# Basic Concepts List

for All Available Subjects

Last updated August 2019

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<td>MS Excel</td>
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<tr>
<td>Principles of CS</td>
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<tr>
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<td>Adobe Photoshop</td>
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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
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
- Complex Number

Introduction to Trigonometry: Linear Relationships and Functions
- Introduction to Trigonometry
- 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

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

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

Separable Differential Equations and Slope Field
Slope Fields
Differential Equations and Models
Euler’s Method
Exponential Growth
Application of Differential Equations

Sequences and Series
Sequences
Series
Convergence Tests
Radius of Convergence
Functions Defined by Power Series
Taylor and Maclaurin Series
Taylor's Theorem and Lagrange Error
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, Wilcoxon 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 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
- Prediction, forecast and measurement
- Tools for measuring weather conditions
- Weather map construction and interpretation
- Clouds
- Air Mass
- Climates

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

**Astronomy**
- Earth, Sun, and Moon System
- 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 Semipermeability
- 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
- Orbital electrons
- 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’ Law
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
- Otolaryngology
- 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
  - Antipsychotic 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)
- Africa
- American Historical Figures
- American Revolution
- China
- Citizenship
- Civil Rights
- Civil War
- Colonial Settlements in America
- Communities
- East Asia and Pacific
- Egypt
- Elections
- Europe
- Family and Authority
- French and Indian War
- Geography
- Government
- Greece
- Holidays and Diversity
- India
- Japan
- Latin America
- Louisiana Purchase
- Mesopotamia
- Middle East
- Native American Culture
- Religions of the World
- Rome
- Slavery in America
- South and Southeast Asia
- The Bill of Rights
- The Constitution
- The Declaration of Independence
- The Incas
- The Mayans
- Trade
- War of 1812
- Westward Expansion
- World Cultures

#### Middle Grades (Grades 7-8)
- Africa
- American Revolution
- Articles of Confederation
- Byzantine Empire
- Central and South America
- China
- Civil Rights
- Civil War
- Colonial Settlements in America
- Demographic Concepts
- Early American government and political systems
- Economics
- European History
- Exploration
- French and Indian War
- Geography
- India
- Japan
- Louisiana Purchase
- Mapping
- Middle East
- Monroe Doctrine
- Native Americans
- North America
- Religions of the World
- Slavery in America
- The Bill of Rights
- The Constitution
- The Declaration of Independence
- The Physical Environment
- War of 1812
- Westward Expansion

#### High School (Grades 9-12)
- Africa
- American Revolution
- Ancient Civilizations
- Articles of Confederation
- Asia
- Civil War
- Cold War
- Colonial Settlements in America
- Contemporary World Events
- Declaration of Independence
- Early American Government and Political Systems
- Economics
- European History
- Geography
- Gulf War
- Industrialism
- Korean War
- Latin America
- Louisiana Purchase
- Middle East
- Native Americans
- Prehistoric America
- Reconstruction
- Slavery in America
- Soviet Union and Eastern Europe
- The Bill of Rights
- The Constitution
- The Monroe Doctrine
- Vietnam War
- War of 1812
- Westward Expansion
- World War 1
- World War 2
English

**Elementary (Grades 4-6)**
- Adjectives
- Adverbs
- Antonyms
- 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
- Prefix/Suffix
- Presentations
- Pronouns
- Punctuation and Capitalization
- Reading Comprehension
- Research Skills
- Root Words
- Sentence Structure
- Synonyms
- Verbs
- Vocabulary
- Writing Sentences

**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
- Reading Comprehension
- Research Skills – Sources and Documentation
- 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 a 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 Criminology
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 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
- 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
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-Profitis
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
- Market Efficiency, Market Inefficiency, and Market Failure
- Positive Externalities, Negative Externalities, and Solutions for Externalities

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

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
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
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
Principles of CS

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**
**Python**

*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