Hillside Township School District

# Mathematics Department
# Geometry CP

## Grades 9 and 10

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**Board of Education Approved:**
**January 19, 2017**

Revised 12/2016

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# Table of Contents





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# District Mission Statement

The mission of the Hillside Public Schools is to ensure that all students at all grade levels achieve the New Jersey Core Curriculum Content Standards and make connections to real-world success. We are committed to strong parent-community school partnerships, providing a safe, engaging, and effective learning environment, and supporting a comprehensive system of academic and developmental support that meets the unique needs of each individual.

# Academic Area Overview

The Hillside Township School District is committed to excellence. We believe that all children are entitled to an education that will equip them to become productive citizens of the twenty-first century. We believe that a strong foundation in mathematics provides our students with the necessary skills to become competent problem solvers and pursue math intensive careers in the sciences and engineering.

A strong foundation in mathematics is grounded in exploration and rigor. Children are actively engaged in learning as they model real-world situations to construct their own knowledge of how math principles can be applied to solve every day problems. They have ample opportunities to manipulate materials in ways that are developmentally appropriate to their age. They work in an environment that encourages them to take risks, think critically, and make models, note patterns and anomalies in those patterns. Children are encouraged to ask questions and engage in dialogue that will lead to uncovering the math that is being learned. Facts and procedures are important to the study of mathematics. In addition to learning the common facts and procedures that lead efficient solutions of math problems, children will also have the opportunity to explore the "why" so that they can begin to understand that math is relevant to the world.

Our program provides teachers with resources both online and in print that incorporates the use of technology to help students reach the level of rigor that is outlined in the Common Core State Standards for Mathematics. Textbooks and materials have been aligned to the standards and teachers are trained on an ongoing basis to utilize the resources effectively and to implement research-based strategies in the classroom.

# Affirmative Action Statement

# Equality and Equity in Curriculum

The Hillside Township School District ensures that the district's curriculum and instruction are aligned to the State's Core Curriculum Content Standards and addresses the elimination of discrimination and the achievement gap, as identified by underperforming school-level AYP reports for State assessment, 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.

N.J.A.C. 6A:7-1.7(b): Section 504, Rehabilitation Act of 1973; N.J.S.A. 10:5; Title IX, Education Amendments of 1972



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# Math Department Lesson Plan Template

## Lesson Information

Lesson Name: _____

Unit: _____

Date: _____

## Lesson Data

1. Essential Questions & Enduring Understanding:

2. CCSS:

3. Knowledge:

   *Students will know……*

4. Skills:

   *Students will be able to…..*



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5. Informal/Formal Assessment of Student Learning:

*Evidence of student learning:*

6. Lesson Agenda:

*Include in Lesson Outline:*
- *Anticipated timing*
- *DO NOW*
- *Activities and Investigations*
- *Discussion prompts*
- *Journal writing prompts*
- *Student uses of technology*
- *Safety precautions*
- *Materials*

7. Homework:



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## Content Overview

| Topics in Curriculum | Reference in Curriculum | Time Frame |
|---|---|---|
| Fundamentals of Geometry<br>● Definitions, representations, notations, postulates, and theorems<br>Midpoint (one dimension, two dimensions)<br>Distance (one dimension, two dimensions)<br>Partitioning of a Segment (one dimension, two dimensions)<br>Perimeter (including in the coordinate plane)<br>Circumference<br>● Arc length<br>Area of polygons<br>Modeling withGeometry (ex. applications with volume)<br>Area of a circle<br>● Area of sector | Unit 1: Fundamentals of Geometry<br><br><br><br><br><br>Unit 5: Perimeter, Area, and Volume<br>Unit 4: Circles<br><br>Unit 5: Perimeter, Area, and Volume<br><br>Unit 4: Circles | Marking Period 1 |
| Equation of a circle<br>Formal Geometric Constructions<br>Special Angles Pairs (not on parallel lines)<br>Special Anlges on Parallel Lines<br>Parallelograms (including the slope criteria)<br>Congruence in Terms of Rigid Motion | Unit 4: Circles<br>Unit 1: Fundamentals of Geometry<br><br><br><br><br>Unit 3: Transformation and Congruence | Marking Period 2 |
| Congruence theorems<br>Similarity<br>Right Triangle Trigonometry<br>Theorems about triangles | Unit 3: Transformation and Congruence<br>Unit 2: Similarity and Right Triangle Trigonometry | Marking Period 3 |
| Triangle Relationships | Unit 1: Fundamentals of Geometry | Marking Period 4 |



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| | | |
|---|---|---|
| • Special segments<br>• Points of concurrency<br>Parts of circles<br>Theorems about circles<br>Similarity in circles<br>Applications | Unit 4: Circles<br><br>Units: 1, 2, 3, 4 & 5 | |



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**UNIT 1: Fundamentals of Geometry**

| ENDURING UNDERSTANDINGS | ESSENTIAL QUESTIONS |
|---|---|
| ✓ Geometry is a mathematical system built on accepted assumptions, basic terms, and definitions.<br>✓ Visualization is essential to the study of geometry and helps connect properties of real objects with drawings of these objects.<br>✓ Intersecting lines create angles with special relationships<br>✓ The concepts of parallel and perpendicular lines help us to develop our spatial sense and solve real life problems. | ✓ How does geometry explain or describe the structure of our world?<br>✓ What is the difference between sketching and constructing figures?<br>✓ How can you make generalizations about angle relationships and prove that they are true?<br>✓ What are the advantages of having streets that are parallel or perpendicular? |

| CCSS | KNOWLEDGE | SKILLS |
|---|---|---|
| Geometric Constructions<br><br>G-CO1<br>G-GPE6 | **Students will know that:**<br><br>● A Point, a line, and a plane are undefined geometric terms:<br>o A Point has no shape or size yet it can be represented by a dot.<br>o A Line is a set of points that has no thickness and continues without end in both directions.<br>o A Plane has no thickness and is created from points and lines that extend infinitely in only two dimensions. | **Students will be able to:**<br><br>● Draw geometric representations of points, lines and planes while labeling each figure using proper naming conventions. |
| | ● The precise definitions of geometric constructions are:<br>o A Line Segment is part of a line consisting of two endpoints and all point in between.<br>o An Angle is formed by two rays that share a common endpoint. The common endpoint is called the vertex.<br>o The Distance (in one dimension) between two points is the positive value of the difference between the coordinates of the points. | ● Make formal geometric constructions with a variety of tools and methods (compass and straightedge, string, reflective devices, paper folding, dynamic geometric software, etc.).<br>o *copy a segment, copy an angle, bisect a segment, bisect an angle*<br>● Prove theorems about lines and angles.<br>o *Vertical angles are congruent*<br>o *Linear pair angles add to 180 degrees*<br>o *Congruent angle relationships in parallel lines crossed by a transversal.*<br><br>● Determine the distance between two points in one dimension. |



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| | | • Find the point on a line segment (in 1- dimension and 2-dimensions) between two given points that cuts the segment in a given ratio. |
| Parallel and Perpendicular Lines & Slope<br><br>G-CO12<br>G-CO13<br>G-CO9<br>G-CO11<br>G-GPE4<br>G-GPE5 | **Students will know that:**<br><br>• The precise definitions of geometric constructions are:<br>o Two lines are <u>parallel</u> if they lie on the same plane and never intersect.<br>o Two lines are <u>perpendicular</u> if they intersect to form a right angle.<br>o A <u>Circle</u> is the set of all points in a plane that are equidistant from the center.<br>o An <u>Arc</u> is a part of a circle connecting two points on the circle. | **Students will be able to:**<br><br>• Make formal geometric constructions with a variety of tools and methods (compass and straightedge, string, reflective devices, paper folding, dynamic geometric software, etc.).<br>o Construct perpendicular lines, including the perpendicular bisector of a line segment<br>o Construct a line parallel to a given line through a point not on the line.<br>o Construct an equilateral triangle, a square, and a regular hexagon inscribed in a circle.<br>o Construct the inscribed and circumscribed circles of a triangle.<br>• Prove theorems about lines and angles.<br>o When a transversal crosses parallel lines, alternate interior angles are congruent and corresponding angles are congruent<br>o Points on a perpendicular bisector of a line segment are exactly those equidistant from the segment's endpoints.<br>• Use coordinates to prove simple geometric theorems algebraically. For example:<br>o Prove or disprove that a figure defined by four given points in the coordinate plane is a rectangle |
| | • Facts about the slopes of parallel and perpendicular lines:<br>o Slopes of parallel lines are equal.<br>o Slopes of perpendicular lines are reciprocals with opposite signs. | • Prove the slope criteria for parallel and perpendicular lines and use them to solve geometric problems<br>o (e.g., find the equation of a line parallel or perpendicular to a given line that passes through a given point).<br>• Prove theorems about parallelograms<br>o Opposite sides are congruent,<br>o Opposite angles are congruent<br>o The diagonals of a parallelogram bisect each other<br>o Rectangles are parallelograms with congruent diagonals. |



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| | • The equation of a line written in Slope-Intercept Form is:<br>o $y = mx + b$<br>• The Point-Slope formula can be used to determine the equation of a line given a point and the slope:<br>o $y - y_1 = m(x - x_1)$, where $(x_1, y_1)$ is any point on the line. | • Use knowledge of linear equations from algebra and slope relationships from geometry to write the equations of lines that are parallel or perpendicular to a given line. |
| | Critical Vocabulary: Angle, Parallel, Perpendicular, Point, Line, Distance, Line Segment, Theorem, Vertical Angles, Congruent, Corresponding Angles, Alternate Interior, Bisector, Endpoint, Ratio, Slope, Parallelogram, Equidistant, Diagonal, Vertex, Ray, Circle, Arc | |
| Unit 1 Common Assessment | | |



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**Pacing Chart**
**UNIT 1: Fundamentals of Geometry**

| TIME FRAME | TOPIC | SUGGESTED PERFORMANCE TASKS<br>ACTIVITIES/PROJECTS<br>ASSESSMENTS | RESOURCES/INTERDISCIPLINARY CONNECTIONS |
|---|---|---|---|
| Early Sept – Mid Sept | Geometric Constructions | **Constructing perpendicular bisector**<br>Smart Notebook Software – Do search in the gallery for "Bisecting Lines" and click on Interactive and Multimedia<br><br>**Discovering Geometry Textbook, Chapter 3**<br>**Constructing Angle Bisector -** Students learn how to construct angle bisectors using patty paper or compass.<br>**Duplicating Segments and Angles** – Students learn how to copy lines, segments, and angles.<br>**Constructing a Perpendicular Bisector –** Students learn how to use patty paper or compass to construct perpendicular bisectors. | Text Sections: 1-2, 1-3, 1-4, 1-5, 1-6, 1-7, 2-1, 2-2, 2-3, 2-4, 2-5, 2-6, 3-1, 6-8<br><br>Teacher resources have activities, projects, & enrichment. www.khanacademy.com<br><br>exchange.smarttech.com |
| Mid Sept – Mid Oct | Parallel and Perpendicular Lines & Slope | **Discovering Geometry Textbook, Chapter 2**<br>**Angle Relationships –** Students prove statements about linear pairs and vertical angles.<br>**Slope** – Students use a slope triangle to determine the slope of a line.<br>**Discovering Geometry Textbook, Chapter 3**<br>**Constructing perpendiculars to a line –** Students use patty paper to construct perpendicular lines.<br>**Slopes of Parallel and Perpendicular Lines** – Students prove the slope relationships in parallel and perpendicular lines.<br><br>Parallel and perpendicular who wants to be a millionaire game<br>http://www.quia.com/rr/35674.html?AP_rand=1682191100<br>Slope intercept equation on graph<br>http://www.math-play.com/Slope-Intercept/Slope_Intercept.html | Text Sections: 3-1, 3-1, 3-3, 3-4, 3-5, 3-7, 3-8, 5-2, 6-1, 6-2, 6-3, 6-4, 6-5, 6-6, 6-9<br><br>Teacher resources have activities, projects, & enrichment. www.khanacademy.com<br><br>exchange.smarttech.com |



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## UNIT 2: Similarity & Right Triangle Trigonometry

| ENDURING UNDERSTANDINGS | ESSENTIAL QUESTIONS |
|---|---|
| ✓ Similarity of figures can be predicted and verified by transformations.<br>✓ Ratios and proportions can be used to decide if figures are similar and find unknown lengths.<br>✓ Some lengths are too large to measure directly and require alternative methods for calculation.<br>✓ Everyday objects have a variety of attributes, each of which can be measured in a number of ways.<br>✓ (+) Trigonometric ratios can be extended beyond right triangles to address more complex problems.<br>✓ (+) The relationships in right triangles can be extended to non-right triangles. | ✓ How is similarity and congruence the same? Different?<br>✓ When is it important to use similarity in real world applications?<br>✓ What is the advantage of using trigonometry in solving real problems versus direct measurement?<br>✓ How can trigonometry be used to solve problems that involve indirect measurement and large distances?<br>✓ (+) Why would it be necessary to apply trigonometric ratios to situations that do not involve right triangles? |

| CCSS | KNOWLEDGE | SKILLS |
|---|---|---|
| Similarity<br><br>G-SRT2<br>G-SRT3<br>G-SRT4<br>G-SRT5 | **Students will know that:**<br><br>● Similarity transformation is any transformation that results in a figure that is congruent or differs by a scale factor.<br>o All congruent figures are similar figures with a scale factor of 1.<br>o Geometric figures are similar when corresponding lengths are proportional and corresponding angles are congruent. | **Students will be able to:**<br><br>● Use the definition of similarity in terms of similarity transformations to decide two figures are similar.<br><br>● Use a scale factor to make a similar figure to the original figure. |
| Dilations<br><br>G-SRT1 | ● Dilation takes a line not passing through the center of the dilation to a parallel line, and leaves a line passing through the center unchanged.<br>o Under dilation, all line segments are longer or shorter in the ratio given by the scale factor. | ● Verify experimentally the properties of dilations given by a center and a scale factor.<br>● Compare transformations that preserve distance and angle to those that do not (e.g., translation versus horizontal stretch). |



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|---|---|---|
| Similarity<br><br>G-SRT2<br>G-SRT3<br>G-SRT4<br>G-SRT5 | **Students will know that:**<br><br>● If two angles of one triangle are congruent to two angles of another triangle, then the triangles are similar. | **Students will be able to:**<br>● Use the properties of similarity transformation to establish the AA criterion for two triangles to be similar.<br>● Explain the meaning of similarity for triangles using similarity transformations.<br>● Prove that a line parallel to one side of a triangle divides the other two proportionally. |
| Right Triangle Trigonometry<br><br>G-SRT4<br>G-SRT6<br>G-SRT7<br>G-SRT8 | ● The Pythagorean Theorem states that the sum of the square of each leg of a right triangle equals the square of the hypotenuse.<br>o $a^2 + b^2 = c^2$ | ● Prove the Pythagorean Theorem using similar triangles. |
| | ● The ratios of side lengths in the two special right triangles.<br>o For a $45^o - 45^o - 90^o$ triangle, the ratio is $1:1:\sqrt{2}$<br>o For a $30^o - 60^o - 90^o$ triangle, the ratio is $1:\sqrt{3}:2$ | ● Understand that similarity, side ratios in the right triangles are properties of the angles in triangle, leading to definitions of trigonometric ratios for acute angles.<br>● Recognize special right triangles and compute the sine, cosine, and tangent of all angles <u>without</u> a calculator. |
| | ● By similarity, side ratios in right triangles are properties of the angles in the triangle, leading to definitions of trigonometric ratios for acute angles and their **<u>reciprocals</u>** .<br>o The following trigonometric ratios are:<br>$\sin\theta = \frac{Opposite}{Hypotenuse}$<br>$\cos\theta = \frac{Adjacent}{Hypotenuse}$<br>$\tan\theta = \frac{Opposite}{Adjacent}$ or $\tan\theta = \frac{\sin\theta}{\cos\theta}$ | ● Use trigonometric ratios and the Pythagorean Theorem to solve right triangles in applied problems<br>o Explain and use the relationship between the sine and cosine of complementary angles. |



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|---|---|---|
| Extensions of Trigonometry Laws of Sines and Cosines<br><br>G-SRT9<br>G-SRT10<br>G-SRT11 | **Students will know that:**<br><br>• (+) The Law of Sines and the Law of Cosines can be used to find unknown measurements in right and non-right triangles (e.g., surveying problems, resultant forces). | **Students will be able to:**<br><br>• (+) Prove the Laws of Sines and Cosines and use them to solve problems.<br><br>• (+) Apply the Law of Sines and Cosines to find unknown measurements in both right and non-right triangles<br><br>• (+) Derive the formula $A = \frac{1}{2}ab\sin C$ for the area of a triangle by drawing an auxiliary line from a vertex perpendicular to the opposite side. |
| | Critical Vocabulary: Acute Angles, Similarity, Similarity Transformations, Triangles, Pythagorean Theorem, Trigonometric Ratios, Complementary Angles, Sine, Cosine, Tangent, Law of Sines, Law of Cosines, Vertex, | |
| Unit 2 Common Assessment / Common Midterm Exam | | |



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**UNIT 2: Similarity & Right Triangle Trigonometry**

| TIME FRAME | TOPIC | SUGGESTED PERFORMANCE TASKS<br>ACTIVITIES/PROJECTS<br>ASSESSMENTS | RESOURCES/INTERDISCIPLINARY CONNECTIONS |
|---|---|---|---|
| Mid Oct. – Mid Nov. | Similarity | **Discovery Geometry Textbook Chapter 4 & 11**<br>-Similar triangles – student will be able to examine the AA similarity conjecture.<br><br>http://www.icoachmath.com/math_dictionary/AA_Similarity_Conjecture.html | Text Sections: 7-1, 7-2, 7-3, 7-4, 7-5<br><br>Teacher resources have activities, projects, & enrichment.<br>www.khanacademy.com<br><br>exchange.smarttech.com |
| Mid Nov. – End Nov. | Dilations | Very nice, dynamic visual of dilation and scale factor on a coordinate plane<br>http://intranet.pymblelc.nsw.edu.au/teachingresources/TheLearningFederation/DVD/los/L6566/a15_ei_content_en.swf | Text Sections: 9-6, 9-7<br><br>Teacher resources have activities, projects, & enrichment.<br>www.khanacademy.com<br><br>exchange.smarttech.com |
| Dec. | Right Triangle Trigonometry | **Geometry Common Core Textbook pg. 497 problem #49**<br>- Proof of the Pythagorean theorem.<br>**Discovery Geometry Textbook Chapter 12**<br>- Trigonometric Ratios- student will be able to encounter trigonometry and define the sine, cosine, and tangent ratios.<br>ts/math/ALGEBRA/AT2/Ltrig.htmhttp://regentsprep.org/REgen | Text Sections: 8-1, 8-2, 8-3, 8-4<br><br>Teacher resources have activities, projects, & enrichment.<br>www.khanacademy.com<br><br>exchange.smarttech.com |
| (If time permits) | Extensions of Trigonometry Laws of Sines and Cosines | **Discovery Geometry Textbook Chapter 12**<br>● **The Law of Sines** – student will be able to find the measure of missing parts and areas of triangles when we know only ASA or SAA.<br>● **The Law of Cosines**- students apply the Law of Cosines.<br><br>Smart Notebook Software- Do search in the gallery for "Law of Sines and Cosines" | Text Sections: 8-5, 8-6<br><br>Teacher resources have activities, projects, & enrichment.<br>www.khanacademy.com<br><br>exchange.smarttech.com |



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**UNIT 3: Transformations & Congruence**

| ENDURING UNDERSTANDINGS | ESSENTIAL QUESTIONS |
|---|---|
| ✓ Transformations can be defined geometrically or by coordinates.<br>✓ Congruence of figures can be predicted and verified by transformations.<br>✓ Comparing the corresponding parts of two figures can show whether the figures are congruent. | ✓ How do the various transformations affect the points on the figure?<br>✓ How does an understanding of transformation help in determining congruence in geometric figures?<br>✓ What alternatives to transformations can be used to verify congruence? |

| CCSS | KNOWLEDGE | SKILLS |
|---|---|---|
| Transformations & Congruence<br><br>G-CO3<br>G-CO4<br>G-CO5<br>G-CO6<br>G-CO7 | **Students will know that:**<br><br>● The transformations of translation, reflection and rotation are all rigid motions, thus size and shape are preserved whenever these motions occur.<br>o Figures under rigid motions are congruent.<br>o Rigid motions can be used to overlay one figure onto itself or another figure.<br><br>● The coordinates of points in a figure change in a predictable way under rotation, reflection, and translation.<br><br>● Congruence can be verified by transforming one figure into the other using a finite number of rigid motions<br><br>● Figures are congruent if they are the same shape and same size. | **Students will be able to:**<br><br>● Perform the following using knowledge of translations, reflections, and rotations:<br>o Given a geometric figure and a rotation, a reflection, or a translation, draw the transformed figure using graph paper, patty paper, or geometry software.<br>o Describe the rotations and reflections that carry a rectangle, parallelogram, trapezoid, or regular polygon onto itself.<br>o Identify a sequence of transformations that will carry a given figure onto another.<br><br>● Use the definition for transformations in a plane using geometric tools or software; given two figures, use the definition of congruence in terms of rigid motions to decide if they are congruent.<br>o Show translation as the consecutive reflection over parallel lines.<br>o Demonstrate reflection by using parallel lines, perpendicular lines, and line segments.<br>o Perform rotations by using angles, arcs, and circles.<br>● Use the definition of congruence in terms of rigid motions to show that two triangles are congruent if and only if corresponding pairs of |



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| | | |
|---|---|---|
| G-CO2 | | angles are ongruent.<br><br>• Describe transformations as functions that take points in the plane as inputs and give other points as outputs. |
| Triangles & Congruence<br><br>G-CO8<br>G-CO10 | **Students will know that:**<br><br>• There are other forms of geometry and the theorems studied in this course are true only in Euclidean geometry. | **Students will be able to:**<br><br>• Prove theorems about triangles:<br>o *Measures of interior angles of a triangle sum to 180°;*<br>o *Base angles of isosceles triangles are congruent*<br>o *Segment joining midpoints of two sides of a triangle is parallel to the third side and half the length*<br>o *The medians of a triangle meet at a point.* |



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|---|---|---|
| | • Triangles are congruent if the following corresponding parts are congruent:<br>o ASA – If two angles and the included side of one triangle are congruent to two angles and the included side of the other triangle, then the two triangles are congruent.<br>o SAS – If two sides and the included angle of one triangle are congruent to two sides and the included angle of the other triangle, then the two triangles are congruent.<br>o SSS – If three sides of one triangle are congruent to three sides of the other triangle, then the two triangles are congruent. | • Explain how the criteria for triangle congruence (ASA, SAS, and SSS) follow from the definition of congruence in terms of rigid motions. |
| | Critical Vocabulary: Transformations, Rigid Motion, Translation, Reflections, Rotations, Dilation, Scale Factor, Function, Interior, Base Angles, Isosceles, Midpoints, Median, Polygon, Regular, Congruence, Corresponding, | |
| Unit 3 Common Assessment | | |



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**Pacing Chart**
**UNIT 3: Transformations & Congruence**

| TIME FRAME | TOPIC | SUGGESTED PERFORMANCE TASKS<br>ACTIVITIES/PROJECTS<br>ASSESSMENTS | RESOURCES/INTERDISCIPLINARY CONNECTIONS |
|---|---|---|---|
| Early Jan. – Early Feb. | Transformations & Congruence | **Discovery Geometry Text Book Chapter 7**<br>**- Transformations and Symmetry** –Student will be able to identify and create translations, rotations, and reflections of figures in the plane using patty paper, graph paper, and small mirror<br>-**Properties of Isometry**- Students will be able to develop visual thinking and problem solving skills<br>-**Compositions of Transformatio**ns –Students will discover the result of reflecting a figure across two intersecting lines<br><br>**Smart Notebook Software-**Do search in the Exchange for "Transformations on a coordinate plane"<br>http://www.nutshellmath.com/textbooks_glossary_demos/demos_content/alg_transformations_on_the_coordinate_plane.html | Text Sections: 4-1, 9-1, 9-2, 9-3, 9-4, 9-5<br><br>Teacher resources have activities, projects, & enrichment.<br>www.khanacademy.com<br><br>exchange.smarttech.com |
| Early Feb. - Early Mar. | Triangles & Congruence | **Discovering Geometry Textbook Chapter 4**<br>**-Are there Congruence Shortcuts? –** Students will be able to discover that SSS and SAS are valid congruence shortcuts but SSA is not.<br><br>http://www.mathopenref.com/congruenttriangles.html | Text Sections: 3-5, 4-2, 4-3, 4-4, 4-5, 4-6, 4-7, 5-1, 5-4, 5-5, 5-6, 5-7<br><br>Teacher resources have activities, projects, & enrichment.<br>www.khanacademy.com<br><br>exchange.smarttech.com |



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**UNIT 4: Circles**

| ENDURING UNDERSTANDINGS | ESSENTIAL QUESTIONS |
|---|---|
| ✓ When lines intersect a circle or within a circle, there is a relationship between the resulting angles, arcs, and segments.<br>✓ Different geometric tools and techniques can be used to find measurements in a variety of situations.<br>✓ Real world situations can be illustrated by characteristics of circles, radii, and tangent lines.<br>✓ The position and size of a circle in the coordinate plane can be represented with an equation. | ✓ How can you prove relationships between angles and arcs in a circle?<br>✓ How can you best choose the most appropriate measurement technique to use in a situation?<br>✓ How are circles used in the world to solve problems?<br>✓ How can the knowledge of right triangles be used to write the equation of a circle? |

| CCSS | KNOWLEDGE | SKILLS |
|---|---|---|
| Circles & Arcs<br><br>G-C1<br>G-C2<br>G-C3<br>G-C5 | **Students will know that:**<br><br>● The precise definitions of geometric figures are:<br>o A Circle is the set of all points in a plane that are equidistant from the center.<br>o A Radius is the distance from the center of a circle to any point on the circle.<br>o A Chord is the line segment whose endpoints lie on the circle.<br>o A Tangent to a circle is a line that intersects the circle at exactly one point.<br>o An Arc is a part of a circle connecting two points on the circle. | **Students will be able to:**<br><br>● Identify and describe relationships among inscribed angles (central, inscribed, and circumscribed), radii, and chords.<br>● Observe the following:<br>o Inscribed angles on a diameter are right angles;<br>o The radius is perpendicular to the tangent line.<br>● Prove properties of angles for a quadrilateral inscribed in a circle. |



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| | • A radian is the ratio between the length of an arc and its radius.<br>  o A radian can be thought of as a constant of proportionality.<br>• Circumference and area formulas for a circle are:<br>  o $C = 2\pi r$ or $C = \pi d$<br>  o $A = \pi r^2$ | • Derive the fact that the length of the arc intercepted by an angle is proportional to the radius using similarity.<br>• Prove that all circles are similar.<br>• Derive the formula for the area of a sector. |
| Equations of Circles<br><br>G-GPE1 | **Students will know that:**<br>• The Pythagorean Theorem states that the sum of the square of each leg of a right triangle equals the square of the hypotenuse.<br>  o $a^2 + b^2 = c^2$ | **Students will be able to:**<br>• Derive the equation of a circle with a given center and radius using the Pythagorean Theorem<br>• Use coordinates to prove simple geometric theorems algebraically. For example:<br>  o Prove or disprove that the point $\left(1, \sqrt{3}\right)$ lies on the circle centered at the origin and containing the point (0, 2). |
| | • Completing the square can be used to solve simple quadratic equations. | • Solve quadratic equations using completing the square.<br>• Complete the square to find the center and radius of a circle given an equation. |
| Extensions Beyond Circles & Arcs<br><br>G-C4 | **Students will know that:**<br>• (+) For any point outside of a circle, there are exactly two lines that intersect the circle at a single point and form a right angle to the radius there. Such lines are called tangent lines.<br>• (+) A perpendicular bisector can be used to construct tangent lines. | **Students will be able to:**<br>• (+) Recognize a tangent line by observing the right angle formed between the line and the radius of the circle.<br>• (+) Construct a tangent line from a point outside a given circle to the circle. |
| | Critical Vocabulary: Radius, Diameter, Tangent, Central Angles, Inscribed Angles, Circumscribed Angles, Hexagon, Quadrilateral, Radian, Sector, Constant of Proportionality, Completing the Square | |
| Unit 4 Common Assessment | | |



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**Pacing Chart**
**UNIT 4: Circles**

| TIME FRAME | TOPIC | SUGGESTED PERFORMANCE TASKS<br>ACTIVITIES/PROJECTS<br>ASSESSMENTS | RESOURCES/INTERDISCIPLINARY CONNECTIONS |
|---|---|---|---|
| Early Mar. - Mid. Apr. | Circles & Arcs | **Discovery Geometry Textbook Chapter 6 –Discovering and proving circle properties**<br>-**Arcs and Angles**- Student will be able to discover relationships between an inscribed angle of a circle and its intercepted arc.<br>-**Proving Circle Conjectures**- Students will be able to create flowchart proofs<br><br>http://www.sparknotes.com/testprep/books/newsat/powertactics/geometry/chapter2section4.rhtml | Text Sections: 5-3, 10-6, 10-7, 12-2, 12-3, 12-4, 12-6<br><br>Teacher resources have activities, projects, & enrichment. www.khanacademy.com<br><br>exchange.smarttech.com |
| Mid Apr. – End Apr. | Equations of Circles | Solving quadratic equations by completing the square<br>http://www.mathsisfun.com/algebra/completing-square.html<br>Shows how to derive the quadratic formula by completing the square<br>http://www.mathsisfun.com/algebra/quadratic-equation-derivation.html | Text Sections: 12-5<br><br>Teacher resources have activities, projects, & enrichment. www.khanacademy.com<br><br>exchange.smarttech.com<br><br>: |



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| (If time permits) | Extensions Beyond Circles | **Discovery Geometry Textbook Chapter 6- Discovering and proving circle properties**<br>-**Tangent Properties -** Construct a tangent line from a point outside a given circle to the circle using protractors, sketchpads, and rulers.<br>**Discovery Geometry Textbook Chapter 13 -** Circle Proofs-Students will be able to compare and contrast circle relationships and prove circle conjectures<br><br>**Smart Notebook Software**- Do search for "Tangent Properties of a circle"<br>http://www.mathwarehouse.com/geometry/circle/tangent-to-circle.php | Text Sections: 12-1<br><br>Teacher resources have activities, projects, & enrichment.<br>www.khanacademy.com<br><br>exchange.smarttech.com |

**UNIT 5: Perimeter, Area, and Volume**

| ENDURING UNDERSTANDINGS | ESSENTIAL QUESTIONS |
|---|---|
| ✓ Congruence and similarity can be extended beyond triangles to help in solving problems that involve other figures.<br>✓ Distance can be calculated in various ways that are equivalent.<br>✓ 2D and 3D shapes are often used to simplify complex objects in problem solving.<br>✓ Geometric ideas and the coordinate plane can be connected to create interesting figures commonly seen in Algebra. | ✓ How can you use your knowledge of congruence in triangles to solve problems involving other figures?<br>✓ How are the Pythagorean Theorem and Distance formula related?<br>✓ Why would it be necessary to represent real objects using geometric figures?<br>✓ How would you find the area or volume real objects?<br>✓ How can the definition of a conic figure be used to construct it? |

| CCSS | KNOWLEDGE | SKILLS |
|---|---|---|
| Perimeter, Area, and Volume with Applications<br><br>G-GPE7<br>G-GMD1<br>G-GMD3<br>G-MG1 | **Students will know that:**<br><br>● The Distance Formula states:<br>$D = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$<br>o<br>● The distance formula or the Pythagorean Theorem can be used to find the length between two points. | **Students will be able to:**<br><br>● Use coordinates to compute perimeters of polygons and areas of triangles and rectangles using the distance formula.<br>● Use coordinates to prove simple geometric theorems algebraically. *For example:*<br>● Prove or disprove that a figure defined by four given points in the coordinate plane is a rectangle |



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| G-MG2<br>G-MG3 | • The following formulas for geometric figures:<br>  o Circumference of a circle: $C = 2\pi r$<br>  o Area of a circle: $A = \pi r^2$<br>  o Volume of a cylinder: $V = \pi r^2 h$<br>  o Volume of a pyramid: $V = \frac{1}{3}lwh$<br>  o Volume of a cone: $V = \frac{1}{3}\pi r^3$<br>  o Volume of a sphere: $V = \frac{4}{3}\pi r^3$<br>• Cavalieri's Principle states that if two figures have the same height and the same cross sectional area at every level, then they have the same volume. | • Use volume formulas for cylinders, pyramids, cones, and spheres to solve problems.<br><br>• Give an informal argument by using dissection arguments, Cavalieri's principle or informal limit arguments:<br>  o Circumference of a circle<br>  o Area of a circle<br>  o Volume of a cylinder, pyramid, and cone. |
| | • Figures are congruent if their corresponding parts are congruent.<br>• In similar figures:<br>  o The ratio of the perimeters is the same as the scale factor.<br>  o The ratio of the area is the square of the scale factor. | • Use congruence and similarity criteria for triangles to solve problems and to prove relationships in geometric figures. |



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| | • Area and volume can be used to represent various aspects of the world around us.<br>• Drawings of geometric figures can be used to model more complex shapes to aid in solving problems. | • Use geometric shapes, their measures, and their properties to describe objects (e.g., modeling a tree trunk or a human torso as a cylinder).<br>• Apply geometric methods to solve design problems for example:<br>o Designing an object or structure to satisfy physical constraints or minimize cost<br>o Working with typographic grid systems based on ratios (Area of irregular figures).<br>o Find the resolution of a screen |
| | • Density is the quantity of something per unit measure, such as per unit length, area, or volume. | • Apply concepts of density based on area and volume in modeling situations. For example:<br>o Persons per square mile<br>o BTUs per cubic foot |
| Cross Sectional Area & Parabolas<br><br>G-GMD4<br>G-GPE2 | **Students will know that:**<br><br>• The cross section of various three dimensional figures depends on the angle of the slice relative to the base of the figure. | **Students will be able to:**<br><br>• Identify the shapes of two-dimensional cross-sections of three dimensional objects, and identify three-dimensional objects generated by rotations of two-dimensional objects. |
| | • A Parabola is the set of all points in a plane that are equidistant from a fixed line and a fixed point on the line of symmetry.<br>• Any parabola can be repositioned and rescaled to fit exactly on another parabola so all parabolas are similar. | • Derive the equation of a parabola given a focus and directrix using the Distance Formula and definition of parabola. |



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| Extensions to Perimeter, Area, and Volume<br><br>G-GMD2<br>G-GPE3 | **Students will know that:**<br>● Cavalieri's Principle states that if two figures have the same height and the same cross sectional area at every level, then they have the same volume.<br>● (+) An Ellipse is the set of all points, P in a plane such that the sum of the distances from P to two fixed points (foci) is constant.<br>● (+) A Hyperbola is the set of all points P in a plane such that the difference of the distances from P to two fixed points (foci) is constant. | **Students will be able to:**<br><br>● (+) Give an informal argument using Cavalieri's principle for the formulas for the volume of a sphere and other solid figures.<br>● (+) Derive the equations of ellipses and hyperbolas given the foci, using the definitions each term. |
| | Critical Vocabulary: Distance Formula, Cavalieri's Principle, Volume, Cylinder, Pyramid, Cone, Sphere, Density, Cross-Section, Parabola, (+)Focus, (+)Foci, (+)Directrix, (+)Ellipses, (+) Hyperbolas | |
| Unit 5 Common Assessment | | |



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**Pacing Chart**
**UNIT 5: Perimeter, Area, and Volume**

| TIME FRAME | TOPIC | SUGGESTED PERFORMANCE TASKS<br>ACTIVITIES/PROJECTS<br>ASSESSMENTS | RESOURCES/INTERDISCIPLINARY CONNECTIONS |
|---|---|---|---|
| Early May - Mid May | Perimeter, Area, and Volume with Applications | **Discovery Geometry Textbook Chapter 8**<br>-**Area Problems**- Students will be able to find areas of a variety of shapes<br><br>**Discovery Geometry Textbook Chapter 10**<br>-**Volume Problems**- Students will be able to find areas of a variety of shapes<br><br>Interactive demonstration of Cavalieri's Principle<br>http://www.classzone.com/books/geometry_2007_tx/animations/geom07_ch12_pg821.swf<br>Sample practice problems on perimeter, area, and volume<br>http://www.algebra.com/algebra/homework/formulas/Perimeter-Area-Volume-by-Rapalje.lesson<br><br>**Smart Notebook Software**- Do search for "Tangent Properties of a circle" | Text Sections: 1-8, 6-7, 10-1, 10-2, 10-3, 10-4, 10-5, 11-1, 11-2, 11-3, 11-4, 11-5, 11-6, 11-7<br><br>Teacher resources have activities, projects, & enrichment.<br>www.khanacademy.com<br><br>exchange.smarttech.com |
| Mid May - End May | Cross Sectional Area & Parabolas | **Discovery Geometry Textbook Chapter 10 –**<br>**-Volume of a Sphere**-Give an informal argument using Cavalieri's priniciple for the formulas for the volume of a sphere and other solid figures.<br><br>**Smart Notebook Software**- Do search for "area and parabolas" | Text Sections: 11-1<br><br>Teacher resources have activities, projects, & enrichment.<br>www.khanacademy.com<br><br>exchange.smarttech.com |



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| (If time permits) | Extensions to Perimeter, Area, and Volume | Interactive flash sketcher for hyperbolas<br>http://hotmath.com/learning_activities/interactivities/hyperbola.swf<br>Interactive flash sketcher for ellipse<br>http://hotmath.com/learning_activities/interactivities/ellipse.swf | Text Sections: (Not Supported by current textbook)<br><br>Teacher resources have activities, projects, & enrichment.<br>www.khanacademy.com<br><br>exchange.smarttech.com |



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**UNIT 6: Probability**

| ENDURING UNDERSTANDINGS | ESSENTIAL QUESTIONS |
|---|---|
| ✓ Visualizing the different ways that events can occur can help in making critical decisions in life.<br>✓ Probability can be used to make fair decisions based on prior experience.<br>✓ Sometimes the occurrence of an event affects the outcome of other events resulting in unexpected outcomes.<br>✓ Algebra can be used to analyze probability more efficiently. | ✓ What does it mean for an event to be random?<br>✓ How can we use prior experiences to predict the future?<br>✓ How do you know whether the occurrence of one event affects the other event?<br>✓ In what situations would it be beneficial to use algebra to solve probability problems? |

| CCSS | KNOWLEDGE | SKILLS |
|---|---|---|
| Probability<br><br>S-CP1<br>S-CP2<br>S-CP3<br>S-CP4<br>S-CP5<br>S-CP6<br>S-CP7 | **Students will know that:**<br><br>● The Sample Space is the set of all possible outcomes.<br>$\text{Probability} = \frac{\text{The number of ways an event can occur}}{\text{Total number of possible outcomes}}$<br>● | **Students will be able to:**<br><br>● Describe events as subsets of a sample space using:<br>o Characteristics or categories of the outcomes<br>o Unions, intersections, or complements of other events ("or," "and," "not").<br>● Construct and interpret two-way frequency tables of data when two categories are associated with each object being classified.<br>● Use the two-way table as a sample space to decide if events are independent and to approximate conditional probabilities.<br>o *For example, collect data from a random sample of students in your school on their favorite subject among math, science, and English. Estimate the probability that a randomly selected student from your school will favor science given that the student is in tenth grade. Do the same for other subjects and compare the results.* |



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| | • Two events *A* and *B* are independent if the probability of *A* and *B* occurring together is equal to the product of their individual probabilities.<br>o *For example: If there are 1 red, 2 yellow and 3 white marbles in a bag and you would like to take out 1 red marble and 1 yellow with replacing, create a sample space the situation and find the probability. Create the sample space for taking each one red marble and one yellow separately. Multiply the probabilities to determine if they match the original.*<br>o For Independent Probability:<br>$P(A \text{ and } B) = P(A) \cdot P(B)$ | • Identify independent events by verifying that the probability of the event occurring together matches the product of the individual probabilities. |
| | • The conditional probability of an event is the chance of the event occurring after a different event has occurred.<br>o The event may or may not be affected by the other event.<br>o The conditional probability of *A* given *B* as:<br>$P(A\|B) = \frac{P(A \text{ and } B)}{P(B)}$ where $P(B) \neq 0$<br>• Two events are independent if the conditional probability is equal to the probability of the single event. Both of the following must be true:<br>o $P(A\|B) = P(A)$ and $P(B\|A) = P(B)$ | • Find the conditional probability of *A* given *B* as the fraction of *B*'s outcomes that also belong to *A*, and interpret the answer in terms of the model.<br>• Recognize and explain the concepts of conditional probability and independence in everyday language and everyday situations.<br>o *For example, compare the chance of having lung cancer if you are a smoker with the chance of being a smoker if you have lung cancer.* |
| | • The Addition Rule for probability is:<br>o P(A or B) = P(A) + P(B) – P(A and B) | • Apply the Addition Rule and interpret the answer in terms of the model. |
| Extensions in Probability<br><br>S-CP8<br>S-CP9<br>S-CP5<br>S-CP6<br>S-CP7 | **Students will know that:**<br><br>• (+) The general Multiplication Rule in a uniform probability model is:<br>o P(A and B) = P(A)P(B\|A)<br>or<br>o P(A and B) = P(B)P(A\|B) | **Students will be able to:**<br><br>• (+) Apply the general Multiplication Rule and interpret the answer in terms of the model.<br>• (+) Use probabilities to make fair decisions. For Example:<br>o Drawing by lots<br>o Using a random number generator<br>• (+) Analyze decisions and strategies using probability concepts. For Example:<br>o Product testing<br>o Medical testing |



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| | | o Pulling a hockey goalie at the end of a game |
| | • (+) The following formulas can be used to calculate permutations and combinations:<br>o ${}_nP_r = \frac{n!}{(n-r)!}$<br>o ${}_nC_r = \frac{n!}{(n-r)!r!}$ | • (+) Use permutations and combinations to compute probabilities of compound events and solve problems. |
| | Critical Vocabulary: Sample Space, Outcomes, Unions, Intersections, Complements, Two-Way Table, Probability, Independent, Conditional, Fair Decisions, (+) Permutations, (+) Combinations (+) Compound Events | |
| Unit 6 Common Assessment / Common Final Exam | | |



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**Pacing Chart**
**UNIT 6: Probability**

| TIME FRAME | TOPIC | SUGGESTED PERFORMANCE TASKS<br>ACTIVITIES/PROJECTS<br>ASSESSMENTS | RESOURCES/INTERDISCIPLINARY CONNECTIONS |
|---|---|---|---|
| June | Probability | www.khanacademy.com<br><br>exchange.smarttech.com<br><br>**Discovering Geometry Textbook**-Exploration Chapter 1 and Chapter 8<br>Students will use geometry top think about probability problems.<br>**Smart Notebook Software**- Do search for "Probability"<br><br>http://www.algebra-class.com/geometric-probability.html<br>http://www.classzone.com | Text Sections: 10-8, 13-1, 13-2, 13-4, 13-5, 13-6<br><br>Teacher resources have activities, projects, & enrichment.<br>www.khanacademy.com<br><br>exchange.smarttech.com |
| (If time permits) | Extensions in Probability | **Discovering Geometry Textbook**-Exploration Chapter 1 and Chapter 8<br>Students will use geometry top think about probability problems.<br><br>http://www.algebra-class.com/geometric-probability.html<br>http://www.ics.uci.edu/~eppstein/junkyard/random.html<br>http://www.youtube.com/watch?v=j_tZZZ9IojM | Text Sections: 13-3, 13-7<br><br>Teacher resources have activities, projects, & enrichment.<br>www.khanacademy.com<br><br>exchange.smarttech.com |



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