patterns in Graphs

Limits and Continuity
- Finding Limits Analytically
- Asymptotes as Limits
- Relative Magnitudes for Limits
- When Limits Do and Don’t Exist
- Continuity
- Intermediate and Extreme Value Theorems

Derivatives
- Slope and Change
- Derivatives at a Point
- The Derivative
- The Power Rule
- Sums, Differences, Products and Quotients
- Graphs of Functions and Derivatives
- Continuity and Differentiability
- Rolles and Mean Value Theorems
- Higher Order Derivatives
- Concavity
- Chain Rule
- Implicit Differentiation

Rates of Change
- Extrema
- Optimization
- Tangent and Normal Lines
- Tangents to Polar Curves
- Tangent Line Approximation
- Rates and Derivatives
- Rectilinear Motion
- Motion with Vector Functions

Integrals
- Riemann’s Sums
- Area Approximations
- The Definite Integral
- Properties of Integrals
- Graphing Calculator Integration
- Application of Accumulated Change
- The Fundamental Theorem of Calculus
- Definite Integrals of Composite Functions
- Analyzing Functions and Integrals
- Area Between Curves
- Volumes of Revolution
- Cross Sections
- Arc Length

Inverse and Transcendental Functions
- Derivatives of Inverses
- Inverse Trigonometric Functions
- Logarithmic and Exponential Review
Transcendentals and 1/x
Derivatives of Logarithms and Exponentials
L'Hopital's Rule
Analysis of Transcendental Curves
Integrating Transcendental Functions
Partial Fractions
Integration by Parts
Improper Integrals
Application of Transcendental Integrals
Derivatives of Parametric Functions
Integrating Parametric and Polar Functions

**Separable Differential Equations and Slope Field**
- Slope Fields
- Differential Equations and Models
- Euler's Method
- Exponential Growth
- Application of Differential Equations

**Sequences and Series**
- Sequences
- Series
- Convergence Tests
- Radius of Convergence
- Functions Defined by Power Series
- Taylor and Maclaurin Series
- Taylor's Theorem and Lagrange Error
Pre-Calculus

Functions
Know and use a definition of a function
Write a function that describes a relationship between two quantities
Perform algebraic operations on functions and apply transformations
Write an expression for the composition of one given function with another and find the domain, range, and graph of the composite function
Determine whether a function has an inverse and express the inverse, if it exist
Know and interpret the function notation for inverses
Identify and describe the discontinuities of a function and how these relate to the graph
Understand the concept of limit of a function as x approaches a number or infinity
Analyze a graph as it approaches an asymptote
Computer limits of simple functions
Explain how rates of change of functions in different families differ

Exponents and Logarithms
Use the inverse relationship between exponential and logarithmic functions to solve equations and problems
Graph logarithmic functions
Graph translations and reflections of functions
Compare the large-scale behavior of exponential and logarithmic functions with different bases and recognize that different growth rates are visible in the graphs of the functions
Solve exponential and logarithmic equations
Find an exponential or logarithmic function to model a given set of data or situation
Solve problems involving exponential growth and decay

Quadratic Functions
Solve quadratic type equations by substitution
Apply quadratic functions and their graphs in the context of motion under gravity and simple optimization problems
Find a quadratic function to model a given set of data or situation

Polynomials
Given a polynomial function, find the intervals on which the function's values are positive and those where it is negative
Solve polynomial equations and inequalities of degree of three or higher
Graph polynomial functions given in factored form using zeros and their multiplicities, testing the sign on intervals and analyzing the function's large scale behavior
The Remainder Theorem
The Factor Theorem
Fundamental Theorem of Algebra

Rational Functions and Difference Quotients
Solve equations and inequalities involving rational functions
Graph rational functions; identify asymptotes, analyzing their behavior for large x values and testing intervals
Given vertical and horizontal asymptotes, find an expression for a rational function
Know and apply the definition and geometric interpretation of difference quotient
Simplify difference quotients
Interpret difference quotients as rates of change and slopes of secants lines

Trigonometric Functions
Define and graph and use all trigonometric functions of any angle
Convert between radian and degree measure
Calculate arc lengths in given circles
Graph transformations of the sine and cosine functions
Explain the relationship between constants in the formula and transformed graph
Know basic properties of the inverse trigonometric functions, including their domains and ranges. Recognize their graphs
Know the basic trigonometric identities for sine, cosine, and tangent
Pythagorean identities
Sum and difference formulas
Co-functions relationships
Double-angle and half angle formulas
Solve trigonometric equations using basic identities and inverse trigonometric functions
Prove and derive trigonometric identities
Find a sinusoidal function to model a given set of data or situation

**Vectors, Matrices and Systems of Equations**
Perform operations on vectors in the plan
Solve applied problems using vectors
Know and apply the algebraic and geometric definitions of the dot product of vectors
Know the definitions of matrix addition and multiplication
Add, subtract and multiply matrices
Multiply a vector by a matrix
Represent rotations of the plane as matrices and apply to find the equations of rotated conics
Define the inverse of a matrix and computer the inverse of two-by-two and three-by-three matrices
Computer determinants of two-by-two and three-by-three matrices
Write systems of two and three linear equations in matrix form
Solve systems using Gaussian elimination or inverse matrices
Represent and solve inequalities in two variables
Linear programming

**Sequence, Series and Mathematical Induction**
Know, explain and use sigma and factorial notation
Write an expression for the nth term
Write a particular term of a sequence when given the nth term
Understand, explain and use the formulas for the sums of finite arithmetic and geometric sequences
Compute the sums of infinite geometric series
Understand and apply the convergence criterion for geometric series
The principle of mathematical induction
Pascal’s triangle
Binomial theorem

**Polar Coordinates, Parameterizations, and Conic Sections**
Convert between polar and rectangular coordinates
Graph functions given in polar coordinates
Write complex numbers in polar form
De Moivre’s theorem
Evaluate parametric equations for given values of the parameter
Convert between parametric and rectangular forms of equations
Graph curves described by parametric equations
Use parametric equations in applied contexts to model situations
Identify parabolas, ellipses and hyperbolas from equations
Write the equation in standard form and graph parabolas, ellipses and hyperbolas
Derive the equation for a conic section from given geometric information
Identify key characteristics of a conic section from its equation or graph
Identify conic sections whose equations are in polar or parametric form

**Modeling Mathematics**
Construct a tangent from a point outside a given circle to a circle
Cavalieri’s principle
Identify the shapes of two dimensional cross sections of three dimensional objects
Identify three dimensional objects generated by rotations of two-dimensional objects
Statistics

Analyze Data
- Confidence Intervals
- Correlation
- Expected Values and Probability Distributions
- Hypothesis Testing
- Infer and Predict
- Regression
- Sample Distributions and Central Limit Theorem

Collect Data
- Experiments and Data Collection
- Sampling

Probability
- Computing Probability
- Counting - Combinations and Permutations

Summarize Data
- Data Distribution
- Display Data
- Measures of Data
- Read, Interpret, Classify Data
Intermediate Statistics

Describing Data
- Numerical summary measures
- The effect of changing units on summary measures
- Tabular and graphical methods (dotplots, stemplots, boxplots)
- Comparing distributions (back to back stemplots, parallel boxplots)
- Comparing center and spread: within group, between group variation
- Comparing shapes
- Comparing outliers and other unusual features (clusters, gaps)

Probability
- Interpreting probability, including long run relative frequency interpretation
- "Law of Large Numbers" concept
- Addition rule, multiplication rule, conditional probability and independence
- Discrete random variables and their probability distributions, including binomial and geometric
- Mean (expected value) and standard deviation of a random variable
- Linear transformation of a random variable
- Combining independent random variables
- Notion of independence versus dependence
- Mean and standard deviation for sums and differences of independent random variables
- Simulation of random behavior and probability distributions

The Normal Distribution
- Properties of the normal distribution
- Using tables of the normal distribution
- The normal distribution as a model for measurements

Sampling and Experimentation: Planning and conducting a study
- Methods of data collection (census, sample survey, experiment, observational study)
- Planning and Conducting Surveys
- Characteristics of a well-designed and well-conducted survey
- Populations, samples, and random selection
- Sources of bias in sampling and surveys
- Sampling methods, including simple random sampling, stratified random sampling and cluster sampling
- Planning and Conducting Experiments
- Characteristics of a well-designed experiment
- Treatments, control groups, experimental units, random assignments and replication
- Sources of bias and confounding, including placebo effect and blinding
- Completely randomized design
- Randomized block design, including matched pairs design
- Generalizability of results and types of conclusions that can be drawn from observational studies, experiments and surveys

Sampling distribution
- Sampling distribution of a sample proportion
- Sampling distribution of a sample mean
- Central Limit Theorem
- Sampling distribution of a difference between two independent sample proportions
- Sampling distribution of a difference between two independent sample means
- Simulation of sampling distributions
- t distributions
- Chi-square distributions
- F distributions

Statistical Inference: Estimating population parameters and testing hypotheses
Estimation (point estimators and confidence intervals)
Estimating population parameters and margin of error
Properties of point estimators, including unbiasedness and variability
Logic of confidence intervals, meaning of confidence level and confidence intervals, and properties of confidence intervals
Confidence interval for a mean
Confidence interval for a proportion
Confidence interval for a difference between two means (unpaired and paired)
Confidence interval for a difference between two proportions
Confidence interval for a variance
Confidence interval for a ratio of two variances
Test of significance
Logic of significance testing, null and alternative hypotheses; p-values; one and two sided tests; interpret the results; concepts of Type 1 and Types 2 errors; concept of power
Test for a mean
Test for a proportion
Test for a difference between two means (unpaired and paired)
Test for a difference between two proportions
Test for a variance
Test for a ratio of two variances
Effect sizes

Anova
One-way ANOVA
Two-way ANOVA
Factorial – interactions
Randomized block ANOVA
Repeated Measures
Post-hoc analysis/multiple comparisons (Bonferroni, Tukey, LSD)

Exploring Categorical Data
Frequency tables and bar charts
Marginal and joint frequencies for two way tables
Conditional relative frequencies and association
Comparing distributions using bar charts
Chi-square test for goodness of fit, test for homogeneity, and test of independence (one and two-way tables)

Nonparametric tests (sign test, Wilcoxon rank sum test, Wicoxon signed rank test)

Regression and Correlation
Exploring bivariate data - analyzing patterns in scatter plots
Correlation and linearity
Simple linear regression - least-squares regression
Interpreting intercept and slope
Confidence interval for the slope of a least squares regression line
Test for the slope of a least squares regression line
Coefficient of determination
Residual plots, outliers and influential points
Transformations to achieve linearity: logarithmic and power transformations
Multiple regression
Test and confidence interval for parameters in a multiple regression model
Interpreting parameters in a multiple regression model

Determine the type of hypothesis test to use for different types of data
Finite Math

Solve linear equations and inequalities.
Graph linear equations in two variables.
Use mathematical modeling and linear regression to make predictions.
Solve function problems.
Quadratic Functions
Polynomial and Rational Functions
Solve exponential function problems.
Solve logarithmic function problems.
Solve simple interest problems.
Solve compound interest problems.
Solve problems involving future and present value of annuities. (sinking funds and amortization)
Solve systems of linear equations.
Gauss Jordan Elimination
Perform operations on matrices.
Inverse of a square matrix
Solve matrix equations.
Apply matrices in a real world scenario.
Inequalities in two variables
Systems of linear inequalities in two variables
Solve linear programming problems geometrically
Geometric Introduction to the Simplex Method
Maximization and Minimization with Mixed Problem Constraints
Basic Counting Principles
Permutations and Combinations
Sample Spaces, Events and Probability
Apply counting principles to solve problems.
Conditional Probability, Intersection and Independence
Solve probability problems.
Random Variables, Probability Distribution and Expected Value
Solve problems involving discrete probability.
Solve problems involving discrete probability.
Make decisions by computing the expected value of random variables.
Summarize and present data using graphs, measures of central tendency, and measures of dispersion.
Bernoulli Trials and Binomial Distribution
Normal Distributions
Solve linear programming problems geometrically.
Solve linear programming problems by the simplex method.
Solve problems involving Markov chains.
Properties of Markov Chains
Regular Markov Chains
Absorbing Markov Chains
Solve problems involving game theory.
Strictly Determined Games
Mixed Strategies Games
Linear Programming and 2 x 2 games - geometric approach
Linear programming and m x n games - simplex method and the dual
Discrete Math

Apply basic enumeration techniques.
Simplify assertions and compound statements in first-order logic.
Apply basic set-theoretic concepts.
Apply the principles of mathematical induction and recursion.
Apply the basic concepts of computational complexity and algorithmic analysis.
Solve problems of iteration.
Manipulate relations and simple functions and their inverses.
Use the properties of relations.
Apply the properties of equivalence relations and partitions.
Use the Principle of Inclusion and Exclusion.
Identify graph isomorphism, planarity, connected components, and chromatic numbers.
Identify properties of a tree.
Apply properties of general graphs.
Apply the basic concepts of Boolean algebra.
Use the basic laws of Boolean algebra.
Convert Boolean expressions into a disjunctive or conjunctive normal form.
Science – Elementary (Grades 4-6)

- 5 Senses
- Animals
- Astronomy
- Atmosphere
- Atoms
- Basic Needs for Living Organisms
- Calendar
- Carbon Cycle
- Cells
- Classifying Living Things
- Earthquakes
- Earth’s Resources
- Earth’s Surface
- Ecosystem
- Electricity
- Energy
- Energy Conservation
- Environment
- Food Chain/Web
- Forces and Motion
- Fossils
- Genetics
- Heat
- Insect Life Cycle
- Invertebrates
- Investigation
- Light
- Light Energy
- Magnets
- Matter
- Nitrogen Cycle
- Organ Systems
- Plants
- Reproduction
- Resources
- Rock Cycle
- Rocks
- Seasons
- Simple Machines
- Soil
- States of Matter
- Tools
- Vertebrates
- Volcanoes
- Water
- Weather
- Work
Science – Middle Grades (Grades 7-8)

Astronomy
Cell Structure and Function
Earth
Ecology
Genetics
Human Body
Living Organisms
Matter
Metric system
Motion
Optics
Periodic Table
Scientific Method
Scientific Tools
Earth Science

Math basics
- Algebra
- Dimensional analysis
- Metric system
- Scientific notation
- Significant digits

Nature of Science
- Accuracy and precision
- Bias and Ethics
- Communication
- Data collection and analysis
- Models
- Scientific Method
- Scientific Quantities
- Scientific Thinking
- Scientists and Discoveries
- Theories and Laws
- Tools and Measurement
- Graphical interpretations

Geology
- Time
  - Relative Time
  - Absolute Time
  - Divisions of Geologic Time
  - Origin of Earth
  - Evolution of life on Earth
- First Principle of Geology
- Principle of Uniform Process
- Law of Superposition
- Relative Age
- Unconformity
- Fossils
- Radioactive dating of rocks
- Plate Tectonics
  - Parts of the Earth – characteristics and classification
    - Chemical layers of the Earth
    - Physical layers of the Earth
  - Evidence and theories of Plate Tectonics
  - Alfred Wegener
  - Pangaea
  - Sea Floor Spreading
  - Tectonic Plates
  - Plate Boundaries
  - Subduction zones
  - Earthquakes
    - Richter Scale
    - Seismic Waves
  - Volcanoes
    - Ring of Fire
    - Hot Spots
Landforms
Paleomagnetism and Plate Dynamics

Minerals
Elements
Mineral composition of Earth
Identification
Simple Identity Tests

Planetary composition and distribution

Types of Rock and the Rock Cycle
Chemical Cycles
Nitrogen – Oxygen – Carbon

Erosion and Weathering
Glaciers
Soil
Water
Water cycle

Biomes
Population
Growth rate
Food supply

Pollution
Land – Water (sewage) – Air – Chemical -- Thermal

Ecosystems
Energy flow – Carbon cycle – Population Growth

Natural Resources
Renewable/Non-renewable energy sources
Green House Effect
Acid Rain
Management

Climate change
Human impact/changes to planet
Natural disasters – causes, effects, impact

Meteorology

Air
Composition
Smog
Pressure
Temperature
Layers
Energy Absorption/reflection
Solar and Terrestrial Radiation
Convection currents
Moisture and Atmospheric stability
Wind – local and global
Convection Cell
Coriolis Effect

Weather Conditions and how they are created
Humidity
Saturation
Relative Humidity and calculations
Dew Point
Fronts
Jet Stream
Global Weather
Predication, forecast and measurement
Tools for measuring weather conditions
Weather map construction and interpretation
Clouds
Air Mass
Climates

**Oceanography**
Sea Floor Profile
Parts of the Ocean
Salinity
Contributories to the water in the ocean
Resources
Coriolis Effect
Major currents in the world and features
Waves
Tsunami characteristics

**Astronomy**
Earth, Sun, and Moon System
  - Historical views of the solar system
    - Geocentric (Ptolemy)
    - Heliocentric (Copernicus)
  - Time Zones
  - Day Length
  - Seasons
  - Phases of the moon
  - Eclipses - Lunar and Solar
  - Tides
Features of the Moon
Theories of the creation of the moon
Sun
  - Energy production - Fusion
  - Life cycle
  - Layers
  - Sunspots
  - Prominences – solar flares
  - Auroras
Solar system
  - Structure and composition
  - Inner (Terrestrial) Planet characteristics and specifics
  - Outer (Jovian) planet characteristics and specifics
Motion
  - Kepler’s Law
Stars
  - Classifications
  - Life span/cycle
  - Creation of elements
  - Spectroscopy
  - H-R Diagram
  - Distances
Galaxies
Distances
Amount
Types
Composition
Gravity
Formation of planets
Big Bang Theory and evidence
Space probes and exploration
Telescopes
Biology

Basic Chemistry
Atoms
Properties of Water Due to its Polarity and Hydrogen Bonding
Molecular Movement, Osmosis and Diffusion
Chemical Gradients
Monomers and Polymers
Carbohydrates, Lipids, Proteins, and Nucleic Acids

Cell Structure and Function
Structure and Function of the following:
   - Cell Membrane, Cell Wall,
   - Cytoplasm, Cytoskeleton, Centriole
   - Nucleus, Nuclear Membrane, Nucleolus
   - Golgi Apparatus, Endoplasmic Reticulum, Ribosome, Lysosome, Mitochondrion, Chloroplast
   - Vacuole, Vesicle
Cellular Transport Across the Cell Membrane
Fluid Mosaic Model of the Cell Membrane and Semipermiability
Active Transport
Facilitated Diffusion
Passive Transport
Receptor Proteins
Signaling Molecules

Cell Energy & Related Processes
Enzymes, Enzymatic Functions, and Enzymatic Pathways
Autotrophs and Heterotrophs
Glycolysis
Kreb's Cycle
Electron Transport Chain
Fermentation
ATP and Activation Energy
Exergonic and Endergonic Reactions
Light-Dependent Reactions of Photosynthesis
Calvin Cycle
Chemosynthesis

Cell Cycle
Ploidy
Mitosis/Meiosis
G0, G1, S, G2, and M Phases of the Cell Cycle
Cell Cycle Checkpoints
Oncogenes and Tumor Suppressors in relation to cell cycle: p53, MLH1,BRCA1/2 etc.

Basic Genetics
Inheritance
Mendel's Law of Heredity
Monohybrid, Dihybrid, and Trihybrid Crosses
Probability of Genotypes or Phenotypes based on Genetic Crosses
Sex-linked Traits
Pedigree Analysis
Mitochondrial DNA

Molecular Genetics
Famous genetic experiments-Hershey/Chase, Fred Griffith, Avery, Meselson/Stahl, Chargaff, and Watson/Crick.
Semi-conservative replication
Transcription
Translation and Protein Processing
Regulation of Gene Expression and Epigenetics
Mutations and Chromosomal Abnormalities
Genetic Engineering Techniques (PCR, Gel Electrophoresis, Restriction Enzymes, Cloning, and DNA Sequencing, and Gene Mapping) and Their Uses

Evolution & Phylogeny
Common Ancestry
Cell Theory and Characteristics of Life
Theory of Endosymbiosis
RNA World Hypothesis
Natural Selection and Fitness
Evidence Supporting Evolution (Fossil Record, DNA, Protein, Mathematical Models, etc.)
Examples of Selective Pressures and Their Effects on Population
Types of Selection
The Role of Genetic Drift, Mutation, and Sexual Reproduction in Evolution
Hardy-Weinberg Equilibrium
Phylogenetic Trees & Cladograms
Speciation & Extinction
Taxonomy

Bacteria
Characteristics
Basic Structures Including:
  Cell Wall, Cell Membrane, Ribosomes, Plasmids, Flagella
Bacterial Conjugation
Binary Fission

Viruses
Characteristics
Basic Structure Including:
  Capsid/Coat Proteins
  Genetic Material (including Reverse Transcriptase for RNA viruses)
Relationship of Cell Receptors to Entrance of Viruses into Host cells
Lytic and Lysogenic Stages of Virus Life Cycle
Relationship of Viruses to Cancer
Role of Mutation on the Evolution of Viruses

Animal Form & Function
Body Plan Development
Surface Area to Volume
Origin and Function of the Following Cell Types
  Epithelial
  Connective
  Muscle
  Nervous
Tissues, Organs and Organ Systems
Homeostasis, Feedback Loops, and Hormones
Animal Behavior
Animal Reproduction
Endotherms and Ectotherms
Characteristics of the Following Phyla...
  Protists, Porifera, Cnidaria, Nematoda, Mollusca, Annelida, Arthropoda, Echinodermata, Chordata

Plant Form & Function
Evolution of Plants from Algae
Adaptations of Plants to Land
  **Vascular and Nonvascular Plants**
  **Pollen, Seeds, Flowers, and Fruit**

Plant Reproduction
Alternation of Generations
Plant Structures Including...
  Leaf, Stomata, Cuticle
  Xylem, Phloem
  Rhizoids, Sporangium, Spores
  Roots, Meristem, Sepal, Petal
  Anther, Filament, Stamen, Stigma, Style, Ovary, Pistil, Fruit
  Pollen, Seed, Flower

Angiosperms (including Monocots and Dicots) and Gymnosperms (including Conifers)
Response to Stimuli (hormones involved) Including
  Auxins
  Phototropism
  Gravitropism

**Fungi**
Role In Decomposition
Reproduction
Fungal Structures Including...
  Spores, Hyphae, Ascus, Stalk, Cap

**Ecology**
Biomes
Biodiversity
Ecosystem Energy Flow
Life History Strategies
Producers, Consumers, and Decomposers
Population Growth and Regulation
Biotic and Abiotic Factors Affecting Environments
All biogeochemical cycles including: Water, Carbon, Nitrogen, Sulfur, and Phosphorus Cycles
Interactions between species and types of symbiosis

**General Science**
Interpreting and Graphing Scientific Data
Interpreting and Summarizing Information from Literature
Development of Science Fair Projects
Assistance with Lab-related Assignments
Proofreading Reports for Science Content

**Lab techniques**
Microscopy
Serial dilution
Gel electrophoresis
Bacterial culturing
Anatomy & Physiology

Anatomical Terminology
Anatomical Regions, Cavities, Planes of Symmetry, and Directional Terms

General Chemistry
Protons, Neutrons, Electrons, Atoms, Elements, and Compounds
Bonding: Ionic, Covalent, and Hydrogen
pH scale, Acids and Bases
Organic and Inorganic Compounds
Macromolecules: Carbohydrates, Lipids, Proteins, and Nucleic Acids

Cellular Biology
Light and Electron Microscope Images and Uses
Cell Structure: Cell Membrane, Cytoplasm, Nucleus
Organelle Structure and Function
Protein Synthesis
Metabolism and Homeostasis
Mitosis and Meiosis

Histology
Structure, Function, Location, and Subtypes of Epithelial, Connective, Muscular, and Nervous Tissue

Embryology
Ectoderm, Mesoderm, and Endoderm and their derivatives

Organ Systems
Integumentary
Functions of the Integument
Layers composing the epidermis and dermis
Nutrient and Oxygen Supply to the epidermis and dermis
Subcutaneous layer
Accessory Organ Structure and Function: Hair, Nails, and Glands
Basic Knowledge skin cancer types and prognoses

Skeletal
Functions of the Skeletal System
Structure and Function of Cartilage
Bone Markings, Shapes, Matrix, Structures, and Names
Bone Cells Structure and Function: Osteocyte, Osteoclast, and Osteoblast
Differentiate between Compact & Spong Bone
Differentiate between Endochondral and Intramembranous Ossification
Differentiate between Axial and Appendicular Skeleton
Basic knowledge of bone fractures and osteoporosis
Supporting Ligaments and discs
Types of Joints and their locations

Muscular
Functions of the Muscular System
Types and Locations of Muscular Tissue
Muscle Cell Structure and Function
Sliding Filament Theory & Excitation – Contraction Coupling
Sources of Energy for Muscle
Role of Exercise and Muscle Function
Knowledge of Names and Locations of muscles

Digestive
Structure and Function of Esophagus, Stomach, Small Intestines, Colon, Liver, Gall Bladder, Appendix and Rectum

Mechanical Digestion
Chemical Digestion
Absorption and transport of nutrients
pH balance and enzymatic function
Hormone regulation of digestive function and appetite
Extrinsic and Intrinsic Nervous function
Digestive Disease
Normal Flora of the gut

Nervous
Functions and Divisions of the Nervous System
Structure and Function of Neurons and Neuroglia
Generation and Propagation of an action potential
Synapses, Neurotransmitters, and Myelination
Brain Structure, Divisions, and Functions
Spinal Cord and Peripheral Nerve Structure and Function
Special Senses: Olfaction, Taste, Vision, Hearing, and Balance
Structure and Function of the Autonomic Nervous System

Endocrine
Second Messenger Pathways
Steroid production and function
Role of Hypothalamus
Structure & Function of Pituitary, Thyroid, Parathyroid, Adrenal, Pancreas, testes, Ovaries, and Pineal Glands
Hormones produced and their function

Cardiovascular
Functions and Composition of Blood
Clotting Cascade
Blood typing and diagnostic tests
Structure and Function of the heart
Electrical Activity of the Heart
Cardiac Cycle
Cardiac Output
Knowledge of Arteries and Veins that supply the body
Immunity & Lymphatic
Innate and Adaptive Immunity
Types and Functions of Immune Cells
Immunological Surveillance and Tolerance
Acquired Immunity
Structure and Function of Lymph Nodes, Spleen, Lymphoid Tissue, and Peyers Patches
Lymphatic Circulation

Respiratory
Functions of the Respiratory System
Anatomy and Histology of the Respiratory Tract and Lungs
Properties of Ventilation and Pulmonary Function Tests
Oxygen and Carbon Dioxide exchange and circulation

Urinary
Structure and Function of the Kidney
Glomerular Filtration and Tubular Section & Reabsorption
Renin-Angiotensin Aldosterone Pathway
Function of Vasopressin (ADH) and Atrial Natriuretic Peptide
Structure and Function of the Ureter, Bladder, and Urethra

Reproductive
Meiosis and Gamete Production
Structure and Function of the Male & Female Reproductive System
Fertilization and Pregnancy
Chemistry

Math basics
Algebra – Dimensional analysis – Metric system – Scientific notation – Significant digits

Nature of Science
Accuracy and precision
Bias and Ethics
Communication
Data collection and analysis
Models
Pseudo Sciences
Safety
Science and Society
Scientific Method
Scientific Quantities
Scientific Thinking
Scientists and Discoveries
Theories and Laws
Tools and Measurement
Graphical interpretations
Basic laboratory equipment identification

Atoms, Molecules, and Compounds
Matter
Atoms
Molecules
Compounds
Mixture
Homogeneous and Heterogeneous
Chemical and Physical Properties
Symbols
Ions
Polyatomic ions
Isotopes
Elements
Atomic Mass
Atomic Number
Mass Number
Periodic Table
Law of Definite Proportions
Creating compound based on their charges
Mole Concept
Molar Mass
Determining of a formula of a compound ionic and covalent
Nomenclature for ionic and covalent compounds including the rules for transition metals
Hydrates
Atmospheric Chemistry

Using Chemical Equations in Calculations
Density
Avogadro’s number
Conversions between atoms, molecules, moles, and masses
Percent composition
Balancing Chemical Equations
Classification of Reactions
   - Single Displacement (replacement)
   - Double displacement (replacement)
   - Decomposition
   - Synthesis (composition)
   - Combustion

Stoichiometry
Empirical formula
Molecular formula
Limiting Reagent

**Gas Laws and Kinetic Theory**

- Kinetic-Molecular Theory
- Pressure and equivalent units (ex. atm, psi, kPa, Pa, etc)
- Volume and equivalent units (ex. mmHg, Torr, etc)
- Temperature and equivalent units
- STP
- Maxwell-Boltzman Distribution
- Graham’s Law
- Diffusion
- Effusion
- Boyle’s Law
- Charles’ Law
- Guy-Lussac’s Law
- Combined gas Law
- Ideal Gas Law
- Determine density and molar mass from ideal gas law
- Dalton’s Law
- Collecting gas over water and partial pressures
- Avogadro’s Principle
- Gas Mixtures and Partial Pressure
- Kinetic Molecular Theory
- Non-ideal Gases

**Atomic and Molecular Structure**

- Atomic Theories
- Atomic Structure
- Octet Rule
- Electron Configurations
- Lewis Dot Structure
- Periodic Trends
  - Ionization energies
  - Electron Affinity
  - Electronegativity
  - Ionic Size
  - Atomic Size
  - Reactivity
- Chemical Bonding
  - Ionic – Covalent – Hydrogen – Metallic
- Valence electrons
- Orbitals
- Orbital Geometry
- Molecular Geometry
- VSEPR theory
- Quantum Theory
- Polarity
- Dipole moment
Hybridization
Sigma bond
Pi Bond
Resonance structures

**Solids**
Crystalline Solids
Bragg's Law
Unit cell
  *Simple – Face centered – Body centered – End-centered*

**Liquids and Changes of State**
Compressibility
Surface tension
Transition states
  *Evaporation*
  *Evaporation*
  *Condensation*
  *Boiling*
  *Freezing*
  *Melting*
  *Fusion*
  *Sublimation*
  *Triple point*
  *Critical temperature*
  *Critical pressure*
States of Matter
  *Solids – Non-Newtonians – Liquids – Gases – Plasma*
Phase Diagram
Kinetic Molecular Theory of Liquids

**Physical Chemistry**
Colligative Properties of Solutions
Enthalpy
Hess's Law

**Aqueous Solutions**
Solution
Solvent
Solute
Saturated
Unsaturated
Supersaturated
Dilute
Molarity
Molality
Normality
Mole Fraction (X)
Weight percent (wt%)
Parts per million (ppm)

**Acids, Bases and Salts**
Acid
Base
Salt
Anion and Cation
Electrolyte
Non-electrolyte
Indicators
Neutralization
Dissociation
Conjugate acid
Conjugate base
Strong acids and bases
Weak acids and bases
Monoprotic
Polyprotic
Bronsted-Lowry Acid/Base
Lewis Acid/Base
pH and pOH
Hydrolysis

Kinetics
Chemical Reaction Rates
Rate Expressions
Reaction Mechanisms
Activation Energy

Chemical Equilibria
Le Chatelier Principle
The Equilibrium Constant
Equilibrium Calculations
Factors Affecting Equilibria
ICE Tables

Ionic Equilibrium: Acids and Bases
Lewis Concept
Strong Acids and Bases
Weak Acids and Bases
pKa and pKb
Hydrolysis

Aqueous Equilibria
Common Ion Effect and Buffer Solutions
Henderson-Hasselbach Equation
Titration
End Point
Equivalence point
Acid-Base Titration Curves
Acid-Base Indicators
The Solubility Product Ksp
Solubility and the Common Ion Effect
Solubility and Complex Ions

Redox
Reduction – Oxidation – Oxidizing agent – Reducing agent – Oxidation numbers – Half reactions – Activity series

Chemical Thermodynamics
Heat of formation/reactions
Enthalpy
Spontaneity, Disorder and Entropy
Exothermic and Endothermic
Differentiate between heat and temperature
Calories vs calories
Specific heat capacity
Various temperature scales (Fahrenheit, Celsius, and Kelvin)
Entropy and the Second Law
Gibbs Free Energy
Equilibrium Constants

**Electrochemistry**
- Electrochemical Cells and Potentials
- Voltaic Cells at Nonstandard Conditions
- Electrolytic Cells
- Faraday's Law

**Nuclear Chemistry**
- Types of radiation
  - **Alpha – Beta – Gamma**
- Radioactive Decay
- Fission and Fusion
- Nuclear equations
- Half-life
- Isotopes
- Bohr equations
- Rydberg equation
- Energy relationship to wavelength, frequency and period
- Heisenberg Uncertainty Principle
- Electromagnetic Radiation
- Sources of energy

**Basic Organic Chemistry**
- Carbon groups
- Polymers
- Names and chemical composition of functional groups
- Basic nomenclature of organic compounds
- Alkanes – Alkenes – Alkynes
- Saturated
- Unsaturated
- Cyclic hydrocarbons
- Aromatic Hydrocarbons

**Biochemistry**
- Proteins – Carbohydrates – Nucleic acids

**Lab techniques**
- Synthesis of compounds (solid and gas)
- Separation techniques
  - Precipitation
  - Filtration
  - Centrifugation
  - Distillation
  - Chromatography
- Titration using indicators and meters
- Spectrophotometry/calorimetry
- Gravimetric Analysis
Organic Chemistry

Structure & Bonding
- Electron Configurations of Atoms
- Chemical Bonding & Valence
- Charge Distribution in Molecules
- The Shape of Molecules
- Isomers
- Analysis of Molecular Formulas
- Resonance
- Atomic and Molecular Orbitals

Intermolecular Forces
- Boiling & Melting Points
- Hydrogen Bonding
- Crystalline Solids
- Water Solubility

Functional Groups – Properties, Nomenclature, Synthesis, & Reactions of...
- Alkanes
- Alkenes
- Alkynes
- Alkyl halides
- Alcohols
- Aromatics
- Ketones
- Ethers
- Esters
- Carboxylic acids
- Amides
- Amines

Acids & Bases
- Arrhenius acids and bases
- Lowry-Brønsted Acids & Bases
- Lewis Acids and Bases
- Acid dissociation constants and pH
- Effect on acidity by...
  - Structure
  - Electronegativity effects
  - Hybridization effects
  - Resonance effects
  - Inductive effects

Stereochemistry
- Isomers
- Constitutional isomers
- Stereoisomers
- Chiral and achiral
- Enantiomers
- Optical activity
- R and S configurations
- Diastereomers
- Fischer projections
- Meso compounds
Nucleophilic Substitution, Elimination, and Addition reactions

Biochemicals – Structure & Function of...
- Carbohydrates
- Lipids
- Amino acids
- Proteins
- Enzymes
- Vitamins

Lab techniques
- Synthesis of compounds (solid and gas)
- Separation techniques
  - Precipitation
  - Filtration
  - Centrifugation
  - Distillation
  - Chromatography
- Solubility
- Melting point determination
- Nuclear Magnetic Resonance (NMR) spectrometer operation and analysis
- Infrared (IR) spectrometer operation and analysis
- Gas chromatography and Mass Spectrometry (GC-MS) analysis
Physics – Algebra-based

Math basics
- Algebra and Trigonometry
- Dimensional analysis
- Metric system
- Scientific notation
- Significant digits
- Vectors and scalars
  - Addition using graphical methods
  - Addition using algebraic methods
  - Components of vectors
  - Equilibriants

Nature of Science
- Accuracy and precision
- Bias and Ethics
- Communication
- Data collection and analysis
- Models
- Pseudo Sciences
- Safety
- Science and Society
- Scientific Method
- Scientific Quantities
- Scientific Thinking
- Scientists and Discoveries
- Theories and Laws
- Tools and Measurement

Kinematics
- Position, Distance, and Displacement
- Speed and velocity
- Acceleration
- Position vs time graphs
- Velocity vs time graphs
- Kinetic equations under constant acceleration
- Free fall equations
- Projectiles
- Circular motion
- Center of mass

Dynamics
- Newton’s Laws
  - Static equilibrium (1st Law)
    - Translational equilibrium
    - Rotational equilibrium (torque)
  - Free Body Diagram
  - Dynamics of a single body (2nd law) -- Force
  - Systems of two or more bodies (3rd law)
- Weight and weightless
  - Universal Gravitation
  - Gravitational Fields
  - Orbits
  - Kepler’s Laws of Planetary Motion
Static and kinetic friction
Air resistance
Elevator problems
Incline planes
Atwood Machines
Circular motion and rotation
Uniform circular motion
Circular speed
Centripetal Force
Frequency and Period
Vertical Circular motion
Rotational Kinematics
Moment of inertia
Rotational Kinetic Energy

Work, energy and power
Work and work-kinetic energy theorem
Conservative forces and Potential energy
Gravity – Springs
Conservation of mechanical energy
Power
Simple Harmonic motion
Springs and Hooke’s Law
Pendulums
Energies of SHM
Graphs of SHM
Spring-mass system
Momentum
Momentum definition
Impulse
Impulse-Momentum Theorem
Non-constant force
Conservation of linear momentum and collisions
Inelastic and elastic collisions
Two dimensional collisions
Angular momentum
Conservation of angular momentum
Sources of energy on Earth

Fluid Mechanics
Density and Pressure
Density
Specific gravity
Pressure as a function of depth
Pascal’s Law
Buoyancy – Archimedes’ Principle
Fluid dynamics
Fluid Flow continuity equation
Bernoulli’s Equation
Hydrostatics
Fluid Pressure

Thermal Physics
Heat
Temperature
Mechanical Equivalent of heat
Heat Transfer and thermal expansion
  Linear expansion of solids
  Volume expansion of solids and liquids
Calorimetry
Kinetic Theory
Ideal Gases
Gas laws
Thermodynamics
  Processes and PV diagrams
    Isothermal – Isobaric – Isometric -- Adiabatic – Cyclic
  Zeroth law of Thermodynamics
  First law of Thermodynamics
    Internal energy – Energy conservation – Molar heat capacity of a gas
  Second law of Thermodynamics
    Directions and processes
    Entropy
  Third Law of Thermodynamics
Heat engines and Carnot engines
Refrigerators
Rms speed of gas molecules
Avogadro’s number and Boltzmann’s constant

Electrostatics
  Electric charges
  Conductors, insulators and semi-conductors
  Charging by conduction
  Charging by induction
  Coulomb’s Law
  Electric fields
  Gauss’ Law
Electric Potential Energy and Electric Potential
Motion of charges particles in electric fields
Capacitance
  Graphical description of capacitance (charge vs. voltage)
    Slope – capacitance
    Area – energy storage
  Capacitors in series and parallel
  Point charge distribution
  Parallel plates
  Cathode Ray tubes
  Millikan Oil Drop Experiment
  Condensers

Current Electricity
  EMF
  Circuits
  AC/DC
  Current
  Resistance
  Electric Power
  Electric Energy
  Resistors in series
Resistors in Parallel
Batteries and Internal Resistance
Kirkoff's Law
Ohm's Law
Voltmeters
Ammeters
RC circuits

**Electromagnetism**
- Force of a magnetic field on a moving charge
- Force of a magnetic field on a current carrying wire
- Torque on a current carrying loop
- Magnetic fields due to straight and coiled wires
- Electromagnetic Induction
- Magnetic flux
- Faraday's Law
- Lens's Law
- Motors
- Mass Spectrometers
- Generators

**Wave Motion and Sound**
- Description and characteristics of waves
- Types of waves
- Standing waves
- Beats
- Harmonics
- Wave on a string
- Wave in a tube
- Doppler Effect
- Sound intensity
- Sound Power
- Relative sound intensity

**Optics**
- Reflection
- Law of reflection
- Refraction
- Snell's Law
- Total Internal reflection
- Critical angle
- Images formed by plane mirrors
- Images formed by spherical mirrors
- Images formed by parabolic mirrors
- Images formed by lenses
- Ray-diagrams
- Thin lens
- Mirror equation
- Image formation by a two-lens system

Interference
  - Superposition Principle
  - Double slit interference
  - Thin Film
  - Newton's Ring
Non-reflective coating for glass
Diffraction
  Single slit
  Superposition of double slit
  Diffraction gratings
  Interference and Diffraction patterns
Polarization
The electromagnetic spectrum
Inverse square law

Modern Physics
Atomic Physics and Quantum Effects
  Photons and photoelectric effect
  Energy and linear momentum of photons
  X-ray production
  Electron energy levels
    Ionization energy
    Emission spectrum
    Absorption spectrum
    Lasers
    Continual spectrum
  Compton Effect
  Wave nature of matter
  DeBroglie equation
  DeBroglie Hypothesis: Davisson-Germer experiment

Nuclear Physics
Atomic mass
Mass number
Atomic number
Mass defect and binding energy
Nuclear processed
  Modes of radioactive decay (alpha, beta, gamma)
  Fission
  Fusion
Mass-energy equivalence
Conservation of energy-mass
Nuclear symbols
Nuclear reactions
Neutrino
Chain reactions
Isotopes
States of matter
Atomic Models
Physics – Calculus-based

This subject covers the material from AP Physics C-Mechanics, AP Physics C-Electricity and Magnetism, and introductory college level physics courses that require calculus as a prerequisite.

Math Basics
- Algebra, trigonometry and calculus
- Dimensional analysis
- Units and unit conversions
  - The metric system
- Scientific notation
- Estimates and orders of magnitudes
- Significant figures
- Vectors and scalars
  - Addition using graphical methods
  - Addition using algebraic methods
  - Components of vectors
  - Unit vectors
  - Equilibrants
- Cross product
- Dot product
- Derivatives
- Integrals

Nature of Science
- Accuracy and precision
- Data collection via observation and measurement and the analysis of this data
- Error analysis
- Experimental design
- Models
- Scientific method
- Tools and measurement
- Communicating scientific results

Newtonian Mechanics

Kinematics (Motion Along a Straight Line)
- Position, distance, and displacement
- Average and instantaneous velocity
  - Difference between velocity and speed
- Average and instantaneous acceleration
- Position vs time graphs
- Velocity vs time graphs
- Acceleration vs time graphs
- Differential determination of position, velocity and acceleration as a function of time
- Kinematic equations under constant acceleration

Dynamics
- Newton’s Laws of Motion
  - Static equilibrium (1st Law)
    - Translational equilibrium
- Free Body Diagram
- Dynamics of a single body (2nd law) – Force
  - Write differential equation for velocity as a function of time
  - Method of separation of variables to derive the equation for velocity as a function of time
  - Expression of acceleration as a function of time while under the influence of drag
- Systems of two or more bodies (3rd law)
Mass and weight
Fundamental forces of nature
Static and kinetic friction
Air resistance
Elevator problems
Incline planes
Atwood Machines
Dynamics of circular motion
   Centripetal force

Work, energy and power
   Work and the work-kinetic energy theorem
   Integrate to calculate the work performed by a varying force
   Conservative forces and potential energy
      Gravitational potential energy
      Elastic potential energy (springs)
   Non-conservative forces
   Conservation of mechanical energy
   Energy diagrams
   Power

Systems of particles, linear momentum, impulse and collisions
   Center of mass
      Symmetrical object
   Two object system
      Integration to determine for a thin rod of non-uniform density
      Linear momentum concerns
   Momentum
      Momentum definition
      Impulse
      Impulse-Momentum Theorem
      Non-constant force
      Conservation of linear momentum and collisions
         Inelastic and elastic collisions
         Two dimensional collisions
   Rocket Propulsion

Circular Motion and Rotations
   Uniform circular motion
   Angular velocity and acceleration
   Frequency and period
   Vertical circular motion
   Rotational kinematics
   Moment of inertia
   Rotational inertia
   Parallel axis theorem
   Rotational kinetic energy
   Work and power in rotational motion
   Torque
   Torque and angular acceleration for a rigid object
   Rotation of a rigid object around a fixed axis
      Angular momentum
         Conservation of angular momentum
         Gyroscopes and precession

Equilibrium and Elasticity
Rotational equilibrium (torque)
Conditions for static equilibrium
Center of gravity
Stress, strain, and elastic moduli
Elasticity

Fluid Mechanics
Density and Pressure
  Density
  Specific gravity
  Pressure as a function of depth
  Pascal’s Law
Buoyancy – Archimedes’ Principle
Fluid dynamics
Fluid Flow continuity equation
Bernoulli’s Equation
Hydrostatics
Fluid Pressure
Viscosity and Turbulence

Gravitation
Universal Gravitation
Gravitational Fields
Orbits
Kepler’s Laws of Planetary Motion
The Motion of satellites
Apparent Weight
Oscillatory Motion
  Springs and Hooke’s Law
  Pendulums
  Energies of simple harmonic motion
  Graphs of simple harmonic motion
  Spring-mass system
  Resonance and sinusoidal external force
  Damped oscillations
  Parallel combinations of identical or differing lengths of springs
  Torsional pendulum

Thermal Physics
Heat
Temperature
Mechanical Equivalent of heat
Heat Transfer and thermal expansion
  Linear expansion of solids
  Volume expansion of solids and liquids
Calorimetry
Kinetic Theory
Ideal Gases
Gas laws
Thermodynamics
  Processes and PV diagrams
    Isothermal
    Isobaric
    Isometric
    Adiabatic
Cyclic
Zeroth law of Thermodynamics
First law of Thermodynamics
  Internal energy
  Energy conservation
  Molar heat capacity of a gas
Second law of Thermodynamics
  Directions and processes
  Entropy
Third Law of Thermodynamics
Heat engines and Carnot engines
Refrigerators
Rms speed of gas molecules
Avogadro’s number and Boltzmann’s constant

Electricity and Magnetism

Electrostatics
  Electric charges
  Conductors, insulators and semiconductors
  Charging by conduction
  Charging by induction
  Coulomb’s Law
  Electric fields
  Electric Field Lines
  Electric Dipoles
  Electric Flux
  Gauss’s Law
  Electric Potential Energy and Electric Potential
  Potentials of charge distributions

Conductors, Capacitors and Dielectrics
  Electrostatics with conductors
  Equipotential surfaces
  Capacitance
    Graphical description of capacitance (charge vs. voltage)
    Slope – capacitance
    Area – energy storage
  Capacitors in series and parallel
  Point charge distribution
  Parallel plates
  Cathode Ray tubes
  Millikan Oil Drop Experiment
  Condensers
  Voltage, charge and stored energy in a capacitor
  Cylindrical vs. Spherical capacitors

Dielectrics

Current and Resistance
  Current
  Resistivity
  Resistance

Direct Current Electric Circuits
  EMF
  Electric Power
  Electric Energy
Resistors in series
Resistors in Parallel
Batteries and Internal Resistance
Kirchhoff’s Law
Ohm’s Law
Voltmeters
Ammeters
RC circuits

**Magnetic Fields**
Sources of magnetic fields
Right-hand rule
Left-hand rule
Force of a magnetic field on a moving charge
Force of a magnetic field on a current carrying wire
Torque on a current carrying loop
Magnetic fields due to straight and coiled wires
Biot-Savart Law
Ampère’s Law

**Electromagnetism**
Motion of charged particles in electric and magnetic fields
Electromagnetic induction
Magnetic flux
Inductance
RL circuits
LC circuits
LRC circuits
Faraday’s Law
Lenz’s Law
Alternating current circuits
  Phasors and alternating currents
  RMS voltages and currents
  Resistance and reactance
  AC LRC circuits
  Power in AC circuits
  Resonance in AC circuits
Displacement current
Maxwell’s equations
Motors
Mass spectrometers
Generators
Transformer

**Wave, Motion, and Sound**
Description and characteristics of waves
Types of waves
Standing waves
Beats
Harmonics
Wave on a string
Wave in a tube
Doppler Effect
Sound intensity
Sound Power
Relative sound intensity

Optics

Nature and Propagation of Light
Reflection
Law of reflection
Refraction
Snell’s Law
Total internal reflection
Critical angle

Geometric Optics
Images formed by plane mirrors
Images formed by spherical mirrors
Images formed by parabolic mirrors
Images formed by lenses
Ray-diagrams (Geometric Optics)
Thin lens
Mirror equation
Image formation by a two-lens system

Physical Optics
Interference
Superposition principle
Double slit interference
Thin film
Newton’s ring
Non-reflective coating for glass

Diffraction
Single slit
Superposition of double slit
Diffraction gratings
Interference and diffraction patterns

Huygen’s Principle

Polarization
The electromagnetic spectrum
Inverse square law

Modern Physics
Quantum Mechanics and the nature of light

Relativity
Frames of reference
Time dilation
Length Contraction
Relativistic momentum
Rest mass energy

Atomic physics and quantum effects
Photons and photoelectric effect
Energy and linear momentum of photons
X-ray production
Electron energy levels
Ionization energy
Emission spectrum
Absorption spectrum
Lasers
Continuum spectrum
Compton Effect
Wave nature of matter
DeBroglie equation
DeBroglie Hypothesis: Davisson-Germer experiment

Nuclear physics
Atomic mass
Mass number
Atomic number
Mass defect and binding energy
Nuclear processed
  Modes of radioactive decay (alpha, beta, gamma)
  Fission
  Fusion
Mass-energy equivalence
Conservation of energy-mass
Nuclear symbols
Nuclear reactions
Neutrino
Chain reactions
Isotopes
States of matter
Atomic models
The microbiology course is considered an advanced science course. It is expected that tutors are knowledgeable in foundational biological, chemical and mathematical concepts as they underlie and relate to microbiology.

**Basic Biology**
- Eukaryotes
- Prokaryotes
- Cellular division of eukaryotic and prokaryotic cells
- Functional anatomy of various cells
- Whitaker Five Kingdoms
- Woese Three Domain clarification

**Microbial Traits**
- Types
  - Bacteria
  - Algae
  - Fungi
  - Protists
  - Helminthes
  - Viruses
  - Viroids
  - Prions
  - Archaea
- Nutrition
- Growth
- Control in various environments
  - Acidic
  - Basic
  - High temperature
  - Low temperature
  - Saline
  - Nutrient rich and nutrient poor
- Structure
- Metabolism
- Pathways
- Catabolism
- Anabolism
- Gram positive bacteria anatomy
  - Low G + C gram positives
  - High G + C gram positives
- Gram negative bacteria anatomy
  - Deinococci
  - Nonproteobacteria
- Biochemistry processes
- Recombinant DNA technology
  - Vectors
  - PCR
  - Restriction enzymes
  - Gene cloning
- Taxonomy and classification (Bergey)
Cytology
Cellular physiology

**Genetics**
- Structure
- Replication
- Expression
- Mechanisms of variation
- Mapping of distances in genes
- Lac operon
- Lac repressor
- Trp operon
- Arabinose operon
- Genetic recombination
- Transformation
- Conjugation
- Transduction

**Ecology**
- Biogeochemical cycling
  - Carbon cycle
  - Nitrogen cycle
  - Oxygen cycle
  - Phosphorous cycle
  - Sulfur cycle
  - Water cycle
  - Mercury cycle
  - Atrazine cycle
- Microorganisms in marine and freshwater ecosystems
- Microorganisms in terrestrial ecosystems
- Symbiosis
- Mutualism
- Commensalism
- Parasitism

**Pathogenicity**
- Germ Theory
- Infection and reproduction
- Host and parasite relationship
- Infectious disease
- Disease transmission
- Nosocomial infections
- Mechanisms of pathogenicity
- Antimicrobial drugs
- Important pathogens and diseases
  - Respiratory system
  - Cardiovascular system
  - Lymphatic system
  - Nervous system
  - Gastrointestinal system
  - Endocrine system
  - Urinary and reproductive systems
  - Integument system and eyes
  - Immune system
- Sterilization
Disinfection

**Immunization**
- Innate host resistance
- Adaptive Immunity
- Sanitation
- Hygiene

**Health**
- Epidemiology
- Antimicrobial chemotherapy
- Microbiology of food
- Industrial microbiology

**Laboratory Techniques**
- Basic laboratory equipment identification
- Guidelines for safe handling of microorganisms and infectious materials
- Microscope use including oil emersion
- Methods for taking clinical samples
- Incubation techniques
- Inoculation techniques
- Isolation techniques
- Identification techniques
  - Gram stain
  - ELISA
- Chromatography
- Spectrophotometry
- Serial dilution technique and calculations
Nursing

Nursing Medical Surgical Fundamentals
Tutors must be knowledgeable about the fundamentals of nursing including nursing roles, settings, health care trends, all body systems and their disorders, emergency and disaster management, and mental health nursing. In particular, tutors should be familiar with nursing care in all of the following areas:

- Role of the medical-surgical nurse
- Nursing practice and interventions
- Health and nursing assessments
- Diagnostic testing and evaluation
- Care of clients in the following areas:
  - Pain Management
  - Altered fluid electrolyte or acid-base balance
  - Trauma and shock
  - Pre- and post surgery
  - Infections
  - Altered immunity
  - Cancer
  - Loss, grief and death
  - Problems with substance abuse
  - Maternal-Child Health (OB)
  - Pediatrics
  - Psychiatric Nursing

Nursing Care Plans
Tutors must be familiar with all aspects of the creation of nursing care plans including:

- Assessment
- Nursing diagnosis
- Outcomes and Interventions
- Creating the Nursing Care Plan
- Documentation
- Implementation of the Nursing Care Plan
- Evaluation of the Nursing Care Plan

Nursing Pathophysiology:
Tutors must be knowledgeable of the following systems and associated disorders:

- Cardiovascular system
- Circulatory system
- Renal system
- Respiratory system
- Nervous system
- Gastrointestinal system
- Endocrine system
- Reproductive system
- Musculoskeletal system
- Integumentary system
- Cell and body tissue physiology
- Fluid and electrolyte balances
- Genetic and hereditary disorders
- Inflammation, infection and immune response systems
- Oncological diseases
Nursing Pharmacology

Nursing process in drug therapy
Pharmacologic principles
Principles and practices of administration of medication
Drug calculations
Dosage calculations
Legal and ethical requirements in drug therapy
Life span of pharmaceuticals
Gene therapy and pharmacogenetics
Medication error response and prevention
Essential knowledge of the following drug types:
  - Analgesic drugs
  - General and local anesthetics
  - Depressants and muscle relaxants
  - Stimulants and related drugs
  - Antiepileptic drugs
  - Psychotherapeutic drugs
  - Antiparkinsonian drugs
  - Adrenergic drugs
  - Cholinergic drugs
  - Heart failure drugs
  - Antidysrhythmic drugs
  - Antianginal drugs
  - Antihypertensive drugs
  - Diuretic drugs
  - Coagulation modifier drugs
  - Antilipemic drugs
  - Pituitary drugs
  - Thyroid and antithyroid drugs
  - Adrenal drugs
  - Women's health drugs
  - Men's Health drugs
  - Antihistamines, decongestants and antitussives
  - Bronchodilators and other respiratory drugs
  - Antibiotics
  - Antiviral drugs
  - Antitubercular drugs
  - Antifungal drugs
  - Antimalarial, antiprotozoal, antihelmintic drugs
  - Anti-inflammatory and antigout drugs
  - Immunosuppressants
  - Immunizing drugs
  - Antineoplastic drugs
  - Biologic response drugs
  - Acid controlling drugs
  - Bowel disorder drugs
  - Antiemetic and antinausea drugs
  - Anemia drugs
  - Dermatologic drugs
  - Ophthamic and otic drugs
Hormones that regulate calcium and bone metabolism
Drugs used in oncologic disorders
OTC drugs, herbal and dietary supplements
Social Studies

Elementary (Grades 4-6)

Africa
American Historical Figures
American Revolution
China
Citizenship
Civil Rights
Civil War
Colonial Settlements in America
Communities
East Asia and Pacific
Egypt
Elections
Europe
Family and Authority
French and Indian War
Geography
Government
Greece
Holidays and Diversity
India
Japan
Latin America
Louisiana Purchase
Mesopotamia
Middle East
Native American Culture
Religions of the World
Rome
Slavery in America
South and Southeast Asia
The Bill of Rights
The Constitution
The Declaration of Independence
The Incas
The Mayans
Trade
War of 1812
Westward Expansion
World Cultures
Social Studies

Middle Grades (Grades 7-8)

- Africa
- American Revolution
- Articles of Confederation
- Byzantine Empire
- Central and South America
- China
- Civil Rights
- Civil War
- Colonial Settlements in America
- Demographic Concepts
- Early American government and political systems
- Economics
- European History
- Exploration
- French and Indian War
- Geography
- India
- Japan
- Louisiana Purchase
- Mapping
- Middle East
- Monroe Doctrine
- Native Americans
- North America
- Religions of the World
- Slavery in America
- The Bill of Rights
- The Constitution
- The Declaration of Independence
- The Physical Environment
- War of 1812
- Westward Expansion
Social Studies
High School (Grades 9-12)

- Africa
- American Revolution
- Ancient Civilizations
- Articles of Confederation
- Asia
- Civil War
- Cold War
- Colonial Settlements in America
- Contemporary World Events
- Declaration of Independence
- Early American Government and Political Systems
- Economics
- European History
- Geography
- Gulf War
- Industrialism
- Korean War
- Latin America
- Louisiana Purchase
- Middle East
- Native Americans
- Prehistoric America
- Reconstruction
- Slavery in America
- Soviet Union and Eastern Europe
- The Bill of Rights
- The Constitution
- The Monroe Doctrine
- Vietnam War
- War of 1812
- Westward Expansion
- World War 1
- World War 2
English

Elementary (Grades 4-6)
Adjectives
Adverbs
Antonyms
Contractions
Fiction
Grammar
Letter Writing
Literary Analysis
Literary Device
Literary Themes
Non-Fiction
Nouns
Paragraphs
Parts of Speech
Phonemes
Plays and Theater
Poetry
Presentations
Pronouns
Punctuation and Capitalization
Reading Comprehension
Research Skills
Sentence Structure
Synonyms
Verbs
Vocabulary
Writing Sentences

(Back to Humanities)
English

Middle Grades (Grades 7-8)

- American Literature
- Characterization
- Grammar
- Literary Analysis
- Literary Criticism
- Literary Devices
- Literary Themes
- Narrative
- Plays and Theater
- Point of View
- Prose and Poetry
- Punctuation and Capitalization
- Reading Comprehension
- Research Skills - Sources and Documentation
- Sentence Structure
- Setting
- Structural Elements of Plot
- Theme
- Vocabulary
- World Literature
English

High School (Grades 9-12)
- American Literature
- Grammar
- Literary Analysis
- Literary Criticism
- Literary Devices
- Literary Periods
- Literary Themes
- Plays and Theater
- Prose and Poetry
- Punctuation and Capitalization
- Reading Comprehension
- Research Skills - Sources and Documentation
- Vocabulary
- World Literature

(Back to Humanities)
Essay Writing

Business Writing
Citation and Documentation
College and Job Application Writing
Cover Letter Writing
Creative Writing
Descriptive Essay
Editing and Proofreading
Elements of Composition
Expository Essay
Five Paragraph Essay
Grammar
Journal Writing
Literary Analysis Writing
Organization and Outlining Essays
Paragraphs
Persuasive Essay
Poetry Writing
Pre-writing Skills
Punctuation and Capitalization
Research Paper Writing
Research Skills and Resources
Resume Writing
Speech Writing
Story Writing
Technical Writing
Thesis Statements
Topic Sentences
Transitions
Use of Literary Devices
Vocabulary and Word Choice
Voice
Writing Conclusions
Writing for Standardized Tests
Writing Leads, Introductory Paragraphs, Conclusions
Writing Research Papers
Writing Sentences
Writing Strategies
Writing Styles
College Essay Writing

Business Writing
Citation and Documentation
Citation and Effective Content Analysis
College and Job Application Writing
Cover Letter Writing
Creative Writing
Descriptive Essay
Editing and Proofreading
Elements of Composition
Expository Essay
Five Paragraph Essay
Grammar
Journal Writing
Literary Analysis Writing
Organization and Outlining Essays
Paragraphs
Persuasive Essay
Poetry Writing
Pre-writing Skills
Punctuation and Capitalization
Research Paper Writing
Research Skills and Resources
Resume Writing
Speech Writing
Story Writing
Technical Writing
Thesis Statements
Topic Sentences
Transitions
Use of Literary Devices
Vocabulary and Word Choice
Voice
Writing Conclusions
Writing for Standardized Tests
Writing Leads, Introductory Paragraphs, Conclusions
Writing Research Papers
Writing Sentences
Writing Strategies
Writing Styles
Symbolic Logic

Inferences and Arguments (Premises and Conclusions)
  Recognition of argument
  Validity
  Soundness
  Contingency
  Factual Statements
  Invalidity
  Form versus Content
  Statements and Propositions
  Deductive versus inductive logic
  Sentential logic
  Terms, predicates, variables, and pronouns
  Compound formals
  Necessary versus sufficient conditions
  Statement connectives
  Truth-functional derivations

Categorical Propositions
  Components of a Categorical Proposition
  Venn diagrams and the square of opposition
  Aristotelian versus Boolean logic

Categorical Syllogisms
  Standard form, mood and figure
  Venn diagrams applied to syllogisms
  Rules
  Fallacies of Relevance
  Fallacies of Ambiguity

Propositional Logic
  Symbols and translation
  Truth functions
  Truth tables
    Tautology, contradiction, contingency, and replacement
  Complex truth-functional formals
  If statements versus Only if statements
  Symbolizing the statement form

Natural deduction in propositional logic
  Rules of implication and replacement
  Proving logical truths

Predicate Logic
  Symbols and translation
  Change of Quantifier
  Relational and Overlapping Quantifiers
  Translations in monadic predicate logic
  Translations in polyadic predicate logic
  Complex predicates
  Wide-scope quantifiers
  Derivations in predicate logic
  Symbolizing the statement form

Logic Truth Trees
  Propositional Logic
  Predicate Logic
**Reading**

Describe features of different genres of writing or poetry. Apply suitable analysis strategies.

- Fiction- narrative - identify features and analyze
- Fiction-mystery/suspense- identify features and analyze
- Poetry- identify features and analyze
- Nonfiction-informational - identify features and analyze
- Nonfiction-persuasive - identify features and analyze
- Biography - identify features and analyze
- Other

Identify main ideas and details, both explicit and implied, within a text.

- Main idea- explicitly stated
- Main idea- implied
- Locating details

Draw valid inferences from a written text and be able to identify supporting text evidence.

- Create valid inferences
- Locate text evidence to support an inferred claim

Correctly identify point of view (first person, second person, third, etc.) and analyze for potential bias within a text.

- First person point of view features and characteristics
- Second person point of view features and characteristics
- Third person point of view features and characteristics
- Omniscient and Limited Omniscient Points of View
- Reliable/Unreliable point of view narration

Identify text structures (cause and effect, chronological order, etc.) within a given text.

- Cause and Effect
- Problem solution
- Compare/Contrast
- Description
- Main idea and Details
- Chronological Order (Sequence)

Use an appropriate graphic organizer or other systematic approach (i.e. note-taking) to demonstrate conceptual understanding of a text.

- Venn Diagram
- Identify an Author's purpose for writing
- Alphanumeric/Structured outline format
- Timeline
- Concept Web
- T-chart
- Other

Draw valid generalizations from a given text.

- Create and/or identify valid generalizations from a text.
- Locate text evidence to support a generalization

Correctly establish facts from opinions within a text.

- Identify facts from a text
- Identify opinions from a text

Evaluate how graphic sources such as graphs, tables, charts, and other visual images increase understanding of a text.

- Analysis- graph, chart or table in a text
- Analysis- picture
- Other graphics in text context
Integrate main ideas and key details or events to create an effective summary of a text, passage, or book.

- Summarizing a passage
- Details in a summary
- Evaluate a given summary for completeness

Evaluate word meaning within a passage context, or in isolation.

- Vocabulary in isolation
- Vocabulary in context

Assess an author’s purpose, use of tone, and theme based on a given text.

- Identify an Author’s purpose for writing
- Identify tone of a given text
- Identify theme of a given text

Evaluate reliability of sources, giving consideration to tone, mood or potential bias of the author.

- Tone of text/effect on reliability
- Mood of text/effect on reliability
- Potential bias of author/effect on reliability

Evaluate persuasive writing to determine if an argument is presented logically, clearly, and adequately to influence the reader.

- Text features of persuasive writing
- Argument effectiveness

Formulate connections between texts, compare and contrast two texts on related topics.

- Text connections
- Compare/contrasts related texts

Explain pre-reading activities that increase comprehension.

- Justify pre-reading strategies
- Analyze effective pre-reading activities

Utilize figurative language and textual elements to gain a better understanding of literature.
ESL

English Language Use
  Word form
  Verbs followed by gerunds or infinitives
  Verb tense formation and uses
  Time expressions
  Tag questions
  Subjunctive mood
  Subject-verb agreement
  Relative clauses
  Pronouns
  Prepositions
  Phrase usage: Neither, nor, such, so
  Phrasal verbs
  Passive causatives
  Passive and active voice
  Parts of a sentence
  Participial adjectives
  Modal verbs
  Irregular verb forms
  Indirect speech
  Countable and non-countable nouns
  Conditionals
  Comparisons
  Articles
  Sentence Diagramming
  Vocabulary--finding meaning in context
  Vocabulary--dictionary definitions, appropriate usage, collocations, word families, and connotations
  Using dictionaries

English Writing
  Conventions of standard written English syntax
  Inversion
  Linking words and text organizers
  Parallel structure
  Prewriting--Brainstorming, outlining
  Finishing the writing process--revising & editing
  Avoiding Plagiarism
  Using sources--credibility, citation, synthesizing info
  Introductions and thesis statements
  Conclusions
  Paragraph construction (topic sentence, body, concluding sentence)

Types of Writing
  Critical Response
  Synthesis
  Argumentative
  Analysis
  Compare/contrast
  Narrative
  Descriptive
  Opinion
  Process
Summary/paraphrase
Research Papers

**Speaking**
- Presentations
- Daily communication--giving directions, giving advice, etc.
- Pronunciation--Stress and intonation patterns
- Pronunciation--Phonetic (International Phonetic Alphabet) transcription
- Pronunciation--Identification of cause of pronunciation errors

**Listening**
- Note taking
- Processing academic discourse (lectures, presentations, videos, etc.)
- Identifying main ideas vs. details
- Visual Organizers (Venn diagrams, concept maps, etc.)
- Predicting

**Reading**
- Note taking
- Reading and processing academic texts
- Identifying main ideas vs. details
- Visual Organizers (Venn diagrams, concept maps, etc.)
- Skimming/scanning
- Predicting
Accounting

Financial Reporting and Accounting Cycle
- Accrual vs. cash accounting
- Worksheets and t-accounts
- Adjusting Entries
- Financial Statement Preparation (including direct/indirect statement of cash flows)
- Closing Entries

Accounting for Service and Merchandising Companies
- Journal Entries
- Multi-step income statements
- Perpetual vs. periodic
- LIFO, FIFO, & weighted average
- Accounting for uncollectible accounts (allowance method vs. direct write off method)

Internal Controls & Cash
- Bank reconciliations
- Petty cash

Accounting for Property, Plant, and Equipment
- Entries for PPE purchases
- Entries for PPE sales/disposal
- Depreciation (straight-line, double-declining-balance, units-of-production)

Accounting for Partnerships
- Forming a partnership
- Income allocation
- Partner admission/withdrawal
- Partnership liquidation

Accounting for Corporations
- Entries for stock
- Entries for dividends
- Stock splits
- Financial ratio analysis
- Treasury stock

Accounting for Investments
- Accounting for investments in stocks (purchase, sale, equity method, fair value method, etc.)
- Accounting for investments in bonds

Bonds Payable
- Accounting for bonds
- TVM Analysis for bonds
- Amortization & amortization tables

Payroll and Taxes
- Accounting for taxes
- Accounting for payroll

Managerial Accounting
- Job order costing
- Process costing
- Activity-based costing
- Cost-volume-profit analysis
- Variable vs. absorption costing
- Budgets

Planning, control, and performance evaluation
Differential analysis
Capital investment decisions
Economics

Intro Microeconomics

Comparative Advantage
  Opportunity Cost
  Production Possibilities Curve

Supply and Demand
  Market Equilibrium
  Income effect and substitution effect
  Price ceilings and floors

Elasticity
  Price Elasticity of Demand
  Income Elasticity and Cross-Price Elasticity of Demand
  Price Elasticity of Supply
  Taxes

Demand
  Marginal Utility
  Consumer Surplus

Perfectly Competitive Supply
  Short-Run Costs
  Long-Run Costs
  Profit maximization
  Producer Surplus

Monopoly, Oligopoly, and Monopolistic Competition
  Market power
  Economies of Scale
  Monopoly Marginal Revenue
  Price Discrimination
  Regulation

Game Theory
  Nash Equilibrium
  Prisoner’s Dilemma
  Cartels

Market Failure
  Efficiency
  Adverse Selection
  Moral Hazard
  Externalities
  Coase Theorem
  Tragedy of the Commons

Intro Macroeconomics

Comparative Advantage
  - Production Possibilities Curve
  - Specialization
  - International Trade
  - Exchange Rates

Supply and Demand
  - Market Equilibrium
GDP and Unemployment
- National Income Measures
- Measuring GDP
- Nominal vs. Real GDP
- Measuring Unemployment Rate

Price Level and Inflation
- Consumer Price Index
- Adjusting for Inflation
- True Costs of Inflation
- Aggregate Demand

Economic Growth and Productivity
- Business Cycles
- Labor Productivity
- Capital
- Human Capital
- Technology

Labor and Wages
- Real Wages
- Demand for Labor
- Supply of Labor

Saving and Capital Formation
- Real Interest Rate
- Stocks and Flows
- National Saving
- Fiscal Policy
- Investment

Money and Prices
- Money Supply
- Federal Reserve System
- Monetary Policy
- Interest Rates
- Velocity
Finance
Role and objective of financial management
Review of the four basic financial statements
Analysis of financial statements and financial performance
Markets and Financial Institutions
Stock and Bond Valuation
Time Value of Money
Techniques of Analysis (cash flow valuation; capital budgeting and risk analysis)

Financial Choices of Firms
Distributions to shareholders
Dividends and share repurchases/treasury stock
Managing current assets/working capital
Financing current assets/managing current liabilities

The Financial Environment
Markets, institutions, interest rates, and taxes
Risk and rates of return
Bonds and their valuation
Stocks and their valuation
Cost of capital
Capital budgeting, including cash flow estimation, decision criteria, and risk analysis
Capital structure and leverage
Distributions to shareholders
Dividends and share repurchases/treasury stock
Managing current assets/working capital
Financing current assets/managing current liabilities
Financial planning, budgeting, and forecasting.
Intermediate Accounting

Accounting Cycle, Income Statement, Balance Sheet
  Accrual vs cash
  Adjusting entries
  Extraordinary items
  Financial statement presentation and disclosures

Statement of Cash Flows
  Indirect method of cash flows
  Direct method of cash flows
  Investing & financing cash flows

Time value of money
  PV and FV of lump sum
  PV and FV of annuities
  Deferred annuities

Revenue recognition issues
  General criteria for recognizing revenue
  Long term contracts
  Installment sales
  Multi-component contracts

Revenue, Receivables and Cash Cycle
  Sales adjustments (discounts, returns, allowances)
  Notes receivable
  Sale of receivables
  Cash equivalents
  Estimating uncollectible accounts & net realizable value

Inventory & Cost of Goods Sold
  Perpetual vs periodic systems
  Inventory valuation methods
  Lower of cost or market
  Special issues: in transit, consignment, purchase adjustments

Noncurrent operating assets
  Establishing asset cost
  Valuation of assets and impairment
  Depreciation and amortization methods
  Retirement, sale or exchange of assets

Debt
  Short term liabilities
  Bond pricing
  Bond issues and retirements

Equity
  Issuance of capital stock
  Treasury stock transactions
  Cash and stock dividends
  Accounting for share-based compensation

Investment in Debt & Equity Securities
  Classification of investment securities
  Recognition of revenue from investment securities
  Accounting for the change in value of securities
  Sale of securities

Leases
Lease classification criteria
Accounting for capital leases
Accounting for operating leases

**Income Taxes**
- Computation of deferred assets and liabilities
- Carryback and carryforward of operating losses

**Earnings Per Share**
- Basic EPS
- Diluted EPS

**Pensions**

**Contingencies**

**Accounting Changes and Error Corrections**
- Changes in accounting principle
- Changes in accounting estimate
- Error corrections
Intermediate Economics

Macroeconomics
- RBC, Keynesian, New Keynesian, and Fischer Models
- Equilibrium in Endowment and Production Economies
- Consumption, Savings, Capital and Investment
- GDP and National Accounts
- IS-LM/AS-AD Model & Framework
- Output and Employment
- Uncertainty and Expectations
- Unemployment Modeling
- Fiscal Policy
- Money and Inflation

Microeconomics
- Consumer Theory
  - Preferences, Utility, Choice (Revealed Preference)
  - The Slutsky Equation
  - Compensating Variation
  - Budget Constraints
  - Demand
  - Consumer Surplus
- Theory of the Firm
  - Technology and Production Functions
  - Profit Maximization (Profit Function, Cost Minimization)
- Market Theory
  - Industry Supply under perfect competition
  - Monopoly/Oligopoly Behavior
  - Price Discrimination, Market Power, Tariffs
  - General Equilibrium and Efficiency
  - Externalities, Public Good
  - Market Failures and Corrections
- Game Theory
  - Game Theory Application
  - Monopoly and Oligopoly: Cournot and Stackleberg
  - Nash Equilibrium, Mixed Strategies
  - Sequential Games: Subgame Perfection
  - Adverse Selection, Bayesian Equilibrium, Signaling Equilibria
  - Moral Hazard: Insurance, Wages
Business Law

Foundations of Law
- Criminal vs. Civil Law
- Substantive vs. Procedural Law
- Sources of Law
- Administrative Law & Regulation
- Consumer Protection Laws
- Anti-Trust Regulations
- Unfair Trade Practices
- Employment Law & Labor Relations
- Professional Liability and Accountability
- Environmental Law

Dispute Settlement
- Means of Dispute Settlement
- State and Federal Court Organization
- Alternative Dispute Resolution
- Court Procedure
- Criminal Concerns
- Intentional Torts
- Liability

Contracts & E-Contracts
- Elements of Contracts
- Offer & Acceptance (Agreement)
- Consideration
- Form and Meaning
- Capacity
- Consent, Mistakes, Fraud, Undue influence & Duress
- Statute of Frauds & Writing Requirement
- Third Party Rights
- Performance and Discharge
- Breach & Remedies

Sales & Lease Contract Formation
- Uniform Commercial Code (UCC)
- Title
- Risk
- Insurable Interest
- Performance, Breach and Remedies
- Warranties & Limitations
- Products Liability

Agency and Employment
- Agency Formation and Duties
- Agency Rights and Remedies
- Agency Liability and Termination
- Employment at Will
- Employment Discrimination
- Employment & Immigration

Business Organization
- Partnerships
- Hybrid Business Forms
- Corporations Formation
- Management of Corporations

Property

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Personal Property vs. Real Property
Landlord-Tenant Relationships
Zoning & Government Regulations
Estates and Trusts
Insurance Terms, Concepts & Types
Intellectual Property

**Commercial Paper**
Negotiable Instruments Definition
Transferability & Holder in Due Course
Liability of Parties
Checks and Electronic Fund Transfers
E-money & Online Banking

**Creditor Rights**
Creditor Rights and Remedies
Debtor Protections
Surety & Guarantees
Bankruptcy Concepts
Mortgage and Foreclosure
Business Management

History and Theories of Management
- Scientific Management
- Organizational Developments
- Sociotechnical Theory
- Hierarchy of Needs
- Five disciplines of the Learning Organization

The Role of Customer Relations
- Building customer relationships
- Promotions, Pricing & Credit
- Environmentalism (burdens and potentials)
- Psychological & Sociological influences

Professional Management & Managing Growth
- Managing Human Resources
- Managing Operations
- Managing Risk
- Leadership & Authority
- Time management

Entrepreneurial Opportunities
- Small Businesses Concepts

Ethics in Business
- Integrity framework
- Supporting Organizational Culture

Business Analysis
- SWOT
- Internal & External (outside-in analysis & inside-out analysis)

The Business Plan
- Function of and formatting plan
- Main types of plans

Employee Relations & Leadership
- Roles in motivation
- Specifying structure and creating balance

Legal forms of Organizations
- Sole proprietorship, partnerships, C corp, LLC, etc.

Financial Planning
- Income statement
- Balance sheet
- Cash Flow statement
- Financial forecasting
- Debt & Equity

Product & Supply Chain Management
- Product lifecycle
- Branding, labeling, strategies
Psychology

History and Research
Approaches/schools of psychology
  Biological approach
  Structuralism
  Functionalism
  Gestalt
  Freud & psychoanalysis
  Behaviorism
  Cognitive revolution
Research approaches:
  Experimental approach (scientific method)
  Correlational research
  Clinical research
Ethics in research, clinical and applied psychology

Biopsychology
Physiological research techniques
Nervous system – functional organization
Neurons, electrical and chemical signaling
Neuroanatomy
Endocrine system
Animal models in psychology, evolution
Genetics
Neuroplasticity

Sensation and Perception
Sensory systems & receptors
  Vision
  Audition
  Olfaction
  Gustatory
  Tactile
  Proprioception
Attention
Perceptual processes
Psychophysical mechanisms
  Adaptation
  Threshold
  Signal detection

Consciousness
Sleep and dreaming
Meditation
Psychoactive drugs and consciousness

Conditioning and Learning
Biological (neural) basis for learning
Classical conditioning
Operant conditioning
Observational learning
Cognitive processes in learning
Constructivism
Social learning
Implicit learning
Cognition
  Memory
    Working memory
    Memory storage and retrieval
    Long & short term memory
    Semantic/episodic
    Implicit/explicit
    Forgetting
    Memory errors
  Language
    Development
    Speech
    Reading
  Thinking
    Concepts
    Categories
  Problem solving
    Decision making
    Analogical problem solving
    Creativity
    Insight
  Intelligence
    IQ
    Intelligence testing
    General/specific intelligences
    Cultural impact

Motivation, emotion
  Biological basis
    Emotion and the brain
    Hunger
    Thirst
    Sex
    Pain
  Social motivation
  Theories of emotion
  Stress

Developmental
  Types of development
    Physical
    Cognitive
    Social
    Moral
  Gender, sex, and sexuality
  Heredity and environment
  Lifespan: prenatal through geriatric
  Developmental research methods
    Longitudinal
    Cross-sectional

Personality
  Assessment: measuring personality
  Theories of personality
Type
Trait
Behaviorist
Biopsychological
Psychodynamic
Humanistic
Social cognitive
Self-concept and self-esteem

Psychological disorders
Defining “normality” and “abnormality”
Anxiety disorders
Dissociative disorders
Mood disorders
Neurocognitive disorders
Personality disorders
Psychoses
Somatoform disorders
Health, stress, coping

Treatment
Psychological therapies
   Behavioral
   Cognitive
   Humanistic
   Group
   Psychodynamic
Medical therapies, psychopharmacology
Community psychology

Social psychology
Aggression & antisocial behavior
Attitudes, attitude change
Attribution processes
Conformity, compliance & obedience
Group dynamics
Interpersonal perception
Cultural influences

Statistics, tests, measurement
Descriptive & inferential statistics (definitions)
Measurement, operational definitions
Reliability and validity
Samples, populations, standardization & norms
Research Methods

Scientific Method
  Cause and effect
  Research hypotheses
  Testability

Developing research ideas
  Defining and using constructs
  Theories, models, and hypotheses
  Pilot research

Literature searches
  Conducting a literature search
  Evaluating quality of sources
  Peer review
  Reading journal articles

Research ethics
  Belmont report
  Deception
  Institutional Review Boards and human-subjects research
  Animal Care and Use Committees and non-human subjects

Bias
  Experimenter bias
  Participant bias
  Research and Culture

Sampling
  Populations and samples
  Probability sampling methods
  Nonprobability sampling
  Sampling Error

Validity and Reliability
  Internal validity
  External validity
  Threats to validity
  Measurement
  Inter-rater reliability

Non-Experimental & Quasi-Experimental Research
  Correlational studies
  Pre-Post, time-series, and longitudinal designs
  Quasi-independent variables
  Ex Post Facto research
  Survey construction and administration
  Likert scale questions
  Tests, Inventories, and self-report

Qualitative research
  Naturalistic observation
  Case study
  Focus groups
  Coding and categorizing

Small-N and single-subject designs
  Phases and phase changes
  Reversal designs
  Multiple baseline designs
  Evaluating single-subject research
Quantitative research and Experimental Design

- Independent variables
- Dependent variables and measurement choices
- Control
- Counterbalancing
- Extraneous variables
- Confounding variables
- Group selection
- One factor, two or more groups
- Factorial designs
- Interaction
- Sample size and power

Evaluating Research

- Hypothesis testing
- Appropriate statistical tests for experimental design
- Interpreting statistical results
- Effect size
- Drawing conclusions
- Generalizability
- Causality

Tutors should be familiar with parametric and nonparametric hypothesis tests included in the College Statistics subject.
MS Excel

Proficiency with Excel 2010 required, preferably older versions as well.

Environment & Capabilities
File Tab
Excel Options – including finding and customizing
Templates – including finding and implementing
Add-Ins – including finding and installing

Toolbars
Ribbon – including identification, usage, customization, etc.
Quick Access Toolbar – including identification, usage, customization, etc.
Custom Tabs – including creation and arrangement of custom tabs, custom groups, etc.
Formula Bar and Name Box

Spreadsheet Basics
Rows and Columns
Ranges – including selecting, naming, finding, using named ranges, etc.
Views – including page layout, page break, custom, etc.
Entering Data
Printing
Worksheet Management – including inserting, deleting, hiding, unhiding, moving, copying, etc.
Panes and Page Breaks
Headers and Footers – inserting, using templates, customizing, etc.
Keyboard Shortcuts

Formatting
Formatting Cells, Worksheets, Workbooks
Format Painter
Paste Special
Conditional Formatting – including built-in styles and formula-based styles

Filtering & Sorting
Filters – including implementing, using, customizing, etc.
Sorting – including basic and custom sorts

Formulas & Functions
Entering Formulas – including basic formula syntax, etc.
Using Functions – including commonly used functions, using function helper, etc.
Evaluating Formulas and Function Results – including tracing formulas/precedents, error checking, etc.
Interpreting and Troubleshooting Formulas and Functions
Calculation Operations – including manual vs. automatic

Charts, Tables, & PivotTables
Creating, Using, and Formatting Charts
Creating, Using, and Formatting Tables
Creating, Using, and Formatting PivotTables
Smart Art and Illustrations
Sparklines

Importing & Exporting
Importing and Exporting Data/Documents
Importing and Exporting Pictures
Picture Editing

Macros
Recording Macros
Running Macros

Saving, Sharing & Protecting
Auto-Save – including default settings and customizing
Recovery
File Types (e.g., .xls, .xlsx, .xlsm, etc.)
Sharing and Protecting Worksheets and Workbooks
Evaluating Changes in Shared Documents
**MS Word**

Proficiency with Word 2010 required, preferably older versions as well.

**Program Fundamentals**
- Giving Commands in Word
- Using Command Shortcuts
- Creating, Opening, Previewing, Printing, Saving, and Closing a Document
- Using Help

**Getting Started with Documents**
- Entering, Deleting, Selecting, and Replacing Text
- Navigating, Browsing, and Viewing a Document
- Working with the Document Window and Viewing Multiple Document Windows

**Working With and Editing Text**
- Checking Spelling and Grammar
- Finding and Replacing Text
- Using Word Count and the Thesaurus
- Inserting Symbols and Special Characters
- Copying and Moving Text
- Collecting Multiple Items to Move or Copy
- Using Undo, Redo, and Repeat

**Formatting Characters and Paragraphs**
- Changing Font Type, Size, Color, Highlighting, Styles, and Effects
- Applying Spacing and Ligatures
- Creating Lists
- Changing Paragraph Alignment, Paragraph Spacing, and Line Spacing
- Adding Paragraph Borders and Shading
- Copying Formatting
- Setting, Adjusting, and Removing Tab Stops
- Using Left and Right Indents, and First Line and Hanging Indents

**Formatting the Page**
- Adjusting Margins, Page Orientation, and Size
- Using Columns, Page Breaks, Section Breaks, Line Numbers, and Hyphenations
- Working with the Page Background
- Rearranging, Numbering, and Viewing an Outline
- Rearranging and Navigating Long Documents
- Using Headers, Footers, Bookmarks, Cross-references, Footnotes, Endnotes, Citations, and Bibliographies
- Working with Picture Captions
- Adding a Table of Contents, Index, Cover Page, and Page Numbers

**Working with Themes and Styles**
- Creating, Modifying, Applying, and Deleting a Style
- Working with the Styles Gallery
- Creating a New Quick Style Set
- Selecting, Removing, and Printing Styles
- Comparing and Cleaning Up Styles
- Applying Document Themes
- Creating and Saving New Theme Colors and Fonts

**Working with Shapes and Pictures**
- Inserting and Formatting Clip Art, Screenshots, Pictures, Text Boxes, Shapes, and Graphics Files
- Removing a Picture's Background
- Formatting and Otherwise Altering the Look of Pictures and Graphics
- Resizing, Moving, Copying, Positioning, Grouping, and Deleting Objects
- Applying Special Effects
Aligning, Distributing, Flipping, Rotating, and Layering Objects

**Working with WordArt, SmartArt, and Charts**
- Inserting, Editing, and Formatting WordArt
- Inserting and Formatting SmartArt
- Working with SmartArt Elements
- Inserting, Editing, and Formatting a Chart
- Working with Labels
- Using Chart Templates

**Working with Tables**
- Creating, Resizing, Moving, and Manipulating a Table
- Adjusting Table Alignment and Text Wrapping
- Working with Cell Formatting
- Merging and Splitting Cells and Tables
- Inserting and Deleting Rows and Columns
- Adjusting Row Height and Column Width
- Using Table Drawing Tools
- Working with Sorting and Formulas
- Working with Borders and Shading
- Using Table Styles and Table Style Options
- Converting or Deleting a Table
- Using Quick Tables

**Working with Mailings**
- Setting Up the Main Document for Mail Merge
- Creating and Editing a Data Source
- Selecting an Existing Data Source
- Inserting Merge and Rules Fields
- Previewing and Completing a Mail Merge
- Creating Labels and Envelopes

**Using Collaborative Editing Tools**
- Tracking, Accepting, and Rejecting Revisions
- Using Comments
- Comparing and Combining Documents
- Protecting a Document (with or without password)

**Working with Templates**
- Creating and using a Document Template
- Creating and Using Building Blocks and AutoText
- Attaching a Different Template to a Document
- Copying Styles between Documents and Templates

**Working with Forms**
- Creating a New Form
- Adding Content Controls
- Assigning Help to Form Content Controls
- Preparing the Form for Distribution
- Filling Out a Form

**Customizing Word**
- Customizing the Ribbon and Quick Access Toolbar
- Using and Customizing AutoCorrect
- Changing Word’s Default Options

**More Topics**
- Converting an Older Document to Word 2010
- Translating Text
- Publishing a Blog Entry
Using Hyperlinks
Viewing Document Properties and Finding a File
Recovering Your Documents
Managing Versions
Recording, Playing, and Deleting a Macro
MS PowerPoint

Apply and change advanced options
Customizing the ribbon
Customizing the quick access toolbar
Creating/using macros
Using different view options
Proofreading options
Creating presenter notes
Setting up a slideshow
Adding animations
Utilizing transitions
Using & creating themes
Inserting charts & graphs
Inserting images
Grouping shapes and pictures
Creating tables
Inserting text options
Using audio & video in presentations
Working with watermarks
Creating and printing handouts
Adding headers & footers
Flowchart creation
Using and creating templates
Using drawing tools
Adding, removing, publishing slides
Creating layouts
Save & send options
Font options
Print options
Properties and Protecting File
Object-Oriented Program Design

Program design
- Read and understand a problem description, purpose, and goals
- Apply data abstraction and encapsulation.
- Read and understand class specifications and relationships among the classes ("is-a," "has-a" relationships).
- Understand and implement a given class hierarchy.
- Identify reusable components from existing code using classes and class libraries.

Class design
- Design and implement a class.
- Choose appropriate data representation and algorithms.
- Apply functional decomposition.
- Extend a given class using inheritance.

Program Implementation

Implementation techniques
Methodology
- Object-oriented development
- Top-down development
- Encapsulation and information hiding
- Procedural abstraction

Programming constructs
- Primitive types vs. objects
Declarations
- Constant declarations
- Variable declarations
- Class declarations
- Interface declarations
- Method declarations
- Parameter declarations

Console output (System.out.print/println)

Control
- Methods
- Sequential
- Conditional
- Iteration
- Understand and evaluate recursive methods

Java library classes
C++ library classes

Program Analysis

Testing
- Test classes and libraries in isolation.
- Identify boundary cases and generate appropriate test data.
- Perform integration testing.

Debugging
- Categorize errors: compile-time, run-time, logic.
- Identify and correct errors.
- Employ techniques such as using a debugger, adding extra output statements, or hand-tracing code.

Understand and modify existing code
- Extend existing code using inheritance
- Understand error handling
- Understand runtime exceptions.
Reason about programs
  Pre- and post-conditions
  Assertions
Analysis of algorithms
  Informal comparisons of running times
  Exact calculation of statement execution counts
  Basic big-O questions
Numerical representations and limits
  Representations of numbers in different bases
  Limitations of finite representations (e.g., integer bounds, imprecision of floating-point representations, and round-off error)

**Standard Data Structures**
  Simple data types (int, boolean, double)
  Classes
  Lists
  Arrays
  Trees, binary trees, and binary search trees

**Standard Algorithms**
  Operations on data structures previously listed
    Traversals
    Insertions
    Deletions
  Searching
    Sequential
    Binary
  Sorting
    Selection
    Insertion
    Mergesort

**Computing in Context**
  System reliability
  Privacy
  Legal issues and intellectual property
  Social and ethical ramifications of computer use
Spanish

Basic Sentence Structure
- Gender & Number of Nouns
- Definite Articles
- Indefinite Articles
- Noun-Adjective Agreement
- Negation (& Double Negatives)
- Contractions Al / Del
- Questions and Exclamations

Advanced Sentence Structure
- Direct and Indirect Object Pronouns
- Relative Pronouns & Adjectives
- Possessive Pronouns
- Superlatives
- Demonstratives
- Comparisons of Quantity and Number
- The Personal “a”
- Por vs. Para
- Pero / Sino / Sino Que

Basic Verb Forms
- Present Indicative
- Stem Changing Verbs
- Gustar Type Verbs
- Irregular 1st Person Verbs (“go, zco, jo, oy, eo “verbs)
- Present Progressive
- Ser vs. Estar
- Saber vs. Conocer

Intermediate Verb Forms
- Preterit (Definite Past)
- Imperfect (Undefined Past)
- Reflexive Verbs
- Conditional Tense
- Future Tense
- Irregular Preterit Verbs

Advanced Verb Forms
- Subjunctive Tenses & Conditions
- Perfect Tenses
- Past Participles
- Formal Commands
- Informal (tú) Commands
- Negative Commands

Idiomatic Expressions
- Acabar de
- Hay / Hay que
- Hace… (To indicate time that has passed)
- Valer la Pena

Basic Vocabulary Units
- Ordinal Numbers
- Telling Time
- Expressions for Weather
Sports & Recreation
Science & Technology
Animals
Home Decor and Furnishings
Food & Kitchen
School & Office
Family Expressions & Relationships
Clothing
Medical Care & Human Physiology
Feelings & Emotions
Travel (Train & Air)
Customary Greetings & Protocol
French

Basic Sentence Structure
- Gender & Number of Nouns

Vocabulary (including but not limited to...)
- Numbers and time
- Greetings, letter writing, speaking on the phone
- Food and drink
- Marketplace
- Clothing
- Education and careers
- Personal relationships, friends, family
- Emotions
- Hobbies, sports, leisure, travel
- Animals, plants, scenery, weather
- Body parts, illnesses, basic medical terms
- Residences, rooms, furniture
- Government, public institutions, infrastructure, news
- French/English faux amis
- Common French idioms

Grammar and Style
- Verb conjugations, tenses, and moods
  - Indicative present and imperative
  - Passé compose, including which verbs take avoir and être
  - Imperfect (imparfait), including when to use it instead of passé composé
  - Literary use of passé simple
  - Indicative future
  - Conditional present and past
  - Pluperfect (plus-que-parfait)
  - Subjunctive present and past, including when to use subjunctive instead of indicative
  - Past participle (e.g. mangé) and present participle (e.g. mangeant)
- Pronouns
  - Subject pronouns (je, tu, il...)
  - Direct object pronouns (me, te, le...)
  - Indirect object pronouns (me, te, lui...)
  - Stressed pronouns (moi, toi, lui...)
  - Possessive pronouns (le mien, le tien...)
  - Demonstrative pronouns (celui, celle...)
  - Relative pronouns (que, qui, lequel...)
  - y and en
  - Order of pronouns in sentence
- Determiners
  - Definite articles (le, la, les)
  - Indefinite articles (un, une, des)
  - Partitive articles (du, de la)
  - Possessive articles (mon, ton, son...)
  - Demonstrative articles (ce, cette, ces)
- Other grammatical components
  - Adjectives, including comparative and superlative adjectives (e.g. meilleur)
  - Adjective placement relative to noun
  - Adverbs, including comparative and superlative adverbs (e.g. bien, mieux)
  - Prepositions
Sentence structures
   Negation
   Interrogative sentences
   Passive voice
   Conditional constructions
   Compound and complex sentences with independent and dependent clauses

Literature (including but not limited to...)
   Louise Labé
   Jean-Jacques Rousseau
   Guy de Maupassant
   Paul Verlaine
   Jules Verne
   Victor Hugo
   Albert Camus

Pronunciation and Phonetics
   Describe how French vowels and certain French consonants differ from their English counterparts
   Identify silent consonants and vowels
   Identify and pronounce nasalized vowels
   Use liaison and enchaînement to enhance euphony
   Describe how stress functions in words and sentences
   Describe how pronunciation and stress differ in poetry

French History and Culture
   Basic history of France, from Roman Gaul to modern times
   Basic geography of France, French territories, and other French-speaking nations
   French education system
   Present-day government of France
   French holidays and customs
German

Adjectives
- Adjective Endings
- Comparative & Superlative
- Definite & Indefinite Articles
- Der- & ein-Words
- Extended Adjective Modifiers
- Present & Past Participles

Adverbs
- Expressions of Time
- Negation

Conjunctions
- Coordinating Conjunctions
- Subordinating Conjunctions
- Main and Subordinate Clauses

Nouns
- Appositives
- Case: Nominative, Accusative, Dative, & Genitive
- Gender

Prepositions
- Accusative, Dative, Genitive, & Two-way
das & wo-compounds
- Idiomatic Use of Prepositions

Pronouns
- Personal, Interrogative, Demonstrative, Indefinite, Possessive, Relative, & Reflexive

Punctuation
- Comma Rules

Verbs
- Conjugation
- Imperative
- Indirect Discourse & Subjunctive I
- Infinitival Constructions (um...zu, (an)statt...zu, ohne...zu)
- Modal Verbs
- Passive Voice, Statal Passive, Alternatives to Passive
- Regular & Irregular Verbs
- Subjunctive II
- Tense: Present, Present Perfect, Simple Past, Past Perfect, Future & Future Perfect
- Verbs with Separable & Inseparable Prefixes

Word Order
Italian

Basic Sentence Structure
- Italian alphabet, special characteristics
- Regular verbs
- Greetings
- Common salutations
- Expressing opinions
- Masculine versus feminine nouns
- Pronouns

Numbers/currency
- Date
- Time

Weather/seasons
- Action verbs
- Direction, travel
- Culinary, food

Advances sentence structure
- Irregular verbs
- Direct pronouns
- Indirect-object pronouns
- Reflexive verbs
- Adjectives
- Using prepositions
- Imperfect subjunctive
- Il congiuntivo trapassato
- Il congiuntivo passato
- Il congiuntivo futuro
- Modal verbs
- Articulated prepositions
- Double object pronouns
- Future perfect
- Words with dual meaning
- Adverb
- Negative statements
- Conosce/Sapere
- Prepositions

Anatomy/Medical/Dental
- Body parts
- Symptoms
- Study of

Italian lifestyle
- Culture
- Politics
- Current affairs
- Business
- Professional writing
- Culinary, food