

DARIEN PUBLIC SCHOOLS

CURRICULUM GUIDE

CAPT MATH WORKSHOP

Approved by the Board of Education: October 11, 2005

DARIEN PUBLIC SCHOOLS

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TABLE OF CONTENTS

SECTION I – Course Information

Statement of Philosophy.....	5
Program Goals.....	6
Overview.....	7
Essential Questions.....	8
Process Skills.....	9
Student Performance Summary.....	9
Grading Guidelines.....	10
Performance Assessment.....	10

SECTION II – Units of Study

Summary of Units.....	13
Unit 1: Number and Quantity.....	14
Unit 2: Measurement and Geometry.....	16
Unit 3: Statistics, Probability.....	18
Unit 4: Algebra and Functions.....	20

SECTION III - Related Goals and Standards

The Connecticut Framework: K-12 Curricular Goals and Standards.....	23
National Standards.....	24

SECTION IV – Learning Resources

Supplemental Resources.....	27
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SECTION I - Course Information

STATEMENT OF PHILOSOPHY

HS MATHEMATICS DEPARTMENT PHILOSOPHY

We believe in creating learning environments where students practice and acquire the knowledge of mathematics. We believe that students should be able to proficiently apply a range of numerical, algebraic, geometric, and statistical concepts and the skills to formulate, analyze, and solve real world problems. The learning environment will facilitate inquiry, use of technology and the exploration of real world phenomena. It will support continuous development of mathematical skills and the appreciation of mathematics as a discipline. Our mathematics program seeks to graduate students who will possess a sense of numbers, data analysis, spatial relationships, symbolic representations, and the ability to communicate mathematics with others.

DISTRICT MATHEMATICS PHILOSOPHY

Mathematics is a vigorous and growing discipline – a universal language useful for communication and research in other disciplines. We want our students to reason and communicate mathematically, to be mathematical problem-solvers, to value mathematics and to feel confident in their ability to use mathematics. Creating such a foundation necessitates a well-articulated and developmentally appropriate mathematics program for all, developing the mathematical power of each.

Mathematics is more than a collection of concepts and skills to be mastered. It is the exploration of ideas and concepts, the understanding of relationships, the ability to make predictions, to analyze data, to estimate results, to communicate ideas and to solve problems in this ever-changing world. It is no longer limited to the study of complex calculations and formulas. We are moving from a curriculum often dominated by memorization of isolated facts and procedures to one that emphasizes conceptual understandings, multiple representations, deliberate connections and mathematical problem solving. Rather than being a transmitter of knowledge, the teacher becomes a facilitator of learning, guiding, questioning, listening, clarifying and creating an environment in which the student is an active participant in learning.

The needs of today's society demand that all students become mathematically literate to function effectively. It will be necessary for our students to be able to use mathematics in their personal lives, further studies and future workplaces. As educators, we must recognize that students have differing abilities, performance levels, needs and interests and provide them with the best mathematics education possible so that they may achieve their personal ambitions and career goals.

Too often, students have learned to compute without understanding why the computation procedures make sense or how they apply to their lives. Instruction must focus on the behaviors that contribute to the development of mathematical thinking and number sense – explaining procedures used, justifying reasoning, judging the reasonableness of solutions and reflecting on the application of concepts.

When students gain knowledge from meaningful experiences, they are much more likely to retain and use what they have learned. Sound practice in the teaching of mathematics means that students are guided to use concrete materials and explore ideas with classmates. In this way, knowledge evolves from personal experience.

The fundamental objective of education has always been to prepare students to be contributing members of the society in which they live. The objectives of this mathematics curriculum support and affirm this tradition.

PROGRAM GOALS

- Enable students to express quantitative relationships numerically in multiple ways in order to make connections and simplify calculations using a variety of strategies, tools and technology.
- Provide students with the opportunity to analyze, visualize, measure and transform shapes and structures.
- Allow students to analyze data to make informed decisions.
- Enable students to represent and analyze patterns and functional relationships.

OVERVIEW

This course focuses on the CAPT (Connecticut Academic Performance Test) mathematics content strands:

- Number and Quantity
- Measurement and Geometry
- Statistics, Probability and Discrete Mathematics
- Algebra and Functions

Students will show proficiency in the following mathematical areas in each of these content strands: problem solving and reasoning; communicating; and computing and estimating. Much of the assessment will focus on generalized abilities and an integrated understanding of key mathematical concepts drawn from everyday experiences.

The CAPT Mathematics Workshop is provided as one of the alternatives for students who do not meet Darien Public School district's CAPT goals for graduation.

ESSENTIAL QUESTIONS

For course:

1. How are quantitative relationships represented by numbers?
2. How do geometric relationships and measurements help us to solve problems and make sense of our world?
3. How can collecting, organizing and displaying data help us analyze information and make reasonable and informed decisions?
4. How do patterns and functions help us describe data and physical phenomena and solve a variety of problems?

K-12 Math Curriculum Essential Questions

- How does math help us to make sense of our world?
- How does math help us to understand real-world phenomena, make decisions and meet challenges?
- What are the natural and cultural patterns around us?
- How does math, as a universal language, empower us and help us to communicate?

PROCESS SKILLS

Indicate and explain the process skills which are included in this curriculum guide, using only those applicable to this course:

- Reading (Comprehending)
- Reading (Analyzing)
- Writing mathematical equations
- Speaking the language of mathematics
- Listening
- Viewing
- Using Maps
- Studying
- Reasoning and Reflecting
- Using Learning Resources and Technology
- Working Independently and Collaboratively
- Designing
- Creating
- Quantifying
- Understanding Number Operations
- Using and Creating Formulas
- Problem Solving
- Graphing
- Applying Probability and Statistics
- Applying Scientific Method

STUDENT PERFORMANCE SUMMARY

- Oral Presentation with Visuals (story board, overhead transparencies, Power Point, Whiteboard, Data Projector, Internet site, etc.)
- Portfolio
- Model with Written Explanation
- Cooperative Learning
- Computer based lab work

GRADING GUIDELINES

This is a portfolio based class. Students must satisfactorily complete the tasks for each of the four CAPT Mathematics content strands.

	<u>Expectations of Students</u>	<u>% of Report Card Grade</u>
Homework	100% of all assignments	0-20%
Portfolio	All items completed satisfactorily	70-80%
Final Exam		20% of semester grade
Class Participation		0-10%

PERFORMANCE ASSESSMENT: CAPT MATHEMATICS GRADING RUBRIC

All work completed for all four CAPT Mathematics content strands will be graded using the same rubric as the CAPT Mathematics items are graded.

Grid-in Items

Grid-in items are those for which a student must arrive at an answer and enter it into a grid. The grid-in items are scored as either correct or incorrect; however, there may be several correct answers for an item. There are times in mathematics when because of rounding (38.21 or 38.2), or representing percents (35% or .35), a number of responses are correct and acceptable.

Open-ended Items

Open-ended items are those for which a student must write a response to a question. For example, students may be asked to solve a problem and show all of their work or be asked to make a choice and justify it mathematically.

Open-ended items are scored on a four-point scale (0-3) using a holistic method. This means that the overall quality of a student's response is considered when making a scoring judgment. The following scoring rubric for the mathematics open-ended items describes the characteristics of a response at each given score point. Each score category contains a range of student responses which reflect the descriptions given below.

Score 3: The student has demonstrated a **full and complete** understanding of all concepts and processes embodied in this application. The student has addressed the task in a mathematically sound manner. The response contains evidence of the student's competence in problem-solving and reasoning, computing and estimating, and communicating to the full extent that these processes apply to the specified task. The response may, however, contain minor arithmetic errors that do not detract from a demonstration of full understanding. Student work is shown.

Score 2: The student has demonstrated a **reasonable** understanding of the essential mathematical concepts and processes embodied in this application. The student's response contains most of the attributes of an appropriate response including a mathematically sound approach and evidence of competence with applicable mathematical processes, but contains flaws that do not diminish countervailing evidence that the student comprehends the essential mathematical ideas addressed by this task. Such flaws include errors ascribable to faulty reading, writing, or drawing skills; errors ascribable to insufficient, non-mathematical knowledge; and errors ascribable to negligent or inattentive execution of mathematical processes or algorithms.

Score 1: The student has demonstrated a **limited** understanding of some of the concepts and processes embodied in this application. The student's response contains some of the attributes of an appropriate response, but lacks convincing evidence that the student fully comprehends the essential mathematical ideas addressed by this task. Such deficits include evidence of insufficient mathematical knowledge; errors in fundamental mathematical procedures; and other omissions or anomalies that bring into question the extent of the student's ability to solve problems of this general type.

Score 0: The student has demonstrated **merely an acquaintance** with the topic. The student's response is associated with the task in the item but contains few attributes of an appropriate response. There are significant omissions or anomalies that indicate a basic lack of comprehension in regard to the mathematical ideas and procedures necessary to adequately address the specified task. No evidence is present to suggest that the student has the ability to solve problems of this general type.

SECTION II – Units of Study

SUMMARY OF UNITS

Unit Title	Duration (weeks)
UNIT 1: NUMBER AND QUANTITY	4-5
UNIT 2: MEASUREMENT AND GEOMETRY	4-5
UNIT 3: STATISTICS, PROBABILITY AND DISCRETE MATHEMATICS	4-5
UNIT 4: ALGEBRA AND FUNCTIONS	4-5

UNIT 1: NUMBER AND QUANTITY

1. Does the student understand that a variety of numerical representations can be used to describe quantitative relationships?
2. Can the student use numbers and their properties to compute flexibly and fluently and to reasonably estimate measures and quantities?

STANDARDS

2. Numerical And Proportional Reasoning – Quantitative relationships can be expressed numerically in multiple ways in order to make connections and simplify calculations using a variety of strategies, tools and technology.

CONTENT KNOWLEDGE OBJECTIVES

Content:

1. Number sense
2. Operations
3. Estimation and approximation
4. Ratios, proportions and percentages

Skills:

1. Use integers, fractions, decimals, percents, and scientific notation in real-world situations to count, measure, compare, order, scale, locate, and label.
 2. Use a variety of representations (including graphs, tables, words, number lines, pictures, etc.) to present, interpret, and communicate various kinds of numerical information.
 3. Demonstrate an understanding of order, magnitude, and equivalent forms of numbers.
 4. Identify appropriate operations (including addition, subtraction, multiplication, division, exponentiation, and square roots) and use these operations in a variety of contexts.
 5. Select and use appropriate methods for computing (including mental mathematics, paper-and-pencil, and calculator methods).
 6. Select and use estimation strategies in problem situations. Assess the reasonableness of answers to problems.
 7. Use ratios, proportions, and percentages to solve problems.
 8. Use dimensional analysis to determine equivalent rates.
 9. Use direct and inverse variation to solve numerical, geometric, and algebraic problems.
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VOCABULARY

Integers, fractions, decimals, percents, scientific notation, order, magnitude, exponent, power, radical, ratio, proportion, rate, variation, direct, inverse and scale.

ACTIVITIES

Students will analyze, discuss, complete, write about and present CAPT type problems from the Number and Quantity Mathematics Strand. The problems will be both open-ended tasks as well as the grid-in type.

PERFORMANCE ASSESSMENT

See section I, Course Information
Performance Assessment: Capt Mathematics Grading Rubric (p.10)

CORE TEXT FOR STUDENTS

None

ADDITIONAL TEXTS/ RESOURCES FOR USE BY STUDENTS

See section IV, Learning Resources
Supplemental Resources (p. 27)

MATERIALS AND SUPPLIES

See section IV, Learning Resources
Supplemental Resources (p. 27)

INTEGRATED TECHNOLOGY

See section IV, Learning Resources
Supplemental Resources (p. 27)

UNIT 2: Measurement and Geometry

1. Can the student use the properties and characteristics of two- and three-dimensional shapes and geometric theorems to describe relationships, communicate ideas and solve problems?
2. Is the student able to use spatial reasoning, location and geometric relationships to solve problems?
3. Can the student develop and apply units, systems, formulas and appropriate tools to estimate and measure?

STANDARDS

3. Geometry and Measurement – Quantitative relationships can be expressed numerically in multiple ways in order to make connections and simplify calculations using a variety of strategies, tools and technology.

CONTENT KNOWLEDGE OBJECTIVES

Content:

1. Measurement
2. Spatial relationships and geometry

Skills:

1. Use the concepts of length, perimeter, area, volume, angle measure, capacity, weight and mass to solve problems, using both metric and customary units.
2. Identify appropriate metric and customary measurement units and use appropriate measurement tools (including rulers and protractors).
3. Estimate, make and use measurements in realistic situations.
4. Use formulas and scales to determine measures.
5. Interpret, describe and draw 2- and 3-dimensional objects.
6. Use the concepts of rotation, reflection and translation to transform geometric figures.
7. Describe and use fundamental concepts and properties of, and relationships among, points, lines, planes, angles and shapes (including incidence, parallelism, perpendicularity and the Pythagorean Theorem).
8. Use the concepts of congruence and similarity to solve realistic problems.
9. Use coordinate representations of geometric figures.
10. Solve problems using geometric models.

VOCABULARY

Length, perimeter, area, volume, angle measure, degree, capacity, weight, mass, scale, dimension, rotation, reflection, translation, transformation, point, line, plane, parallel, perpendicular, Pythagorean Theorem, congruent, similar, coordinates, circumference, prism, cylinder, sphere and right.

ACTIVITIES

Students will analyze, discuss, complete, write about and present CAPT type problems from the Measurement and Geometry Mathematics Strand. The problems will be both open-ended tasks as well as the grid-in type.

PERFORMANCE ASSESSMENT

See section I, Course Information
Performance Assessment: Capt Mathematics Grading Rubric (p.10)

CORE TEXT FOR STUDENTS

None

ADDITIONAL TEXTS/ RESOURCES FOR USE BY STUDENTS

See section IV, Learning Resources
Supplemental Resources (p. 27)

MATERIALS AND SUPPLIES

See section IV, Learning Resources
Supplemental Resources (p. 27)

INTEGRATED TECHNOLOGY

See section IV, Learning Resources
Supplemental Resources (p. 27)

UNIT 3: STATISTICS, PROBABILITY AND DISCRETE MATHEMATICS

1. Can the student collect, organize and display data using appropriate statistical and graphical methods?
2. Has the student learned to analyze data sets to form hypotheses and make predictions?
3. Is the student able to understand and apply basic concepts of probability?

STANDARDS

4. WORKING WITH DATA: PROBABILITY AND STATISTICS: Data can be analyzed to make informed decisions using a variety of strategies, tools and technology.

CONTENT KNOWLEDGE OBJECTIVES

Content:

1. Statistics
2. Probability
3. Discrete mathematics

Skills:

1. Demonstrate an understanding of sampling and its role in statistical assertions.
 2. Describe, calculate, and apply the concepts of mean, median, mode, and range. Construct, read, and interpret tables, charts, and graphs of real-world data.
 3. Make and evaluate inferences from tables, charts, graphs, and other representations of data.
 4. Use probability to make predictions and evaluate the likelihood of simple and compound events. Use simulations to determine experimental probabilities.
 5. Compare experimental and theoretical probabilities and make predictions based on these probabilities.
 6. Use systematic listing and counting strategies, including simple combinations and permutations, to solve problems.
 7. Use recursive processes, including iteration, to solve problems.
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VOCABULARY

Sampling, mean, median, mode, range, inference, theoretical probability, experimental probability, simple and compound events, simulation, permutations, combinations, recursive, iteration

ACTIVITIES

Students will analyze, discuss, complete, write about and present CAPT type problems from the Statistic, Probability and Discrete Mathematics Strand. The problems will be both open-ended tasks as well as the grid-in type.

PERFORMANCE ASSESSMENT

See section I, Course Information
Performance Assessment: Capt Mathematics Grading Rubric (p.10)

CORE TEXT FOR STUDENTS

None

ADDITIONAL TEXTS/ RESOURCES FOR USE BY STUDENTS

See section IV, Learning Resources
Supplemental Resources (p. 27)

MATERIALS AND SUPPLIES

See section IV, Learning Resources
Supplemental Resources (p. 27)

INTEGRATED TECHNOLOGY

See section IV, Learning Resources
Supplemental Resources (p. 27)

UNIT 4: ALGEBRA AND FUNCTIONS

1. Is the student able to understand and describe patterns and functional relationships?
2. Can the student represent and analyze quantitative relationships in a variety of ways?
3. Has the student learned to use operations, properties, and algebraic symbols to determine equivalence and solve problems?

STANDARDS

1. ALGEBRAIC REASONING: PATTERNS AND FUNCTIONS: Patterns and functional relationships can be represented and analyzed using a variety of strategies, tools, and technology..

CONTENT KNOWLEDGE OBJECTIVES

Content:

1. Patterns
2. Algebra and Functions

Skills:

1. Construct, describe, extend, and analyze a variety of numerical, geometric, and statistical patterns
 2. Describe, analyze, and generalize patterns using tables, rules, algebraic expressions, and equations and graphs.
 3. Make and justify predictions based on patterns.
 4. Represent and analyze situations involving variable quantities with tables, graphs, verbal rules, and equations, and translate among representations.
 5. Construct and use linear functions to model and solve real-world situations.
 6. Use the coordinate plane to represent functions.
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VOCABULARY

Table, algebraic expression, equation, inequality, pattern, variable, constant, formula, function, graph, coordinate plane, verbal rule

ACTIVITIES

Students will analyze, discuss, complete and write about CAPT type problems covering the Algebra and Functions Mathematics strand.

PERFORMANCE ASSESSMENT

See section I, Course Information
Performance Assessment: Capt Mathematics Grading Rubric (p.10)

CORE TEXT FOR STUDENTS

None

ADDITIONAL TEXTS/ RESOURCES FOR USE BY STUDENTS

See section IV, Learning Resources
Supplemental Resources (p. 27)

MATERIALS AND SUPPLIES

See section IV, Learning Resources
Supplemental Resources (p. 27)

INTEGRATED TECHNOLOGY

See section IV, Learning Resources
Supplemental Resources (p. 27)

SECTION III - Goals and Standards

RELATED GOALS and STANDARDS

The Connecticut Framework – K-12 Curriculum Goals and Standards

- 1. Algebraic Reasoning: Patterns and Functions – Patterns and functional relationships can be represented and analyzed using a variety of strategies, tools, and technology.**

Students should:

- 1.1 Understand and describe patterns and functional relationships.*
- 1.2 Represent and analyze quantitative relationships in a variety of ways.*
- 1.3 Use operations, properties, and algebraic symbols to determine equivalence and solve problems.*

- 2. Numerical and Proportional Reasoning - Quantitative relationships can be expressed numerically in multiple ways in order to make connections and simplify calculations using a variety of strategies, tools and technology.**

Students should:

- 2.1 Understand that a variety of numerical representations can be used to describe quantitative relationships.*
- 2.2 Use numbers and their properties to compute flexibly and fluently, and to reasonably estimate measures and quantities.*

- 3. Geometry and Measurement - Shapes and structures can be analyzed, visualized, measured and transformed using a variety of strategies, tools and technology.**

Students should:

- 3.1 Use properties and characteristics of two- and three-dimensional shapes and geometric theorems to describe relationships, communicate ideas and solve problems.*
- 3.2 Use spatial reasoning, location and geometric relationships to solve problems.*
- 3.3 Develop and apply units, systems, formulas and appropriate tools to estimate and measure.*

- 4. Working with Data: Probability and Statistics - Data can be analyzed to make informed decisions using a variety of strategies, tools and technology.**

Students should:

- 4.1 Collect, organize and display data using appropriate statistical and graphical methods.*
- 4.2 Analyze data sets to form hypotheses and make predictions.*
- 4.3 Understand and apply basic concepts of probability.*

NCTM Standards

1. Number & Operations

- Understand numbers, ways of representing numbers, relationships among numbers, and number systems
- Understand meanings of operations and how they relate to one another
- Compute fluently and make reasonable estimates

2. Algebra

- Understand patterns, relations, and functions
- Represent and analyze mathematical situations and structures using algebraic symbols
- Use mathematical models to represent and understand quantitative relationships
- Analyze change in various contexts

3. Geometry

- Analyze characteristics and properties of two- and three-dimensional geometric shapes and develop mathematical arguments about geometric relationships
- Specify locations and describe spatial relationships using coordinate geometry and other representational systems
- Apply transformations and use symmetry to analyze mathematical situations
- Use visualization, spatial reasoning, and geometric modeling to solve problems

4. Measurement

- Understand measurable attributes of objects and the units, systems, and processes of measurement
- Apply appropriate techniques, tools, and formulas to determine measurements

5. Data Analysis & Probability

- Understand and apply basic concepts of probability

6. Problem Solving

- build new mathematical knowledge through problem solving;
- solve problems that arise in mathematics and in other contexts;
- apply and adapt a variety of appropriate strategies to solve problems;
- monitor and reflect on the process of mathematical problem solving

7. Reasoning & Proof

- recognize reasoning and proof as fundamental aspects of mathematics;
- make and investigate mathematical conjectures;
- develop and evaluate mathematical arguments and proofs;
- select and use various types of reasoning and methods of proof

8. Communication

- organize and consolidate their mathematical thinking through communication;
- communicate their mathematical thinking coherently and clearly to peers, teachers, and others;
- analyze and evaluate the mathematical thinking and strategies of others;
- use the language of mathematics to express mathematical ideas precisely

9. Connections

- recognize and use connections among mathematical ideas;
- understand how mathematical ideas interconnect and build on one another to produce a coherent whole;
- recognize and apply mathematics in contexts outside of mathematics.

10. Representation

- create and use representations to organize, record, and communicate mathematical ideas;
- select, apply, and translate among mathematical representations to solve problems;
- use representations to model and interpret physical, social, and mathematical phenomena

SECTION IV – Learning Resources

SUPPLEMENTAL RESOURCES

- Problems which appeared on past administration of the Mathematics section of the CAPT and their published graded solutions.
- Similar problems created by teacher or students to those that appeared on past administration of the Mathematics section of the CAPT
- CAPT Mathematics, Webster House Publishing LLC, Ridgefield, Connecticut
- CAPT Coach: Mathematics, Grade 10, Triumph Learning, New York, NY 10016
- Internet resources

Websites

- www.nctm.org
- www.learner.org/exhibits/dailymath
- www.math.temple.edu/~paulos
- www.mathforum.org
- www.maa.org
- www.mathematicallycorrect.com
- www.personal.cfw.com/~clayford
- www.math.com
- www.math.uah.edu/psol
- www.nilesonline.com/stats
- www.mathmistakes.com
- www.innumeracy.com
- www.techlar.com/fractals
- www.superstringtheory.com

Other Resources

- Computer Lab
- Microsoft Excel
- TI-83 graphing calculator
- Media center

Special Education Students

Every student in this class will be required to complete all the assigned work covering the four CAPT Mathematics content strands. When necessary, assignments will be modified appropriately according to each special education student's IEP. Each student will be assured success if he/she completes all the required work modified for his/her needs.