Math Department

Guiding Principles & Goals

2009-2010

# I. Guiding Principles

- **Broad concepts and widely applicable methods should be emphasized**. The focus of our courses is neither **manipulation** nor memorization of an extensive taxonomy of functions, curves, theorems or problem types. Thus, although facility with manipulation and computational competence are important outcomes, they are not the core of these courses.

- **Technology** should be used regularly by students and teachers to reinforce the **relationships among the multiple representations of functions**, to confirm written work, to implement experimentation, and to assist in interpreting results.

- Students should be able to work with **functions represented in a variety of ways: graphical, numerical, analytical, or verbal. They should understand the connections among these representations.**

- Students should be able to **communicate mathematics both orally and in well-written sentences** and should be able to explain solutions to problems.

- Students should be able to **model a written description of a physical situation with a function**.

- Students should be able to use **technology** to help solve problems, experiment, interpret results and verify conclusions.

- Students should be able to determine the **reasonableness of solutions**, including sign, size, relative accuracy, and units of measurement.

Adapted from College Board AP Philosophy

# II. GOALS: M.A.T.H.

## M. Meaningful Collaboration w/ Focus on Effective Instruction

- Departmental—Instructional Strategies, Vertical Alignment of Curriculum

- Collaboration for Core Courses—“Study Group” Model
- Common Prep Time for Co-Teachers—once per cycle

# A. Assessment of Student Learning to Enhance Instruction

- Backward Design Model
- Align Written (Curriculum Maps), Taught, Assessed & Learned Curriculum
- Calculator versus Non-Calculator Tests/Quizzes
- Open Response Questions/Rubrics
- Common Midyear and Final Exams
  - Align with Objectives from Curriculum Maps
  - Analysis with Mastery Manager Software
- Summarizers
- Journals, Projects and Presentations
- Portfolios—Unit Assessments for CP2 classes
- Balance Levels of Task
  - Lower Level Demands (Memorization, Procedures w/out Connections)
  - Higher Level Demands (Procedures w/ Connections, Doing Mathematics)

# T. Technology as an Instructional and Exploratory Tool

- Graphing Calculators—TI83Plus, TI84Plus, TI89 CAS
- TI-InterActive Labs
- Geometer's Sketchpad Labs—Once per cycle for Geometry classes.

# H. High Quality Mathematics Instruction

By Building

- On Students' Prior Knowledge
- Conceptual Understanding, Procedure Fluency and Connected Knowledge
- Resourceful, Self-Regulating Problem Solvers

By Using

- Directed Instruction
- Cooperative Learning
  - Carousel, JIGSAW, "Get It Together"
- Pair Activities
  - Think-Pair-Share
- Concept Splashes
- Graphic Organizers
  - LINKs—Connecting Multiple Representations

- Webs—Activating Prior Knowledge
- Function Graph Labs
- Matching & Sorting Activities

# Mathematics Curriculum Frameworks

## Number Sense and Operations

*Students engage in problem solving, communicating, reasoning, connecting, and representing as they:*

10.N.1 Identify and use the properties of operations on real numbers, including the associative, commutative, and distributive properties; the existence of the identity and inverse elements for addition and multiplication; the existence of $n^{th}$ roots of positive real numbers for any positive integer n; and the inverse relationship between taking the $n^{th}$ root of and the $n^{th}$ power of a positive real number.

10.N.2 Simplify numerical expressions, including those involving positive integer exponents or the absolute value, e.g., $3(2^4 - 1) = 45$, $4|3 - 5| + 6 = 14$; apply such simplifications in the solution of problems.

10.N.3 Find the approximate value for solutions to problems involving square roots and cube roots without the use of a calculator, e.g., $\sqrt{3^3 - 1} \approx 2.8$ .

10.N.4 Use estimation to judge the reasonableness of results of computations and of solutions to problems involving real numbers.

# Patterns, Relations, and Algebra

*Students engage in problem solving, communicating, reasoning, connecting, and representing as they:*

10.P.1 Describe, complete, extend, analyze, generalize, and create a wide variety of patterns, including iterative, recursive (e.g., Fibonnacci Numbers), linear, quadratic, and exponential functional relationships.

10.P.2 Demonstrate an understanding of the relationship between various representations of a line. Determine a line's slope and x- and y-intercepts from its graph or from a linear equation that represents the line. Find a linear equation describing a line from a graph or a geometric description of the line, e.g., by using the "point-slope" or "slope y-intercept" formulas. Explain the significance of a positive, negative, zero, or undefined slope.

10.P.3 Add, subtract, and multiply polynomials. Divide polynomials by monomials.

10.P.4 Demonstrate facility in symbolic manipulation of polynomial and rational expressions by rearranging and collecting terms; factoring (e.g., $a^2 – b^2 = (a + b)(a – b)$, $x^2 + 10x + 21 = (x + 3)(x + 7)$, $5x^4 + 10x^3 – 5x^2 = 5x^2 (x^2 + 2x – 1)$); identifying and canceling common factors in rational expressions; and applying the properties of positive integer exponents.

10.P.5 Find solutions to quadratic equations (with real roots) by factoring, completing the square, or using the quadratic formula. Demonstrate an understanding of the equivalence of the methods.

10.P.6 Solve equations and inequalities including those involving absolute value of linear expressions (e.g., $|x - 2| > 5$) and apply to the solution of problems.

10.P.7 Solve everyday problems that can be modeled using linear, reciprocal, quadratic, or exponential functions. Apply appropriate tabular, graphical, or symbolic methods to the solution. Include compound interest, and direct and inverse variation problems. Use technology when appropriate.

10.P.8 Solve everyday problems that can be modeled using systems of linear equations or inequalities. Apply algebraic and graphical methods to the solution. Use technology when appropriate. Include mixture, rate, and work problems.

## Geometry

*Students engage in problem solving, communicating, reasoning, connecting, and representing as they:*

10.G.1 Identify figures using properties of sides, angles, and diagonals. Identify the figures' type(s) of symmetry.

10.G.2 Draw congruent and similar figures using a compass, straightedge, protractor, and other tools such as computer software. Make conjectures about methods of construction. Justify the conjectures by logical arguments.

10.G.3 Recognize and solve problems involving angles formed by transversals of coplanar lines. Identify and determine the measure of central and inscribed angles and their associated minor and major arcs. Recognize and solve problems associated with radii, chords, and arcs within or on the same circle.

10.G.4 Apply congruence and similarity correspondences (e.g., DABC @ DXYZ) and properties of the figures to find missing parts of geometric figures, and provide logical justification.

10.G.5 Solve simple triangle problems using the triangle angle sum property and/or the Pythagorean theorem.

10.G.6 Use the properties of special triangles (e.g., isosceles, equilateral, 30º–60º–90º, 45º–45º–90º) to solve problems.

10.G.7 Using rectangular coordinates, calculate midpoints of segments, slopes of lines and segments, and distances between two points, and apply the results to the solutions of problems.

10.G.8 Find linear equations that represent lines either perpendicular or parallel to a given line and through a point, e.g., by using the "point-slope" form of the equation.

10.G.9 Draw the results, and interpret transformations on figures in the coordinate plane, e.g., translations, reflections, rotations, scale factors, and the results of successive transformations. Apply transformations to the solutions of problems.

10.G.10 Demonstrate the ability to visualize solid objects and recognize their projections and cross sections.

10.G.11 Use vertex-edge graphs to model and solve problems.

## Measurement

*Students engage in problem solving, communicating, reasoning, connecting, and representing as they:*

10.M.1 Calculate perimeter, circumference, and area of common geometric figures such as parallelograms, trapezoids, circles, and triangles.

10.M.2 Given the formula, find the lateral area, surface area, and volume of prisms, pyramids, spheres, cylinders, and cones, e.g., find the volume of a sphere with a specified surface area.

10.M.3 Relate changes in the measurement of one attribute of an object to changes in other attributes, e.g., how changing the radius or height of a cylinder affects its surface area or volume.

10.M.4 Describe the effects of approximate error in measurement and rounding on measurements and on computed values from measurements.

## Data Statistics and Analysis

*Students engage in problem solving, communicating, reasoning, connecting, and representing as they:*

10.D.1 Select, create, and interpret an appropriate graphical representation (e.g., scatterplot, table, stem-and-leaf plots, box-and-whisker plots, circle graph, line graph, and line plot) for a set of data and use appropriate statistics (e.g., mean, median, range, and mode) to communicate information about the data. Use these notions to compare different sets of data.

10.D.2 Approximate a line of best fit (trend line) given a set of data (e.g., scatterplot). Use technology when appropriate.

10.D.3 Describe and explain how the relative sizes of a sample and the population affect the validity of predictions from a set of data.