## Basic Concepts List

for All Available Subjects

Last updated September 2019

### Math

<table>
<thead>
<tr>
<th>Level</th>
<th>Subject</th>
</tr>
</thead>
<tbody>
<tr>
<td>Elementary Math</td>
<td>Trigonometry</td>
</tr>
<tr>
<td>Mid-level Math</td>
<td>Pre-Calculus</td>
</tr>
<tr>
<td>Algebra</td>
<td>Calculus</td>
</tr>
<tr>
<td>Algebra II</td>
<td>Calculus BC</td>
</tr>
<tr>
<td>Geometry</td>
<td>Multivariable Calculus</td>
</tr>
</tbody>
</table>

### Science/Health/Engineering

<table>
<thead>
<tr>
<th>Subject</th>
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<tbody>
<tr>
<td>Elementary Science</td>
</tr>
<tr>
<td>Physics – Algebra Based</td>
</tr>
<tr>
<td>Organic Chemistry</td>
</tr>
<tr>
<td>Medical Coding</td>
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<tr>
<td>Earth Science</td>
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<tr>
<td>Physics – Calculus Based</td>
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<tr>
<td>Health Administration</td>
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<tr>
<td>Electrical Engineering</td>
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<tr>
<td>Biology</td>
</tr>
<tr>
<td>Anatomy &amp; Physiology</td>
</tr>
<tr>
<td>Nursing RN (Pediatrics)</td>
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<tr>
<td>Chemistry</td>
</tr>
<tr>
<td>Microbiology</td>
</tr>
<tr>
<td>Nursing</td>
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### Humanities

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<thead>
<tr>
<th>Subject</th>
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<tbody>
<tr>
<td>Social Studies</td>
</tr>
<tr>
<td>Essay Writing</td>
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<tr>
<td>College Essay Writing</td>
</tr>
<tr>
<td>Literature</td>
</tr>
<tr>
<td>Symbolic Logic</td>
</tr>
<tr>
<td>Reading</td>
</tr>
<tr>
<td>Primary Reading</td>
</tr>
<tr>
<td>ESL</td>
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<tr>
<td>Primary ESL</td>
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### Social Sciences

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<tr>
<th>Subject</th>
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<tbody>
<tr>
<td>Intro Criminal Justice</td>
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<tr>
<td>Intro Ethics</td>
</tr>
<tr>
<td>Intro Philosophy</td>
</tr>
<tr>
<td>Intro Psychology</td>
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<tr>
<td>Intro Sociology</td>
</tr>
<tr>
<td>Research Methods</td>
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### Business

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<thead>
<tr>
<th>Subject</th>
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<tbody>
<tr>
<td>Intro Accounting</td>
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<tr>
<td>Intermediate Accounting</td>
</tr>
<tr>
<td>Managerial Accounting</td>
</tr>
<tr>
<td>Intro Economics</td>
</tr>
<tr>
<td>Intro Finance</td>
</tr>
<tr>
<td>Cost Accounting</td>
</tr>
<tr>
<td>Tax Accounting</td>
</tr>
<tr>
<td>Intermediate Macroeconomics</td>
</tr>
<tr>
<td>Business Law</td>
</tr>
</tbody>
</table>

### Computer Science/Technology

<table>
<thead>
<tr>
<th>Subject</th>
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<tbody>
<tr>
<td>MS Access</td>
</tr>
<tr>
<td>Adobe Illustrator</td>
</tr>
<tr>
<td>Principles of CS</td>
</tr>
<tr>
<td>MS Excel</td>
</tr>
<tr>
<td>Adobe InDesign</td>
</tr>
<tr>
<td>C++</td>
</tr>
<tr>
<td>MS Word</td>
</tr>
<tr>
<td>Adobe Photoshop</td>
</tr>
<tr>
<td>Java</td>
</tr>
<tr>
<td>MS PowerPoint</td>
</tr>
<tr>
<td>Webdesign</td>
</tr>
<tr>
<td>Python</td>
</tr>
<tr>
<td>Windows</td>
</tr>
<tr>
<td>Database Systems</td>
</tr>
</tbody>
</table>

### Foreign Languages

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<thead>
<tr>
<th>Language</th>
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<tbody>
<tr>
<td>French</td>
</tr>
<tr>
<td>German</td>
</tr>
<tr>
<td>Italian</td>
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<tr>
<td>Spanish</td>
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</tbody>
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Confidential – Do Not Distribute
Elementary Math (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 Math (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
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
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
Trigonometry

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


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
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
- Trigonometric graphs
- Perform translations for various conic sections
- Law of Cosines and Law of Sines
- Arithmetic and Geometric sequences
- Functions and Graphs (Linear and Polynomial)
- Trigonometric Ratios and Identities
- 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
- Riemanns 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 Funcitons
- 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
Multivariable Calculus

Vectors & Geometry of Space in Multiple Dimensions
  Two Dimensional Coordinate Systems
  Three Dimensional Coordinate Systems
  Vectors
  Cylindrical Coordinates
  Spherical Coordinates
  The Dot Product
  The Cross Product
  Equations of Lines and Planes
  Cylinders and Quadric Surfaces
  Functions of Several Variables

Vector Functions
  Vector Functions and Space Curves
  Derivatives of Vector Functions
  Integrals of Vector Functions
  Tangent, Normal, and Binormal Vectors
  Arc Length and Curvature
  Motion: Position, Velocity, and Acceleration

Multivariable Differentiation
  Limits and Continuity
  Partial Derivatives
  Differentials
  Chain Rule
  Tangent Planes and Linear Approximations
  The Gradient Vector Operator and Directional Derivative
  Critical Points: Relative and Absolute Extrema
  Lagrange Multipliers

Multivariable Integration
  Double Integrals over General Regions
  Double Integrals in Polar Coordinates
  Applications of Double Integrals
  Triple Integrals
  Triple Integrals in Cylindrical and Spherical Coordinates
  Applications of Triple Integrals
  Change of Variables: Jacobian of a Transformation

Vector Calculus: Line Integrals
  Vector Fields
  Line Integrals
  The Fundamental Theorem For Line Integrals
  Conservative Vector Fields
  Potential Functions of Vector Fields
  Green's Theorem
  The Divergence and Curl Vector Operators

Vector Calculus: Surface Integrals
  Parametric Surfaces and Area
  Surface Integrals
  Stokes' Theorem
  Gauss' Divergence Theorem
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.
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 Type 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
Quantitative Reasoning

Logic/Critical Thinking
Truth Tables
Simple Statements
Venn Diagrams
Compound Statements
Analyzing Arguments

Arithmetic Knowledge
Fractions
Decimals and Rounding
Scientific Notation, Powers of 10, and Approximations
Rate, Ratio and Proportion
Percentages
Uses and Abuses of Percentages
Index Numbers
Unit Conversions
Interpretation of Graphs

Geometry/Trigonometry
Perimeters and Areas of Basic Geometric Shapes
Measures of Distance and the Pythagorean Theorem
Volume and Surface Area
Basic Trigonometry
Graphs of the Trigonometric Functions
Applications of Trigonometry

Functions
Definition and the Vertical Line Test
One-to-one and Inverse Functions, the Horizontal Line Test
Linear Functions (Standard and Slope-Intercept Forms of Equations)
Applications of Linear Models
Linear Inequalities
Nonlinear Models (Exponential, Power, Logarithmic)
Graphing Functions (Excel or TI-84/83)
Solving systems of equations (Linear & Nonlinear)
Linear Programming (Graphical Method)
Linear Programming (Simplex Method)

The Mathematics of Finance
Simple Interest
Compound Interest (Lump Sums and Annuities)
Applications of Compound Interest
Amortization Schedules

Descriptive Statistics
Measures of Central Tendency
Measures of Spread/Dispersion/Variation
Percentiles & Z-scores
Graphing Tools Used to Summarize Data

Designing & Analyzing Studies
Observational vs Experimental Studies
Sampling Methods (Strengths and Weaknesses)
Critical Evaluation of Statistical Studies

Probability Rules & Simulation
Counting Methods - Multiplication Principle, Permutations, Combinations
Probability Concepts and Rules
Independent vs. Dependent Events
Joint vs. Disjoint (Mutually Exclusive) Events
Law of Large Numbers
Simulation Using TI-84/83 or MS Excel
Probability Distributions
Discrete vs Continuous Distributions
Normal Distribution
Random Variables and Probability Distributions
Expected Value & Risk Assessment
Binomial and Geometric Distributions, including
Normal Approximation to the Binomial Distribution

Inductive/Deductive Reasoning

Inference & Regression
Central Limit Theorem
Logic of Confidence Intervals
Logic of Hypothesis Testing
One Sample Inference Testing
One Sample Inference About a Population Mean
One Sample Inference About a Population Proportion
Scatterplots & Correlation
Simple Linear Regression
Quantitative Methods

Applications and Limitations of Quantitative Analysis
  Business and Decision Analysis
  Arts and Social Sciences
  Medical and Health Sciences

Data and Terms
  Data Quality and measures
  Multivariate data
  F Statistic
  Coefficient Interpretation
  Data Sensitivity
  Hypothesis Testing

Decision Models
  Maxmin and Maximax
  Hurwicz
  Expected Value and Expected Value Perfect Information
  Decision Tree
  Equal Likelihood
  Highest Value vs Lowest Cost

Forecasting
  Linear Regression
  Non-Linear Regression
  Moving Average
  Exponential Smoothing
  Seasonal Index

Linear Algebra
  Vector
  Matrix
  Determinant
  Solving systems

Calculus
  Functions
  Derivatives
  Optimization

Advanced Statistical Modeling
  Chi Square
  Data Clustering
  ANOVA
  Simulation
  Probability Modeling
Linear Algebra

Systems of Linear Equations
- Homogeneous and non-homogeneous systems
- Matrix representation of system
- Row reduction and echelon forms
- Gaussian and Gauss-Jordan elimination
- Consistent and inconsistent systems

Matrix Properties and Arithmetic
- Addition, Subtractions, Scalar Multiplication
- Matrix multiplication
- Transpose of a matrix
- Special Matrices - Identity, zero, diagonal, etc.
- Elementary matrices and elementary row operations
- Row equivalence

Determinants
- Determinant of 2 x 2 and 3 x 3 matrices
- Co-factor expansion
- Cramer’s Rule
- Theorems involving determinants and invertibility
- Properties of determinants

Linear Transformations
- Properties of linear transformations
- Matrix representation of linear transformation
- Kernel
- Range
- Change of basis

Vector Spaces
- Linear dependence and independence
- Rank and nullity of a matrix
- Properties of vector spaces
- Subspaces
- Span of a vector space
- Basis of a vector space
- Properties of vectors and vector arithmetic

Eigenvalues and Eigenvectors
- Eigenvalues and Eigenvectors
- The Characteristic Equation

Matrix Decomposition
- LU decomposition
- QR decomposition
- Diagonalization
- Singular Value decomposition

Orthogonality/Least Squares
- Inner product spaces
- Orthogonality
- Orthonormal bases
- Gram-Schmidt orthonormalization
- Least squares regression
Differential Equations

Introduction to Ordinary Differential Equations
- Define and classify differential equations
- Determine whether a function is a solution to a DE
- Existence and Uniqueness Theorem
- Principle of Superposition

1st order Ordinary Differential Equations
- Identify 1st order linear, separable, exact, Bernoulli, and homogeneous 1st order ODEs
- Find general solution for 1st order ODEs
- Solve 1st order initial value problems
- Construct and solve ODEs for applications such as mixtures, populations, and Newtonian Mechanics

Gaining information about ODEs without solving
- Identify autonomous 1st order ODEs
- Find and classify equilibrium solutions to autonomous 1st order ODEs with constant coefficients
- Predict end behavior of solution to autonomous ODE given initial condition
- Construct, identify, and interpret slope/direction fields
- Euler's method

Higher Order ODEs
- Linear independence of solutions
- Construct and solve problems involving harmonic motion, electrical circuits, and projectile motion
- Solve linear higher order ODEs with constant coefficients using method of undetermined coefficients
- Find second solution to 2nd order ODE using method of Reduction of Order
- Find particular solution to 2nd order nonhomogeneous ODE using variation of parameters
- Solve Cauchy-Euler equations

Laplace Transforms
- Compute Laplace transforms of simple functions using definition of Laplace transform
- Compute Laplace transforms of polynomial, exponential, and trig functions using table
- Solve IVPs using Laplace transforms

Power Series Solutions of ODEs
- Manipulate power series
- Identify ordinary and singular points of ODEs
- Evaluate recurrence relations
- Find power series solutions of ODEs

Systems of 1st Order Differential Equations
- Use row operations to reduce matrices
- Compute eigenvalues and eigenvectors of square matrices
- Solve system of two 1st order linear ODEs with constant coefficients using matrix methods
- Convert 2nd order linear ODE to a system of two first order linear ODEs
- Orthogonality
- Orthonormal bases
- Gram-Schmidt orthonormalization
- Least squares regression
Elementary Science

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

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
  Graphical interpretations
  Models
  Scientific Method
  Scientific Quantities
  Scientific Thinking
  Scientists and Discoveries
  Theories and Laws
  Tools and Measurement

Geology
  Biomes
  Chemical Cycles
  Climate change
  Ecosystems
  Energy flow – Carbon cycle – Population Growth
  Erosion and Weathering
  First Principle of Geology
  Fossils
  Glaciers
  Human impact/changes to planet
  Law of Superposition
  Minerals
  Natural disasters – causes, effects, impact
  Natural Resources
  Plate Tectonics
  Pollution
  Population
  Principle of Uniform Process
  Radioactive dating of rocks
  Relative Age
  Soil
  Time
  Types of Rock and the Rock Cycle
  Unconformity
  Water

Meteorology
  Air
  Weather Conditions and how they are created
  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
  Contributions 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
  Features of the Moon
  Theories of the creation of the moon
  Sun
  Solar system
  Stars
  Galaxies
  Big Bang Theory and evidence
  Space probes and exploration
  Telescopes
Biology

Chemistry of Life
- Atoms
- Carbohydrates, Lipids, Proteins, and Nucleic Acids
- Chemical Gradients
- Important properties of water
- Molecular Movement, Osmosis and Diffusion
- Monomers and Polymers
- Origins of life
- pH

Cell Structure and Function
- Active and Passive Transport
- Cell junctions
- Cellular Transport across the Cell Membrane
- Facilitated Diffusion
- Fluid Mosaic Model of the Cell Membrane and Semi-permeability
- Prokaryotic and eukaryotic cells
- Receptor Proteins
- Signaling Molecules
- Structure and function of cellular components

Cellular Energetics
- Autotrophs and Heterotrophs
- Calvin Cycle
- Cell cycle
- Cell Cycle Checkpoints
- Cell Reproduction
- Change in free energy
- Chemosynthesis
- Coupled reactions, activation energy, and ATP
- Electron Transport Chain
- Enzymes, Enzymatic Functions, and Enzymatic Pathways
- Exergonic and Endergonic Reactions
- Fermentation
- G0, G1, S, G2, and M Phases of the Cell Cycle
- Glycolysis
- Krebs Cycle
- Light-Dependent Reactions of Photosynthesis
- Meiosis
- Mitosis
- Oncogenes and Tumor Suppressors in relation to cell cycle
- Ploidy

Molecular Biology
- DNA and genome structure
- Famous experiments
- Genetic Engineering Techniques and Their Uses
- Introns and mRNA splicing
- Mutations and Chromosomal Abnormalities
- Regulation of Gene Expression and Epigenetics
- Semi-conservative replication
- Transcription
- Translation and protein processing

Heredity
- Dominance, co-dominance, and incomplete dominance
- Inheritance
- Mendel’s Law of Heredity
- Mitochondrial DNA
- Monohybrid, Dihybrid, and Trihybrid Crosses
- Pedigree Analysis
- Probability of Genotypes or Phenotypes based on Genetic Crosses
- Sex-linked Traits

Evolution and Phylogeny
- Cell Theory and Characteristics of Life
- Common Ancestry
- Evidence Supporting Evolution
- Examples of Selective Pressures and Their Effects on Population
- Natural Selection and Fitness
- RNA World Hypothesis
- The Role of Genetic Drift, Mutation, and Sexual Reproduction in Evolution
- Theory of Endosymbiosis
- Three-Domain Hypothesis
- Types of Selection
- Hardy-Weinberg Equilibrium
- Phylogenetic Trees & Cladograms
- Speciation & Extinction
- Taxonomy

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

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

Plant Form & Function
- Adaptations of Plants to Land
- Alternation of Generations
- Evolution of Plants from Algae
- Plant Reproduction
- Plant Structures
- Pollen, Seeds, Flowers, and Fruit
- Response to Stimuli (hormones involved)
- Vascular and Nonvascular Plants

Fungi
- Fungal Structures
- Reproduction
- Role in Decomposition

Ecology
- Biodiversity
- Biogeochemical cycles
- Biomes
- Biotic and Abiotic Factors Affecting Environments
- Ecosystem Energy Flow
- Interactions between species and types of symbiosis
- Life History Strategies
- Population Growth and Regulation
- Producers, Consumers, and Decomposers

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

Lab techniques
- Bacterial culturing
- Centrifugation
- Gel electrophoresis
- Microscopy
- Serial dilution
- Spectrophotometry
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
- 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 and Structure
- Octet Rule
- Electron Configurations
- Lewis Dot Structure
- Periodic Trends
- Chemical Bonding
- Valence electrons
- Orbitals
- Orbital Geometry
- Molecular Geometry
- VSEPR theory
- Quantum Theory
Atomic and Molecular Structure (cont’d)
- Polarity
- Dipole moment
- Hybridization
- Sigma bond
- Pi Bond
- Resonance structures

Solids
- Crystalline Solids
- Bragg’s Law
- Unit cell

Liquids and Changes of State
- Compressibility
- Surface tension
- Transition states
- States of Matter
- 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 and 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 and 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
- Radioactive Decay
- Fission and Fusion
- Nuclear equations
- Half-life
Nuclear Chemistry (cont’d)
- 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
- Titration using indicators and meters
- Spectrophotometry/calorimetry
- Gravimetric Analysis
Physics – Algebra-based

Math basics
   Algebra and Trigonometry
   Dimensional analysis
   Metric system
   Scientific notation
   Significant digits
   Vectors and scalars

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

Work, energy and power
   Work and work-kinetic energy theorem
   Conservative forces and Potential energy
   Conservation of mechanical energy
   Power
   Simple Harmonic motion
   Momentum
   Sources of energy on Earth

Fluid Mechanics
   Density and Pressure
   Buoyancy – Archimedes’ Principle
   Fluid dynamics
   Fluid Flow continuity equation
   Bernoulli’s Equation

Fluid Mechanics (Cont’d)
   Hydrostatics
   Fluid Pressure

Thermal Physics
   Heat
   Temperature
   Mechanical Equivalent of heat
   Heat Transfer and thermal expansion
   Calorimetry
   Kinetic Theory
   Ideal Gases
   Gas laws
   Thermodynamics

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

Current Electricity
   EMF
   Circuits
   AC/DC
   Current
   Resistance
   Electric Power
   Electric Energy
   Resistors in series
   Resistors in Parallel
   Batteries and Internal Resistance
   Kirchhoff’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

(Back to Science)
Electromagnetism (cont’d)
- 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
- Diffraction
- Polarization
- The electromagnetic spectrum
- Inverse square law

Modern Physics
- Atomic Physics and Quantum Effects

Nuclear Physics
- Atomic mass
- Mass number
- Atomic number
- Mass defect and binding energy
- Nuclear processed
- 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
- Scientific notation
- Estimates and orders of magnitudes
- Significant figures
- Vectors and scalars
- 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
- 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
- Mass and weight
- Fundamental forces of nature
- Static and kinetic friction
- Air resistance
- Elevator problems
- Incline planes
- Atwood Machines
- Dynamics of circular motion

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
- Non-conservative forces

Work, energy, and power (cont’d)
- Conservation of mechanical energy
- Energy diagrams
- Power

Systems of particles, linear momentum, impulse and collisions
- Center of mass
- Two object system
- Momentum

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

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

Fluid Mechanics
- Density and Pressure
- 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
Thermal Physics
Heat, Temperature
Mechanical Equivalent of heat
Heat Transfer and thermal expansion
Calorimetry
Kinetic Theory
Ideal Gases, Gas laws
Thermodynamics

Electricity and Magnetism

Electrostatics
Electric charges
Conductors, insulators and semiconductors
Charging by conduction and 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
Dielectrics

Current and Resistance
Current
Resistivity
Resistance

Direct Current Electric Circuits
EMF
Electric Power, Electric Energy
Resistors in series and 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

Electromagnetism (Cont’d)
RL circuits, LC circuits, LRC circuits
Faraday’s Law, Lenz’s Law
Alternating current 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
Physical Optics

Modern Physics
Quantum Mechanics and the nature of light
Relativity
Atomic physics and quantum effects
Nuclear physics
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 & Spongy 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
Microbiology

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
- Nutrition
- Growth
- Control in various environments
- Structure
- Metabolism
- Pathways
- Catabolism
- Anabolism
- Gram positive bacteria anatomy
- Gram negative bacteria anatomy
  - Deinococci
  - Nonproteobacteria
- Biochemistry processes
- Recombinant DNA technology
- 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
- 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
- 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
- Chromatography
- Spectrophotometry
- Serial dilution technique and calculations
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

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
- 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
Health Administration

Governance and Organizational Structure
Organizational structures, key players, and their impact on health care delivery system
Responsibility, authority, and accountability at each level of an organization
Developing, implementing, and updating strategic plans
Accreditation, regulatory, licensing, and certification programs

Quality and Performance Improvement
Quality assessment programs and procedures
Importance of regulation in health care organizations and its impact on continuous quality improvement
Processes of continuous quality improvement, including the cost-quality paradigm

Law, Ethics, and Professionalism
Government regulations and laws affecting the healthcare environment
Relationship between healthcare law and healthcare ethics
Application of moral, ethical, and legal principles in the delivery of healthcare
Role of healthcare workers in protecting patient rights

Human Resources
Assessing personnel needs
Recruitment, selection, compensation, and training of personnel
Evaluation of personnel including disciplinary actions

Management
General management principles
Role of leadership in promoting organizational effectiveness
Management change theories and strategic management

Healthcare Finance, Technology, and Information Management
Common financial tools, processes, and techniques used in healthcare
Revenue cycle & reimbursement
Financial considerations in the provision of health services (e.g. admitting and registration, case management/denials, credit and collections)
Management and clinical information systems
Electronic health records including legal and ethical issues

Healthcare
Trends that are likely to shape the future of healthcare
Role, structure, and funding of various health care organizations (e.g. physician’s office, walk-in clinic, hospital, ambulatory surgery center, rehabilitation center, etc.), community health services, and public health
Patient relations
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

Nursing Pathophysiology (Cont’d)
- Integumentary system
- Cell and body tissue physiology
- Fluid and electrolyte balances
- Genetic and hereditary disorders
- Inflammation, infection and immune response systems
- Oncological diseases
- Otalarynchology
- Ophthalmology

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
Nursing Pharmacology (Cont’d)

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
Ophthalmic and otic drugs
Hormones that regulate calcium and bone metabolism
Drugs used in oncologic disorders
OTC drugs, herbal and dietary supplements
Nursing RN (Pediatrics)

Systems and Associated Disorders
- Cardiovascular and circulatory
- Endocrine
- Excretory
- Gastrointestinal
- Immune
- Integumentary
- Musculoskeletal
- Nervous and sensory
- Reproductive
- Respiratory

Health Assessments
- Communication with patients and family
- Diagnostic testing and evaluation
- Physical and developmental assessments

Health Promotion
- Health promotion for pediatric patients
- Health promotion for the families of pediatric patients
- Influences of family on child health promotion
- Influences of socioeconomics, culture, and religion on child health promotion

Nursing Care
- Chronic illness
- Cognitive and sensory impairment
- Community-based nursing care
- Disability
- End-of-life care
- Family-centered care

Interventions
- Behavioral
- Community
- Family
- Health System
- Physiological
- Safety

Professional Performance
- Advocacy
- Ethics
- Evidence-based practice and research
- Law and regulation

Fundamentals of nursing
- Nursing roles, settings, and health care trends

Systems and associated disorders seen in all stages of childhood (newborn, infant, toddler, preschooler, school-age, and adolescent)
- Cardiovascular system
- Circulatory system
- Excretory system
- Respiratory system
- Nervous system
- Gastrointestinal system
- Endocrine system
- Reproductive system
- Musculoskeletal system
- Integumentary system
- Immune system
- Otolaryngology
- Ophthalmology

Nursing care as it applies to pediatric patients
- Communication with the patient and family
- Pediatric nursing skills
- Physical and developmental assessments
- Diagnostic testing and evaluation
- Health promotion for patients in all stages of childhood (newborn, infant, toddler, preschooler, school-age, and adolescent) and their families
- Family, social, cultural, and religious influences on child health promotion
- Community-based nursing care
- Family-centered care at home and during hospitalization
- Care of the child and family in the following contexts:
  - Chronic illness
  - Disability
  - Cognitive and sensory impairment
  - End-of-life care

Pediatric variations of standard nursing practices and interventions
- Pain assessment and management
- Altered fluid electrolyte or acid-base balance
- Medication administration
- Trauma and shock
- Pre- and post-surgery
- Infections
- Altered immunity
- Cancer
Medical Coding

Anesthesia
Medicine
Endocrine system
Nervous system
Urinary system
Integumentary system
Pathology
Laboratory
Hemic and lymphatic system
ICD-10-CM
Practice management
Medical terminology
Radiology
Musculoskeletal system
Digestive system
Evaluation and management
Respiratory system
Mediastinum and diaphragm
Male/female genital system
Maternity and delivery
Eye and ocular adnexa
HCPCS Level II
Electrical Engineering

Communication skills in engineering
Overview of the process of engineering design for electrical and electronic systems
Electrical and Electronic Careers
Engineering Notation & Measurements
Fundamental Electrical Properties
  Ohm’s Law and Power
  Measuring voltage, current, and resistance with multimeters
  Preparing electrical cables (Romex) for use in residential wiring
  Series circuits
  Parallel circuits
  Wiring a basic lighting circuit
Analog and Power Electronics
Digital Electronics & Design
Measurements & Instrumentation
Mathematical Modelling and Analysis
AC Circuit Analysis
  Complex Numbers and Phasors in Polar or Rectangular Form
  AC Circuits Phasors and Impedance Transformers
Computer Organization & Architecture
Physics of Electronics and Nanotechnology
Programming and Control systems
Photonics and Communication Systems
Transducer & Sensors
Microprocessor and Microcontrollers
Electromagnetic Theory and Semiconductor Devices
Electrical Machine Design & Signal Processing
Materials Science
Labs:
  Circuits & Network Lab
  Electrical & Electronic Measurement Lab
  Data Structure Lab
  Numerical Methods & Programming Lab
  Analog Electronic Circuits Lab
  Digital Electronics & Integrated Circuits Lab
  Electronic Measurements & Instrumentation
  Transducer & Sensors Lab
  Technical Report writing for the Lab
# Social Studies

## Elementary (Grades 4-6)

<table>
<thead>
<tr>
<th>Africa</th>
<th>French and Indian War</th>
<th>Slavery in America</th>
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<tbody>
<tr>
<td>American Historical Figures</td>
<td>Geography</td>
<td>South and Southeast Asia</td>
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<tr>
<td>American Revolution</td>
<td>Government</td>
<td>The Bill of Rights</td>
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<td>China</td>
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<td>Citizenship</td>
<td>Holidays and Diversity</td>
<td>The Declaration of Independence</td>
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<td>Civil Rights</td>
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<td>Family and Authority</td>
<td>Rome</td>
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## Middle Grades (Grades 7-8)

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<td>Central and South America</td>
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<td>Colonial Settlements in America</td>
<td>Mapping</td>
<td>Westward Expansion</td>
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<td>Demographic Concepts</td>
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<td>Early American government and political systems</td>
<td>Monroe Doctrine</td>
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## High School (Grades 9-12)

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<td>Vietnam War</td>
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<tr>
<td>Declaration of Independence</td>
<td>Native Americans</td>
<td>World War 2</td>
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<td>Early American Government and Political Systems</td>
<td>Prehistoric America</td>
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<td>Reconstruction</td>
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**English**

**Elementary (Grades 4-6)**
- Adjectives
- Adverbs
- Antonyms
- Compare/Contrast
- Connotation
- Contractions
- Cross-Curricular
  - Reading/Writing
- Denotation
- Extract ideas from a variety of texts
- Fiction
- Grammar
- Graphemes
- Letter Writing
- Literary Analysis
- Literary Device
- Literary Themes
- Non-Fiction
- Nouns
- Paragraphs
- Parts of Speech
- Phonemes
- Plays and Theater
- Poetry
- Point of View

**Middle Grades (Grades 7-8)**
- Characterization
- Connotation
- Content Area Literacy
- Contextual Analysis
- Denotation
- Elements of a Story
- Grammar
- Interdisciplinary Subjects
- Interpreting Graphs in Text
- Literary Analysis
- Literary Criticism
- Literary Devices
- Literary Themes
- Modes of Persuasion
- Narrative
- Non-Fiction
- Oral Communication
- Plays and Theater
- Point of View
- Prose and Poetry
- Punctuation and Capitalization
- Research Comprehension
- Research Skills
- Sentence Structure
- Subject Area Themes
- Theme
- Vocabulary

**High School (Grades 9-12)**
- Argument
- Copyright
- Exposition
- Expression through writing and presenting
- Figures of Speech
- Functional Texts
- Grammar
- Literary Analysis
- Literary Criticism
- Literary Devices
- Literary Periods
- Literary Themes
- Logical Development of Ideas
- Multimedia Communication
- Oral Communication
- Organizational Features of Text
- Persuasion
- Plays and Theater
- Point of View
- Presenting Media
- Prose and Poetry
- Punctuation and Capitalization
- Reading Comprehension
- Research Skills
- Sources and Documentation
  - (APA/MLA/Chicago/Turabian)
- Viewing Media
- Visual Communication
- Vocabulary
Literature

**Literary Periods and Movements**
- British Literature
- The Enlightenment
- Existentialism
- Medieval Literature
- Modernism
- Multi-Media
- Naturalism
- Post-Colonial Literature
- Post Modernism
- Realism
- Religious Texts
- Renaissance Literature
- Romanticism
- Transcendentalism
- Victorian Literature

**Literary Criticism**
- Feminist and Gender Criticism
- Formalism
- Historical Criticism and New Historicism
- Marxist Criticism
- Mythological Criticism
- Psychological/Sociological Criticism
- Reader Response Criticism
- Structuralism/ Deconstruction

**Prose Non-Fiction**
- Biography
- Creative Non-Fiction
- Essay
- News Media
- Non-Fiction

**Dramatic Elements/Genres**
- Classical Drama
- Comedy of Manners/Farce/Satire
- Drama: Tragedy/Comedy/Tragicomedy/Heroic
- Medieval Mystery/Miracle Plays
- Renaissance Theater
- World Drama Traditions

**Prose Fiction**
- Ballad
- Elegy
- Epic
- Lyric
- Novellas
- Novels
- Poetry
- Prosody: Rhyme/Meter/Rhythm/Stanza
- Short Stories
- Sonnet Italian/English
- World Fiction Traditions
- World Poetry Traditions

**Literary Elements**
- Character Development
- Character Types
- Narrative Point of View: First, Second, Third Person
- Plot Structure
- Setting: Geographic, Historical, Socio-Economic
- Stylistic Characteristics of Literature
- Thematic Characteristics of Literature
- Theme
- Versification

**Literary Devices**
- Allegory
- Irony: Verbal/Dramatic
- Figurative Language: Imagery
- Hyperbole and Synecdoche
- Mimesis/Metonymy
- Symbolism/Metaphor/Simile
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
Functional Writing
Grammar
Interdisciplinary Writing
Journal Writing
Literary Analysis Writing
Narrative
Organization and Outlining Essays
Paragraphs
Persuasive Essay
Poetry Writing
Pre-writing Skills
Punctuation and Capitalization
Research Skills and Resources
Resume Writing
Source Documentation (APA/MLA/Chicago/Turabian)
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 Process
Writing Sentences
Writing Strategies
Writing Styles
College Essay Writing

Argument
Business Writing
Citation and Documentation
College and Job Application Writing
Cover Letter Writing
Creative Writing
Descriptive Essay
Editing and Proofreading
Effective Content Analysis
Elements of Composition
Expository Essay
Grammar
Interdisciplinary Writing
Journal Writing
Lab Reports
Literary Analysis Writing
Narrative
Oral Communication
Organization and Outlining Essays
Paragraphs
Performance Pieces
Persuasive Essay
Poetry Writing
Pre-writing Skills
Punctuation and Capitalization
Research Skills and Resources
Resume Writing
Source Documentation (APA/MLA/Chicago/Turabian)
Speech Writing
Story Writing
Technical Writing
Thesis Statements
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 Strategies
Writing Styles
Primary Reading

Comprehension
- Main idea and supporting details
- Synthesizing
- Summarizing
- Making predictions and inferences
- Questioning

Vocabulary and Word Recognition
- Root words and affixes
- Syllabication patterns
- Spelling patterns
- Context clues
- Phonemic awareness

Author’s Craft
- Tone and mood
- Figurative language
- Point of view
- Author’s purpose
- Theme
- Literary devices
- Types of genres

Text Structure
- Literary elements
- Cause and effect
- Problem / solution
- Compare and contrast
- Order and sequence
- Description
- Summarization

Understanding Features of Genres
- Poetry
- Fictional narratives
- Drama
- Informational texts
- Non-fiction
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.
Primary ESL

Use of English
- Articles
- Comparisons and Superlatives
- Conditionals
- Countable and non-countable nouns
- Determiners
- Indirect speech
- Irregular verb forms
- Modal verbs
- Participial adjectives
- Parts of a sentence
- Passive and active voice
- Passive causatives
- Phrasal verbs
- Phrase usage: Neither, nor, such, so
- Prepositions
- Pronouns
- Question formation
- Relative clauses
- Subject-verb agreement
- Tag questions
- Time expressions
- Uses of gerunds and infinitives
- Using dictionaries
- Verb tense formation and uses
- Vocabulary: definitions, usage, collocations, word families, and connotations.
- Vocabulary--finding meaning in context
- Word form/Morphology

English Writing
- Conventions of standard written English syntax
- Linking words and text organizers
- Essay structure and development
- Parallel structure
- Word order

Speaking
- Daily communication--giving directions, giving advice, etc.
- Differences between English pronunciation and spelling
- Presentations
- Pronunciation - Phonics as used in Primary ESL
- Pronunciation: Identification of cause of pronunciation errors
- Pronunciation: Phonetic (International Phonetic Alphabet) transcription
- Pronunciation: Stress and intonation patterns

Listening
- Identifying main ideas vs. details
- Listening comprehension strategies (scaffolding, note taking, predicting, etc)
- Processing contextual audio (lectures, presentations, videos, etc.)
- Visual Organizers (Venn diagrams, concept maps, etc.)

Reading
- Analysis of figurative language
- Identifying main ideas vs. details
- Reading comprehension strategies (note taking, predicting, skimming, etc)
- Visual Organizers (Venn diagrams, picture-walks, concept maps, etc.)

Pedagogy of ESL
- Error correction strategies (response-repetition, prompting, recasting, integration, metalinguistic information, etc).
- Concept of communicative competence
- Differences among languages (phonology, morphology, syntax, and semantics)
- Literacy learning strategies
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
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
Introduction to Criminal Justice
Ethical Issues in Justice and Security
Criminological Theory
Information Technology
Policy Issues
Physical and Personal Protection
Response Planning and Crisis Management
Weapons and Personal Protective Equipment
Management of Criminal Justice Organizations
Victimology
Critical Incident Planning and Preparedness
Governmental Regulation of Policing Policies
Forensic Science
Introduction to Ethics

Normative Ethical Theories
  - Egoism
  - Consequentialism
  - Deontological Ethics
  - Obligatory and Superobligatory Actions
  - Hedonism
  - Stoic Ethics
  - Pragmatic Ethics
  - Virtue Ethics
  - Existentialism/Radical Freedom
  - Feminist Ethics

Metaethics
  - Moral Realism and Anti-Realism
  - Naturalism and Non-Naturalism
  - Cognitivism and Non-Cognitivism
  - Objectivism and Subjectivism
  - Divine Command Theory (Theological

Voluntarism
  - Error Theory
  - Is-Ought Gap
  - Moral Relativism

Applied Ethics
  - Bioethics
  - Business Ethics
  - Animal Ethics
  - Religious Ethics
  - Political Ethics
  - Sexual Ethics
  - Environmental Ethics
  - Social Justice

Key Ethical Terms
  - Autonomy
  - Free Will and Determinism
  - Sympathy and Empathy
  - Good and Evil
  - Happiness
  - Pleasure and Pain
  - Normative
  - Justice

Key Ethical Thought Experiments
  - Trolley Problem
  - Veil of Ignorance
  - Utility Monster
  - Experience Machine
  - Violinist
  - Ring of Gyges
  - Drowning Child
  - Organ Transplant

Key Ethical Philosophers
  - Plato
  - Aristotle
  - Thomas Aquinas
  - Immanuel Kant
  - John Stuart Mill
  - Peter Singer
  - Derek Parfit
  - John Rawls
  - Robert Nozick
  - Philippa Foot
  - Judith Butler
Introduction to Philosophy

Ancient Philosophy
Greek (Thales, Pythagoras, Zeno of Elea, Skeptics, Socrates, Plato, Aristotle)
Hellenistic Philosophy (Epicurus, Stoicism)
Philosophy & religion (Saint Augustine, Thomas Aquinas, Anselm of Canterbury)

Early Modern Philosophy
The Renaissance (Humanism, Machiavelli, Hobbes)
Descartes (Doubt & Existence, Mind & Body)
Locke (Origin of ideas, British Moralists)
Hume (Empiricism, Scientific Methods, Skepticism)

Recent Modern Philosophy
The Enlightenment
Kant (Ethics, Philosophy of Mind, Moral Philosophy)
Idealism (Transcendental Ego, Objective Reality)
Utilitarianism (John Stuart Mill, Women’s Rights, Individual Liberty)

Contemporary Philosophy
Phenomenology
Existentialism (Kierkegaard, Nietzsche)
Pragmatism (Charles Sanders Pierce, William James, John Dewey)
Post Modernism
Ludwig Wittgenstein (Analysis of Language)

Eastern Philosophy
Buddha
Daoism
Confucius

Branches and Foundations in Philosophy
Metaphysics (Ontology, Mind, Spirit)
Epistemology (Agnotology, Alethiology, Truth, Belief, Validity)
Axiology (Value Theory)
Ethics
Aesthetics
Logic & Reasoning (Critical thinking, Deductive, Inductive, Syllogism, Formal, Informal)
Applied Philosophy (Law, Education, Math, Religion, Science, Engineering)
Metatheory
Schools & Traditions
Social Philosophy (Feminism, Politics, Language)
Introduction to Psychology

History and Research
- Approaches/schools of psychology
- Research approaches
- 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
- Attention
- Perceptual processes
- Psychophysical mechanisms

Consciousness
- Sleep and dreaming
- 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
- Language
- Thinking
- Problem solving
- Intelligence

Motivation, emotion
- Biological basis
- Social motivation
- Theories of emotion
- Stress

Developmental
- Types of development
- Gender, sex, and sexuality
- Heredity and environment
- Lifespan: prenatal through geriatric
- Developmental research methods

Personality
- Assessment: measuring personality
- Theories of personality
- 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
- 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.
Introduction to Sociology

History and Theory
- Purpose of Sociology
- Sociological Imagination
- Structural Functionalism
- Conflict Theory
- Symbolic Interactionism
- Social Exchange Theory
- Ethnomethodology
- Individual and Society
- Social Context of Time, Place, and Location
- Macro- and Micro- Approaches

Theories of Self
- Socialization and the Self
- Looking Glass
- "I" and "Me"
- Dramaturgy
- Status
- Role Conflict, Strain, Performance, and Expectation
- Emotions

Culture and Society
- Norms, Customs, Traditions, Values, Symbols, and Language
- Ethnocentrism
- Cultural Relativism
- Group Behavior
- Power
- Authority
- Leadership

Social Class
- Class Systems
- Inequality
- Income and Wealth
- Subcultures
- Labor Market
- Division of Labor
- Economic Systems
- Privilege and Oppression
- Social Mobility

Deviance and Social Control
- Deviance
- Labelling
- Misdemeanor and Felony
- Group Dynamics
- Criminal Justice, Punishment
- Social Control
- Stigma

Race/Ethnicity
- Common Culture
- Shared Experience
- Divisions

Race/Ethnicity (Cont’d)
- Inequalities
- Dominant Group
- Minority Group(s)
- Discrimination, Prejudice, Racism
- Homogeneity and Heterogeneity

Gender/Sex
- Biological Traits
- Gender Norms
- Gender Orders
- Masculinity/Femininity
- Personal Identity
- Feminism
- Heterosexism

Sexuality
- Sexual Attraction
- Relationship with Sex and Gender
- Non-binary sexuality
- Sexual Harrasment
- Homophobia

Social Institutions and the Family
- Education
- Schooling and Social Class
- Types of Families
- Nuclear/Extended
- Types of Marriage
- Religion
- Protestant Work Ethic
- Religious Organization - Denominations, Cult, Church, Sect
- Types of Politics
- Capitalism, Socialism, and Communism
- Demography
- Deindustrialization
- Migration
- Health
- Morbidity and Mortality

Social Change
- Social Change and Dilemmas
- Threat to Social Order
- Group Reluctance
- Social Change and Movements

Research Methods
- Qualitative Methods
- Quantitative Methods
- Mixed Methods
- Independent and Dependent Variables
- Mean/Median/Mode
- Sample
- Hypothesis
Introductory 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
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
- Error corrections

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
Cost Accounting

Activity Based Costing
Budgetary Planning and Control
Cost & Revenue concepts
Cost-Volume-Profit
Inventory Valuation
Job Order Costing
Manufacturing inventories
Motivating Employees to Perform
Process Costing
Ratio Analysis
Transfer Pricing
Working Capital Management
Govt/Nonprofit Accounting

In addition to a fundamental knowledge of Accounting, tutors will need to know specific applications with regard to:

Governmental Transactions
Budgeting
Nonprofit Transactions
Financial Reporting
Managerial Accounting
Budgetary Planning and Control
Capital Budgeting
Capital Structure
Cost-Volume-Profit
Incremental Analysis
Job Order Costing
Manufacturing inventories
Motivating Employees to Perform
Process Costing
Product costs v. period costs
Ratio Analysis
Transfer Pricing
Working Capital Management
Tax Accounting

1120
Business Income and Deductions
Compensation
Corporate Formation, Reorganization, and Liquidation
Corporate Operations
Corporation: Nonliquidating Distributions
Dispositions of Partnership Interests
Entities Overview
Forming and Operating Non-Profits
Forming and Operating Partnerships
Income and Exclusions
Individual Deductions
Individual Income Tax
Individual Income Tax Computation and Tax Credits
Intro to Tax
Investments
Property Acquisition and Cost Recovery
Property Dispositions
Retirement Savings and Deferred Compensation
S Corporations
State and Local Taxes
Tax Compliance
Tax Consequences of Home Ownership
Tax Planning
Transfer Taxes and Wealth Planning
U.S. Taxation of Multinational Transactions
Advanced Accounting

Intercorporate Investments
  Investments in Financial Assets
  Investments in Associates
  Business Combinations
  Special Purpose Entities
  Equity Method
  Cost Method
  Acquisition Method
  Goodwill

Consolidations
Segment and Interim Reporting

International Accounting
  Foreign Currency Transactions
  Foreign Subsidiaries
  Foreign Exchange Risk and Hedging
  US GAAP vs. IFRS
  Translation of Foreign Currencies
  Financial Statement Conversions

Financial Reporting and Standards
  SEC
  SOX
  Ethical Standards

Accounting for Derivatives

Corporations in Financial Difficulty
  Legal Reorganizations
  Liquidations
  Accounting for Bankruptcy

Partnerships
Introductory Economics

Intro Microeconomics
Basic Supply and Demand (Algebra-Based)
- The Demand Curve and Quantity Demanded
- The Supply Curve and Quantity Supplied
- Equilibrium and Market Demand
- Shortages, Surpluses, and Subsidies
- Taxes, Regulations, Price Controls, Price Ceilings, and Price Floors
- Consumer Surplus and Producer Surplus
- Deadweight Loss
- Income Effect and Substitution Effect

Production Possibilities Frontier (Algebra-Based)
- Opportunity Cost
- Comparative Advantage and Absolute Advantage
- Gains and Losses from Trade
- Marginal Rate of Substitution

Consumer Theory (Algebra-Based)
- Price Elasticity of Demand
- Cross-Price Elasticity
- Price Elasticity of Supply
- Consumer Utility and Marginal Utility

Monopoly and Oligopoly Behavior (Algebra-Based)
- Monopoly Structure and Power
- Monopoly Price Determination and Monopoly
- Marginal Revenue
- Monopoly Deadweight Loss and Inefficiency
- Price Discrimination
- Monopolistic Competition
- Economies of Scale
- Oligopoly Structure and Power
- Cartels, Cheating, and Breakdown of Cartels

Perfect Competition and Managerial Economics (Algebra-Based)
- Profit Maximization
- Short-Run Costs and Lost-Run Costs
- Marginal Cost, Average Cost, Fixed Costs, Variable Costs, and Total Cost
- Marginal Profit, Average Profit, and Total Profit
- Industry Supply and Demand Curves
- Uncertainty and Sunk Costs

Game Theory
- Nash Equilibrium
- Prisoners’ Dilemma
- Application to Oligopoly and Competition

Behavioral Economics (Cont’d)
- Adverse Selection and Moral Hazard
- Public Goods and Private Goods
- The Tragedy of the Commons and the Coase Theorem

Introduction to the Labor Market
- Supply of and Demand for Labor
- Marginal Product of Labor
- Types of Wages
- Tournament Theory

Intro Macroeconomics
National Economic Models and Growth Theories
- Classical and Neoclassical Economic Models
- Keynesian and New Keynesian Economic Models
- Business Cycles and Shocks to Aggregate Demand
- Classical Growth Models
- Solow–Swan Growth Model

National Accounts, Price Indices, and the Circular Flow of Expenditures
- Gross Domestic Product and Gross Domestic Income
- Gross National Product and Gross National Income
- GDP Cycles, Real GDP, and Nominal GDP
- Economic Growth and Loss
- GDP Deflator
- Consumer Price Indices
- CPI Deflator

National Investment and Savings
- Marginal Propensity to Consume
- Marginal Propensity to Save
- The Multipliers

National Labor Market and Labor Force Participation
- Supply of and Demand for Labor
- National Labor Market Equilibrium
- Causes and Types of Unemployment
- Labor Force Participation Rates
- Full Employment Output

Fiscal Policy, Taxation, and Federal Spending
- Income Taxes and Corporate Income Taxes
- Balanced Budgets and Government Debt
- Transfer Payments and Federal Spending
- Insurance and Welfare

Monetary Policy and National Banking
- Fractional Reserve Banking System and Reserve Ratios
- The Power, Functions, and Tools of the Federal Reserve

Behavioral Economics
- Market Efficiency, Market Inefficiency, and Market Failure
- Positive Externalities, Negative Externalities, and Solutions for Externalities
Monetary Policy and National Banking (Cont’d)
  Levels of the Money Supply
  Positive and Negative Shocks to the Money Supply

Inflation and Quantity Theory of Money
  Types and Causes of Inflation
  The Phillips Curve
  Quantity Theory of Money

Introduction to Savings, Investment, and Finance
  The Market for Loanable Funds
  Supply of and Demand for Money
  The Role of Intermediaries and Types of Investments
  Stocks, Bonds, and Returns on Investment
  Simple and Compound Interest

Economic Ethics and Public Policy
  Cultural Goods, Paternalism, and Exploitation
  Fair and Equal Treatment

Economic Ethics and Public Policy (Cont’d)
  Immigration and Meddlesome Preferences
  Poverty, Inequality, and Distribution of Income
  Special Interest Groups

Political Economy
  Democracy, Growth, and Famine
  Median Voter Theorem
  Rational Ignorance and Voter Myopia
  Political Business Cycles

International Economics
  Balance of Payments
  Imports, Exports, and Trade Balance Behavior
  Tariffs and Protectionism
  Types of Exchange Rates
  Currency Speculation
Intermediate Macroeconomics

Capital, Investment, and Market for Loanable Funds*
- Changes in and Factors of Capital Stock: Tobin’s Q
- Cost of Capital and the Demand for Investment
- The Market for Loanable Funds
- Keynesian Cross
- Marginal Product of Capital
- Types of Interest Rates

National Consumption and National Savings*
- Budget Constraints and Consumption Functions
- Income Shocks and Intertemporal Choice
- Measuring National Savings
- The Marginal Propensity to Consume, the Marginal Propensity to Consume, and the Multipliers

National Economic Models and Growth Theories*
- Classical and Neoclassical Economic Models
- Savings and Investment Economic Models
- Consumption and Savings Economic Models
- Keynesian and New Keynesian Economic Models
- Business Cycles
- Fischer Economic Models
- Stylized Facts
- Classical Growth Models
- Endogenous Growth Model
- Solow-Swan Growth Model

Endowment and Production Economies
- Production Economy Model and Production Economy Problems
- Effects of Change in Production Economies
- Production Equilibrium
- Endowment Economy Model and Endowment Economy Problems
- Endowment Equilibrium

Fiscal Policy and Government Debt
- Balanced Budgets, Tax Smoothing, Stabilization Policies
- Government Deficits and Government Spending
- Government Transfer and Taxation Policies
- Traditional View of Government Debt
- Ricardian Debt and Ricardian Equivalence Theorem

National Accounts, Price Indices, and the Circular Flow of Expenditures
- Gross Domestic Product/Gross Domestic Income
- Gross National Product/Gross National Income
- GDP Cycles, Real GDP, and Nominal GDP
- Economic Growth and Loss
- GDP Deflator
- Consumer Price Indices
- CPI Deflator

National Labor Market and Labor Force Participation
- Supply of and Demand for Labor
- National Labor Market Equilibrium
- Causes and Types of Unemployment
- Labor Force Participation Rates
- Full Employment Output
- Labor/Leisure Choice
- Productivity Shocks
- Reservation Wages and Wage Determination

Aggregate Supply and Demand*
- The AS-AD Model
- Aggregate Demand and Long Run Aggregate Supply
- Shifting Aggregate Demand and Aggregate Supply and the AS-AD Equilibrium
- The IS-LM Model
- Shifting the IS-LM Curves and the IS-LM Equilibrium

Inflation, Quantity Theory of Money, and Theory of Liquidity
- Causes and Types of Inflation
- Inflation and Unemployment: The Phillips Curve
- Quantity Theory of Money
- Velocity of Money
- Levels of the Money Supply
- Positive and Negative Shocks to the Money Supply
- Theory of Liquidity

Monetary Policy and National Banking
- National Banking Systems, Tools, Federal Reserve
- The Role and Structure of Intermediaries
- The Fisher Effect and the Laffer Curve
- The Supply of and Demand for Money
- Money Neutrality, Money Non-Neutrality, and Monetary Equilibrium
- Rational and Irrational Expectations
- Welfare Improving Stabilization Policy
- Currency Printing and Seigniorage
- Ex Ante Outcomes, Ex Post Outcomes, Multiple Equilibria, and Animal Spirits

International Economics
- Imports, Exports, and Trade Policies
- Trade Balance Behavior
- Foreign Exchange Markets/Foreign Exchange Rates
- Currency Speculation and Signal Watching
- Balance of Payments
- Income Equality and Inequality: The Gini Coefficient and Autarky
- Poverty and Distribution of Income
- Immigration, Exploitation, and Paternalism
*Calculus-based
Intermediate Microeconomics

**Consumer Theory (Calculus-Based)**
- Budget Constraints and Consumer Surplus
- Consumer Choice and Demand
- Consumer Preferences and Utility
- Insurance, Lotteries, and Risk Aversion
- Compensating Variation and The Slutsky Equation
- Price Elasticity

**Game Theory**
- Nash Equilibrium, Mixed Strategies, and Dominant Strategies
- Sequential Games and Subgame Perfection
- Bayesian Equilibrium and Signaling\Separating Equilibrium
- Adverse Selection
- Threats, Commitments, and Credibility

**Behavioral Economics**
- Asymmetric and Incomplete Market Information
- Positive Externalities, Negative Externalities, and Market Failures
- Solutions for Negative Externalities and Markets for Positive Externalities
- Moral Hazard and the Principal-Agent Problem
- Warranties, Quality, Uncertainty, and Signaling
- Risks, Risk Preferences, and the Demand for Risky Assets
- Public, Private, and Network Goods
- Tragedy of the Commons and the Coase Theorem

**Monopoly and Monopsony (Calculus-Based)**
- Monopoly Structure and Power
- Monopoly Marginal Revenue and Monopoly Profit Maximization
- Price Discrimination
- Social Costs of Market Power
- Monopoly Advertising and Building
- Monopsony Structure and Power
- Tariffs, Price Ceilings, and Price Floors

**Monopolistic Competition and Oligopoly (Calculus-Based)**
- Market for Factor Inputs
- Structure and Power of Monopolistic Competition
- Oligopoly Structure and Power: Cournot and Stackelberg Models
- Price Competition
- Prisoner’s Dilemma and Price Setting
- Cartels and Breakdown of Cartels

**Theory of the Firm and Managerial Economics (Calculus-Based)**
- Cost Minimization and the Cost Function
- Profit Maximization and the Profit Function
- Consumption Duality
- Long-Run Costs and Short-Run Costs
- Long-Run Supply and Short-Run Supply
- The Shutdown Condition
- Economies of Scope and Economies of Scale
- Technology, Inputs, and Outputs
- Marginal Product of Capital

**Labor Market (Calculus-Based)**
- Supply of and Demand for Labor
- Managerial Wage Determination and Minimum Wage
- Total Labor and Marginal Product of Labor
- Labor Market Efficiency Wage Theory
- Labor Unions
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.
Principles of 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
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
- 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
MS Access
Proficiency with Access 2010 required, preferably older and newer versions as well. English version required.

Database Relations and Development
  Database Terminology
  Primary and Secondary Keys - Creating Relationships
  Enforcing Referential Integrity in Key Relationships
  Creating a Database
  Creating a Database from a Template

Tables
  Types of Tables within a DB
  Creating Tables
  Creating Linked Tables
  Changing Tables
  Entering New Data
  Adding Descriptions
  Indexing a field
  Data Validation
  Hiding Fields
  Validating and Managing Records within a Table - Adding and Updating

Queries
  Using Queries within a Database
  Running a Query
  Creating a Simple Query
  Creating a Crosstab Query
  Creating a Parameter Query
  Operations and Expressions in a Query
  Creating an Aggregate Query
  Create an Action Query
  Create a Multiple Table Query
  Saving Queries

Forms
  Using Forms within a Database
  Creating a Blank Form
  Creating a Form from a Template
  Saving Forms
  Adding and Moving Form Controls
  Managing Labels
  Adding Sub-Forms
  Working with Data on Forms
  Modifying Print Settings
  Inserting backgrounds, headers, and footers

Reports and Reporting Tools
  Creating a New Report
  Creating a Report Based on a Query
  Creating a Report Using a Wizard
  Selecting Summary options
  Group and Sort Report Fields
  Report Text Box Controls
  Modify Data Sources
  Inserting headers, footers, and applying themes
  Formatting Reports

Macros
  Using Macros
  Understanding Security
  Creating a Macro
  SubMacros
  Handling Macro Errors

Importing/Exporting
  Creating a DB by importing
  Importing Data into Tables
  Exporting Data

Data Analysis
  Transforming Data
  Calculations and Dates
  Parametrized Queries
  Entering SQL
  Subqueries and Aggregation
Note: Proficiency with Excel 2010 required, preferably older and newer versions as well. English version required.

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

Note: Proficiency with Word 2010 required, preferably older and newer versions as well. English version required.

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
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
Windows

Note: Those wanting to tutor MS Windows must be proficient with BOTH the user side of Windows and the admin side of Windows.

Windows Installation and Setup
- Preparing for Installation
- Adding/Managing User Accounts
- Display Settings & Personalization Options
- Power Settings
- Privacy / Security Settings
- Accessibility Options

File and Folder Operations
- Desktop, Start Menu & Taskbar
- Navigating with File Explorer
- Creating Folders and Saving Files
- Move, Copy, Delete, and Rename Files/Folders
- Folder Views and Settings
- File/Folder Searches
- Managing Hard Drives and Storage - Local, Removable, and Cloud

Windows Utilities
- Desktop Accessories
- Control Panel
- Backup and Recovery Tools
- Security - Antivirus, Antimalware, and Firewall Tools
- Windows Update

Basic Software & Hardware Management
- Windows Apps & Microsoft Store
- Adding/Removing Programs
- Adding/Removing/Managing Printers
- Adding/Removing/Managing Bluetooth Devices
- Locating and Running Programs

Accessing the Internet
- Connecting to a Network - Ethernet & WiFi
- Accessing the Internet with Internet Explorer, Microsoft Edge
- Email and the Mail app
- Searching the Internet/Default Search Engine

Basic Troubleshooting
- Viewing System Information
- Task Manager - Monitoring System Performance
- Windows Troubleshooter
- Safe Mode
Adobe Illustrator

Program Basics
Working with Layers
Colors
Selection Tools
Drawing Tools
Shape Tools
Typography Tools
Painting Tools
Modifying Tools
Automation
Other Program Features
Adobe InDesign

Program Basics
Working with Objects
Drawing and Color Tools
Typography
Page Tools
Using Styles
Other Features
Adobe Photoshop

Program Basics
Working with Layers
Painting, Coloring, and Drawing Tools
Editing Images
Typography
Using Shapes
Animation and Action Panel
Making Selections
Other Program Features
Webdesign

Internet Fundamentals
- Layers of the Internet (application, transport, etc.)
- URL
- Pathway
- FTP and File Management
- Protocols (HTTP, HTTPS)

HTML
- Basic XML
- HTML Structure
- Lists
- Classes and IDs
- Tables
- Linking Resources
- Special Tags
- Div and Span
- Forms

CSS
- Selectors
- Alignment
- Element Position
- Padding and Margins
- Content Decoration
- Variables
- Layout
- Multiple Browser Support

Fundamental Javascript
- Basic programming concepts (functions, loops, etc.)
- DOM
- Events

PHP
- Variables, including PHP Reserved Variables
- Control Structures
- Functions
- Mixing HTML and PHP
- Handling Input (e.g. GET, POST, PUT, DELETE)
- REGEX for PHP
- php.ini

Accessibility
- Web Accessibility Standards
- Presentation of content
- Operable and understandable user interfaces
- Different web browsers and devices like mobile
Database Systems

Database Design
  Primary Keys and Foreign Keys
  Indexes
  Views
  Creation of ERD
  1NF, 2NF and 3NF

CRUD Statements
  INSERT Statement
  SELECT Distinct Statement
  SELECT TOP statement
  UPDATE Statement
  DELETE Statement

Advanced Queries
  Designing Advanced queries
  Query optimization
  Common Table Elements
  Joins

Filtering Query Output
  WHERE Statement
  ORDER BY Statement
  Applying logical filters

Hosting Databases
  Connection Strings
  Database IP
  IOPS Limits and Storage limits
  Monitor Database Health

Remote Database Access
  Designing a client application
  Result Sets
  Designing a Report

Database Management Systems
  SQL Server
  Oracle
  MS Access
NOTE: Computer Science tutors are expected to be familiar with all concepts on this list in addition to the language-specific list of the subject(s) they would like to tutor.

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 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.
- Debugging, adding extra output statements, 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)

Program Implementation

Implementation techniques

- Methodology
- Object-oriented development
- Top-down development
- Encapsulation and information hiding
- Procedural abstraction
- Programming constructs
- Primitive types vs. objects
- 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

Standard Data Structures

Simple data types (int, boolean, double)

- Classes
- Lists
- Arrays
- Sets and Multisets
- Stacks
- Dictionaries
- Queues
- Trees, binary trees, and binary search trees

Standard Algorithms

Operations on data structures previously listed

- Traversals
- Insertions, Deletions
- Searching
- Sequential
- Binary
- Bubble Sort, Selection Sort, Insertion Sort
- Mergesort

Computing in Context

System reliability

- Privacy
- Legal issues and intellectual property
- Social and ethical ramifications of computer use
- Software Methodology
NOTE: Computer Science tutors wishing to tutor C++ are expected to be familiar with all concepts on this list in addition to the Computer Science Principles list.

Namespaces
Functions
Control Structures
  Conditional (if, if else, else, switch statements)
  Iteration (for, while, do-while loops)
  Break and continue
Input/Output
  Standard (iostream)
  File I/O (fstream)
Strings
Pointers
Exception Handling
  Try/Catch blocks
  Throw statement
Arrays
Classes and Structs
Operator Overloading
Parameters
  Call by reference vs Call by value
Inheritance
NOTE: Computer Science tutors wishing to tutor Java are expected to be familiar with all concepts on this list in addition to the Computer Science Principles list.

- **Primitive Data Types**
  - Integers
  - Floating Point Types
    - Characters
  - Boolean
- **Literals**
- **Variables**
  - Variable Scope
  - Initializing Variables
- **Operators**
- **Type Casting and Conversion**
- **Control Statements**
  - For loops
  - While Loops
  - If-Else Statements
  - Switch Statements
- **Classes**
  - Constructors
  - Class Definitions
  - Object Instantiation
- **Methods**
  - Using Parameters
  - Method Overloading
  - Returning Values
- **Arrays**
  - Multidimensional Arrays
  - Irregular Arrays
- **Strings**
  - Constructing Strings
  - Operating on Strings
- **Bitwise Operators**
- **Static Keyword**
- **File I/O**
- **Inheritance and Polymorphism**
  - Superclasses and Subclasses
  - Abstract Classes
  - Method Overriding
- **Packages and Interfaces**
  - Packages and Member Access
  - Implementing Interfaces
- **Exception Handling**
  - Using Try-Catch-Finally
  - The Exception Hierarchy
- **Enumerations**
- **Generics Fundamentals**
NOTE: Computer Science tutors wishing to tutor Python are expected to be familiar with all concepts on this list in addition to the Computer Science Principles list.

- Lists
- Control Flow and Looping (while/for, use of the range() function instead of traditional for loop)
- Tuples (relation to lists, unpacking)
- List/Dictionary/Generator comprehensions
- "Dunder" methods (__init__, __plus__, etc)
- Variadic arguments (*args)
- Keyword arguments (**kwargs)
- List slices
- Generators (yield)
- Lambda functions
- Dictionaries
- Functions (including map, filter, reduce)
- Files
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
Pronouns

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
da- & 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