

Geometry Honors Curriculum Guide

Number: 301

Level: Honors

Textbook: Geometry: Integration, Applications, Connections, Burrill, et. Al., Glencoe, 2001

Credits: 5 credits

Revised: August 2008

Midterm Exam Revised: January 2008

Final Exam Revised: June 2008

I. Prerequisite:

This course is open to those students who have successfully completed the first year of college mathematics, Algebra I, either through the 8th Grade Algebra I program (meeting established standards on a locally prepared exam) or through the 9th grade Academic Algebra I class. Students from the 9th grade Algebra I (A) class must be recommended by their Algebra I teacher. Ninth grade students entering from outside our district who have had Algebra I in eighth grade, must take the locally prepared Algebra I exam and score at least 75%.

II. Course description:

This course is the second year of college preparatory mathematics at an honors level. It is designed for students who have exceptional mathematical ability and motivation and will prepare them for college sequences requiring an extensive mathematical background.

In this course students will study the concept of mathematical proof, which is basic to the student's understanding of a mathematical system. Other topics studied are angle relationships, parallel and perpendicular lines, congruent triangles, similar polygons, right triangles, trigonometric ratios, fractals, vectors, circles, area and volume, coordinate geometry and the application of these concepts. Problem solving and critical thinking skills will be emphasized.

High Point Regional High School's curriculum and instruction are aligned to the State's Core Curriculum Content Standards and address the elimination of discrimination by narrowing the achievement gap, by providing equity in educational programs and by providing opportunities for students to interact positively with others regardless of race, creed, color, national origin, ancestry age, marital status, affectional or sexual orientation, gender, religion, disability or socioeconomic status.

III. District Policy: Academic Integrity

Pupils are expected to be honest in all of their academic work. This means that the students in this course will not engage in any of the following acts:

- Cheating on examinations or other school assignments, including but not limited to, the non-authorized use of books or notes, the use of crib sheets, copying from other students' papers, exchanging information with other students orally, in writing, or by signals, obtaining copies of the examination illegally and other similar activities. Cheating through the use of technology to exchange information on any school assignment, examination, etc. is prohibited. Technology is defined as, but not limited to, computers, telephones, text messaging, palm pilots, calculators, cameras or any other hand held device.
- Plagiarism is not permitted in term papers, themes, essays, reports, images, take-home examinations,

and other academic work. Plagiarism is defined as stealing or use without acknowledgment of the ideas, words, formulas, textual materials, on-line services, computer programs, etc. of another person, or in any way presenting the work of another person as one's own.

- Falsifications, including forging signatures, altering answers after they have been graded, inserting answers after the fact, erasing of grader's markings, and other acts that allow for falsely taking credit.

A pupil found guilty of academic dishonesty may be subjected to a full range of penalties including, but not limited to reprimand and loss of credit for all of the work that is plagiarized. Disciplinary action may also be a consequence of such behavior. Additional consequences may apply as defined in specific department policies and guidelines.

A teacher who believes that a pupil has been academically dishonest in his/her class should resolve the matter in the following manner:

- Reprimand the student orally and/or in writing. The teacher is also authorized to withhold credit in the work due to academic dishonesty.
- If warranted, the teacher shall file a written complaint against the student with the Administration, requesting a more stringent form of discipline. The complaint must describe in detail the academic dishonesty that is alleged to have taken place, and must request that the matter be reviewed by the Administration.
- The Administration will determine if further discipline of the pupil is appropriate, and will determine the nature of the discipline on a case-by-case basis.
- If the pupil is not in agreement with the disciplinary action of the Administration, he/she may appeal the action first to the Principal and secondly to the Superintendent. If the pupil is dissatisfied with the Superintendent's disposition of the case, he/she may grieve the action in accordance with Policy No. 5710, Pupil Grievance.

IV. Description of instruction:

Students are expected to be active participants in the learning process. The teacher will involve them in the introduction and development of material through questioning and class discussions.

Understanding of concepts is stressed rather than rote memorization of skills. When appropriate, students are guided in discovering the concepts themselves through a study of patterns and by relating the new work to their prior knowledge. Students will be expected to apply the concepts they learn to new situations.

Homework will be given almost every and is an important part of the course, providing students the opportunity to apply skills learned in class, strengthen their understanding of the concepts and identify areas they don't understand. It is imperative that students do homework regularly and conscientiously. Homework will be reviewed in class and it is the student's responsibility during that time to ask questions about problems he/she doesn't understand, to identify specific mistakes and to take notes on any further explanations concerning these problems. Some of the homework will be based on the sample problems done in class and students are expected to study these examples and use them as a guide when doing their homework. Other problems will require students to extend the concepts learned in class to new situations. Students may also be given reading assignments either to preview material that will be taught the next day or to learn new concepts and procedures independently.

V. Student Projects

Each student will complete two teacher assigned projects. One project will be to investigate Non-Euclidean Geometry and write a report. The other project will be to read one chapter of the book “ Five Equations that Changed the World “ and report on a famous Mathematician.

VI. Student evaluation:

One to three quizzes based on the course proficiencies will be given during a unit and a chapter test will be given at the end of each unit. An exam will be given at the end of each semester, covering all the work of that semester.

Homework will be checked daily. It will usually not be graded, but will be considered satisfactory if the work show indicates the student has made a conscientious effort to complete the assignment. If the student was unable to complete the assignment because he/she didn't understand the work, he/she may be asked to redo the homework to get credit. Sometimes an assignment given for homework may be collected and graded as a quiz. Students will be informed ahead of time about these assignments.

Grades will be calculated according to the school grading policy and the following guidelines:

A. Marking Period

- | | |
|--|-----------|
| 1. Tests and Quizzes | 90 – 95 % |
| 2. Homework
(Each teacher will explain
his/her policy to the class.) | 5 – 10 % |
| 3. Class Participation | 0 – 5 % |
| 4. Two projects are required; each
will be graded as a quiz or test. | |

B. Final Grade

- | | |
|------------------------|------|
| 1. Each Marking Period | 20 % |
| 2. Midterm Exam | 10 % |
| 3. Final Exam | 10 % |

GEOMETRY PROJECTS

A. Choose one mathematician from the book Five Equations That Changed The World, read the chapter pertaining to him and write a report that answers the questions below. If you answer the questions satisfactorily using the information from the book above, you will earn a grade of B. To earn a grade higher than a B, you must use and cite other sources (books or Internet sources).

- 1) Who was the mathematician that you read about and what was his contribution? (10 %)
- 2) What obstacles did the person overcome? How did those obstacles influence his work? (15 %)
- 3) How did his contributions change what was previously done? Who were the earlier mathematicians that worked on the same problems and what were their theories? (15 %)
- 4) Who were the mathematician's contemporaries? How did their work influence his? (15 %)
- 5) What was happening socially and politically that affected his discoveries? (15 %)
- 6) How has his equation affected our world? (15 %)
- 7) What other contributions did this person make? (15 %)

B. Go to the Internet site: <http://cs.unm.edu/~joel/>

Click down to Basic Concepts.

Click on Non-Euclidean Geometry.

Read through "Area."

Go Back to the Home Page.

Click on "Using Non-Euclid-My first Triangle." Read the instructions. Go back to the home page and click on Non Euclid 2001.03. Follow instructions.

From the home page click on "Activities-How to get started exploring.": Follow the Instructions for Adjacent Angles, Angles, General Triangles, Isosceles Triangles, Equilateral triangles and Right triangles. Make sketches of all your constructions.

Answer any questions that are posed.

Write a one page paper comparing Euclidean Geometry with the Non-Euclidean Geometries.

Turn in your paper, sketches and the answers to the questions in a folder.

VI. Proficiencies:

Unit 1: Discovering Points, Lines, Planes, and Angles

Time: 18 days

Students will be able to:

1. Identify and model points, lines, and planes. Identify coplanar points and intersecting lines and planes.
2. Solve problems using formulas: Find maximum area using perimeter.
3. Find the distance between two points on the number line and the coordinate plane.
4. Apply the Pythagorean theorem to find the lengths of sides of a triangle.
5. Use the midpoint formula and theorems.
6. Identify and classify angles. (angle addition postulate, congruent angles, and bisectors)
7. Identify and use angle relationships: adjacent, vertical, complementary, supplementary, linear pairs, and perpendicular lines)

Resources:

1. Multicultural Activity Masters, pp1, 2
2. Real-world applications, 1, 2
3. Technology, Computer Masters, p. 1
4. Tech Prep Applications, Masters, pp. 1, 2
5. Problem-of-the-week Cards, 1, 2, 3
6. Textbook, Chapter 1 sections 1.1 – 1.7

Unit 2: Connecting Reasoning and Proof

Time: 13 days

Students will be able to:

1. Make conjectures based on inductive reasoning.
2. Write the converse, inverse, and contrapositive of a statement.
3. Identify and use basic postulates about points, lines, and planes.
4. Use conditional statements.
5. Use the Law of Detachment and Law of Syllogism in deductive reasoning.
6. Use the properties of equality in algebra and geometric proofs.
7. Complete proofs involving segment and angle theorems.

Resources:

1. Investigation, pp. 66-67
2. Mathematics and Society, p. 68
3. Working on the Investigation, pp.83 114
4. Multicultural Activity Masters, pp. 3, 4
5. Real-World Applications, 3, 4
6. Tech Prep Applications Masters, pp 3, 4
7. Problem-of-the-Week Cards, 4, 5, 6
8. Textbook, Chapter 2 sections 2.1 – 2.6

Unit 3: Using Perpendicular and Parallel Lines**Time: 13 days**

Students will be able to:

1. Solve problems by drawing diagrams.
2. Identify relationships between lines, planes, and transversals.
3. Find angle measures determined by parallel lines and use properties of parallel lines. Problem solving techniques.
4. Find the slope of lines and use slope to identify parallel and perpendicular lines.
5. Recognize and prove lines parallel based on given angle relationships.
6. Recognize and use distance relationships among points, lines and planes.
7. Find the distance between a point and a line.
8. Identify points, lines, and planes in spherical geometry.
9. Compare and contrast basic properties of plane and Non-Euclidean geometries.

Resources:

1. Chapter Opener, p. 122
2. Mathematics and Society, p. 161
3. Working on the Investigation, p. 153
4. Multicultural Activity Masters, p. 5, 6
5. Real-World Applications, 5, 6
6. Tech Prep Applications Masters, pp.5, 6
7. Problem-of-the-Week Cards, 7, 8, 9
8. Textbook, Chapter 3 sections 3.1 – 3.6
9. Internet project on Non-Euclidean Geometry

Unit 4: Identifying Congruent triangles**Time: 15 days**

Students will be able to:

1. Identify the parts of triangles and classify triangles by their parts.
2. Investigate the relationship of the angles of a triangle. (angle sum and exterior angle theorem)
3. Name and label corresponding parts of congruent triangles. Problem solving techniques.
4. Use SSS, SAS, ASA postulates to test for congruence.
5. Use the AAS congruence postulate.
6. Use the properties of isosceles and equilateral triangles.

Resources:

1. Investigation, pp. 176-177
2. Chapter Opener, p. 178
3. Mathematics and Society, p. 213
4. Working on the Investigation, pp. 187, 228
5. Multicultural Activity Masters, pp. 7, 8
6. Real-World Applications, 7, 8
7. Tech Prep Applications Masters, pp. 7, 8
8. Textbook, Chapter 4 sections 4.1 – 4.6

Unit 5: Applying Congruent triangles**Time: 15 days**

Students will be able to:

1. Identify and use medians, altitudes, angle bisectors, and perpendicular bisectors in a triangle.
2. Recognize and use tests for congruence of right triangles.
3. Use indirect reasoning and indirect proof to reach a conclusion.
4. Recognize and apply properties of inequalities.
5. Solve problems by working backwards.
6. Recognize and apply relationships between sides and angles in a triangle.
7. Use a graphing calculator to investigate the relationship among the measures of the sides of a triangle.
8. Apply the Triangle Inequality Theorem.
9. Apply the SAS inequality and the SSS Inequality.

Resources:

1. Chapter Opener, p. 236
2. Mathematics and Society, p. 272
3. Working on the Investigation, pp. 265, 279
4. Multicultural Activity Masters, pp. 9, 10
5. Real-World Applications, 9, 10
6. Tech Prep Applications Masters, pp.9, 10
7. Problem-of-the-Week Cards, 12, 13, 14
8. Textbook, Chapter 5 sections 5.1 – 5.6

Unit 6: Exploring Quadrilaterals**Time: 14 days**

Students will be able to:

1. Recognize and apply the properties of a parallelogram. Geometric modeling.
2. Recognize and apply the properties and theorems of parallelograms, rectangles, rhombi, squares, and trapezoids.

Resources:

1. Investigation, pp. 286-287
2. Chapter Opener, p. 288
3. Mathematics and Society, p. 304
4. Working on the Investigation, p. 328
5. Multicultural Activity Masters, pp. 11, 12
6. Real-World Applications, 11, 12
7. Tech Prep Applications, pp. 11,12
8. Problem –of-the-Week Cards, 15, 16, 17
9. Textbook, Chapter 6 sections 6.1 – 6.5

Unit 7: Connecting Proportion and Similarity**Time: 15 days**

Students will be able to:

1. Recognize and use the properties of ratio and proportion.
2. Identify similar figures.
3. Use proportional parts of a triangle to solve problems.
4. Divide a segment into congruent parts.
5. Recognize and use the proportional relationships of corresponding perimeters, altitudes, angle bisectors, and medians of similar triangles.
6. Recognize and describe characteristics of fractals.
7. Create Pascal's Triangle and describe patterns in it.
8. Solve problems by solving a simpler problem.

Resources:

1. Chapter Opener, p. 336
2. Mathematics and Society, p. 369
3. Working on the Investigation, pp. 345, 377
4. Multicultural Activity Masters, pp. 13,14
5. Real-World Applications, 13, 14
6. Tech Prep Applications Masters, pp. 13, 14
7. Problem-of-the-Week Cards, 18, 19, 20
8. Sample HSPA Problems (attached at end of proficiencies)
9. Textbook, Chapter 7 sections 7.1 – 7.6

Unit 8: Applying Right Triangles and Trigonometry**Time: 15 days**

Students will be able to:

1. Find the geometric mean between two numbers.
2. Use the Pythagorean Theorem and its converse.
3. Use the properties of 45-45-90 and 30-60-90 triangles
4. Find trigonometric ratios using right triangles. (sine, cosine, and tangent)
5. Use trigonometry to solve word problems including angles of elevation and angles of depression.

Resources:

1. Investigation, pp. 392-393
2. Chapter Opener, p.394
3. Mathematics and Society, p. 404
4. Working on the Investigation, pp. 411, 436
5. Multicultural Activity Masters, pp. 15, 16
6. Real-World Applications, 15, 16, 17
7. Tech Prep Applications Masters, pp. 15, 16
8. Problem-of-the-Week Cards, 21, 22, 23
9. Sample HSPA Problems (attached at end of proficiencies)
10. Textbook, Chapter 8 sections 8.1 – 8.4
11. Textbook, Chapter 12 section 12.5

Unit 9: Analyzing Circles**Time: 15 days**

Students will be able to:

1. Identify and use parts of circles.
2. Recognize major arcs, minor arcs, semicircles, and central angles.
3. Recognize and use relationships among arcs chords and diameters.
4. Recognize and apply properties and theorems of inscribed angles.
5. Recognize tangents and use properties of tangents.
6. Find the measures of angles formed by intersecting secants and tangents in relation to intercepted arcs.
7. Use properties of chords, secants, and tangents to solve word problems.
8. Write and use the equation of a circle in the coordinate plane.

Resources:

1. Chapter Opener, p. 444
2. Mathematics and Society, p. 458
3. Working on the Investigation, pp. 465, 497
4. Multicultural Activity Masters, pp. 17, 18
5. Real-World Applications, 18, 19
6. Tech Prep Applications Masters pp. 17, 18
7. Problem –of-the-Week Cards, 24, 25, 26
8. Textbook, Chapter 9 sections 9.1 – 9.8

Unit 10: Exploring Polygons and Area**Time: 15 days**

Students will be able to:

1. Identify and name polygons.
2. Find the sum of interior and exterior angles of convex polygons and regular polygons.
3. Create tessellations using translations and rotations.
4. Identify regular and uniform tessellations.
5. Find the area of polygons using the formulas for parallelogram, triangle, rhombi, square, and trapezoid.
6. Find the area under a curve using inscribed rectangles
7. Find the area of circles and regular polygons.
8. Use area to solve problems involving patterns and geometric probability.
9. Recognize nodes and edges as used in graph theory.
10. Determine if a network is traceable
11. Recognize and draw reflection images, rotation images, lines of symmetry, and points of symmetry.
12. Perform dilations on a geometric figure.

Resources:

1. Investigation, pp. 510-511
2. Chapter Opener, p. 512
3. Mathematics and Society, p. 558
4. Working on the Investigation, pp. 521, 550
5. Multicultural Activity Masters, pp. 19, 20
6. Real-World Applications, 20, 21
7. Tech Prep Applications Masters, pp. 19, 20
8. Problem-of-the-Week Cards, 27, 28, 29

9. Sample HSPA Problems (attached at end of proficiencies)
10. Textbook, Chapter 10 sections 10.1 – 10.7
11. Textbook, Chapter 13 sections 13.5 - 13.7

Unit 11: Investigating Surface Area and Volume

Time: 15 days

Students will:

1. Use top, front, side, and corner views of three-dimensional solids to make models.
2. Find the lateral area and surface area of a right prism, and a right cylinder.
3. Find the lateral area and surface area of a regular pyramid and a right circular cone.
4. Find the volume of a right prism, and a right cylinder.
5. Find the volume of a pyramid and a right circular cone.
6. Find the surface area and volume of a sphere.
7. Identify congruent or similar solids.

Resources:

1. Chapter Opener, p. 572
2. Mathematics and Society, p. 628
3. Working on the Investigation, p.598
4. Multicultural Activity Masters, pp. 21, 22
5. Real-World Applications, 22, 23
6. Tech Prep Applications Masters, pp. 21, 22
7. Problem-of-the-Week Cards, 30, 31, 32
8. Sample HSPA Problems (attached at end of proficiencies)
9. Textbook, Chapter 11 sections 11.1 – 11.8

Correlation of Course Proficiencies to New Jersey Core Curriculum Content Standards

STANDARD 4.1 (NUMBER AND NUMERICAL OPERATIONS) ALL STUDENTS WILL DEVELOP NUMBER SENSE AND WILL PERFORM STANDARD NUMERICAL OPERATIONS AND ESTIMATIONS ON ALL TYPES OF NUMBERS IN A VARIETY OF WAYS.

A. Number sense

1. Extend understanding of the number system to all real numbers.
2. Compare and order rational and irrational numbers.
3. Develop conjectures and informal proofs of properties of number systems and sets of numbers.

Summary: This indicator is covered in other courses.

B. Numerical operations

1. Extend understanding and use of operations to real numbers and algebraic procedures.
2. Develop, apply, and explain methods for solving problems involving rational and negative exponents.
3. Perform operations on matrices
 - Addition and subtraction
 - Scalar multiplication
4. Understand and apply the laws of exponents to simplify expressions involving numbers raised to powers.

Summary: This indicator is covered in other courses.

C. Estimation

1. Recognize the limitations of estimation, assess the amount of error resulting from estimation, and determine if the error is within acceptable tolerance limits.

Summary: This indicator is covered in other courses.

Standard Summary: Standard has been covered in other courses.

STANDARD 4.2 (GEOMETRY AND MEASUREMENT) ALL STUDENTS WILL DEVELOP SPATIAL SENSE AND THE ABILITY TO USE GEOMETRIC PROPERTIES, RELATIONSHIPS, AND MEASUREMENT TO MODEL, DESCRIBE AND ANALYZE PHENOMENA.

A. Geometric properties

1. Use geometric models to represent real-world situations and objects and to solve problems using those models (e.g., use Pythagorean Theorem to decide whether an object can fit through a doorway).
All units have modeling situations for the current topic. Ex: section 4.5, 5.6, 6.1
2. Draw perspective views of 3D objects on isometric dot paper, given 2D representations (e.g., nets or projective views)

Unit 11, section 11.1

3. Apply the properties of geometric shapes.
 - Parallel lines -transversal, alternate interior angles, corresponding angles
 - Triangles
 - a. Conditions for congruence
 - b. Segment joining midpoints of two sides is parallel to and half the length of the third side

c. Triangle Inequality

Minimal conditions for a shape to be a special quadrilateral
Circles -arcs, central and inscribed angles, chords, tangents
Self-similarity

Unit 3, all sections: Unit 4, all sections: Unit 5 section 5.8

4. Use reasoning and some form of proof to verify or refute conjectures and theorems.
Verification or refutation of proposed proofs
Simple proofs involving congruent triangles.
Counterexamples to incorrect conjectures

Unit 2, sections 2.1 – 2.7; Unit 4, sections 4.1 – 4.6

Summary: All indicators are covered.

B. Transforming Shapes

1. Determine, describe, and draw the effect of a transformation, or a sequence of transformations, on a geometric or algebraic object, and, conversely, determine whether and how one object can be transformed to another by a transformation or a sequence of transformations.
2. Recognize three-dimensional figures obtained through transformations of two-dimensional figures (e.g., cone as rotating an isosceles triangle about an altitude), using software as an aid to visualization.
3. Determine whether two or more given shapes can be used to generate a tessellation.
4. Generate and analyze iterative geometric patterns.
Fractals (e.g., Sierpinski's Triangle)
Patterns in areas and perimeters of self-similar figures
Outcome of extending iterative process indefinitely

Unit 10, section 10.3 – 10.4, 10.10 –10.12; Unit 7, section 7.6 – 7.7

Summary: All indicators are covered.

C. Coordinate Geometry

1. Use coordinate geometry to represent and verify properties of lines.
Distance between two points
Midpoint and slope of a line segment
Finding the intersection of two lines
Lines with the same slope are parallel
Lines that are perpendicular have slopes whose product is -1

Unit 1, section 1.4, 1.6; Unit 3, section 3.4, 3.7

2. Show position and represent motion in the coordinate plane using vectors.
Addition and subtraction of vectors

Unit 8, section 8.7

Summary: All indicators are covered.

D. Units of Measurement

1. Understand and use the concept of significant digits.
2. Choose appropriate tools and techniques to achieve the specified degree of precision and error needed in a situation.

Degree of accuracy of a given measurement tool
Finding the interval in which a computed measure (e.g., area or volume) lies, given the degree of precision of linear measurements

Summary: These indicators are covered in other courses.

E. Measuring Geometric Objects

1. Use techniques of indirect measurement to represent and solve problems.

Similar triangles

Pythagorean theorem

Right triangle trigonometry (sine, cosine, tangent)

Unit 7, sections 7.1 – 7.5; Unit 8, sections 8.2 – 8.7

2. Use a variety of strategies to determine perimeter and area of plane figures and surface area and volume of 3D figures.

Approximation of area using grids of different sizes

Finding which shape has minimal (or maximal) area, perimeter, volume, or surface area under given conditions using graphing calculators, dynamic geometric software, and/or spreadsheets

Estimation of area, perimeter, volume, and surface area

Unit 10, sections 10.5 – 10.6

Summary: All indicators are covered.

STANDARD 4.3 (PATTERNS AND ALGEBRA) ALL STUDENTS WILL REPRESENT AND ANALYZE RELATIONSHIPS AMONG VARIABLE QUANTITIES AND SOLVE PROBLEMS INVOLVING PATTERNS, FUNCTIONS, AND ALGEBRAIC CONCEPTS AND PROCESSES.

A. Patterns

- I. Use models and algebraic formulas to represent and analyze sequences and series.

Explicit formulas for n th terms

Sums of finite arithmetic series

Sums of finite and infinite geometric series

2. Develop an informal notion of limit.
3. Use inductive reasoning to form generalizations.

Unit 2, sections 2.1 – 2.2

Summary: Indicators 1 & 2 are covered in other courses.

B. Functions and Relationships

1. Understand relations and functions and select, convert flexibly among, and use various representations for them, including equations or inequalities, tables, and graphs.

This is covered in other courses.

2. Analyze and explain the general properties and behavior of functions of one variable, using appropriate graphing technologies.
Slope of a line or curve
Domain and range
Intercepts

Continuity
Maximum/minimum
Estimating roots of equations
Intersecting points as solutions of systems of equations.
Rates of change

This is covered in other courses.

3. Understand and perform transformations on commonly used functions.
Translations, reflections, dilations
Effects on linear and quadratic graphs of parameter changes in equations
Using graphing calculators or computers for more complex functions

This is covered in other courses.

4. Understand and compare the properties of classes of functions, including exponential, polynomial, rational, and trigonometric functions.
Linear vs. non-linear
Symmetry
Increasing/decreasing on an interval

This is covered in other courses.

Summary: This indicator is covered in other courses.

C. Modeling

1. Use functions to model real-world phenomena and solve problems that involve varying quantities.
Linear, quadratic, exponential, periodic (sine and cosine), and step functions (e.g., price of mailing a first-class letter over the past 200 years)
Direct and inverse variation
Absolute value
Expressions, equations and inequalities
Same function can model variety of phenomena
Growth/decay and change in the natural world
Applications in mathematics, biology, and economics (including compound interest)

This is covered in other courses.

2. Analyze and describe how a change in an independent variable leads to change in a dependent one.

This is covered in other courses.

3. Convert recursive formulas to linear or exponential functions (e.g., Tower of Hanoi and doubling).

This is covered in other courses.

Summary: This indicator is covered in other courses.

D. Procedures

1. Evaluate and simplify expressions.

Add and subtract polynomials

Multiply a polynomial by a monomial or binomial

Divide a polynomial by a monomial

This is covered in other courses.

2. Select and use appropriate methods to solve equations and inequalities

Linear equations -algebraically

Quadratic equations -factoring (when the coefficient of X^2 is 1) and using the quadratic formula

All types of equations using graphing, computer, and graphing calculator techniques

This is covered in other courses. We review these concepts in class when it is necessary.

3. Judge the meaning, utility, and reasonableness of the results of symbol manipulations, including those carried out by technology.

This is covered in all units.

Summary: All indicators are covered in other courses.

Standard Summary: This standard is covered in other courses.

STANDARD 4.4 (DATA ANALYSIS, PROBABILITY, AND DISCRETE MATHEMATICS) ALL STUDENTS WILL DEVELOP AN UNDERSTANDING OF THE CONCEPTS AND TECHNIQUES OF DATA ANALYSIS, PROBABILITY, AND DISCRETE MATHEMATICS, AND WILL USE THEM TO MODEL SITUATIONS, SOLVE PROBLEMS, AND ANALYZE AND DRAW APPROPRIATE INFERENCES FROM DATA.

A. Data Analysis

- I. Use surveys and sampling techniques to generate data and draw conclusions about large groups.

Advantages/disadvantages of sample selection methods (e.g., convenience sampling, responses to survey, random sampling)

2. Evaluate the use of data in real-world contexts.

Accuracy and reasonableness of conclusions drawn

Bias in conclusions drawn (e.g., influence of how data is displayed)

Statistical claims based on sampling

3. Design a statistical experiment, conduct the experiment, and interpret and communicate the outcome.

4. Estimate or determine lines of best fit (or curves of best fit if appropriate) with technology, and use them to interpolate within the range of the data.

5. Analyze data using technology, and use statistical terminology to describe conclusions.

Measures of dispersion: variance, standard deviation, outliers

Correlation coefficient

Normal distribution (e.g., approximately 95% of the sample lies between two standard deviations on either side of the mean)

Summary: This indicator is covered in other courses.

B. Probability

1. Calculate the expected value of a probability-based game, given the probabilities and payoffs of the various outcomes, and determine whether the game is fair.
2. Use concepts and formulas of area to calculate geometric probabilities.

Unit 10, section 10.8

3. Model situations involving probability with simulations (using spinners, dice, calculators and computers) and theoretical models, and solve problems using these models.
4. Determine probabilities in complex situations.
 - Conditional events
 - Complementary events
 - Dependent and independent events
5. Estimate probabilities and make predictions based on experimental and theoretical probabilities.
6. Understand and use the "law of large numbers" (that experimental results tend to approach theoretical probabilities after a large number of trials).

Unit 10, section 10.8

Summary: Indicators 2 & 6 are covered. The other indicators are covered in other courses.

C. Discrete Mathematics-Systematic Listing and Counting

1. Calculate combinations with replacement (e.g., the number of possible ways of tossing a coin 5 times and getting 3 heads) and without replacement (e.g., number of possible delegations of 3 out of 23 students).
2. Apply the multiplication rule of counting in complex situations, recognize the difference between situations with replacement and without replacement, and recognize the difference between ordered and unordered counting situations.
3. Justify solutions to counting problems.
4. Recognize and explain relationships involving combinations and Pascal's Triangle, and apply those methods to situations involving probability.

Summary: This indicator is covered in other courses.

D. Discrete Mathematics-Vertex-Edge Graphs and Algorithms

1. Use vertex-edge graphs and algorithmic thinking to represent and solve practical problems.
 - Circuits that include every edge in a graph
 - Circuits that include every vertex in a graph
 - Scheduling problems (e.g., when project meetings should be scheduled to avoid conflicts) using graph coloring
 - Applications to science (e.g., who-eats-whom graphs, genetic trees, molecular structures)

Unit 10, sections 10.8 – 10.9

2. Explore strategies for making fair decisions.
 - Combining individual preferences into a group decision (e.g., determining winner of an election or selection process)
 - Determining how many Student Council representatives each class (9th, 10th, 11th, and 12th grade) gets when the classes have unequal sizes (apportionment)

This indicator is covered in other course

Standard Summary: Graph theory is covered. The other indicators are covered in other courses.

STANDARD 4.5 (MATHEMATICAL PROCESSES) ALL STUDENTS WILL USE MATHEMATICAL PROCESSES OF PROBLEM SOLVING, COMMUNICATION, CONNECTIONS, REASONING, REPRESENTATIONS, AND TECHNOLOGY TO SOLVE PROBLEMS AND COMMUNICATE MATHEMATICAL IDEAS.

At each grade level, with respect to content appropriate for that grade level, students will:

A. Problem Solving

1. Learn mathematics through problem solving, inquiry, and discovery.

All Units 1 to 11: Ex: 3.3, 4.5, 5.3, 5.5, &7.6,

2. Solve problems that arise in mathematics and in other contexts (cf. workplace readiness standard 8.3).

Open-ended problems

Non-routine problems

Problems with multiple solutions

Problems that can be solved in several ways

Each unit 1 to 11 contains sections with Mathematics & Society:

3. Select and apply a variety of appropriate problem-solving strategies (e.g., "try a simpler problem" or "make a diagram") to solve problems.

Textbook contains many sections on problem-solving techniques. Ex: 8.6, 5.3, & 5.5.

4. Pose problems of various types and levels of difficulty.

Each unit has three levels of difficulty and critical thinking problems.

5. Monitor their progress and reflect on the process of their problem solving activity.

Summary: All indicators are covered.

B. Communication

1. Use communication to organize and clarify their mathematical thinking.

Reading and writing

Discussion, listening, and questioning

2. Communicate their mathematical thinking coherently and clearly to peers, teachers, and others, both orally and in writing.

3. Analyze and evaluate the mathematical thinking and strategies of others.

4. Use the language of mathematics to express mathematical ideas precisely.

Summary: This indicator is covered in all units.

C. Connections

1. Recognize recurring themes across mathematical domains (e.g., patterns in number, algebra, and geometry).
2. Use connections among mathematical ideas to explain concepts (e.g., two linear equations have a unique solution because the lines they represent intersect at a single point).
3. Recognize that mathematics is used in a variety of contexts outside of mathematics.
4. Apply mathematics in practical situations and in other disciplines.
5. Trace the development of mathematical concepts over time and across cultures (cf. world languages and social studies standards).
6. Understand how mathematical ideas interconnect and build on one another to produce a coherent whole.

Summary: This indicator is covered in other courses. Each unit has problems that reflect Mathematics & Society. Additional connections are found in Tech Prep Masters.

D. Reasoning

1. Recognize that mathematical facts, procedures, and claims must be justified.
2. Use reasoning to support their mathematical conclusions and problem solutions.
3. Select and use various types of reasoning and methods of proof.
4. Rely on reasoning, rather than answer keys, teachers, or peers, to check the correctness of their problem solutions.
5. Make and investigate mathematical conjectures.
Counterexamples as a means of disproving conjectures
Verifying conjectures using informal reasoning or proofs.
6. Evaluate examples of mathematical reasoning and determine whether they are valid.

Summary: This indicator is covered in Unit 2, sections 2.1 – 2.7

E. Representations

1. Create and use representations to organize, record, and communicate mathematical ideas.
Concrete representations (e.g., base-ten blocks or algebra tiles)
Pictorial representations (e.g., diagrams, charts, or tables)
Symbolic representations (e.g., a formula)
Graphical representations (e.g., a line graph)
2. Select, apply, and translate among mathematical representations to solve problems.
3. Use representations to model and interpret physical, social, and mathematical phenomena.

Summary: This indicator is covered in all units where applicable.

F. Technology

1. Use technology to gather, analyze, and communicate mathematical information.
2. Use computer spreadsheets, software, and graphing utilities to organize and display quantitative information (cf. workplace readiness standard 8.4-D).
3. Use graphing calculators and computer software to investigate properties of functions and their graphs.
4. Use calculators as problem-solving tools (e.g., to explore patterns, to validate solutions).
5. Use computer software to make and verify conjectures about geometric objects.
6. Use computer-based laboratory technology for mathematical applications in the sciences (cf. science standards).

Summary: The Geometer Sketchpad and calculators are used when appropriate throughout the course.

Standard Summary: This standard is covered in this course and in other courses.

Sample items for the High School Proficiency Assessment (HSPA)

The following worksheets represent sample questions for HSPA. They cover the following topics:

Spatial Sense and Geometry:

1. Analyze properties of three-dimensional geometric figures by using models.
2. Use inductive and deductive reasoning.
3. Solve real-world and mathematical problems using geometric models.
4. Solve problems in geometry using transformations, coordinates, and vectors.
5. Relate the concepts of symmetry, similarity, and congruence to transformations.
6. Use basic trigonometric ratios to solve problems involving indirect measurement.
7. Solve problems using the Pythagorean Theorem.

Discrete Mathematics:

1. Find the shortest path.
2. Find the number of combinations.