

DARIEN PUBLIC SCHOOLS

CURRICULUM GUIDE

Principles of Mathematics

Approved by the Board of Education on February 25, 2003

DARIEN PUBLIC SCHOOLS

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SECTION I - Course Information

STATEMENT OF PHILOSOPHY

H.S. 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

- Review of algebra and geometry for standardized test preparation
- Data analysis leading to an investigation of regression
- Finding measures of central tendency
- Discovering how the stock market works
- Make the connection between mathematics and investing money
- Discover how mathematical functions model real-life situations
- Investigate college level geometric properties
- Use trigonometry to solve problems
- To develop a strong understanding of probability values
- Create a spread sheet that incorporates mathematical formulas
- Design a power point presentation

OVERVIEW

This course is a topics class for seniors who wish to take a fourth year of mathematics. The topics covered are mathematically relevant to any student who will graduate high school. The course covers practical and useful topics such as the stock market, investing money, statistics and computer mathematics. There are also topics that are covered that will prepare students for college. We will investigate trigonometry and some college level geometry and an introduction to statistics and probability. At the beginning of the year the course will concentrate on SAT test preparation.

The course is open to seniors who have successfully completed a course in Algebra 1, Geometry and Algebra 2.

ESSENTIAL QUESTIONS

- 1) What is the relationship between finance and mathematics?
- 2) How can an understanding of statistics give the student a competitive advantage in the working world?
- 3) Can students understand the range of probability from zero to one?
- 4) What is the relationship between computers and mathematics?

K-12 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

- Reading (Comprehending)
- Reading (Analyzing)
- Reading (Appreciating)
- Writing mathematical equations
- Listening
- Viewing
- Studying
- Reasoning and Reflecting
- Using Learning Resources, manipulatives, Technology
- Working Independently and Collaboratively
- Designing
- Creating
- Quantifying
- Understanding Number Operations
- Compute
- Problem Solving
- Graphing
- Applying Probability and Statistics
- Applying Scientific Method

STUDENT PERFORMANCE SUMMARY

- Cooperative learning
- Computer based lab work
- Statistics project
- Oral Presentation with visuals
- Problem of the Day
- Graphing projects
- Practical and Theoretical Applications
- Preparation for Standardized Tests
- Projects linked to science
- Tests and Quizzes
- Homework
- Class Participation

GRADING GUIDELINES

	<u>Expectations of Students</u>	<u>% of Report Card Grade</u>
Homework	100% of all assignments	0 -10%
Notebook	All notes maintained	
Tests	All tests taken/made up	45 – 60%
Quizzes	All quizzes taken/made up	30 – 40%
Mid-Year Exams		20% of semester grade
Final Exams		20% of semester grade
Projects		0 – 20%
Class Participation		0 – 5%

SECTION II – Units of Study

SUMMARY OF UNITS

Unit Title	Duration (weeks)
UNIT 1: SAT PREPARATION	3-4
UNIT 2: DATA ANALYSIS	4-5
UNIT 3: STOCK MARKET	8-12
UNIT 4: FINANCE	3-4
UNIT 5: COORDINATE GEOMETRY	3-4
UNIT 6: TRIGONOMETRY	3-4
UNIT 7: PROBABILITY	4-5
UNIT 8: COMPUTER MATHEMATICS	2-3

UNIT 1: SAT PREPARATION

- 1) What type of strategy should you use in taking the SAT?
- 2) What topics does the SAT cover?

STANDARDS

1. Number Sense Students will use numbers to count, measure, compare, order, scale, locate and label, and use a variety of numerical representations to present, interpret, communicate and connect various kinds of numerical information.

2. Operations Students will add, subtract, multiply and divide with whole numbers, fractions, decimals and integers, and develop strategies for selecting the appropriate computational and operational methods for solving problems.

4. Ratios, Proportions and Percents Students will use ratios, proportions and percents to represent relationships between quantities and measures and solve problems involving ratios, proportions and percents.

6. Spatial Relationships and Geometry Students will analyze and use spatial relationships and basic concepts of geometry to construct, draw, describe and compare geometric models and their transformations, and use geometric relationships and patterns to solve problems.

CONTENT KNOWLEDGE OBJECTIVES

Content:

1. Mathematical Terminology
2. Arithmetic
3. Algebra
4. Geometry
5. Quantitative comparisons
6. Test taking strategy

Skills:

1. Classifying a number
2. Defining key SAT terms such as integer, factor, etc.
3. Using a calculator properly
4. Basic algebra skills
5. Using the Pythagorean theorem
6. Identifying special right triangle relationships
7. Process of elimination

8. Making a good guess

VOCABULARY

Complex number, real number, imaginary number, rational number, irrational number, integer, radical, digit, natural number, odd number, even number, factor, multiple, prime number

ACTIVITIES

- Practice SAT tests

PERFORMANCE ASSESSMENT

Tests, Quizzes, homework, special projects
See page 8 for additional assessments

CORE TEXT FOR STUDENTS

Access, [10 Real SAT's](#)

ADDITIONAL TEXTS/ RESOURCES FOR USE BY STUDENTS

See Section IV, Learning Resources

MATERIALS AND SUPPLIES

See Section IV, Learning Resources

UNIT 2: DATA ANALYSIS

1. Can the student summarize data?
 2. Can the student create a picture for data?
-

1. Number Sense Students will use numbers to count, measure, compare, order, scale, locate and label, and use a variety of numerical representations to present, interpret, communicate and connect various kinds of numerical information.

3. Estimation and Approximation Students will make estimates and approximations, and judge the reasonableness of results.

5. Measurement Students will make and use measurements in both customary and metric units to approximate, measure and compute length, area, volume, mass, temperature, angle and time.

7. Probability and Statistics Students will use basic concepts of probability and statistics to collect, organize, display and analyze data, simulate events and test hypotheses.

CONTENT KNOWLEDGE OBJECTIVES

Content:

1. Data
2. Graphing
3. Line of best fit

Skills:

1. Collect data
2. Construct a histogram
3. Construct a dot plot
4. Find and graph the line of best fit
5. Calculate the measures of central tendency (mean, median, mode and midrange)
6. Calculate measures of variation (standard deviation, variance and range)

VOCABULARY

histogram, dot plot, stem and leaf plot, pie chart, scatter diagram, central tendency, arithmetic mean, median, mode, bimodal, multimode, midrange, weighted mean, skewed, symmetric, range, standard deviation, variance

ACTIVITIES

1. Create frequency tables
2. Complete statistical analysis
3. Create a graph using Microsoft Excel

PERFORMANCE ASSESSMENT

Tests, quizzes, homework, special projects
See page 8 for additional assessments

CAREER AWARENESS (where appropriate)

Statistician, Lawyer, Salesman, Researcher

CORE TEXT FOR STUDENTS

Elementary Statistics, Mario F. Triola, Addison Wesley

ADDITIONAL TEXTS/ RESOURCES FOR USE BY STUDENTS

See Section IV, Learning Resources

MATERIALS AND SUPPLIES

See Section IV, Learning Resources

UNIT 3: STOCK MARKET

1. How does the stock market work?
2. How do you play the stock market?

STANDARDS

2. Operations Students will add, subtract, multiply and divide with whole numbers, fractions, decimals and integers, and develop strategies for selecting the appropriate computational and operational methods for solving problems.

3. Estimation and Approximation Students will make estimates and approximations, and judge the reasonableness of results.

CONTENT KNOWLEDGE OBJECTIVES

Content

1. Public companies
2. Stock market terminology
3. Stock tables
4. Trading
5. Stock prices
6. Investing

Skills

1. Understand how public companies affect their lives
2. Become familiar with the stock market game glossary
3. Reading a stock table
4. Familiarize themselves on the people who run the stock market
5. Know the anatomy of a trade
6. How stock prices fluctuate
7. How to invest

VOCABULARY

Asked price, assets, balance sheet, bid price, bull market, bear market, capital gain or loss, common stock, current yield, dividend, Dow Jones Industrial Average, earning per share, exchange, IPO, margin, market price, mutual fund, NASDAQ, PE ratio, S & P 500, blue chip, growth stock, stock split, yield

ACTIVITIES

Dow Jones stock investigation
Stock Market game

PERFORMANCE ASSESSMENT

Tests, Quizzes, Homework, Special projects
See page 8 for additional assessments

CAREER AWARENESS (where appropriate)

Investor, Stock Analyst, Banker

CORE TEXT FOR STUDENTS

The Stock Market Game Worldwide (www.smgww.org)
nyse.com
nasdaq.com

ADDITIONAL TEXTS/ RESOURCES FOR USE BY STUDENTS

See Section IV, Learning Resources

MATERIALS AND SUPPLIES

See Section IV, Learning Resources

UNIT 4: FINANCE

1. What is the connection between mathematics and finance?

STANDARDS

2. Operations Students will add, subtract, multiply and divide with whole numbers, fractions, decimals and integers, and develop strategies for selecting the appropriate computational and operational methods for solving problems.

3. Estimation and Approximation Students will make estimates and approximations, and judge the reasonableness of results.

4. Ratios, Proportions and Percents Students will use ratios, proportions and percents to represent relationships between quantities and measures and solve problems involving ratios, proportions and percents.

CONTENT KNOWLEDGE OBJECTIVES

Content:

1. Percent increase/decrease
2. Simple Interest
3. Compound interest
4. Types of savings accounts
5. Borrowing money
6. Checkbook balancing

Skills:

1. Calculate a percent of increase or decrease
2. Calculate simple interest
3. Calculate compound interest
4. Tell the difference between certain savings accounts
5. Finding rates for borrowing money
6. Define the number e
7. Balancing your checkbook
8. Making a budget

VOCABULARY

Interest, compound, certificate of deposit, money market account

ACTIVITIES

What Bank to pick?

PERFORMANCE ASSESSMENT

Tests, Quizzes, homework, special projects
See page 8 for additional assessments

CAREER AWARENESS (where appropriate)

Any financial occupation

CORE TEXT FOR STUDENTS

Practical Math

ADDITIONAL TEXTS/ RESOURCES FOR USE BY STUDENTS

See Section IV, Learning Resources

MATERIALS AND SUPPLIES

See Section IV, Learning Resources

UNIT 5: COORDINATE GEOMETRY

1. What is the difference between 2 dimensional and 3 dimensional?
2. How do we use graphing to solve real-world problems?

STANDARDS

1. Number Sense Students will use numbers to count, measure, compare, order, scale, locate and label, and use a variety of numerical representations to present, interpret, communicate and connect various kinds of numerical information.

2. Operations Students will add, subtract, multiply and divide with whole numbers, fractions, decimals and integers, and develop strategies for selecting the appropriate computational and operational methods for solving problems.

5. Measurement Students will make and use measurements in both customary and metric units to approximate, measure and compute length, area, volume, mass, temperature, angle and time.

6. Spatial Relationships and Geometry Students will analyze and use spatial relationships and basic concepts of geometry to construct, draw, describe and compare geometric models and their transformations, and use geometric relationships and patterns to solve problems.

CONTENT KNOWLEDGE OBJECTIVES

Content:

1. Distance in 2 dimensions
2. Distance in 3 dimensions
3. Magnitude of a vector
4. Direction of a vector
5. Vector word problems
6. Perimeter of polygons in 3 dimensions
7. Volume of prisms in 3 dimensions
8. Quadratic regression
9. Graphing quadratics
10. Solving quadratics

Skills:

1. Find the distance between two points in 2 dimensions
2. Find the distance between two points in 3 dimensions

3. Graph a vector
4. Add and scalar multiply vectors
5. Solve directional problems using vectors
6. Find the perimeter of a polygon in 3 dimensions
7. Find the volume of a polygon in 3 dimensions
8. Write the quadratic equation given 3 non-collinear points
9. Graph the quadratic on the TI-83
10. Use the graph and the equation to solve real-life problems

VOCABULARY

Vector, magnitude, 2-D, 3-D, quadratic, vertex, coordinates, direction

ACTIVITIES

TI-83 graphing exploration

PERFORMANCE ASSESSMENT

Tests, Quizzes, homework, special projects
See page 8 for additional assessments

CORE TEXT FOR STUDENTS

Advanced Mathematical Concepts , Gordon-Holliday, Merrill/Glencoe

ADDITIONAL TEXTS/ RESOURCES FOR USE BY STUDENTS

See Section IV, Learning Resources

MATERIALS AND SUPPLIES

See Section IV, Learning Resources

UNIT 6: TRIGONOMETRY

1. Can the student solve triangles and find the area of triangles?
2. Can the student evaluate trigonometric functions?
3. Can the student measure angles in radians and degrees?

STANDARDS

5. Measurement Students will make and use measurements in both customary and metric units to approximate, measure and compute length, area, volume, mass, temperature, angle and time.

6. Spatial Relationships and Geometry Students will analyze and use spatial relationships and basic concepts of geometry to construct, draw, describe and compare geometric models and their transformations, and use geometric relationships and patterns to solve problems.

CONTENT KNOWLEDGE OBJECTIVES

Content

1. Definition of sine, cosine and tangent
2. Pythagorean theorem
3. Right triangle trigonometry
4. Law of Sines
5. Law of Cosines
6. Trig word problems

Skills

1. Use the Pythagorean theorem to solve a right triangle
2. Discover trig ratios using right triangle side measures
3. Use trig functions to find right triangle side measures
4. Use inverse trig function to find angle measures
5. Apply trig functions to solve word problems
6. Use the law of sines to solve triangle problems
7. Use the law of cosines to solve triangle problems

VOCABULARY

Sine, Cosine, Tangent, Pythagorean theorem, leg, hypotenuse, adjacent opposite

ACTIVITIES

Trig word problem packet
Navigation exercises

PERFORMANCE ASSESSMENT

Tests, Quizzes, Homework, Special projects
See page 8 for additional assessments

CORE TEXT FOR STUDENTS

Advanced Mathematical Concepts , Gordon-Holliday, Merrill/Glencoe

ADDITIONAL TEXTS/ RESOURCES FOR USE BY STUDENTS

See Section IV, Learning Resources

MATERIALS AND SUPPLIES

See Section IV, Learning Resources

UNIT 7: PROBABILITY

1. What does a probability tell us?
2. How do counting techniques help us solve probability problems?

STANDARDS

3. Estimation and Approximation Students will make estimates and approximations, and judge the reasonableness of results.

7. Probability and Statistics Students will use basic concepts of probability and statistics to collect, organize, display and analyze data, simulate events and test hypotheses.

8. Patterns Students will discover, analyze, describe, extend and create patterns, and use patterns to describe mathematical and other real-world phenomena.

CONTENT KNOWLEDGE OBJECTIVES

Content:

1. Outcomes
2. Definition of probability
3. Probability of compound events
4. Addition rule
5. Multiplication rule
6. Counting techniques

Skills:

1. Define probability
2. Count the total number of possible outcomes of an event
3. Use the addition rule to find a compound probability
4. Determine dependent events vs. independent events
5. Use the multiplication rule to find the probability of independent events
6. Use a simulation to find a probability

VOCABULARY

Experiment, event, simple event, sample space, law of large numbers, random sample, complement, subjective probability, odds, compound event, addition rule, mutually exclusive, complement, independent events, dependent events, multiplication rule, conditional probability, simulation, counting rule, factorial, permutations, combinations

ACTIVITIES

Probability experiments
Birthday problem-TI-83 style

PERFORMANCE ASSESSMENT

Tests, Quizzes, homework, special projects
See page 8 for additional assessments

CORE TEXT FOR STUDENTS

Elementary Statistics, Mario F. Triola, Addison Wesley

ADDITIONAL TEXTS/ RESOURCES FOR USE BY STUDENTS

See Section IV, Learning Resources

MATERIALS AND SUPPLIES

See Section IV, Learning Resources

UNIT 8: COMPUTER MATHEMATICS

1. Can the student make the connection between mathematics and computers?

STANDARDS

1. Number Sense Students will use numbers to count, measure, compare, order, scale, locate and label, and use a variety of numerical representations to present, interpret, communicate and connect various kinds of numerical information.

9. Algebra and Functions Students will use algebraic skills and concepts, including functions, to describe real-world phenomena symbolically and graphically, and to model quantitative change.

CONTENT KNOWLEDGE OBJECTIVES

Content

1. Microsoft Excel
2. Microsoft Word
3. The Internet
4. Power Point

Skills

1. Create a math presentation using the Internet
2. Create a math presentation using Microsoft Excel
3. Create a math presentation using Microsoft Word
4. Create a math presentation using Power Point

VOCABULARY

Power Point, spread sheet, window, cell, formula, function

ACTIVITIES

Power Point project

PERFORMANCE ASSESSMENT

Tests, Quizzes, Homework, Special projects
See page 8 for additional assessments

CORE TEXT FOR STUDENTS

TTL training manual

ADDITIONAL TEXTS/ RESOURCES FOR USE BY STUDENTS

See Section IV, Learning Resources

MATERIALS AND SUPPLIES

See Section IV, Learning Resources

SECTION III - Goals and Standards

RELATED GOALS and STANDARDS

Connecticut Content Standards

1. Number Sense Students will use numbers to count, measure, compare, order, scale, locate and label, and use a variety of numerical representations to present, interpret, communicate and connect various kinds of numerical information.

2. Operations Students will add, subtract, multiply and divide with whole numbers, fractions, decimals and integers, and develop strategies for selecting the appropriate computational and operational methods for solving problems.

3. Estimation and Approximation Students will make estimates and approximations, and judge the reasonableness of results.

4. Ratios, Proportions and Percents Students will use ratios, proportions and percents to represent relationships between quantities and measures and solve problems involving ratios, proportions and percents.

5. Measurement Students will make and use measurements in both customary and metric units to approximate, measure and compute length, area, volume, mass, temperature, angle and time.

6. Spatial Relationships and Geometry Students will analyze and use spatial relationships and basic concepts of geometry to construct, draw, describe and compare geometric models and their transformations, and use geometric relationships and patterns to solve problems.

7. Probability and Statistics Students will use basic concepts of probability and statistics to collect, organize, display and analyze data, simulate events and test hypotheses.

8. Patterns Students will discover, analyze, describe, extend and create patterns, and use patterns to describe mathematical and other real-world phenomena.

9. Algebra and Functions Students will use algebraic skills and concepts, including functions, to describe real-world phenomena symbolically and graphically, and to model quantitative change.

10. Discrete Mathematics Students will use the concepts and processes of discrete mathematics to analyze and model a variety of real-world situations that involve recurring relationships, sequences, networks, combinations and permutations.

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 (Most located in math department closet)

Text books

- Algebra 2 and Trigonometry, John Benson et. al., McDougal, Littell
- Advanced Mathematics, Richard G. Brown, McDougal, Littell
- Geometry, Applications and Connections, Merrill
- Statistics and Probability in Modern Life, Newmark

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

- TTL/C-5 Computer Lab
- Microsoft Excel
- TI-83 graphing calculator
- World Almanac
- Media center
- Winplot
- LiveMath
- Access
- Stamford Advocate