

# Basic Concepts List

for All Available Subjects

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## Disclaimer:

***Some clients have specific expectations and approaches they may be expecting tutors to use in sessions. ALWAYS check to see if a session has a Custom Resource Page for information regarding session expectations, approach, and/or resources. Additional information is located in the Tutor Resource Center (TRC).***

## Math

|                       |              |                         |                        |
|-----------------------|--------------|-------------------------|------------------------|
| Primary (K-2) Math    | Geometry     | Multivariable Calculus  | Quantitative Reasoning |
| Elementary (3-6) Math | Trigonometry | Finite Math             | Quantitative Methods   |
| Mid-level (7-8) Math  | Pre-Calculus | Discrete Math           | Linear Algebra         |
| Algebra               | Calculus     | Statistics              | Differential Equations |
| Algebra II            | Calculus BC  | Intermediate Statistics |                        |

## Science & Engineering

|                          |                          |                        |
|--------------------------|--------------------------|------------------------|
| Primary (K-2) Science    | Chemistry                | Electrical Engineering |
| Elementary (3-6) Science | Physics – Algebra Based  | Environmental Science  |
| Midlevel (7-8) Science   | Physics – Calculus Based | Astronomy              |
| Earth Science            | Microbiology             | Mechanical Engineering |
| Biology                  | Organic Chemistry        |                        |

## Health & Medical

|                       |                       |                                     |
|-----------------------|-----------------------|-------------------------------------|
| Anatomy & Physiology  | Health Administration | Medical Coding                      |
| Basic Nursing         | Advanced Nursing      | Mental Health & Psychiatric Nursing |
| Nutrition & Dietetics |                       |                                     |

## English/Humanities

|                         |                          |                 |                            |
|-------------------------|--------------------------|-----------------|----------------------------|
| Secondary Essay Writing | Primary (K-2) Reading    | College English | Art History & Appreciation |
| College Essay Writing   | Elementary (3-6) ELA     | ELL             |                            |
| Doctoral Writing        | Mid-level (7-8) ELA      | Primary ELL     |                            |
| Literature              | Secondary (9-12) English | Symbolic Logic  |                            |

## Social Sciences

|                        |                 |                       |                   |
|------------------------|-----------------|-----------------------|-------------------|
| Intro Criminal Justice | Intro Ethics    | Intro Philosophy      | Intro Psychology  |
| Research Methods       | Intro Sociology | Cultural Anthropology | Political Science |

## Business

|                         |                             |                          |
|-------------------------|-----------------------------|--------------------------|
| Intro Accounting        | Intro Finance               | Business Law             |
| Intermediate Accounting | Intro Economics             | Business & Consumer Math |
| Cost Accounting         | Intermediate Microeconomics | Principles of Management |
| Tax Accounting          | Intermediate Macroeconomics | Auditing                 |
| Managerial Accounting   | Marketing                   |                          |

## Technology

|                   |                |                       |
|-------------------|----------------|-----------------------|
| Adobe Illustrator | Adobe InDesign | Adobe Photoshop       |
| MS Access         | MS Excel       | MS Word               |
| Windows           | Windows Server | Computer Fundamentals |
| MS PowerPoint     |                |                       |

## Computer Science

|                  |        |                  |            |
|------------------|--------|------------------|------------|
| Principles of CS | C      | C++              | C#         |
| Java             | Python | Database Systems | Web Design |

## Foreign Languages

|          |         |            |         |
|----------|---------|------------|---------|
| Arabic   | French  | German     | Italian |
| Mandarin | Spanish | Vietnamese |         |

## Teacher Education

|                   |                      |                   |                    |
|-------------------|----------------------|-------------------|--------------------|
| Elem Math Methods | Elem Reading Methods | General Education | Early Childhood Ed |
|-------------------|----------------------|-------------------|--------------------|

## Communication

|              |                     |                      |            |
|--------------|---------------------|----------------------|------------|
| Business/Org | Interpersonal/Group | Intercultural/Global | Journalism |
| Mass Comm    | Public Speaking     |                      |            |

## Social Studies

|                    |           |            |               |
|--------------------|-----------|------------|---------------|
| Social Studies K-8 | Geography | US History | World History |
|--------------------|-----------|------------|---------------|

## Other

|                                   |                        |
|-----------------------------------|------------------------|
| Student Success & Parent Coaching | Resume and Career Help |
|-----------------------------------|------------------------|

## Counting & Cardinality

- Compare numbers
- Count to tell the number of objects
- Know number names and the count sequence

## Operations & Algebraic Thinking

- Add and subtract within 20
- Represent and solve problems involving addition and subtraction
- Understand addition as putting together and adding to, and understand subtraction as taking apart and taking from
- Understand and apply properties of operations and the relationship between addition and subtraction
- Work with addition and subtraction equations
- Work with equal groups of objects to gain foundations for multiplication

## Number & Operations in Base Ten

- Extend the counting sequence
- Understand place value
- Use place value understanding and properties of operations to add and subtract
- Work with numbers 11-19 to gain foundations for place value

## Measurement & Data

- Classify objects and count the number of objects in each category
- Describe and compare measurable attributes
- Measure and estimate lengths in standard units
- Measure lengths indirectly and by iterating length units
- Relate addition and subtraction to length
- Represent and interpret data
- Tell and write time
- Work with time and money

## Geometry

- Analyze, compare, create, and compose shapes
- Identify and describe shapes
- Reason with shapes and their attributes

## Operations & Algebraic Thinking

- Counting
- Patterns and Relationships
- Addition and Subtraction
- Multiplication and Division
- Factors and Multiples
- Place Value
- Exponents
- Ratios
- Number Theory: Primes, Divisibility, Factors, & Multiples

## Expressions & Equations

- Expressions
- Equations
- Inequalities
- Dependent & Independent Variables

## Number & Operations- Fractions & Decimals

- Fractions
- Decimals
- Decimal & Fraction Equivalents
- Decimal Place Value
- Decimal Compare & Ordering
- Fraction Equivalence & Ordering

## Measurement & Data

- Perimeter and Area
- Volume
- Angles & Angle Measure
- Graphing Data Points
- Measurements & Conversions

## Geometry

- Two-dimensional Figures
- Three-dimensional Figures
- Lines
- Angle & Shape Properties
- Area, Surface Area, & Volume

## Statistics

- Variability
- Distributions

## Money & Time

- Count Bills & Coins
- Tell Time: Analog & Digital

### Ratios and Proportional Relationships

- Ratios
- Proportions
- Rates

### The Number System

- Fractions: multiply, divide, add, & subtract
- Rational & Irrational Numbers
- Radicals & Integer Exponents
- Number Properties
- Order of Operations
- Percents
- Absolute Value
- Estimation & Rounding
- Exponents & Roots
- Arithmetic & Geometric Sequences

### Expressions & Equations

- Linear Equations
- Variables & Substitution
- Systems of Equations
- Formulas
- Equivalent Expressions
- Equations and Expressions with radicals and integers

### Geometry

- Angle Measure
- Two & Three-Dimensional Figures
- Area & Surface Area
- Coordinate Plane
- Volume
- Congruence, Similarity, & Symmetry
- Transformations
- Pythagorean Theorem

### Statistics & Probability

- Comparisons & Inferences
- Statistical Variability
- Sample Space, Combinations, & Permutations
- Theoretical & Experimental Probability
- Random Sampling
- Bivariate Data

### Functions

- Functions: Define, Evaluate, & Compare
- Functions to model relationships

### Data and Graphs

- Experiments & Data Collection
- Central Tendency & Variation
- Infer, Predict, Evaluate, & Compare Data
- Represent, Read, & Interpret Data

### Measurements

- Estimate and Measure
- Measurement Systems
- Measurement Tools
- Rates, Indirect Measurements, & Proportions

## Numbers

- Basic Set Theory
- Number Properties
- Operations with Rational Number
- Exponents and Roots
- Ratios, Proportions, Percents, Rates
- Operations with Irrational Numbers

## Algebraic Expressions

- Translating words into Expressions
- Simplify Expressions
- Evaluate Expressions

## Functions and Sequences

- Identifying Patterns or Functions
- Composition and Operations with Functions
- Inverse of a Function
- Domain and Range
- Parent Functions and Transformations
- Piecewise Functions
- Arithmetic Sequences
- Geometric Sequences

## Linear Equations/ Inequalities

- Slope, Intercept, Points of a Line
- Solving Linear Equations
- Solving Linear Inequalities
- Writing and Graphing Linear Equations
- Writing and Graphing Linear Inequalities
- Systems of Linear Equations and Inequalities
- Applications of Equations and Inequalities
- Absolute Value Equations and Inequalities
- Graphing Solutions on a Number Line
- Solving Absolute Value Equations and Inequalities

## Polynomials

- Add and Subtract Polynomials
- Multiplying Polynomials (FOIL)
- Factoring Polynomials
- Operations with Rational Expressions
- Equations with Rational Expressions

## Quadratic Equations and Inequalities

- Writing and Graphing Quadratic Equations and Inequalities
- Finding Roots of Quadratic Equations: Graphing
- Finding Roots of Quadratic Equations: Factoring
- Finding Roots of Quadratic Equations: Quadratic Formula
- Special Quadratic Equations and Completing the Square
- Systems of Quadratic Equations and Inequalities

## Radical, Exponential, and Logarithmic Equations

- Simplifying Radical Expressions
- Operations with Radical Expressions
- Solving and Graphing Radical Equations
- Simplifying Exponential and Logarithmic Expressions
- Solving and Graphing Exponential and Logarithmic Equations
- Applications of Exponential and Logarithmic Equations

## Probability and Statistics

- Data Displays : Stem and Leaf, Box and Whiskers, Venn Diagram, Dot Plots, etc.
- Data Analysis: Range, Mean, Median, Mode
- Basic Probability using Sample Space
- Independent and Dependent Events

## Numbers

- Basic Set Theory
- Number Properties
- Operations with Rational Number
- Exponents and Roots
- Ratios, Proportions, Percents, Rates
- Operations with Irrational Numbers
- Simplifying Radicals using  $i$
- Operations with Complex Numbers
- The Complex Plane

## Algebraic Expressions

- Translating words into Expressions
- Simplify Expressions
- Evaluate Expressions

## Functions and Sequences

- Identifying Patterns or Functions
- Composition and Operations with Functions
- Inverse of a Function
- Domain and Range
- Parent Functions and Transformations
- Piecewise Functions
- Arithmetic Sequences
- Geometric Sequences
- Continuity

## Linear Equations/ Inequalities

- Slope, Intercept, Points of a Line
- Solving Linear Equations
- Solving Linear Inequalities
- Writing and Graphing Linear Equations
- Writing and Graphing Linear Inequalities
- Systems of Linear Equations and Inequalities
- Applications of Equations and Inequalities

## Absolute Value Equations and Inequalities

- Graphing Solutions on a Number Line
- Solving Absolute Value Equations and Inequalities

## Polynomials

- Add and Subtract Polynomials
- Multiplying Polynomials (FOIL)
- Factoring Polynomials
- Operations with Rational Expressions
- Quadratic Equations and Inequalities
- Vertical Asymptotes and Holes of Rational Equations
- Horizontal and Slant Asymptotes of Rational Equations
- Polynomial Division
- Rational roots of Polynomial Equations
- End Behavior of Polynomial Equations

## Writing and Graphing Quadratic Equations and Inequalities

- Finding Roots of Quadratic Equations: Graphing
- Finding Roots of Quadratic Equations: Factoring
- Finding Roots of Quadratic Equations: Quadratic Formula
- Special Quadratic Equations and Completing the Square
- Systems of Quadratic Equations and Inequalities

## Radical, Exponential, and Logarithmic Equations

- Simplifying Radical Expressions
- Operations with Radical Expressions
- Solving and Graphing Radical Equations
- Simplifying Exponential and Logarithmic Expressions
- Solving and Graphing Exponential and Logarithmic Equations
- Applications of Exponential and Logarithmic Equations

## Probability and Statistics

- Data Displays : Stem and Leaf, Box and Whiskers, Venn Diagram, Dot Plots, etc.
- Data Analysis: Range, Mean, Median, Mode
- Basic Probability using Sample Space
- Independent and Dependent Events
- Combinations and Permutations
- Variance and Standard Deviation
- Properties of Normal Distribution

## Vectors

- Adding and Subtracting Vectors
- Scalar Product
- Dot Product
- Cross Product

## Matrices

- Writing Matrices
- Operations with Matrices
- Determinant of a Matrix
- Inverse of a Matrix
- Gauss-Jordan Elimination

## Conic Sections

- Parabolas: Equations and Graphs
- Circles: Equations and Graphs
- Ellipses: Equations and Graphs
- Hyperbolas: Equations and Graphs

## 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



## Complex Numbers

- Polar Coordinates, DeMoivre's Theorem
- Trigonometric Form
- z Complex Number

## Introduction to Trigonometry:

### Linear Relationships and Functions

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

## Trigonometric Ratios

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

## Graphing Trigonometric Functions

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

## Trigonometric Laws and Identities

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

## Vectors

- Graphing and Operations with Vectors
- Solving problems with Vectors

## 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
- Theorems: The Remainder Theorem, The Factor Theorem, The Fundamental Theorem of Algebra

## Rational Functions and Difference Quotients

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

## Trigonometric Functions

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

## Vectors, Matrices and Systems of Equations

- Perform operations on vectors in the plane
- 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 compute the inverse of two-by-two and three-by-three matrices
- Compute 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  $n$ th term
- Write a particular term of a sequence when given the  $n$ th 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

## 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

- The Limit Definition of a Derivative
- Compute derivatives of functions: power, exponential, logarithmic, trigonometric, inverse trig
- Apply Product Rule, Quotient Rule, Chain Rule, etc.
- Understand the first and second derivative graphically
- Approximate derivative from graph or tables
- Interpretation of the derivative as a rate of change (limit of an average rate of change)
- Relationship between differentiability and continuity
- Tangent line to curve
- Linear approximation and differentials
- Relationship between increasing and decreasing behavior and the sign of the derivative
- Mean Value Theorem
- Relationship between concavity and the sign of the second derivative
- Inflection Points

- Optimization Problems
- Related Rates Problems
- Implicit differentiation
- Antiderivatives and initial value problems
- Particle motion (position, velocity, acceleration)
- Slope fields and solution curves for differential equations

## Integrals

- Riemann sums
- Basic properties of definite integrals
- Integration tables
- 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
- Harmonic series and Alternating series
- Alternating series
- Comparison test and limit comparison test
- Ratio and Root Test
- Power series, radius and interval of convergence
- Maclaurin and Taylor series

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

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

## 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
- Rolle's and Mean Value Theorems
- Higher Order Derivatives
- Concavity
- Chain Rule
- Implicit Differentiation

## Rates of Change

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

## Integrals

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

### **Inverse and Transcendental Functions**

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

### **Separable Differential Equations and Slope Field**

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

### **Sequences and Series**

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

## 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



- 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  $2 \times 2$  games - geometric approach
- Linear programming and  $m \times n$  games - simplex method and the dual

- 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.

## 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

## Probability

- Probability Theory
- Random Variables
- Simulations (including Monte Carlo)

## Discrete Probability Distributions

- General
- Binomial & Negative Binomial
- Geometric & Hypergeometric
- Poisson
- Multinomial

## Continuous Probability Distributions

- Normal/Student's T
- Log Normal
- Bivariate
- Gamma & Beta
- Exponential
- Chi-square
- F

## Statistical Inference

- Confidence Intervals
- Hypothesis Testing
- Errors, Power, & Effect Size

## ANOVA

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

## Nonparametric Tests

- 1-sample sign test
- Wilcoxon rank test
- Kruskal-Wallis Test
- Friedman Test
- Mann-Whitney Test
- Mood's Median Test
- Spearman Rank Correlation

## Regression and Correlation

- Simple Linear Regression
- Multiple Regression
- Logistic Regression
- Polynomial Regression
- ANCOVA

## 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

## 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

- Maximin 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

## 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  $2 \times 2$  and  $3 \times 3$  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

## 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



## Primary (K-2) Science

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### **Interdependent Relationships in Ecosystems: Animals, Plants, and Their Environment**

- Organization for Matter and Energy Flow in Organisms
- Biogeology
- Natural Resources
- Human Impacts on Earth Systems
- Developing Possible Solutions

### **Structure, Function, and Information Processing**

- Structure and Function of Organisms
- Growth and Development of Organisms
- Plant and Animal Responses
- Inheritance of Traits
- Variation of Traits

### **Interdependent Relationships in Ecosystems**

- Interdependent Relationships in Ecosystems
- Biodiversity and Humans
- Developing Possible Solutions

### **Weather and Climate**

- Conservation of Energy and Energy Transfer
- Weather Patterns
- Natural Hazards
- Defining and Delimiting Engineering Problems

### **Space Systems: Patterns and Cycles**

- The Universe and Its Stars
- Earth and the Solar System

### **Earth's Systems: Processes That Shape the Earth**

- The History of Planet Earth
- Earth Materials and Systems
- Plate Tectonics and Large-Scale Interactions
- The Roles of Water in Earth's Surface Processes
- Optimizing the Design Solution

### **Forces and Interactions: Pushes and Pulls**

- Forces and Motion
- Types of Interactions
- Relationship Between Energy and Forces

### **Waves: Light and Sound**

- Wave Properties
- Electromagnetic Radiation
- Information Technologies and Instrumentation

### **Structures and Properties of Matter**

- Phases of Matter
- Chemical Reactions

## Elementary (3-6) Science

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### Physical Science

- Forces and Interactions
- Energy
- Waves: Waves and Information
- Structure and Properties of Matter

### Earth & Space Science

- Weather and Climate
- The History of Planet Earth
- Earth's Materials and Systems
- Space Systems: Stars and the Solar System

### Life Science

- Interdependent Relationships in Ecosystems
- Inheritance and Variation of Traits
- Structure, Function, and Information Processing
- Matter and Energy in Organisms and Ecosystems

## Elementary (7-8) Science

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### Life Science

- Cells and Multicellular Organisms
- Matter and Energy in Organisms and Ecosystems
- Interdependent Relationships in Ecosystems
- Natural Selection and Adaptations
- Growth, Development, and Reproduction of Organisms

### Earth and Space Science

- Space Systems
- History of Earth
- Earth's Systems
- Weather and Climate
- Human Impacts

### Physical Science

- Chemical Reactions & Matter
- Forces and Interactions
- Energy
- Waves and Electromagnetic Radiation

## 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

## Chemistry of Life

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

## Cell Structure and Function

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

## Cellular Energetics

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

## Molecular Biology

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

## Heredity

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

## Evolution and Phylogeny

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

## Bacteria

- Bacterial Conjugation
- Basic Structures
- Binary Fission
- Characteristics

## Viruses

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

## Animal Form & Function

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

## Plant Form & Function

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

## Fungi

- Fungal Structures
- Reproduction
- Role in Decomposition

## Ecology

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

## General Science

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

## Lab techniques

- Bacterial culturing
- Centrifugation
- Gel electrophoresis
- Microscopy
- Serial dilution
- Spectrophotometry

## Atoms, Elements, Compounds

- Atomic Theory, Elements
- Avogadro's Number, Mole
- Compounds, Mixtures
- Isotopes
- Atomic and Mass Number
- Charge and Ions
- Nomenclature, Formulas
- Periodic Table
- Periodic Trends
- Subatomic Particles
- Orbitals
- Electron Configuration
- Quantum Numbers

## Chem-based Math

- Measurement
- Accuracy, Precision
- Metric System, Units
- Significant Figures, Rounding
- Unit Conversions
- Scientific Notation

## Chemical Equations, Reactions

- Balance Chemical Equations
- Predicting Reaction Products
- Net Ionic Equations
- Rates, Rate Laws
- Redox Reactions
- Stoichiometry, Limit. Reactants
- % Yield, Excess Reactant
- % Composition
- Emp. and Mol. Formulas
- Types of Chemical Reactions

## Bonding

- Types of Bonding
- Intermolecular Forces
- Lewis Structures
- VSEPR Theory
- Polarity, Resonance
- Orbitals, Hybridization

## Lab Techniques

- Tools, Measurement
- Lab Safety

## Matter

- States, Types
- Chemical, Physical Properties
- Chemical, Physical Changes
- Gas Laws
- Kinetic-Molecular Theory

## Organic Chem., Biochemistry

- Org. Cmpds., Nomenclature
- Functional Groups
- Biochemical Compounds

## Other

- Disconnect
- Other
- Out of Scope

## Physical, Nuclear Chemistry

- Electromagnetic Radiation
- Enthalpy, Entropy
- Free Energy, Spontaneity
- Exothermic, Endothermic
- Thermodynamics
- Radioactive Decay, Half-Life

## Scientific Method, Lab Report

- Lit. Review, Research
- Question, Hypothesis
- Theories, Laws
- Instrumentation, Data
- Variables
- Data Analysis
- Inferences, Conclusions

## Solutions, Rxns in Solution

- Acids, Bases (Strong and Weak)
- Chemical Equilibrium
- ICE Tables
- Colligative Properties
- Electrochemistry
- Molarity, Other Concentrations
- pH, pOH
- Solubility
- Electrolytes
- pKa and Buffers

## 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
- Kirkoff's Law
- Ohm's Law
- Voltmeters



- Ammeters
- RC circuits

- The electromagnetic spectrum
- Inverse square law

## **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
- Lenz's 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

## **Modern Physics**

- Atomic Physics and Quantum Effects

## **Nuclear Physics**

- Atomic mass
- Mass number
- Atomic number
- Mass defect and binding energy
- Nuclear processes

- Mass-energy equivalence
- Conservation of energy-mass
- Nuclear symbols
- Nuclear reactions
- Neutrino
- Chain reactions
- Isotopes
- States of matter
- Atomic Models

# Physics – Calculus-based

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*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

# Microbiology

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*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

## 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

## 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

## **Chemistry of Environmental Science**

- Atmosphere & pollution
- Air composition
- Particulate matter
- Analytical methods and equipment
- Health effects
- Ozone
- Regulations
- Toxicology

## **Ecosystem Ecology**

- Flora and fauna
- Biodiversity
- Nutrient cycling
- Biogeography
- Forestry
- Invasive species
- Ecological Disturbance and Successions
- Biotic and abiotic factors
- Biomes and ecosystems

## **Energy and the environment**

- Renewable energy sources
- Non-renewable energy sources
- Environmental impacts of fossil fuels
- Energy efficiency and conservation

## **Human Population Impact**

- Human population growth
- Consumption
- Deforestation
- Urbanization
- Waste management

## **Energy and the environment**

- Renewable energy sources
- Non-renewable energy sources
- Environmental impacts of fossil fuels
- Energy efficiency and conservation

## **Water resources and pollution**

- Water cycle
- Chemistry of water
- Physical properties of water
- Freshwater systems
- Salt water systems
- Groundwater
- Water contamination
- Water treatment
- Water sampling and analysis
- Regulations

## **Soil, Agriculture, and Food Sources**

- Soil composition formation and development processes
- Soil physical properties
- Soil chemical properties
- Agriculture
- Soil and/or groundwater pollution
- Threats to the environment by soil pollution
- Remediation
- Soil sampling and analysis
- Regulations
- Solid hazardous waste

## **Environmental management**

- Environmental economics
- Environmental policies, procedures, and strategies
- Sustainability
- Green business
- Environmental Ethics & Equity

## **Conservation & Climate Change**

- Greenhouse gases
- Impacts
- Technologies
- policies
- Orbital and solar forcing
- Properties of light and albedo
- Climate and weather
- Climate modeling
- Paleoclimate and proxies



## History/Philosophy of Astronomy

- Geocentrism vs. Heliocentrism
- Ptolemy and Aristotle
- Copernicus and Galileo

## Astronomical Instruments

- Telescopes and Light
- Radio Telescopes
- Terrestrial vs. Orbiting Telescopes

## Orbits and Gravity

- Isaac Newton and Gravity
- The Laws of Planetary Motion
- Gravity with More than two bodies

## Stellar Nucleosynthesis and The Origin of the Solar System

- Stellar Nucleosynthesis
- Stellar Mass and H-R Diagram
- Origin of the Solar System

## Terrestrial Planets

- Mercury Geology and Meteorology
- Venus Geology and Meteorology
- Earth Geology and Meteorology
- Mars Geology, Meteorology, and Divergent Planetary Evolution

## Earth and Moon Dynamics

- Origin of the Moon
- Lunar Cycles
- Tidal Relationships with the Moon

## Gas Giants

- Overview of Gas Giants
- Meteorology of Gas Giants
- Rings, Moons, and Pluto

## Interstellar Space and Celestial Distances

- Fundamental Units of Distance
- The Interstellar Medium
- The Life Cycle of Cosmic Material

## Asteroids, Comets, and Black Holes

- Asteroid Characteristics
- Comet Characteristics
- Black Hole Overview

## ME Basics

- Unit systems
- Engineering drawing practice
- Ethics
- Economic analysis

## Fluids

- Compressible fluid dynamics
- Fluid properties
- Fluid statics
- Fluid flow parameters
- Fluid dynamics
- Hydraulics
- Fluid power
- Fans and ductwork

## Thermodynamics

- Inorganic chemistry
- Fuels and combustion
- Energy, work and power
- Thermodynamic properties of substances
- Changes in thermodynamic properties

## Power Cycles

- Vapor power equipment
- Vapor power cycles
- Combustion power cycles
- Power-generating systems
- Gas compression cycles
- Refrigeration cycles

## Heat Transfer

- Modes of heat transfer
- Units and parameters of heat transfer
- Conduction
- Convection
- Radiation
- Natural convection, evaporation, and condensation

## HVAC

- Psychometrics
- Ventilation
- Heating and cooling loads

- AC Systems and controls

## Statics

- Beams
- Trusses
- Cables and pulleys

## Materials

- Engineering materials
- Material properties and testing
- Thermal treatment of metals
- Properties of areas
- Strength of materials
- Failure

## Machine Design

- Types of columns
- Types of beams
- Types of tanks
- Types of connections and joints
- Compression and tension of members
- Springs
- Gears
- Bearings

## Dynamics and Vibrations

- Kinematics
- Dynamics
- Mechanisms and power transmission
- Vibrating systems (mass, spring, damper)

## Control Systems

- Modeling systems
- Feedback
- Steady state analysis
- Transient analysis

## Plant Design

- Plant management
- Instrumentation and measurements
- Manufacturing processes
- Transient

## 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 Peyer's 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

## **Governance, Organizational Structure, and Management**

- Organizational structures
- Total quality management
- Responsibility, authority, and accountability
- Developing, implementing, and updating strategic plans
- Accreditation, regulatory, licensing, and certification programs
- Management principles
- Promoting organizational effectiveness
- Leadership strategies
- Strategic change management
- Creating a safe and healthy work environment

## **Quality and Performance Improvement**

- Quality assessment programs and procedures
- Regulation in health care organizations
- Continuous quality improvement
- Cost-quality paradigm
- Work Hours Per Unit of Service (WHPUOS)
- Data-based decision making
- Physician engagement and quality

## **Law, Ethics, and Professionalism**

- Government regulations and laws in the healthcare environment
- Healthcare law versus healthcare ethics
- Health insurance regulations
- Application of moral, ethical, and legal principles
- Root cause analysis
- Protecting patient rights
- Patient safety
- Behavioral health regulations

## **Human Resources**

- Assessing personnel needs
- Recruitment, selection, compensation, and training
- Personnel evaluation and discipline
- Turnover, satisfaction and burnout

## **Healthcare Finance, Technology, and Information Management**

- Financial tools, processes, and techniques
- Developing a master budget
- Revenue cycle and reimbursement
- Financial considerations (e.g. admitting and registration, case management/denials, credit and collections)
- Management and clinical information systems
- Legal and ethical issues with electronic health records
- Health information exchanges

## **Healthcare**

- Future trends in healthcare
- Role, structure, and funding of various health care organizations, community health services, and public health

## **Patient relations**

- Patient satisfaction driving change
- The relationship between patient satisfaction and reimbursement
- Measuring and improving patient satisfaction

## Nursing Medical Surgical Fundamentals

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

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

## Nursing Care Plans

*Tutors must be familiar with all aspects of the creation of nursing care plans including:*

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

## Nursing Pathophysiology:

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

- Cardiovascular system
- Circulatory system
- Renal system
- Respiratory system
- Nervous system
- Gastrointestinal system
- Endocrine system

- Reproductive system
- Musculoskeletal system
- Integumentary system
- Cell and body tissue physiology
- Fluid and electrolyte balances
- Genetic and hereditary disorders
- Inflammation, infection and immune response systems
- Oncological diseases
- 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
  - Antiparkinsonian drugs
  - Adrenergic drugs
  - Cholinergic drugs
  - Heart failure drugs
  - Antidysrhythmic drugs
  - Antianginal drugs
  - Antihypertensive drugs
  - Diuretic drugs
  - Coagulation modifier drugs
  - Antilipemic drugs
  - Pituitary drugs
  - Thyroid and antithyroid drugs
  - Adrenal drugs
  - Women's health drugs
  - Men's Health drugs
  - Antihistamines, decongestants and antitussives

## **Nursing Pharmacology (Cont'd)**

- Bronchodilators and other respiratory drugs
- Antibiotics
- Antiviral drugs
- Antitubercular drugs
- Antifungal drugs
- Antimalarial, antiprotozoal, anthelmintic 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

## **Use of Healthcare Information and Technology (HIT)**

## 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 socioeconomic, 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

## Use of Healthcare Information and Technology (HIT)

## 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



## **Abuse and Neglect**

- Types of Violence
- Assessment and Physical Exam
- Nursing Interventions

## **Eating Disorders**

- Types of Eating Disorders
- Risk Factors and Assessment
- Symptoms and Behaviors
- Diagnosis
- Treatments

## **Personality Disorders**

- Types of Personality Disorders
- Risk Factors
- Assessment
- Symptoms
- Treatment

## **Neurocognitive Disorders**

- Types of Neurocognitive Disorders
- Risk Factors
- Nursing Interventions

## **Depressive Disorders**

- Types of Depressive Disorders
- Contributing Factors
- Treatment

## **Psychotic Disorders**

- Types of Psychotic Disorders
- Contributing Factors

- Treatment

## **Therapies**

- Modeling
- Operant Conditioning
- Systematic Desensitization
- Aversion Therapy
- Natural Therapies (meditation, relaxation, deep breathing)

## **Suicide**

- Risk Factors
- Assessment
- Treatment

## **Substance Use and Addictive Disorders**

- Substance Abuse Defined
- Substance Assessment
- Dependency
- Withdrawal
- Common Abusive Substances
- Treatment

## **Psychopharmacological Therapies**

- Medications for Anxiety
- Medication for Depressive Disorders
- Medication for Bipolar Disorder
- Medications for Psychotic Disorders
- Medications for Substance Abuse

## **Use of Healthcare Information and Technology (HIT)**

## Overview of Human Nutrition

- Nutritional sources biochemistry
- Metabolism of food types
- Nutrition through the ages effect on longevity
- Nutritional needs over a lifespan

## Professional Nutrition Management

- Dietetics and Nutritional Counseling
- Adult education principles in practice
- Nutrition in Disease Management
- Nutrition for Athletics
- FDA, USDA and Non-Profit Agencies
- Professional Development as a Nutritionist
- Foodbank management

## Dietetics and Nutrition for Healthy Lifestyles

- Principles of Nutrition for Health
- Nutrition concerns before and during pregnancy
- Dietetics to support breast feeding
- Nutritional needs birth to year one
- Nutritional requirements year one to year 10
- Designing nutritional programs for Jr. High students
- Great nutrition for High School students
- Creating Nutritional guidelines for Adults
- Teaching Adults nutrition choices for health
- Supermarket shopping/teaching nutrition

## Cultural Dietetics and Nutrition

- Diet differences around the world
- Teaching nutrition for various cultures
- Food Alternatives & Upcycled Foods
- Meal planning for Healthcare, cultural considerations

## Holistic Nutrition

- The Lymphatic Drainage System
- The Lungs
- The Digestive System
- The Liver
- The Skin
- The Skeletal System
- The Muscular System
- The Cardiovascular System
- Kidneys and Bladder
- Hormones
- Nervous System

## Mental Health & Eating Disorders

- Anorexia nervosa
- Bulimia nervosa
- Binge Eating Disorder
- Avoidant-restrictive food intake Disorder
- Purging Disorder
- Pica
- Rumination Disorder

## Medical Coding & Billing

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- Anesthesia
- Medicine
- Endocrine system
- Nervous system
- Urinary system
- Integumentary system
- Pathology
- Laboratory
- Hemic and lymphatic system
- 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
  - International Classification of Diseases, Tenth Revision, Clinical Modification (currently ICD-10-CM)
  - International Classification of Diseases, Tenth Revision, Procedure Coding System (currently ICD-10-PCS)
  - Current Procedural Terminology (CPT)
  - Healthcare Common Procedure Coding Systems (HCPCS)

## Art Historical Periods

- Prehistory
- Ancient Near Eastern/Mesopotamia
- Ancient Egyptian
- Classical - Crete/Greece/Etruria/Rome
- Late Antique/Medieval (Europe)
- Byzantium/Islam
- Pre-Columbian/South American/North American
- African Art and Architecture
- Art of Asia and Oceania
- Renaissance/Baroque/Rococo
- 19th Century
- 20th Century
- Global Modern/Contemporary (since 1950 CE)

## Formal Elements and Principles of Design

- Composition
- Color
- Texture
- Value
- Line
- Shape/Form
- Balance
- Emphasis
- Unity/Variety
- Scale/Proportion
- Rhythm
- Time/Motion

## Artistic Devices

- Chiaroscuro
- Tenebrism
- Linear Perspective
- Composite view/twisted perspective
- Hierarchy of scale
- Calligraphy
- Trompe l'oeil
- Foreshortening
- Impasto
- Plein-air painting
- Memento mori

## Artistic Media

- Drawing
- Painting (tempera/oil/watercolor/fresco)
- Collage
- Sculpture
- Mosaic
- Photography

- Textile arts
- Ceramics
- Printmaking
- Installation
- Video/Film/Digital
- Earthworks

## Artistic Movements

- Impressionism
- Post-Impressionism
- Abstraction/Expressionism
- Realism
- Neo-Classicism/Romanticism
- Cubism
- Pop Art
- Surrealism/Dada
- Performance art

## Theoretical Approaches

- Feminist
- Psychoanalysis
- Modernism/Post-modernism
- Queer theory
- Hermeneutics
- Archaeology of Knowledge
- Reader-response theory
- Marxist
- Formalism/Semiotics
- Post-Colonial
- Structuralism/Post-structuralism
- Deconstruction

## Art Terms

- Sublime
- Miniature
- Portrait
- Decorative arts
- Academy/Salon
- Aesthetics
- Narrative
- Still-life
- Avant-garde
- Genre painting
- Iconography
- Landscape
- Symbol
- Naturalism
- Vanishing point
- History painting

## Secondary (9-12) English

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- Active and Passive Voice
- Argument
- Concision and Wordiness Revisions
- Descriptive Essays
- Exposition
- Expository essays (cause/effect, compare/contrast, descriptive, problem/solution)
- Expression through writing and presenting
- Figures of Speech
- Functional Texts
- Genres of Writing
- Grammar
- Literary Analysis
- Literary Criticism
- Literary Devices
- Literary Periods
- Literary Themes
- Logical Development of Ideas
- Multimedia Communication
- Narrative Essays
- Oral Communication
- Organizational Features of Text
- Parts of Speech
- Persuasion
- Plays and Theater
- Point of View
- Prefixes/suffixes
- Presenting Media
- Prose and Poetry
- Punctuation and Capitalization
- Reading Comprehension
- Research Skills
- Rhetorical analysis
- Sources and Documentation (APA/MLA/Chicago/Turabian)
- Summarization
- Types of sentences (simple, compound, complex, compound-complex)
- Viewing Media
- Visual Communication
- Vocabulary/Context Clues

## Literary Periods and Movements

- Medieval Literature
- Renaissance Literature
- The Enlightenment
- Romanticism
- Transcendentalism
- Victorian Literature
- Realism
- Naturalism
- Modernism
- Post Modernism
- Existentialism
- Post-Colonial Literature

## Literary Criticism

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

## Prose Nonfiction

- Essay
- Biography
- Creative Nonfiction

## Dramatic Elements/Genres

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

## Prose Fiction

- Short stories
- Novellas
- Novels
- World Fiction Traditions

## Poetry

- Epic
- Elegy
- Ballad
- Lyric
- Sonnet Italian / English
- Prosody: Rhyme / Meter / Rhythm / Stanza
- World Poetry Traditions

## Literary Elements

- Character Types / Development
- Plot Structure
- Theme
- Narrative Point of View: First, Second, Third Person
- Setting: Geographic, Historical, Socio-Economic
- Versification

## Literary Devices

- Symbolism/ Metaphor/ Simile
- Hyperbole and Synecdoche
- Allegory
- Irony: Verbal / Dramatic
- Figurative Language: Imagery
- Mimesis/ Metonymy

## Types of Writing

- Literary Analysis
- Personal Essays
- Compare/Contrast Essays
- Explanatory Essays
- College Application Essays
- Creative Writing
- Letters, Memos, and Emails

## Thesis Statements

- Argument/Persuasion
- Descriptive
- Expository
- Narrative

## Idea Development

- Synthesis of Ideas
- Supporting Ideas with Evidence
- Expanding Ideas
- Showing Instead of Telling

## Essay Structure

- 5-Paragraph Essays
- Topic Sentences
- Body Paragraph Structure
- Transitions
- Introductions
- Conclusions

## Source Documentation

- Academic Integrity
- Using Sources Effectively
- MLA Format
- APA Format

## Grammar/Mechanics

- Grammar
- Punctuation
- Spelling
- Academic Tone
- Avoiding Wordiness & Redundancy

## Grammar

- Parts of Speech
- Sentence Structure
- Ending Strategies
- Consistent Tense
- Subject-Verb Agreement
- Noun-Pronoun Agreement

## Mechanics and Usage

- Punctuation
- Spelling
- Capitalization
- Homophones
- Comma-splices
- Run-ons
- Incomplete Sentences

## Reading

- Evaluating Sources
- Summary/Paraphrase
- Analyzing Texts
- Literary Devices

## Source Documentation

- APA (American Psychological Association)
- MLA (Modern Language Association)
- Chicago/Turabian

## Style

- Varied Sentence Structure
- Qualifiers
- Positive Form
- Concrete Language
- Concise Writing

## Tone

- Formality
- Word Choice
- Clarity
- Academic Expression
- Point of View
- Bias
- Active vs. Passive Voice

## Vocabulary

- Synonyms/Antonyms
- Academic Word Choice



**NOTE:** Tutors wishing to tutor College Essay Writing are expected to be familiar with all concepts on this list ***in addition to*** the College English list.

## Reading

- Literary Devices
- Comprehension
- Summary/Paraphrase

## Source Documentation

- APA/MLA/Turabian-Chicago
- Evaluating Sources
- Integrating Sources

## Modes of Persuasion

- Logical Fallacies
- Argument Types (Toulmin, Rogerian, Classical/Aristotelian)

## Writing Process

- Prewriting Strategies
- Thesis Statement
- Organizational Structure
- Grammar and Mechanics

## Writing Purpose

- Analysis
- Narrative
- Persuasive
- Work-Related
- Speech Writing

## Proofreading

- Spelling, punctuation, capitalization

## Copy Editing

- Grammar
- Syntax
- Consistency of terms

## Formatting

- Reference page
- Citations
- Headings
- Auditing references and citations
- Table of Contents
- Headers and footers
- Appendix, tables, and figures
- Spacing
- Pagination

## Scholarly Writing

- Concise language
- Sentence structure
- Transitions between paragraphs
- Organization of thoughts and sections
- Flow
- Academic Tone

## Argument

- Clarity of ideas
- Non-biased, logical argument
- Alignment of argument throughout the manuscript

## Vocabulary & Word Recognition

- Phonemic awareness
- Root words and affixes
- High-frequency words
- Syllabication patterns
- Context clues

## Comprehension

- Main idea and supporting details
- Central message, lesson, or moral
- Making predictions
- Questioning

## Text Structure

- Setting
- Characterization
- Plot
- Compare and contrast
- Order and sequence

## Author's Craft

- Point of view
- Author and illustrator role
- Illustrations' relationship to the text
- Author's purpose

## Recognizing Text

- Fiction
- Non-fiction
- Poetry

### Vocabulary Application

- Figurative language
- Connotative language
- Vocabulary in isolation
- Vocabulary in context

### Comprehension

- Analyzing
- Synthesizing
- Making inferences and interpretations
- Identifying biases
- Citing textual evidence
- Evaluating claims

### Text Structure

- Plot development
- Order and sequence
- Compare and contrast
- Cause and effect
- Poetry and drama structure

### Author's Craft

- Theme
- Central ideas
- Point of view
- Tone and mood
- Literary devices

### Understanding Genres

- Poetry
- Drama
- Fictional narrative
- Informational texts
- Non-fiction
- Film vs audio vs text

### Writing

- Research
- Narrative
- Informative/Explanatory
- Argument

# Elementary (3-6) ELA

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## Vocabulary Acquisition

- Context clues
- Root words and affixes
- Figures of speech
- Phonemic Awareness
- Consulting dictionaries and thesauruses

## Comprehension

- Analyzing
- Synthesizing
- Making predictions and inferences
- Summarizing
- Main idea and supporting details

## Text Structure

- Compare and contrast
- Characterization
- Setting
- Plot
- Cause and effect
- Problem/Solution
- Order and sequence

## Author's Craft

- Theme
- Point of view
- Tone and mood
- Author's purpose
- Literary devices

## Understanding Genres

- Poetry
- Drama
- Fictional narrative
- Informational texts
- Non-fiction

## Writing

- Research
- Narrative
- Informative/Explanatory
- Argument
- Opinion

## Use of English

- Articles
- Comparisons and Superlatives
- Conditionals
- Contractions
- Countable and uncountable nouns
- Determiners
- Indirect speech
- Participial adjectives
- Passive and active voice
- Passive causatives
- Phrase usage
- Prepositions
- Pronouns
- Relative clauses
- Tag questions
- Time expressions
- Uses of gerunds and infinitives
- Using dictionaries
- Verbs
- Vocabulary
- Word form

## Writing

- Conventions of standard written English syntax
- Linking words and text organizers
- Essay structure and development
- Parallel structure
- Research skills
- Spelling
- Stages of the writing process

## Speaking

- Daily communication
- Differences between English pronunciation and spelling
- Idioms
- Presentations
- Phonemic awareness

## Listening

- Identifying main ideas vs. details
- Listening comprehension strategies
- Processing contextual audio
- Visual organizers

## Reading

- Analysis of figurative language
- Concepts of print
- High-frequency sight words
- Reading comprehension strategies
- Phonics as used in Primary ELL
- Rhyme
- Segmenting
- Visual organizers

## Pedagogy of ELL

- Concept of communicative competence
- Differences among languages
- Error correction strategies
- Literacy learning strategies

**Grammar and mechanics**

- Capitalization rules
- Determiners
- Direct and indirect speech
- Grammatical moods
- Modifier placement
- Noun-pronoun agreement
- Parts of speech (types and usage)
- Punctuation rules
- Sentence diagraming
- Sentence structure variations
- Sentence types
- Spelling
- Subject-verb agreement

**Building vocabulary**

- Academic vocabulary
- Cognates
- Contextual vocabulary activities
- Conversational (social) vocabulary
- Homonyms, homophones, and homographs
- Idioms
- Inferring word meaning through context
- Root words and affixes
- Semantic mapping/graphic organizers
- Synonyms vs antonyms
- Using a dictionary

**Reading comprehension**

- Analysis of figurative language
- Comparing and contrasting
- Distinguishing between fact and opinion
- Drawing conclusions
- Evaluating sources
- Identifying main ideas vs details
- Inferring meaning through context
- Note-taking while reading
- Predicting content/previewing
- Sequencing
- Summarizing
- Types of text (key components)
- Using visual organizers (story maps, diagrams, etc.)

**Listening Comprehension**

- Identifying language signposts while listening
- Inferring word meaning through context while listening

- Listening for gist/main idea vs details
- Note-taking while listening
- Processing academic lectures, presentations, etc.
- Reviewing vocabulary/content concepts in preparation
- Using visual organizers

**Writing**

- Academic writing style
- Active vs passive voice
- Citing Sources (MLA, APA, Chicago/Turabian)
- Combining sentences: subordination and coordination
- Conciseness vs wordiness
- Consistency in point of view
- Consistency in verb tense, mood, voice
- Creating cohesive paragraphs
- Essay structure and development
- Formal and informal writing
- Parallel structure in sentences
- Paraphrasing, summarizing, quoting
- Research skills
- Run-ons, comma splices, sentence fragments
- Transitional words and phrases
- Types of essays

**Speaking**

- Conversational and academic English
- Pronunciation and speaking practice strategies
- Speeches and oral presentations
- Strategies to overcome speaking anxiety

**Pedagogy**

- Knowledge of stages of proficiency for ELL students
- Listening and responding to student feedback
- Using sheltered instruction strategies
- Speaking slowly and increasing wait time for responses
- Using culturally responsive approaches
- Using effective language modeling
- Using multiple modalities to increase understanding
- Using scaffolding techniques

## 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

- 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

## 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



## Introduction to Criminal Justice

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- 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

## Normative Ethical Theories

- Egoism
- Consequentialism
- Deontological Ethics
- Obligatory and Super obligatory Actions
- Hedonism
- Stoic Ethics
- Pragmatic Ethics
- Virtue Ethics
- Existentialism/Radical Freedom
- Feminist Ethics

## Metaethics

- Moral Realism and Anti-Realism
- Naturalism and Non-Naturalism
- Cognitivism and Non-Cognitivism
- Objectivism and Subjectivism
- Divine Command Theory (Theological Voluntarism)
- Error Theory
- Is-Ought Gap
- Moral Relativism

## Applied Ethics

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

## Key Ethical Terms

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

## Key Ethical Thought Experiments

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

## Key Ethical Philosophers

- Plato
- Aristotle
- Thomas Aquinas
- Immanuel Kant
- John Stuart Mill
- Peter Singer
- Derek Parfit
- John Rawls
- Robert Nozick
- Philippa Foot
- Judith Butler

## Ancient Philosophy

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

## Early Modern Philosophy

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

## Recent Modern Philosophy

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

## Contemporary Philosophy

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

## Eastern Philosophy

- Buddha
- Daoism
- Confucius

## Branches and Foundations in Philosophy

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

## 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

## **Cultural Anthropology**

- Subdisciplines of Anthropology
- Culture
- Method and Theory
- Applied Anthropology

## **Language and Art**

- Communication and Language
- Art and Media

## **Ethnicity, Gender and Religion**

- Race and Ethnicity
- Gender and Sexuality
- Religion

## **Politics and Economics**

- Subsistence
- Political Arrangements

## **Kinship and Marriage**

- Kinship
- Marriage

## **Global Perspective**

- Colonialism and Global Systems
- Trade
- Ecology
- Current Issues

## American Politics

- Structure of Federal and Local Governments
- Civil Rights and Liberties
- Political Behavior and Culture
- Communication and Political Strategies
- Homeland Security
- Current Political Issues
- Institutions

## Comparative Politics

- The Modern State
- Identity
- Regimes and Governing Institutions
- Participation and Representation
- Political Economy
- Conflicts and Violence
- Intercultural Awareness

## International Relations

- Realist Theories
- Liberal and Social Theories
- Globalization and Global Citizenship
- Violence, Terrorism and Counter-Terrorism
- International Organizations and Law
- Foreign Policy
- International Security and Military Strategies
- Geopolitics and Human Geography

## Methodology in Political Science

- Research Design
- Research Ethics
- Qualitative Method
- Quantitative Method
- Statistical Inference
- Data Collection and Interpretation

## Political Thoughts

- The Meaning of Politics
- Freedom and Social Contract
- Power, War and Conflicts
- Justice and Law
- Individual v. Collective Rights
- Political Culture and Behavior

## Public Policy

- Contexts of Public Policy
- Economic Issues
- Environmental Policies
- Criminal Justice
- Morality and the Role of Religion
- Social Policies
- Defense Policies Subdisciplines of Anthropology

## Scientific Method

- Cause and effect
- Research hypotheses
- Testability

## Developing research ideas

- Defining and using constructs
- Theories, models, and hypotheses
- Pilot research

## Literature searches

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

## Research ethics

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

## Bias

- Experimenter bias
- Participant bias
- Research and Culture

## Sampling

- Populations and samples
- Probability sampling methods
- Nonprobability sampling
- Sampling Error

## Validity and Reliability

- Internal validity
- External validity
- Threats to validity
- Measurement
- Inter-rater reliability

## Non-Experimental & Quasi-Experimental Research

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

## Qualitative research

- Naturalistic observation
- Case study
- Focus groups
- Coding and categorizing

## Small-N and single-subject designs

- Phases and phase changes
- Reversal designs
- Multiple baseline designs
- Evaluating single-subject research

## Quantitative research and Experimental Design

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

## Evaluating Research

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

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

## 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 Harassment
- 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



## Financial Reporting and Accounting Cycle

- Accrual vs. cash accounting
- Accounting equation
- Worksheets and t-accounts
- General Ledgers
- Trial Balances
- Adjusting Entries
- Financial Statement Preparation (including direct/indirect statement of cash flows)
- Closing Entries

## Accounting for Service and Merchandising Companies

- Journal Entries
- Single Step vs. Multi-step income statements
- Perpetual vs. periodic
- LIFO, FIFO, & weighted average & specific identification
- Accounting for uncollectible accounts (allowance method vs. direct write off method)
- Notes receivables

## Internal Controls & Cash

- Objectives and Elements of internal control
- 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)
- Intangible Assets
- Natural Resources

## 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

## Liabilities

- **Current Liabilities**
- **Longterm Liabilities**
- **Contingencies**

## 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

## Accounting Cycle, Financial Statements, & Conceptual Framework

- Accrual vs. Cash
- Adjusting Entries
- Extraordinary Items
- Financial Statement Presentation/Disclosures
- Conceptual Framework
- Closing entries
- General Ledgers
- Trial Balances
- Accounting equation
- Worksheets and T-accounts

## Statement of Cash Flows

- Indirect Method
- Direct Method
- Investing and Financing Cash Flows

## Time Value of Money

- PV and FV of Lump Sum
- PV and FV of Annuities
- Deferred Annuities

## Revenue Recognition Issues

- Revenue Recognition Criteria
- Revenue from Long Term Contracts
- Revenue from Installment Sales
- Revenue from Multi-Component Sales
- Performance Obligations

## Revenue, Receivables, and Cash Cycle

- Sales Adjustments (discounts, returns, allowances)
- Single Step vs. Multi-step income statements
- Notes Receivable
- Sale of Receivables
- Cash and Cash Equivalents
- Estimating Uncollectible Receivables and Net Realizable Value

## Inventory and Cost of Goods Sold

- Perpetual vs. Periodic Inventory 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/Impairment
- Depreciation and Amortization Methods
- Retirement, Sale, or Exchange of Assets

## Accounting for Partnerships

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

## Debt

- Bond Pricing
- Bond Issues and Retirements
- Notes Payable

## Equity

- Issuance of Capital Stock
- Treasury Stock Transactions
- Cash and Stock Dividends
- Accounting for Share-Based Compensation

## Investment in Debt and Equity Securities

- Classification of Investment Securities
- Revenue Recognition from Investment Securities
- Accounting for Change in Value of Securities
- Sale of Securities

## Leases

- Lease Classification Criteria
- Accounting for Capital Leases
- Accounting for Operating Leases

## Income Taxes

- Calculating Deferred Assets and Liabilities
- Carryback and Carryforward of Operating Losses
- Permanent vs Temporary Differences
- Conceptual Issues

## EPS & Advanced Statement Analysis

- Basic or Diluted EPS
- Comparative ratio interpretation

## Special Issues: Pensions, Contingencies, Errors, Accounting Changes

- Pensions
- Contingencies
- Changes in Accounting Principle
- Changes in Accounting Estimate
- Error Corrections

## Managerial Accounting

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

## Internal Controls & Cash

- Objectives and Elements of internal control
- Bank reconciliations
- Petty cash

# Cost Accounting

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- Activity Based Costing
- Budgetary Planning and Control
- Capital Budgeting
- Capital Structure
- Cost & Revenue concepts
- Cost-Volume-Profit
- Incremental Analysis
- Inventory Valuation
- Job Order Costing
- Manufacturing inventories
- Motivating Employees to Perform
- Process Costing
- Product costs v. period costs
- Ratio Analysis
- Transfer Pricing
- Working Capital Management
- Joint Cost Allocation
- Differential Analysis
- Lean Manufacturing
- Balanced Scorecard

# Managerial Accounting

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- Budgetary Planning and Control
- Activity Based Costing
- Capital Budgeting
- Capital Structure
- Cost & Revenue concepts
- 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
- Joint Cost Allocation
- Differential Analysis
- Lean Manufacturing
- Balanced Scorecard

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

# Auditing

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## Audit Reports

- Types of Audit Reports and Audit Opinions
- Components of an Audit Report

## Quality Control Standards

- Elements of a System of Quality Control
- Acceptance and Continuance of Client Relationships
- Evaluating and Communicating Deficiencies
- Documentation of the system of internal control

## Audit Risk and Analytical Procedures

- Materiality and Risk
- Audit Risk Model
- Internal Control and Control Risk
- Inherent Risk
- Planned Detection Risk
- Analytical Review Techniques

## Professional Ethics and Legal Liability

- Auditor selection, compensation and termination
- Auditor vs Client responsibility for auditing statements
- Rights and Responsibilities of Auditors

## Audit Evidence

- Types of Audit Evidence
- Procedures for Obtaining Evidence
- Sources of Substantive Audit Evidence

## Fraud

- Types of Fraud
- Assessing the Risk of Fraud
- Responsibilities When Fraud is Suspected

## 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 Long-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
- 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



## 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 Save, 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

## 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

## **Role and objective of financial management**

- Review of the four basic financial statements
- Analysis of financial statements and financial performance
- Financial ratio analysis
- Financial Institutions
- Valuation Methods and Models (cash flow valuation; capital budgeting and risk analysis)

## **Time Value of Money**

- Single cash flow and annuity valuation
- Using Excel for TVM
- Advanced TVM word problems

## **Financial Choices of Firms**

- Dividend Policy
- Managing current assets/working capital
- Raising capital and financing decisions

## **The Financial Environment**

- Interest rates
- 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
- Financial planning, budgeting, and forecasting

# Principles of Management

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## 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 Statistics

- Data Interpretation
- Graphs and Charts
- Measures of Central Tendency

## Consumer Credit

- Credit
- Depreciation
- Loans and Mortgages

## Equations

- Formulas
- Solving Equations
- Writing Equations

## Investing

- Bank Accounts
- Interest
- Present and Future Value
- Stocks, Bonds, and Mutual Funds

## Numbers

- Decimals
- Fractions
- Whole Numbers and Integers
- Probability
- Ratios and Proportions
- Real Number System

## Payroll

- Deductions
- Gross Pay
- Taxes

## Percent

- Converting
- Discounts
- Markups and Markdowns
- Problem Solving
- Sales Terms

## 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

## Introductory Legal Research and Writing

- Effective Legal Research Strategies
- Researching Cases, Statutes, and Regulations
- Legal Databases and Governmental Codes
- Organizing Legal Research Notes
- Summarizing Case Law

## **Marketing Strategy Fundamentals**

- Establishing SMART marketing objectives, strategies, and tactics
- Identifying target markets
- Understanding the marketing mix or Four Ps
- Conducting situation and competitor analysis
- Navigating B2B, B2C, and non-profit marketing

## **Product or Service Development**

- Designing a product or service concept and prototype
- Formulating brand positioning
- Calculating development costs and projecting sales
- Preparing a launch strategy

## **Market Research and Data Analysis**

- Writing research proposals
- Planning the research design
- Conducting research through focus groups, surveys, and interviews
- Analyzing and Interpreting data
- Reporting on research findings

## **Consumer Behavior**

- Understanding consumer decision making process
- Examining consumer information searches
- Exploring subcultures influencing consumer behavior
- Distinguishing between planned versus impulse purchases
- Defining brand equity, perception, and reputation

## **Public Relations and Communications**

- Composing ethical marketing policies
- Determining social responsibility strategies and campaigns
- Pitching compelling stories for the media
- Designing a crisis communication plan
- Recognizing owned, earned and paid media methods
- Measuring and evaluating public relations results

## **Supply Chain and Distribution Logistics**

- Creating supply chain management processes
- Implementing a customer service management system
- Negotiating for suppliers, vendors, and intermediaries
- Estimating and fulfilling orders
- Planning warehousing and distribution logistics

## **Creative Strategy, Advertising, and New Media**

- Writing a creative brief
- Formulating promotional strategies via traditional
- Constructing digital marketing and social media strategies
- Developing interactive and mobile marketing strategies

**Proficiency with Access 2010 required, preferably older and newer versions as well. English version required.**

## Database Relations and Development

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

## Tables

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

## Queries

- Using Queries within a Database
- Running a Query
- Creating a Simple Query
- Creating a Crosstab Query
- Creating a Parameter Query
- Operators 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
- Sub Macros
- 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 & Wi-Fi
- 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

## **Program Basics**

- Workspace
- Artboards
- Sharing
- Working with Layers
- Colors

## **Program Tools**

- Selection Tools
- Drawing Tools
- Shape Tools
- Typography Tools
- Painting Tools
- Modifying Tools

## **Automation**

## **Other Program Features**

## **Program Basics**

- Working with Objects
- Drawing Tools
- Color Tools
- Page Tools

## **Typography**

## **Using Styles**

## **Other Program Features**

## **Program Basics**

- Working with Layers
- Painting Tools
- Coloring Tools
- Drawing Tools
- Making Selections
- Editing Images
- Using Shapes

## **Typography**

## **Animation and Action Panel**

## **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 Design

- Methodology - Conceptual/Logical/Physical
- ER Modeling
- Advanced ER
- Normalization
- Security and Administration

## Structured Query Language

- CRUD Statements
- Aggregates
- Subqueries
- Filtering Query Output
- JOINS

## Advanced Queries

- Designing Advanced queries
- Query optimization
- Common Table Elements
- Constraints
- Triggers

## Business Intelligence

- Designing a client application
- Data Warehousing
- Reporting

## Database Management Systems

- SQL Server
- Oracle
- MySQL
- Cloud Computing/Web DBMS

**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
- Merge sort

## 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 C are expected to be familiar with all concepts on this list **in addition to** the Computer Science Principles list.

### Syntax and Structures

- Variables
- Data Types
- Arrays (single and multidimensional)
- Strings
- Operators
- Structures (struct)

### Control Flow

- If/Else Statements
- Iterators
- Break/Continue
- Switch
- Goto

### Input/Output

- Standard I/O
- Formatting
- Error Handling
- Preprocessor
- Streams

### C Fundamentals

- Functions
- Standard Library
- Data Structures

### Pointers

- Declaration and Usage
- Arrays and Pointers
- Pointer to Pointer
- Pointers and Functions

## COMPTIA A+

- Principles and Procedures
- Safety and Security
- Windows 10

## Hardware Overview

- Processors
- Memory
- BIOS
- Motherboards
- Storage
- Power

## Operating Systems

- OS basics
- CLI
- Virtualization
- Mobile
- Troubleshooting OS
- File Systems
- Users and Groups

## Building/Imaging a PC

- Custom components
- Install or upgrade OS
- Patching/SP
- Drivers
- Migrate data

## Peripherals

- USB/Thunderbolt
- Keyboards
- Pointers (Mouse)
- KVM
- Multimedia
- Touch Screens
- Smartcard and Biometric
- Display

## Hard Drives

- RAID
- Types (SATA,SSD,Magnetic)
- Formatting & Partitioning
- Removable Storage

## Multifunction Devices

- Printers
- Copier/Scanners
- Fax
- Installation/Drivers
- Troubleshooting

## Network

- Ethernet
- LAN
- WAN
- Wireless
- Internet
- Mobile
- Network Security

**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

- Super classes and Subclasses
- Abstract Classes
- Method Overriding

## Packages and Interfaces

- Packages and Member Access
- Implementing Interfaces

## Exception Handling

- Using Try-Catch-Finally
- The Exception Hierarchy

## Enumerations

## Generics Fundamentals

**NOTE:** Computer Science tutors wishing to tutor Python are expected to be familiar with all concepts on this list **in addition to** the Computer Science Principles list.

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



## Server Setup and Installation

- Prep for Installation
- New install/Upgrade to Existing
- Selecting Server Hardware

## Server Manager

- Accessing and starting server manager
- Create/Edit groups of servers
- View/Change roles, role services, and features
- Access Management Tools
- Managing Services
- Server Status - issues, events, and failures
- Manage Remote Computers

## Managing Storage

- Access storage options/Disk Management
- Disk types
- RAID options
- Network Storage (NAS/SAN)
- Disk volumes/partitioning
- Mounting/Unmounting

## Windows Services

- File services, NTFS/Sharing Drives
- Installing/Setting up printers
- Naming resolution, DNS, Hosts
- DHCP
- Active Directory
- IIS

## Virtualization and Cloud

- Basic Concepts
- Hypervisors
- Install Hyper -V
- Configure VM
- Manage or Modify VM
- Azure

## Monitor and Troubleshoot

- Performance and Resource Monitor
- Server Repair and Boot Options
- Fault Tolerance and Clustering
- Power - UPS, Redundancy
- Safe Mode

## Windows Server 2019

- Storage Migration Service
- Containers
- Security

**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.

**Fundamentals**

- Namespaces
- Directives
- LINQ
- .NET Framework

**Syntax and Structures**

- Variables
- Data Types
- Arrays
- Operators
- Lambda Expressions

**Input/Output**

- File Read/Write
- Escape Sequencing
- Convert data

**Control Structures**

- Conditional Statements
- Iterators
- Jump/Break/Continue
- Exception Handling

**OOP Concepts in C#**

- Methods
- Constructors
- Classes
- Inheritance
- Polymorphism
- Interfaces

**NOTE:** *Voice-approval is required to tutor this subject. You will conduct a Voice test in your Classroom Introduction and Interview (CII). If you are an existing tutor who does not yet have voice approval, please contact Tutor Support.*

## Vocabulary

- Greetings and Polite Expressions
- Numbers and Time
- Common Phrases
- Various Common Words

## Grammar

- Sentence Structure
- Verbs and Adverbs
- Nouns and Adjectives
- Possessive Phrases
- Gender and Plurality

## Literary Arabic

- Arabic Alphabet
- Vowels and Consonants
- Phonology

## Pronunciation

- Full Pronunciation
- Formal Short
- Informal Short
- Proper Diction

## Types of Arabic

- Modern Standard Arabic
- Classical Arabic
- Regional Dialects

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## 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
- Hacer... (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

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## 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

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## 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

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## 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

## Anatomy/Medical/Dental

- Body parts
- Symptoms
- Study of

## Italian lifestyle

- Culture
- Politics
- Current affairs
- Business
- Professional writing
- 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

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## Pinyin

- Initials and Finals
- Four Tones
- Chinese Syllables

## Vocabulary

- Number, Time, Age, Money, Math
- Measure Words, Quantifiers
- Greetings
- Relationships, Family Members
- Body Parts, Basic Medical Terms
- Animals, Plants, Fruits, Vegetables
- Places, Locations, Directions
- Transportation and Travel
- Food, Restaurant, Dining
- Colors and Shapes
- Households, Furniture
- Media and News
- Sports
- Emotions and Feelings
- Education
- Business
- Government, Provinces, Cities

## Grammar

- Pronouns
- Verbs
- Adjectives
- Adverbs
- Prepositions
- Basic Sentence Structure (Subject-Verb-Object)
- Conjunctions and Connectors
- Imperative
- Passive
- Negation
- Questions

## Classical Literature

- Classical Poetry - Shi form
- Classical Poetry - Ci form
- Classical Prose
- Classical Fiction and Drama

## Chinese Culture and Traditions

- Politeness and Courtesy
- Festivals and Celebrations
- Art (Calligraphy, Painting Performing Art, etc.)
- Chinese Food
- Religion and Philosophy (Confucianism, Taoism and Buddhism)



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## Literary

- Alphabet
- Vowels and Consonants
- Tones

## Vocabulary

- Number
- Time and Dates
- Money
- Math
- Quantifiers
- Family members
- Greetings and Polite expressions
- Transportation
- Places
- Animals
- Home essentials
- Clothes
- Colors
- Emotions
- Food
- Weather
- Human body
- Medical terms
- Education
- Business
- Government
- Word play
- Common words and Phrases

## Parts of Speech

- Nouns
- Demonstrative noun modifiers
- Articles
- Classifiers
- Numerals
- Quantifiers
- Focus marker particle
- Verbs
- Adjectives
- Adverbial particles
- Prepositions

## Grammar

- Sentence structure
- Word formation
- Figures of speech
- Passivization

## Regional Dialects

- Northern
- North-Central
- Mid-Central
- South-Central
- Southern

## Literature

- Folk literature
- Medieval literature
- Modern literature
- Poetry

## Culture

- Festival and Celebrations
- Lifestyle and Customs
- Religion and Philosophy
- Cuisine
- History
- Geography
- Visual arts
- Performing arts

### Planning, Teaching and Assessing

- Develop a Lesson
- Develop Assessments
- Evaluate Learning

### Mathematical Practices and Processes

- Solve Problems using various and appropriate strategies
- Reason abstractly and quantitatively
- Construct and evaluate mathematical arguments
- Use representations to model with mathematics, such as counters, linked cubes, a balance and a number line
- Use tools strategically
- Use precise mathematical language, symbols and units
- Find and use patterns to make generalizations
- Determine if repeated processes are reasonable
- Make connections among mathematical ideas

### Number Sense

- Classify numbers and use numbers in patterns
- Use conservation, group recognition, comparison, one-to-one correspondence
- Develop counting strategies counting on, counting back or skip counting
- Use place value to introduce the base 10 number system and decimals

### Geometry

- Draw and identify lines and angles
- Classify shapes by properties of their lines and angles
- Graph points on the coordinate plane to solve problems
- Reason with shapes and their attributes

### Operations, Basic Facts and Computation

- Apply properties of operations
- Solve problems involving the four operations with whole numbers and fractions
- Add and subtract whole numbers within 20 fluently
- Multiply and divide whole numbers within 100 fluently
- Write and interpret numerical expressions
- Use models (such as geometric shapes and other objects) to order fractions, understand equivalent fractions and compute with fractions
- Compare decimal quantities and convert from fractions

### Measurement and Data

- Solve problems involving measurement and estimation
- Represent and interpret data
- Tell and write time using analog and digital clocks
- Solve problems involving money
- Find the perimeter, area and volume of objects
- Convert like measurement units within a given measurement system
- Measure and sketch angles

## **Reading Development**

- Signs student is ready for reading instruction
- Discourse-Oral Language Development
- Print/Book Awareness
- Listening and Retelling
- Phonemic Awareness
- Letter Recognition
- Letter-Sound Correlations/ Language Development

## **Instructional Strategies for Reading**

- Identifying Student's Current Reading Level
- Reading Theories
- The 5 Components of Reading
- Balanced Literacy/ Whole Language/ Phonics
- Developing Curriculum
- Vocabulary
- Creating Activities for Instruction
- Fluency
- Comprehension strategies
- Scaffolding Instruction
- Differentiating Instruction
- Technology Use

## **Types of Assessment**

- Affective Reading assessments
- Summative Assessment for the 5 Components of Reading
- Formative Assessment for the 5 Components of Reading
- Analyzing Student Assessment Data
- Diagnosing Reading Issues
- Maintaining student records/portfolios
- Identifying Students Who May Need Additional Intervention

## Active Learning

- Collaborative discussion
- Independent Learning
- Critical Thinking
- Creative thinking
- Brainstorming
- Journaling
- Group Work
- Focused listening
- Formulating Questions
- Note-taking
- Annotating
- Role-playing
- Scaffolding
- Assessment

## Hybrid Learning (Blended Learning)

- On-line activities
- Project based learning
- Peer instruction
- Small group discussion
- Just-in-time teaching
- Flipped learning

## Critical Thinking

- Deep learning
- Concept mapping (mind-mapping)
- Goal setting
- Considering alternatives
- Utilizing past strategies
- Time Management
- Self-reflection
- Activating prior Knowledge
- Reviewing
- Summarizing
- Study skills

## Emotional Intelligence

- Assertive communication
- Conflict resolution
- Active listening skills
- Promoting positive attitude
- Self-awareness
- Student engagement strategies
- Empathy
- Responding to Criticism
- Developing Leadership skills
- Journaling
- Peer Conferences
- Teacher-student Conferencing

- Self-regulated learning
- Organizing and transforming information
- Keeping Records
- Rehearsing and memorizing
- Environmental awareness
- Recognizing Individual learning styles
- Goal-setting
- Reflective dialogue
- Constructive feedback
- Abstract Thinking
- Link new learning to prior learning

## Professional Learning

- Self-evaluating
- Adapting new strategies to individuals
- Accept leadership opportunities

## Growth mindset

- Learning from failure
- Accepting challenge
- Process over result
- Sense of purpose
- Growth over speed
- Effort before talent
- Learning from others' mistakes

## Bias

- Test anxiety and performance
- Ignore triggers
- Cross-group interactions
- Positive role models
- Managing stress and threat
- High standards for all
- Personal value affirmation
- Positive role models

## Community and service learning

- Volunteer project learning
- Community involvement

## Rhetorical communication

- Production of discourse
- Response to discourse
- Effective communication in the classroom
- Problem-solving communication

## Curriculum Development

- Identifying overarching objectives
- Lesson plans
- Grading standards
- Common core/benchmarks
- Rubrics

## Development Stages (Milestones)

- Birth-18 months
- 18 months-2 Years
- 3 years-5 years
- 6 years-8 years

## Theorists

- Urie Bronfenbrenner
- Erik Erikson
- Abraham Maslow
- Maria Montessori
- Jean Piaget
- Lev Vygotsky
- Reggio Emilia
- BF Skinner

## Observation and Assessment

- Anecdotal Records
- Work Samples
- Observations
- Why is it important?

## Diversity in the Classroom

- How to Promote Diversity

## Curriculum Development

- Social/Emotional Development
- Cognitive Development
- Language/Literacy Development
- Math/Scientific Reasoning
- Physical Development
- Differentiation and Accommodations
- Music

## Health, Safety and Nutrition

- Mandatory Reporter
- Safe Sleep Practices
- First Aid/CPR
- Abusive Head Trauma
- Importance of Physical Development
- Nutrition

## **Culture & Cross-Cultural Values**

- What is Culture?
- Defining Cross-Cultural
- Stereotypes vs. Cultural Values
- Communication Styles Reflective of Cultural Values
- Hofstede's Cultural Dimensions
- Ethics and Cross-Cultural Communication

## **Cross-Cultural Communication Comparisons**

- Chinese vs. American Technical Communication
- Japanese vs. American Technical Communication
- Hispanic/Latino vs. American Technical Comm.
- Korean vs. American Technical Communication

## **Intercultural Communication**

- Defining Intercultural Communication
- Intercultural vs. Cross-Cultural Communication

## **Challenges in Intercultural and Global Communication**

- Intercultural Communication Conflicts
- Cross-Cultural and Global Communication Barriers

## **Practical Intercultural & Global Comm. Strategies**

- Using Interpersonal Skills
- Practicing Relationship vs. Deal Focused Comm.
- Non-Verbal Communication
- Technical Skills
- Simplified and Plain English

## **Digital Communication**

- Defining Digital Communication
- Text Messages
- E-mail
- Social Networks

## **Health Communication**

- Healthcare Professional vs. Patient Understanding
- Plain Language
- Patient Considerations
- Multicultural Communication

## **Theoretical/Ideological Influences**

- Survey of Communication Theories
- Leadership Communication Theories
- Importance of Effective Professional Communication

## **Practical Application**

- Effective Written Communication
- Effective Oral Communication
- Interpersonal Communication
- Conflict Management
- Non-verbal Communication

## Essentials of Communication

- Communication Models
- Public Speaking Apprehension
- Communication Ethics

## Language

- Language Characteristics
- Language Devices

## Intercultural Communication

- Culture & Communication
- Cultural Identity & Co-Cultures

## Interpersonal Communication

- Perception
- Defining Self, Self-Concept, Self-Esteem
- Self-Disclosure
- Conflict Management

## Nonverbal Communication

- Principles of Nonverbal Communication
- Functions of Nonverbal Communication
- Types of Nonverbal Communication

## Audience Analysis

- Methods of Audience Analysis
- Gathering Audience Information

## Speech Organization & Topic Selection

- Brainstorming, Concept Maps
- Introductions, Conclusions, Connectives
- General and Specific Purpose Statements
- Narrowing the Topic

## Research and Support

- Where to Locate Credible Sources
- How to Identify Credible Sources
- Using Examples, Testimony, and Statistics
- Source Documentation

## Speech Delivery

- Types of Delivery
- Components of a Quality Delivery
- Delivery & Practice

## Listening

- Active Listening Practices
- Challenges to Listening

## Informative Speaking

- Types of Informative Speeches
- Effective Use of Research & Support

## Persuasive Speaking

- Reasoning
- Types of Persuasive Speaking
- Persuasive Speech Organizational Patterns
- Emotional Appeals
- Rhetorical Appeals



## **News Writing/Reporting**

- Lead
- Layout/Organization Styles
- Content

## **Feature/Magazine Writing**

- Lead
- Layout/Organization Styles
- Content

## **Broadcast News Writing**

- Content, Lead, Layout

## **Journalism and Theory**

- Society/History
- Feminist Theory
- Ethics
- Policies
- Politics

## **Grammar/Copy Editing**

- Basic Grammar concepts
- Copy editing concepts

## **Interviewing**

- How to

## **Statistics**

- Creating Statistics/Infographics
- Analyzing Statistics

## **Using Multimedia**

- Twitter, Podcast, Web, video

## **Research, Newsgathering**

- Conducting research
- Newsgathering

## News Writing/Reporting

- Essential Personal Communication Skills
- Self-Management
- Critical Thinking
- Leadership
- Problem Solving and Decision-Making
- Responsibility and Accountability
- Emotional Integrity

## Principles of Interpersonal & Small Group Communication

- Culture
- Group Culture
- Hofstede's Cultural Dimensions
- Workplace Culture
- Written Communication
- Professional and Workplace Group Documents
- Verbal Communication
- Tone
- Clear Language
- Persuasion
- Rhetorical Strategies
- Non-Verbal Communication
- Team-Working
- Creating Relationships
- Observation
- Active Listening
- Questioning
- Social Awareness
- Diversity
- Assertiveness
- Conflict Management Skills

## Constraints and Barriers

- Language Differences
- Cultural Differences
- Personality Differences
- Emotional Barriers
- Generational Differences
- Physical Disabilities
- Psychological Barriers

## Computer-Mediated Group Communication

- Elements of Computer-Mediated Communication
- Physical Barriers

## Ethics of Small Group Communication

- Ethical Responsibilities

## Theory & Function

- Mass comm vs interpersonal communications
- Mass communication theories
- Mass media functions
- Audience analysis

## Historical and Cultural Context

- Impacts of technological changes
- Ownership and economics of mass media
- Impact on politics & government
- Entertainment & mass culture
- Use in business

## Mass Media Practices

- Newspapers
- Magazines
- Broadcast: Radio & TV
- Cable
- Advertising & PR
- Film

## The Internet & Social Media

- Disruption of traditional media
- Impacts on audience
- Impacts on ownership
- Impact on content development
- Media representation

## Ethics & Laws

- Legal protections: libel, false advertising, FCC role
- Content developer's responsibilities

## Ancient Civilizations

- Political Practices
- Religious Beliefs
- Cultural Traditions

## World Trade & Exploration

- Major European Explorers 120-1519
- Major European Discoveries 120-1519
- 16-17th century world trade
- 18-19th century world trade

## The Middle Ages

- The Renaissance - major philosophers
- The Renaissance - major theories
- Sociopolitical and Sociocultural Practices
- The Medieval Pyramid

## World Religions & Cultures

- Major World Religions
- Family structures
- World holidays
- Cultural diversity

## Geography

- Continents of the World
- Oceans of the World
- U.S. Geographic Regions
- Early map skills

## Early American Settlements

- Roanoke Colony
- Jamestown Colony
- Plymouth Colony
- The 13 Colonies

## The U.S.

- U.S. States and Capitals
- U.S. Presidents 1789-present
- Founding fathers
- Founding documents

## Government

- Early U.S. Political Systems

- Early European Political Systems
- Early Asian Political Systems

## Civics

- Democracy
- The Voting Process
- Immigration
- Voting Rights

## Civil Rights

- Civil Rights Advocates
- Civil Rights Movement
- The Civil Rights Act

## U.S. Wars

- 1754-1812
- 1813-1865
- 1866-1975

## World Wars

- World War 1
- World War 2
- The Cold War

## Westward Expansion

- The Louisiana Purchase
- The Monroe Doctrine
- The Indian Removal Act

## Slavery

- Pre-Civil War
- The Slave Trade 1480-1865
- Post-Civil War

## Major Historical Figures

- American Inventors
- Women's Rights Activists
- Civil Rights Advocates

## The Information Age

- The rise of Mass Media
- The Digital Era
- Forms of Virtual Communication

## **Basic Geography Skills**

- Interpreting Maps and Diagrams
- Defining Regions and Places
- Space and Distance

## **Cultural Patterns and Influences**

- Formation of Social/Cultural Groups
- Diffusion and Migration
- Rural and Urban Land Use
- Impacts of Industrialization and Agriculture

## **Political Patterns and Influences**

- Political Territories and Boundaries
- Types of Political Regions
- Interaction and Conflict

## **Natural Features**

- Types of Natural Regions
- Change and Sustainability

## **Interrelationships and Causes**

- Spatial Association
- Cause and Effect
- Analyzing and Interpreting Data
- Identifying Patterns

## American Identity

- Native Americans
- Colonization/Road to Revolution
- Citizenship, Rights, Voting
- Liberty, Equality, Freedoms
- Sectionalism/States vs National
- THE vs THESE United States
- New World Power
- Individualism

## Politics and Power

- Representation
- Fight for Suffrage
- Role and expansion of federal government
- Segregation/desegregation/Jim Crow Laws
- Political Parties

## Work, Tech, Exchange

- Agrarian America - Cash crops and early economies
- Economic change overtime (Mercantilism - Capitalism - Laissez-faire)
- Panic, Recession, Bust
- Industrialization, Boom
- Labor and Unions
- Invention and Innovation
- Communication and Transportation

## Culture and Society

- Religious influences
- Reform Movements
- Minorities and Immigrants
- Social Revolutions (women, Civil Rights, family)
- Gender Roles over Time

## Migration and settlement

- Push/Pull Factors
- Manifest Destiny/Westward Expansion
- Rural-Urban/Urban-Suburban
- Government policies towards immigration
- Immigration patterns over time
- forced and voluntary immigration
- Internal migrations

## Geography/Environment

- Patterns of settlement
- Pollution
- Westward expansion/frontier
- Conservation and Energy Management
- Regional specialization

## America in the World

- Emergences as a world power
- Involvement in international conflicts
- Imperialism
- Superpower
- The Slave Trade
- Internal Conflicts
- Democracy

## **Historical time periods - Ancient civilizations**

- Greece
- Rome
- River Valley civilizations

## **Historical time periods - Middle Ages**

- Early
- Late
- High

## **Renaissance**

- Art
- Religion
- Philosophy

## **Historical themes**

- War and conflict
- Revolutions
- Cultural development

## **Modern Times**

- Enlightenment
- Industrial Revolution
- Europe - Napoleonic Era

## **Academic Strategies**

- Note-taking Techniques
- Studying Techniques
- Homework
- Selecting a Major
- Managing Knowledge Gaps
- Scholarly Resources

## **Habits for Success**

- Organizational Skills
- Attendance & Punctuality
- Motivation & Goals

## **Stress Management**

- Healthy Habits
- Finding Balance
- Building a Support System

## **Non-Traditional Students**

- Work/Life/Family Balance
- Learning New Technologies
- Financial Planning
- Career Transition
- Scheduling & Organization

## **Parent Coaching for Student Success**

- Scheduling & Organization
- Setting Expectations
- Studying Techniques
- Using Resources
- Motivation & Goals
- Managing Knowledge Gaps
- Finding Balance



## Cover Letters

- Template & formatting
- Content & length
- Grammar & spelling
- Targeted cover letters

## Resumes

- Templates and formatting
- Contact information placement
- Appropriate email address
- Resume language v. conversational language
- Resume grammar and sentence structure
- Identifying and using key words
- Screen-out factors
- Resume length
- Use of color, graphics, photos
- Proper tenses
- Summaries and bullet points
- Job history length
- Summaries and bullet points
- Military crossover resumes
- Power verbs

## Job Search Strategies

- Immediate needs v. long term goals
- Salary and benefits
- Targeted job searches
- Understanding the online application process
- How to prepare for an interview
- Appropriate interview attire
- Online v in-person interviews