



**Mathematics**  
**Unified 3**  
**9th Grade**

Dr. Mark Toback, Superintendent  
Committee: Nancy Mahoney  
Compliance Update Completed June 2022

*This curriculum may be modified through varying techniques, strategies,  
and materials as per an individual student's Individualized Educational  
Plan (IEP)*

**Approved by the Wayne Township Board of Education at the regular meeting held on November 15, 2018.**

**Wayne School District  
Curriculum Format**

<b>Content Area/ Grade Level/ Course:</b>	Mathematics 9 Unified Mathematics 3 Honors
<b>Unit Plan Title:</b>	<b>Unit 1: Congruence, Proof, and Constructions</b> Experiment with transformations in the plane (teaching concept of congruence and triangle congruence theorems to be phased out, transformations remain)
<b>Time Frame</b>	<b>20 days (15 days without congruence theorems for triangles)</b>
<b>Anchor Standards/Domain*      *i.e: ELA: reading, writing i.e.: Math: Algebra</b>	
HS.G.CO- Geometry - Congruence	
<b>Unit Overview</b>	
Students will be able to establish triangle congruence criteria, based on analyses of rigid motions and formal constructions. They should be able to use triangle congruence as a familiar foundation for the development of formal proof. Students should prove theorems using a variety of formats, and solve problems about triangles, quadrilaterals and other polygons. They apply reasoning to complete geometric constructions and explain why they work.	
<b>Standard Number(s)      * i.e: Math: F.LE.A.4      i.e.: NJLSA.R4.</b>	
<ul style="list-style-type: none"> <li>● G.CO.1 Know precise definitions of angle, circle, perpendicular line, parallel line, and line segment, based on the undefined notions of point, line, distance along a line, and distance around a circular arc.</li> <li>● G.CO.2 Represent transformations in the plane using, e.g., transparencies and geometry software; describe transformations as functions that take points in the plane as inputs and give other points as outputs. Compare transformations that preserve distance and angle to those that do not (e.g., translation versus horizontal stretch)</li> <li>● G.CO.3 Given a rectangle, parallelogram, trapezoid, or regular polygon, describe the rotations and reflections that carry it onto itself.</li> <li>● G.CO.4 Develop definitions of rotations, reflections, and translations in terms of angles, circles, perpendicular lines, parallel lines, and line segments.</li> <li>● G.CO.5 Given a geometric figure and a rotation, reflection, or translation, draw the transformed figure using, e.g., graph paper, tracing paper, or geometry software. Specify a sequence of transformations that will carry a given figure onto another.</li> <li>● G.CO.6 Use geometric descriptions of rigid motions to transform figures and to predict the effect of a given rigid motion on a given figure; given two figures, use the definition of congruence in terms of rigid motions to decide if they are congruent.</li> <li>● G.CO.7 Use the definition of congruence in terms of rigid motions to show that two triangles are congruent if and only if corresponding pairs of sides and corresponding pairs of angles are congruent.</li> </ul>	

- G.CO.8 Explain how the criteria for triangle congruence (ASA, SAS, and SSS) follow from the definition of congruence in terms of rigid motions.
- G.CO.9 Prove theorems about lines and angles. *Theorems include: vertical angles are congruent; when a transversal crosses parallel lines, alternate interior angles are congruent and corresponding angles are congruent; points on a perpendicular bisector of a line segment are exactly those equidistant from the segment's endpoints*
- G.CO.10 Prove theorems about triangles. *Theorems include: measures of interior angles of a triangle sum to  $180^\circ$ ; base angles of isosceles triangles are congruent; the segment joining midpoints of two sides of a triangle is parallel to the third side and half the length; the medians of a triangle meet at a point.*
- G.CO.12 Make formal geometric constructions with a variety of tools and methods (compass and straightedge, string, reflective devices, paper folding, dynamic geometric software, etc.). *Copying a segment; copying an angle; bisecting a segment; bisecting an angle; constructing perpendicular lines, including the perpendicular bisector of a line segment; and constructing a line parallel to a given line through a point not on the line.*
- G.CO.13 Construct an equilateral triangle, a square, and a regular hexagon inscribed in a circle.
- G.GPE.6 Find the point on a directed line segment between two given points that partitions the segment in a given ratio
- 8.1.12.DA.5: Create data visualizations from large data sets to summarize, communicate, and support different interpretations of real-world phenomena.
- 8.1.12.DA.6: Create and refine computational models to better represent the relationships among different elements of data collected from a phenomenon or process.
- 8.1.12.AP.1: Design algorithms to solve computational problems using a combination of original and existing algorithms.
- 9.1.12.PB.2: Prioritize financial decisions by considering alternatives and possible consequences.
- 9.2.12.CAP.4: Evaluate different careers and develop various plans (e.g., costs of public, private, training schools) and timetables for achieving them, including educational/training requirements, costs, loans, and debt repayment.
- 9.4.12.CI.1: Demonstrate the ability to reflect, analyze, and use creative skills and ideas (e.g., 1.1.12prof.CR3a).
- 9.4.12.CT.2: Explain the potential benefits of collaborating to enhance critical thinking and problem solving (e.g., 1.3E.12 prof.CR3.a)
- 9.4.12.IML.3: Analyze data using tools and models to make valid and reliable claims, or to determine optimal design solutions (e.g., S-ID.B.6a., 8.1.12.DA.5, 7.1.IH.IPRET.8)
- 9.4.12.TL.1: Assess digital tools based on features such as accessibility options, capacities, and utility for accomplishing a specified task (e.g., W.11-12.6.).
- RST.9-10.3./RST.11-12.3. Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks, attending to special cases or exceptions defined in the text.
- RST.9-10.7. Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words.
- RST.9-10.4. Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 9-10 texts and topics.
- CRP2. Apply appropriate academic and technical skills.
- CRP4. Communicate clearly and effectively and with reason.
- CRP8. Utilize critical thinking to make sense of problems and persevere in solving them.
- CRP11. Use technology to enhance productivity.
- CRP12. Work productively in teams while using cultural global competence.

- In what ways can a figure be transformed?
- What relationships emerge when a transversal intersects two parallel lines?
- What does it mean for two figures to be congruent?
- How can you make a conjecture and prove that it is true?
- How do you identify corresponding parts of congruent triangles?
- What are congruent segments/angles?
- How do you construct a logical argument?
- How do you write a bi-conditional statement?
- How do you use inductive and deductive reasoning?
- How do you write a geometric proof?
- How are corresponding angles, and alternate interior angles related?
- What are congruent figures?
- How can you use side lengths and angle measurements to prove triangles are congruent?
- How can you use congruent triangles to prove angles or sides are congruent?
- What transformations create an image congruent to the original figure?

### Enduring Understandings

- Patterns and relationships can be observed in geometric figures.

In this unit plan, the following 21<sup>st</sup> Century themes and skills are addressed.

<i>Check all that apply.</i> <b>21<sup>st</sup> Century Themes</b>		<i>Indicate whether these skills are E-Encouraged, T-Taught, or A-Assessed in this unit by marking E, T, A on the line before the appropriate skill.</i> <b>21<sup>st</sup> Century Skills</b>	
X	Global Awareness	T,E	Creativity and Innovation
	Environmental Literacy	T,E ,A	Critical Thinking and Problem Solving
	Health Literacy	T,E ,A	Communication
	Civic Literacy	E	Collaboration
	Financial, Economic, Business, and Entrepreneurial Literacy		

## Student Learning Targets/Objectives (Students will know/Students will understand)

- Understand how to prove figures are congruent.
- Understand the difference between rigid and non-rigid transformations
- Understand how to use a protractor, compass and straight-edge to create geometric constructions
- Experiment with transformations in the plane. (G.CO.1 – G.CO.5)
- Understand congruence in terms of rigid motions. (G.CO.6 – G.CO.8)
- Define, describe, and represent congruency of figures in terms of rigid motions
- Explain how the criteria for triangle congruence follow from the definition of congruence in terms of rigid motion.
- Prove theorems about lines, angles, triangles, and parallelograms
- Make formal geometric constructions with a variety of tools and methods
- Recognize when figures are congruent.
- Construct basic geometric figures.
- Transform figures using non-rigid transformations on a coordinate plane

## Assessments (Pre, Formative, Summative, Other)

*Denote required common assessments with an \**

Tests/Quizzes

Clickers

Communicators

Benchmarks (Quarterly and Midterm/Final Exams)

Journaling

Project

## Teaching and Learning Activities

*Activities*

### **Instructional Strategies**

In this unit, students will use a compass, protractor and straight-edge to create geometric constructions and use these constructions to explore and model geometric theorems. Students will use Geometer's Sketchpad to explore triangle congruence theorems.

Use Miras to perform constructions of reflecting points, polygons, parallel and perpendicular lines, angle and segment bisectors.

<http://www.mathchamber.com/PDFs/math8/KHM/KHM%201.1A%20Using%20the%20MI%20RA.pdf>

<http://www.shawnee.edu/acad/ms/ENABLdocs/Summer08pdfs/MIRA%20Lesson%20Plan.pdf>

<http://wveis.k12.wv.us/teach21/public/Uplans/LPview.cfm?page=1&tsele1=2&tsele2=117&upidU=1528&UPid=1530>

<http://wveis.k12.wv.us/teach21/public/Uplans/UPview.cfm?action=V1&tsele1=2&tsele2=117&tsele3i=1528>

Experience visual learning using Gizmos ([www.ExploreLearning.com](http://www.ExploreLearning.com))\* on Dilations, Reflections, Rotations, Similar Figures/Polygons, and Congruence in all polygons.

Demonstrations on Congruence with Transformations using [The Geometer Sketch Pad](#).

Demonstrations on Congruence with Transformations using [The Geometer Sketch Pad](#).

\*Reflections

<http://www.explorelearning.com/index.cfm?method=cResource.dspView&ResourceID=194>

	<p>*Rotations, reflections, translation  <a href="http://www.explorelearning.com/index.cfm?method=cResource.dspDetail&amp;ResourceID=269">http://www.explorelearning.com/index.cfm?method=cResource.dspDetail&amp;ResourceID=269</a></p> <p>*Similar Figures  <a href="http://www.explorelearning.com/index.cfm?method=cResource.dspDetail&amp;ResourceID=296">http://www.explorelearning.com/index.cfm?method=cResource.dspDetail&amp;ResourceID=296</a></p> <p>*Congruence in right triangles  <a href="http://www.explorelearning.com/index.cfm?method=cResource.dspView&amp;ResourceID=179">http://www.explorelearning.com/index.cfm?method=cResource.dspView&amp;ResourceID=179</a></p> <p>*Proving triangles are congruent  <a href="http://www.explorelearning.com/index.cfm?method=cResource.dspView&amp;ResourceID=192">http://www.explorelearning.com/index.cfm?method=cResource.dspView&amp;ResourceID=192</a></p> <p>*Similar figures Activity A  <a href="http://www.explorelearning.com/index.cfm?method=cResource.dspView&amp;ResourceID=271">http://www.explorelearning.com/index.cfm?method=cResource.dspView&amp;ResourceID=271</a></p> <p>*Similar Polygons  <a href="http://www.explorelearning.com/index.cfm?method=cResource.dspView&amp;ResourceID=195">http://www.explorelearning.com/index.cfm?method=cResource.dspView&amp;ResourceID=195</a></p> <p>*Similarity in Right Triangles  <a href="http://www.explorelearning.com/index.cfm?method=cResource.dspView&amp;ResourceID=196">http://www.explorelearning.com/index.cfm?method=cResource.dspView&amp;ResourceID=196</a></p> <p>*Rock Art (Transformations)  <a href="http://www.explorelearning.com/index.cfm?method=cResource.dspView&amp;ResourceID=1031">http://www.explorelearning.com/index.cfm?method=cResource.dspView&amp;ResourceID=1031</a></p>
<i>Differentiation Strategies</i>	Applets, software, and graphing calculators will be used throughout the course. Students will work independently and collaboratively.
<i>Honors</i>	Honors level course.
<b>Resources</b>	
<ul style="list-style-type: none"> <li>● <b><u>Instructional Resources/Tools</u></b>  TI-83/84 and TI emulator  Geometer's Sketchpad  Google Sketch up  www.ExploreLearning.com</li> <li>● <b><u>Interactive applets:</u></b>  <a href="http://www.mathsisfun.com/flash.php?path=%2Fgeometry/images/translation.swf&amp;w=670.5&amp;h=571.5&amp;col=%23FFFFFF&amp;title=Geometry+Translation">http://www.mathsisfun.com/flash.php?path=%2Fgeometry/images/translation.swf&amp;w=670.5&amp;h=571.5&amp;col=%23FFFFFF&amp;title=Geometry+Translation</a> (gives general idea of the translation)  <a href="http://www.regentsprep.org/regents/math/geometry/GT2/Activity.htm">http://www.regentsprep.org/regents/math/geometry/GT2/Activity.htm</a> ** Excellent intro activity.</li> </ul>	

<http://www.shodor.org/interactivate/activities/Transmographer/>

<http://www.misterteacher.com/alphabetsgeometry/reflection.html> (scroll down to "Practice" then click on the grid on the bottom)

[http://nlvm.usu.edu/en/nav/topic\\_t\\_3.html](http://nlvm.usu.edu/en/nav/topic_t_3.html) ( a variety of geometry topics)

<http://www.mathwarehouse.com/geometry/angle/interactive-vertical-angles.php>

<http://www.anlyzemath.com/Geometry/MediansTriangle/MediansTriangle.html>

<http://www.mathwarehouse.com/geometry/quadrilaterals/parallelograms/interactive-parallelogram.php>

**Wayne School District  
Curriculum Format**

<b>Content Area/ Grade Level/ Course:</b>	Mathematics 9 Unified Mathematics 3- Honors
<b>Unit Plan Title:</b>	Unit 2: Linear and Rational Expressions and Equations
<b>Time Frame</b>	15 days
<b>Anchor Standards/Domain*</b>	*i.e: ELA: reading, writing i.e.: Math: Algebra

A.SSE: Algebra: Seeing Structure in Expressions.  
A.CED: Create equations that describe numbers or relationships  
A.REI: Reasoning with Equations and Inequalities

## Unit Overview

Students will work with linear relationships, interpret data, write and graph equations. They will extend reasoning of linear relationships to a variety of non-linear models.

**Standard Number(s)** \* i.e: **Math: F.LE.A.4** i.e.: **NJLSA.R4.**

- A.SSE.1 Interpret expressions that represent a quantity in terms of its context.
  - a. Interpret parts of an expression, such as terms, factors, and coefficients.
  - b. Interpret complicated expressions by viewing one or more of their parts as a single entity. *For example, interpret  $P(1+r)^n$  as the product of  $P$  and a factor not depending on  $P$ .*
- A.SSE.2 Use the structure of an expression to identify ways to rewrite it. *For example, see  $x^4 - y^4$  as  $(x^2)^2 - (y^2)^2$ , thus recognizing it as a difference of squares that can be factored as  $(x^2 - y^2)(x^2 + y^2)$ .*
- A.CED.4 Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations. For example, rearrange Ohm's law  $V = IR$  to highlight resistance  $R$ .
- A.REI.6 Solve systems of linear equations exactly and approximately (e.g., with graphs), focusing on pairs of linear equations in two variables.
- A.REI.7 Solve a simple system consisting of a linear equation and a quadratic equation in two variables algebraically and graphically. For example, find the points of intersection between the line  $y = -3x$  and the circle  $x^2 + y^2 = 3$ .
- A.REI.10 Understand that the graph of an equation in two variables is the set of all its solutions plotted in the coordinate plane, often forming a curve (which could be a line).
- A.REI.11 Explain why the x-coordinates of the points where the graphs of the equations  $y = f(x)$  and  $y = g(x)$  intersect are the solutions of the equation  $f(x) = g(x)$ ; find the solutions approximately, e.g., using technology to graph the functions, make tables of values, or find successive approximations. Include cases where  $f(x)$  and/or  $g(x)$  are linear, polynomial, rational, absolute value, exponential, and logarithmic functions.★
- A.REI.12 Graph the solutions to a linear inequality in two variables as a half-plane (excluding the boundary in the case of a strict inequality), and graph the solution set to a system of linear inequalities in two variables as the intersection of the corresponding half-planes.
- 8.1.12.DA.5: Create data visualizations from large data sets to summarize, communicate, and support different interpretations of real-world phenomena.
- 8.1.12.DA.6: Create and refine computational models to better represent the relationships among different elements of data collected from a phenomenon or process.
- 8.1.12.AP.1: Design algorithms to solve computational problems using a combination of original and existing algorithms.
- 9.1.12.PB.2: Prioritize financial decisions by considering alternatives and possible consequences.
- 9.2.12.CAP.4: Evaluate different careers and develop various plans (e.g., costs of public, private, training schools) and timetables for achieving them, including educational/training requirements, costs, loans, and debt repayment.
- 9.4.12.CI.1: Demonstrate the ability to reflect, analyze, and use creative skills and ideas (e.g., 1.1.12prof.CR3a).
- 9.4.12.CT.2: Explain the potential benefits of collaborating to enhance critical thinking and problem solving (e.g., 1.3E.12 prof.CR3.a)
- 9.4.12.IML.3: Analyze data using tools and models to make valid and reliable claims, or to determine optimal design solutions (e.g., S-ID.B.6a., 8.1.12.DA.5, 7.1.IH.IPRET.8)
- 9.4.12.TL.1: Assess digital tools based on features such as accessibility options, capacities, and utility for accomplishing a specified task (e.g., W.11-12.6.).



- RST.9-10.3./RST.11-12.3. Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks, attending to special cases or exceptions defined in the text.
- RST.9-10.7. Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words.
- RST.9-10.4. Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 9-10 texts and topics.
- CRP2. Apply appropriate academic and technical skills.
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- CRP11. Use technology to enhance productivity.
- CRP12. Work productively in teams while using cultural global competence.

### Intended Outcomes - {Essential Questions}

- How can variables in linear relationships be graphed?
- In what ways can quantities relate to one another?
- In what situations are systems of equations needed to solve for variables?

### Enduring Understandings

- Students will be able to graph linear relationships in two variables.
- Students will understand the concept of 'rate of change' as it applies to linear relationships.
- Students will be able to identify independent and dependent variables in real life problems.
- Students will be able to solve systems of equations
- Students will be able to identify and write equations using direct, inverse and joint variation

In this unit plan, the following 21<sup>st</sup> Century themes and skills are addressed.

<i>Check all that apply.</i> <b>21<sup>st</sup> Century Themes</b>		<i>Indicate whether these skills are E-Encouraged, T-Taught, or A-Assessed in this unit by marking E, T, A on the line before the appropriate skill.</i> <b>21<sup>st</sup> Century Skills</b>	
X	<b>Global Awareness</b>	E,T	<b>Creativity and Innovation</b>
	<b>Environmental Literacy</b>	E,T ,A	<b>Critical Thinking and Problem Solving</b>
	<b>Health Literacy</b>	E,T	<b>Communication</b>
	<b>Civic Literacy</b>	E	<b>Collaboration</b>
X	<b>Financial, Economic, Business, and Entrepreneurial Literacy</b>		

**Student Learning Targets/Objectives (Students will know/Students will understand)**

- Students will be able to graph linear relationships in two variables.
- Students will understand the concept of 'rate of change' as it applies to linear relationships
- Students will be able to identify independent and dependent variables in real life problems
- Students will be able to solve systems of equations
- Students will be able to identify and write equations using direct, inverse and joint variation.

### Assessments (Pre, Formative, Summative, Other)

*Denote required common assessments with an \**

Tests/Quizzes

Clickers

Communicators

Benchmarks (Quarterly and Midterm/Final Exams)

Journaling

Project

### Teaching and Learning Activities

<i>Activities</i>	<p><b><u>Instructional Strategies</u></b></p> <p>Students can develop a better understanding of slope using the following activity:  <a href="http://www.utdanacenter.org/mathtoolkit/downloads/activities/alg1/alg1_linear">http://www.utdanacenter.org/mathtoolkit/downloads/activities/alg1/alg1_linear</a>          Walk the plank: <a href="http://illuminations.nctm.org/LessonDetail.aspx?id=L682">http://illuminations.nctm.org/LessonDetail.aspx?id=L682</a></p> <p>Slope Calculation:  <a href="http://www.explorelearning.com/index.cfm?method=cResource.dspDetail&amp;ResourceID=87">http://www.explorelearning.com/index.cfm?method=cResource.dspDetail&amp;ResourceID=87</a></p> <p>Point-slope form of a line  <a href="http://www.explorelearning.com/index.cfm?method=cResource.dspDetail&amp;ResourceID=79">http://www.explorelearning.com/index.cfm?method=cResource.dspDetail&amp;ResourceID=79</a></p> <p>Slope-intercept form  <a href="http://www.explorelearning.com/index.cfm?method=cResource.dspDetail&amp;ResourceID=88">http://www.explorelearning.com/index.cfm?method=cResource.dspDetail&amp;ResourceID=88</a></p> <p>Slope slider  <a href="http://www.shodor.org/interactivate/activities/slopeslider/index.html">http://www.shodor.org/interactivate/activities/slopeslider/index.html</a></p>
<i>Differentiation Strategies</i>	Applets, software, and graphing calculators will be used throughout the course. Students will work independently and collaboratively.
<i>Honors</i>	Honors level class.

### Resources

- **Instructional Notes:**  
 Interpret the structure of expressions  
 \*A.SSE.1: Focus on linear, quadratic, and an introduction to exponential expressions.  
 \*\*A.SSE.2: Focus on polynomial expressions.
- **Instructional Resources/Tool**  
 TI-83/84 and TI emulator  
[www.ExploreLearning.com](http://www.ExploreLearning.com)  
 NCTM Navigating through Data Analysis 9 - 12  
 Geometer's Sketchpad

**Wayne School District  
Curriculum Format**

<b>Content Area/ Grade Level/ Course:</b>	Mathematics 9 Unified Mathematics 3- Honors
<b>Unit Plan Title:</b>	Unit 3: Similarity and Proof
<b>Time Frame</b>	20 days
<b>Anchor Standards/Domain*    *i.e: ELA: reading, writing i.e.: Math: Algebra</b>	
G-SRT: Geometry -Similarity, Right Triangles, and Trigonometry G-MG: Geometry - Modeling with Geometry G-CO: Geometry – Congruence G-PE: Geometry - Expressing Geometric Properties with Equations	
<b>Unit Overview</b>	
<p>Students apply their earlier experience with dilations and proportional reasoning to build formal understanding of similarity using transformations. They identify criteria for similarity of triangles, use similarity to solve problems, and apply similarity in right triangles to understand right triangle trigonometry, with particular attention to special right triangles and the Pythagorean theorem. Coordinate geometry will be used to prove geometric theorems as will formal proof.</p>	
<b>Standard Number(s)    * i.e: Math: F.LE.A.4    i.e.: NJLSA.R4.</b>	
<ul style="list-style-type: none"> <li>● G.GPE.6 Find the point on a directed line segment between two given points that partitions the segment in a given ratio.</li> <li>● G.SRT.1 Verify experimentally the properties of dilations given by a center and a scale factor               <ol style="list-style-type: none"> <li>a. A 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.</li> <li>b. The dilation of a line segment is longer or shorter in the ratio given by the scale factor.</li> </ol> </li> </ul>	

- G.SRT.2 Given two figures, use the definition of similarity in terms of similarity transformations to decide if they are similar; explain using similarity transformations the meaning of similarity for triangles as the equality of all corresponding pairs of angles and the proportionality of all corresponding pairs of sides.
- G.SRT.3 Use the properties of similarity transformations to establish the AA criterion for two triangles to be similar.
- G.CO.10 Prove theorems about triangles. *Theorems include: measures of interior angles of a triangle sum to 180°; base angles of isosceles triangles are congruent; the segment joining midpoints of two sides of a triangle is parallel to the third side and half the length; the medians of a triangle meet at a point.*
- G.SRT.4 Prove theorems about triangles. *Theorems include: a line parallel to one side of a triangle divides the other two proportionally, and conversely; the Pythagorean Theorem proved using triangle similarity*
- G.SRT.5 Use congruence and similarity criteria for triangles to solve problems and to prove relationships in geometric figures.
- G.SRT.6 Understand that by similarity, side ratios in right triangles are properties of the angles in the triangle, leading to definitions of trigonometric ratios for acute angles.
- G.SRT.7 Explain and use the relationship between the sine and cosine of complementary angles.
- G.SRT.8 Use trigonometric ratios and the Pythagorean Theorem to solve right triangles in applied problems.
- 8.1.12.DA.5: Create data visualizations from large data sets to summarize, communicate, and support different interpretations of real-world phenomena.
- 8.1.12.DA.6: Create and refine computational models to better represent the relationships among different elements of data collected from a phenomenon or process.
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- CRP2. Apply appropriate academic and technical skills.
- CRP4. Communicate clearly and effectively and with reason.
- CRP8. Utilize critical thinking to make sense of problems and persevere in solving them.
- CRP11. Use technology to enhance productivity.
- CRP12. Work productively in teams while using cultural global competence.

### Intended Outcomes - {Essential Questions}

- What does it mean for one figure to be similar to another?
- How will rigid and non-rigid transformations affect a figure?

- How do the area and perimeter of two similar figures relate?
- How do you change a figure's size without changing its shape?
- How do you identify corresponding parts of similar triangles?
- How do you find a side length or angle measure in a right triangle?
- How do trigonometric ratios relate to similar right triangles?
- How do you solve problems that involve measurements of triangles?

### Enduring Understandings

- Similar and congruent geometric figures have proportional attributes.

In this unit plan, the following 21<sup>st</sup> Century themes and skills are addressed.

Check all that apply. 21 <sup>st</sup> Century Themes		Indicate whether these skills are <b>E</b> -Encouraged, <b>T</b> -Taught, or <b>A</b> -Assessed in this unit by marking <b>E, T, A</b> on the line before the appropriate skill. 21 <sup>st</sup> Century Skills	
X	Global Awareness	E	Creativity and Innovation
	Environmental Literacy	E,T ,A	Critical Thinking and Problem Solving
	Health Literacy	E,T ,A	Communication
	Civic Literacy	E	Collaboration
	Financial, Economic, Business, and Entrepreneurial Literacy		

### Student Learning Targets/Objectives (Students will know/Students will understand)

- Students will understand and prove theorems involving similarity.
- Students will understand similarity in terms of non-rigid transformations
- Students will understand the difference between rigid and non-rigid transformations
- Students will be able to use the rectangular coordinate plane as a tool for proving geometric theorems.
- Students will apply properties of similarity to real life situations
- Students will apply scale factors and set up and solve proportions

### Assessments (Pre, Formative, Summative, Other)

*Denote required common assessments with an \**

Tests/Quizzes  
 Clickers  
 Communicators  
 Benchmarks (Quarterly and Midterm/Final Exams)  
 Journaling  
 Project

### Teaching and Learning Activities

*Activities*

Instructional Strategies

	<ul style="list-style-type: none"> <li>• Similarity and transformations <a href="http://www.explorelearning.com/index.cfm?method=cResource.dspResourcesForCourse&amp;CourseID=260">http://www.explorelearning.com/index.cfm?method=cResource.dspResourcesForCourse&amp;CourseID=260</a></li> <li>• Gizmos on Dilations, Reflections, Rotations, Similar Figures/Polygons, and Similarity in Right Triangles</li> <li>• Demonstrations on Similarity and Transformations using Geometers SketchPad</li> </ul>
<i>Differentiation Strategies</i>	Applets, software, and graphing calculators will be used throughout the course. Students will work independently and collaboratively
<i>Honors</i>	Honors level class.

## Resources

### **Instructional Resources/Tools**

TI-83/84 and TI emulator  
 Geometer's Sketchpad  
 Google Sketch up  
 www.ExploreLearning.com

<b>Content Area/ Grade Level/ Course:</b>	<b>Mathematics 9 Unified Mathematics 3 - Honors</b>
<b>Unit Plan Title:</b>	<b>Unit 4: Quadratics, Rational, and Exponential Functions</b>
<b>Time Frame</b>	20 days
<b>Anchor Standards/Domain*    *i.e: ELA: reading, writing i.e.: Math: Algebra</b>	
S.N.CN: Number and HQuantity – The Complex Number System HS.A.SSE: Algebra – Seeing Structure in Expressions HS.A.REI: Algebra – Reasoning with Equations and Inequalities HS.A.APR: Algebra - Arithmetic with Polynomials & Rational Expressions HS.F.IF: Functions – Interpreting Functions	
<b>Unit Overview</b>	
<p>Students will be able to graph and write quadratic functions in several forms. They will be able to solve quadratic equations and inequalities using a variety of methods, and perform operations involving square roots and complex numbers. In addition, students will be able to use rational exponents, perform function operations as well as find the composition of functions, and find inverse functions. They will also be able to graph radical functions and solve radical equations.</p>	
<b>Standard Number(s)    * i.e: Math: F.LE.A.4    i.e.: NJLSA.R4.</b>	
<ul style="list-style-type: none"> <li>● N.CN.7 Solve quadratic equations with real coefficients that have complex solutions.</li> <li>● N.CN.9 (+) Know the Fundamental Theorem of Algebra; show that it is true for quadratic polynomials</li> <li>● A.SSE.1 Interpret expressions that represent a quantity in terms of its context. ★ <ul style="list-style-type: none"> <li>● a. Interpret parts of an expression, such as terms, factors, and coefficients.</li> <li>● b. Interpret complicated expressions by viewing one or more of their parts as a single entity. For example, interpret <math>P(1+r)^n</math> as the product of <math>P</math> and a factor not depending on <math>P</math>.</li> </ul> </li> <li>● A.SSE.2 Use the structure of an expression to identify ways to rewrite it. For example, see <math>x^4 - y^4</math> as <math>(x^2)^2 - (y^2)^2</math>, thus recognizing it as a difference of squares that can be factored as <math>(x^2 - y^2)(x^2 + y^2)</math>.</li> <li>● A.APR.1 Understand that polynomials form a system analogous to the integers, namely, they are closed under the operations of addition, subtraction, and multiplication; add, subtract, and multiply polynomials.</li> <li>● A.REI.4 Solve quadratic equations in one variable. <ul style="list-style-type: none"> <li>● a. Use the method of completing the square to transform any quadratic equation in <math>x</math> into an equation of the form <math>(x - p)^2 = q</math> that has the same solutions. Derive the quadratic formula from this form.</li> <li>● b. Solve quadratic equations by inspection (e.g., for <math>x^2 = 49</math>), taking square roots, completing the square, the quadratic formula and factoring, as appropriate to the initial form of the equation. Recognize when the quadratic formula gives complex solutions and write them as <math>a \pm bi</math> for real numbers <math>a</math> and <math>b</math>.</li> </ul> </li> <li>● A.REI.7 Solve a simple system consisting of a linear equation and a quadratic equation in two variables algebraically and graphically. For example, find the points of intersection between the line <math>y = -3x</math> and the circle <math>x^2 + y^2 = 3</math>.</li> <li>● F.IF.4 For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity. ★</li> <li>● F.IF.5 Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes. For example, if the function <math>h(n)</math> gives the number of person-hours it takes to assemble <math>n</math> engines in a factory, then the positive integers would be an appropriate domain for the function. ★</li> </ul>	

- F.IF.6 Calculate and interpret the average rate of change of a function (presented symbolically or as a table) over a specified interval. Estimate the rate of change from a graph. ★
- 8.1.12.DA.5: Create data visualizations from large data sets to summarize, communicate, and support different interpretations of real-world phenomena.
- 8.1.12.DA.6: Create and refine computational models to better represent the relationships among different elements of data collected from a phenomenon or process.
- 8.1.12.AP.1: Design algorithms to solve computational problems using a combination of original and existing algorithms.
- 9.1.12.PB.2: Prioritize financial decisions by considering alternatives and possible consequences.
- 9.2.12.CAP.4: Evaluate different careers and develop various plans (e.g., costs of public, private, training schools) and timetables for achieving them, including educational/training requirements, costs, loans, and debt repayment.
- 9.4.12.CI.1: Demonstrate the ability to reflect, analyze, and use creative skills and ideas (e.g., 1.1.12.prof.CR3a).
- 9.4.12.CT.2: Explain the potential benefits of collaborating to enhance critical thinking and problem solving (e.g., 1.3E.12 prof.CR3.a)
- 9.4.12.IML.3: Analyze data using tools and models to make valid and reliable claims, or to determine optimal design solutions (e.g., S-ID.B.6a., 8.1.12.DA.5, 7.1.IH.IPRET.8)
- 9.4.12.TL.1: Assess digital tools based on features such as accessibility options, capacities, and utility for accomplishing a specified task (e.g., W.11-12.6.).
- RST.9-10.3./RST.11-12.3. Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks, attending to special cases or exceptions defined in the text.
- RST.9-10.7. Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words.
- RST.9-10.4. Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 9-10 texts and topics.
- CRP2. Apply appropriate academic and technical skills.
- CRP4. Communicate clearly and effectively and with reason.
- CRP8. Utilize critical thinking to make sense of problems and persevere in solving them.
- CRP11. Use technology to enhance productivity.
- CRP12. Work productively in teams while using cultural global competence.

### Intended Outcomes - {Essential Questions}

- Why is the Zero-Product Property important in solving quadratic equations?
- How can maximums and minimums of equations be found using the graph? From an equation?
- Why is a common denominator needed to add or subtract rational expressions?
- What is the difference between linear, quadratic and exponential growth?

### Enduring Understandings

- Students will be able to perform arithmetic operations on rational expressions.
- Students will be able to solve equations and inequalities in one variable.
- Solve systems of equations involving quadratic and linear equations.
- Students will be able to identify intervals of a graph where the graph is positive / negative and increasing / decreasing.
- Students will be able to interpret functions that arise in applications in terms of a context.



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In this unit plan, the following 21<sup>st</sup> Century themes and skills are addressed.

<i>Check all that apply.</i> <b>21<sup>st</sup> Century Themes</b>		<i>Indicate whether these skills are E-Encouraged, T-Taught, or A-Assessed in this unit by marking E, T, A on the line before the appropriate skill.</i> <b>21<sup>st</sup> Century Skills</b>	
	<b>Global Awareness</b>	E	<b>Creativity and Innovation</b>
	<b>Environmental Literacy</b>	E,T ,A	<b>Critical Thinking and Problem Solving</b>
	<b>Health Literacy</b>		<b>Communication</b>
	<b>Civic Literacy</b>	E,T ,A	<b>Collaboration</b>
X	<b>Financial, Economic, Business, and Entrepreneurial Literacy</b>		

**Student Learning Targets/Objectives (Students will know/Students will understand)**

- Factor quadratic expressions
- Solve quadratic equations and inequalities
- Graph quadratic equations and inequalities
- Perform arithmetic operations with complex numbers
- Perform arithmetic operations with rational expressions
- Use complex numbers in polynomial identities and equations
- Use properties of exponents
- Solve basic exponential equations

**Assessments (Pre, Formative, Summative, Other)**

*Denote required common assessments with an \**

- Tests/Quizzes
- Clickers
- Communicators
- Benchmarks (Quarterly and Midterm/Final Exams)
- Journaling
- Project

**Teaching and Learning Activities**

<i>Activities</i>	<p><b>Instructional Strategies</b></p> <p>Quadratic Lab:  <a href="http://stargazers.gsfc.nasa.gov/pdf/activities/math_activities/math_student/math_act_09_s.pdf">http://stargazers.gsfc.nasa.gov/pdf/activities/math_activities/math_student/math_act_09_s.pdf</a>            (student)  <a href="http://stargazers.gsfc.nasa.gov/pdf/activities/math_activities/math_teacher/math_act_09_t.pdf">http://stargazers.gsfc.nasa.gov/pdf/activities/math_activities/math_teacher/math_act_09_t.pdf</a>            (teacher)</p>
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	<p>Using the graphing calculator:  <a href="http://mathbits.com/mathbits/tisection/Algebra2/quadratic-equations.htm">http://mathbits.com/mathbits/tisection/Algebra2/quadratic-equations.htm</a></p> <p>Interactive Applet:  <a href="http://www.mathwarehouse.com/quadratic/parabola/interactive-parabola.php">http://www.mathwarehouse.com/quadratic/parabola/interactive-parabola.php</a></p> <p>Interactive Gizmos:  <a href="http://www.explorellearning.com/index.cfm?method=cSearch.actDoSearch&amp;NewSearch=1&amp;uncompiledQuery=quadratics">http://www.explorellearning.com/index.cfm?method=cSearch.actDoSearch&amp;NewSearch=1&amp;uncompiledQuery=quadratics</a></p>
<i>Differentiation Strategies</i>	Applets, software, and graphing calculators will be used throughout the course. Students will work independently and collaboratively
<i>Honors</i>	Honors level course.
<b>Resources</b>	
<b>Instructional Resources/Tools</b>	
TI-83/84 and TI emulator www.ExploreLearning.com NCTM Navigating through Data Analysis 9-12.	

**Wayne School District  
Curriculum Format**

<b>Content Area/ Grade Level/ Course:</b>	<b>Mathematics</b> <b>9</b> <b>Unified Mathematics 3- Honors</b>
<b>Unit Plan Title:</b>	<b>Unit 5: Quadrilaterals</b>
<b>Time Frame</b>	20 days
<b>Anchor Standards/Domain*    *i.e: ELA: reading, writing i.e.: Math: Algebra</b>	
G.CO: Geometry – Congruence G.GPE: Geometry - Expressing Geometric Properties with Equations S.CP: Statistics – Conditional Probability G. MG: Geometry – Modeling with Geometry	
<b>Unit Overview</b>	
Students will prove geometric theorems dealing with polygons and quadrilaterals, and will use coordinates to prove simple geometric theorems algebraically. In addition, they will extend that knowledge as they apply probability to geometry. Students will understand independence and conditional probability and use them to interpret data and to compute probabilities of compound events in a uniform probability model.	

- G.CO.11 Prove theorems about parallelograms. *Theorems include: opposite sides are congruent, opposite angles are congruent, the diagonals of a parallelogram bisect each other, and conversely, rectangles are parallelograms with congruent diagonals.*
- G.GPE.4 Use coordinates to prove simple geometric theorems algebraically. For example, prove or disprove that a figure defined by four given points in the coordinate plane is a rectangle; prove or disprove that the point  $(1, \sqrt{3})$  lies on the circle centered at the origin and containing the point  $(0, 2)$ .
- G.GPE.5 Prove the slope criteria for parallel and perpendicular lines and use them to solve geometric problems. (e.g. find the equation of a line parallel or perpendicular to a given line that passes through a given point)
- G.GPE.7 Use coordinates to compute perimeters of polygons and areas of triangles and rectangles, e.g., using the distance formula.
- G.MG.2 Apply concepts of density based on area and volume in modeling situations (e.g., persons per square mile, BTUs per cubic foot). ★
- S.CP.1 Describe events as subsets of a sample space (the set of outcomes) using characteristics (or categories) of the outcomes, or as unions, intersections, or complements of other events (“or,” “and,” “not”)
- S.CP.2 Understand that two events  $A$  and  $B$  are independent if the probability of  $A$  and  $B$  occurring together is the product of their probabilities, and use this characterization to determine if they are independent.
- S.CP.3 Understand the conditional probability of  $A$  given  $B$  as  $P(A \text{ and } B)/P(B)$ , and interpret independence of  $A$  and  $B$  as saying that the conditional probability of  $A$  given  $B$  is the same as the probability of  $A$ , and the conditional probability of  $B$  given  $A$  is the same as the probability of  $B$
- S.CP.4 Construct and interpret two-way frequency tables of data when two categories are associated with each object being classified. Use the two-way table as a sample space to decide if events are independent and to approximate conditional probabilities. *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.*
- S.CP.5 Recognize and explain the concepts of conditional probability and independence in everyday language and everyday situations. *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.*
- S.CP.6 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.
- S.CP.7 Apply the Addition Rule,  $P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)$ , and interpret the answer in terms of the model.
- S.CP.8 (+) Apply the general Multiplication Rule in a uniform probability model,  $P(A \text{ and } B) = P(A)P(B|A) = P(B)P(A|B)$ , and interpret the answer in terms of the model
- 8.1.12.DA.5: Create data visualizations from large data sets to summarize, communicate, and support different interpretations of real-world phenomena.
- 8.1.12.DA.6: Create and refine computational models to better represent the relationships among different elements of data collected from a phenomenon or process.
- 8.1.12.AP.1: Design algorithms to solve computational problems using a combination of original and existing algorithms.
- 9.1.12.PB.2: Prioritize financial decisions by considering alternatives and possible consequences.
- 9.2.12.CAP.4: Evaluate different careers and develop various plans (e.g., costs of public, private, training schools) and timetables for achieving them, including educational/training requirements, costs, loans, and debt repayment.
- 9.4.12.CI.1: Demonstrate the ability to reflect, analyze, and use creative skills and ideas (e.g., 1.1.12prof.CR3a).
- 9.4.12.CT.2: Explain the potential benefits of collaborating to enhance critical thinking and problem solving (e.g., 1.3E.12 prof.CR3.a)
- 9.4.12.IML.3: Analyze data using tools and models to make valid and reliable claims, or to determine optimal design solutions (e.g., S-ID.B.6a., 8.1.12.DA.5, 7.1.IH.IPRET.8)

- 9.4.12.TL.1: Assess digital tools based on features such as accessibility options, capacities, and utility for accomplishing a specified task (e.g., W.11-12.6.).
- RST.9-10.3./RST.11-12.3. Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks, attending to special cases or exceptions defined in the text.
- RST.9-10.7. Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words.
- RST.9-10.4. Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 9-10 texts and topics.
- CRP2. Apply appropriate academic and technical skills.
- CRP4. Communicate clearly and effectively and with reason.
- CRP8. Utilize critical thinking to make sense of problems and persevere in solving them.
- CRP11. Use technology to enhance productivity.
- CRP12. Work productively in teams while using cultural global competence.

### Intended Outcomes - {Essential Questions}

- Why is being able to calculate areas and perimeters useful?
- How can probability relate to the idea of area inside of geometric figures?

### Enduring Understandings

- Concepts and formulas of area are related to geometric probability and can help develop informed decisions and predictions.

### In this unit plan, the following 21<sup>st</sup> Century themes and skills are addressed.

Check all that apply. 21 <sup>st</sup> Century Themes		Indicate whether these skills are E-Encouraged, T-Taught, or A-Assessed in this unit by marking E, T, A on the line before the appropriate skill.	21 <sup>st</sup> Century Skills
X	Global Awareness	A, T,E	Creativity and Innovation
X	Environmental Literacy	A, T,E	Critical Thinking and Problem Solving
	Health Literacy	E,T	Communication
X	Civic Literacy	E,T	Collaboration
X	Financial, Economic, Business, and Entrepreneurial Literacy		

### Student Learning Targets/Objectives (Students will know/Students will understand)

- Students will be able to find the area and perimeter of polygons.
- Students will be able to find probabilities dealing with polygons shapes.

### Assessments (Pre, Formative, Summative, Other)

*Denote required common assessments with an \**

Tests/Quizzes  
Clickers  
Communicators

Benchmarks (Quarterly and Midterm/Final Exams)

Journaling

Project

### Teaching and Learning Activities

<i>Activities</i>	<b><u>Instructional Strategies</u></b>  M&M Lab: <a href="http://www.oercommons.org/courses/probability-topics-probability-lab/view">http://www.oercommons.org/courses/probability-topics-probability-lab/view</a>
<i>Differentiation Strategies</i>	Applets, software, and graphing calculators will be used throughout the course. Students will work independently and collaboratively.
<i>Honors</i>	Honors level course.

### Resources

#### **Instructional Resources/Tools**

TI-83/84 and TI emulator

Geometer's Sketchpad

Google Sketch up

NCTM Navigating through Data Analysis 9-12.

## Wayne School District Curriculum Format

<b>Content Area/ Grade Level/ Course:</b>	Mathematics 9 Unified Mathematics 3
<b>Unit Plan Title:</b>	Unit 6: Polynomials
<b>Time Frame</b>	20 days
<b>Anchor Standards/Domain*    *i.e: ELA: reading, writing i.e.: Math: Algebra</b>	
A.SSE: Algebra – Seeing Structure in Expressions A.APR: Algebra – Arithmetic with Polynomials and Rational Expressions N.CN: Number and Quantity – Complex Numbers	
<b>Unit Overview</b>	
Perform arithmetic operations with complex numbers Use complex numbers in polynomial identities and equations Interpret the structure of expressions Write expressions in equivalent forms to solve problems Perform arithmetic operations on polynomials	
<b>Standard Number(s)    * i.e: Math: F.LE.A.4    i.e.: NJLSA.R4.</b>	
<ul style="list-style-type: none"> <li>● A.SSE.1 Interpret expressions that represent a quantity in terms of its context. ★ <ul style="list-style-type: none"> <li>a. Interpret parts of an expression, such as terms, factors, and coefficients.</li> <li>b. Interpret complicated expressions by viewing one or more of their parts as a single entity. <i>For example, interpret <math>P(1+r)^n</math> as the product of <math>P</math> and a factor not depending on <math>P</math>.</i></li> </ul> </li> <li>● A.SSE.2 Use the structure of an expression to identify ways to rewrite it. <i>For example, see <math>x^4 - y^4</math> as <math>(x^2)^2 - (y^2)^2</math>, thus recognizing it as a difference of squares that can be factored as <math>(x^2 - y^2)(x^2 + y^2)</math>.</i></li> <li>● A.APR.1 Understand that polynomials form a system analogous to the integers, namely, they are closed under the operations of addition, subtraction, and multiplication; add, subtract, and multiply polynomials.</li> <li>● A.APR.2 Know and apply the Remainder Theorem: For a polynomial <math>p(x)</math> and a number <math>a</math>, the remainder on division by <math>x - a</math> is <math>p(a)</math>, so <math>p(a) = 0</math> if and only if <math>(x - a)</math> is a factor of <math>p(x)</math>.</li> <li>● A.APR.3 Identify zeros of polynomials when suitable factorizations are available, and use the zeros to construct a rough graph of the function defined by the polynomial.</li> <li>● N.CN.1 Know there is a complex number <math>i</math> such that <math>i^2 = -1</math>, and every complex number has the form <math>a + bi</math> with <math>a</math> and <math>b</math> real.</li> <li>● N.CN.2 Use the relation <math>i^2 = -1</math> and the commutative, associative, and distributive properties to add, subtract, and multiply complex numbers.</li> <li>● N.CN.7 Solve quadratic equations with real coefficients that have complex solutions.</li> <li>● N.CN.9 (+) Know the Fundamental Theorem of Algebra; show that it is true for quadratic polynomials.</li> <li>● 8.1.12.DA.5: Create data visualizations from large data sets to summarize, communicate, and support different interpretations of real-world phenomena.</li> <li>● 8.1.12.DA.6: Create and refine computational models to better represent the relationships among different elements of data collected from a phenomenon or process.</li> </ul>	

- 8.1.12.AP.1: Design algorithms to solve computational problems using a combination of original and existing algorithms.
- 9.1.12.PB.2: Prioritize financial decisions by considering alternatives and possible consequences.
- 9.2.12.CAP.4: Evaluate different careers and develop various plans (e.g., costs of public, private, training schools) and timetables for achieving them, including educational/training requirements, costs, loans, and debt repayment.
- 9.4.12.CI.1: Demonstrate the ability to reflect, analyze, and use creative skills and ideas (e.g., 1.1.12prof.CR3a).
- 9.4.12.CT.2: Explain the potential benefits of collaborating to enhance critical thinking and problem solving (e.g., 1.3E.12 prof.CR3.a)
- 9.4.12.IML.3: Analyze data using tools and models to make valid and reliable claims, or to determine optimal design solutions (e.g., S-ID.B.6a., 8.1.12.DA.5, 7.1.IH.IPRET.8)
- 9.4.12.TL.1: Assess digital tools based on features such as accessibility options, capacities, and utility for accomplishing a specified task (e.g., W.11-12.6.).
- RST.9-10.3./RST.11-12.3. Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks, attending to special cases or exceptions defined in the text.
- RST.9-10.7. Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words.
- RST.9-10.4. Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 9-10 texts and topics.
- CRP2. Apply appropriate academic and technical skills.
- CRP4. Communicate clearly and effectively and with reason.
- CRP8. Utilize critical thinking to make sense of problems and persevere in solving them.
- CRP11. Use technology to enhance productivity.
- CRP12. Work productively in teams while using cultural global competence.

### Intended Outcomes - {Essential Questions}

- Why do we use numbers, what are their properties, and how does our number system function?
- Why do we use estimation and when is it appropriate?
- What makes a strategy effective and efficient and the solution reasonable?
- How do numbers relate and compare to one another?

### Enduring Understandings

- **Mathematical models help us understand the meaning of data and make predictions.**

**In this unit plan, the following 21<sup>st</sup> Century themes and skills are addressed.**

<i>Check all that apply.</i> <b>21<sup>st</sup> Century Themes</b>		<i>Indicate whether these skills are E-Encouraged, T-Taught, or A-Assessed in this unit by marking E, T, A on the line before the appropriate skill.</i> <b>21<sup>st</sup> Century Skills</b>	
	<b>Global Awareness</b>	E,T ,A	<b>Creativity and Innovation</b>
	<b>Environmental Literacy</b>	E,T ,A	<b>Critical Thinking and Problem Solving</b>
	<b>Health Literacy</b>	E,T	<b>Communication</b>
	<b>Civic Literacy</b>	E,T	<b>Collaboration</b>
X	<b>Financial, Economic, Business, and Entrepreneurial Literacy</b>		

**Student Learning Targets/Objectives (Students will know/Students will understand)**

- Perform arithmetic operations with complex numbers
- Use complex numbers in polynomial identities and equations
- Interpret the structure of expressions
- Write expressions in equivalent forms to solve problems
- Perform arithmetic operations on polynomials
- Understand the relationship between zeros and factors of polynomials
- Factor polynomials over rational, real and complex numbers.
- Analyze end behavior of a polynomial function

**Assessments (Pre, Formative, Summative, Other)**

*Denote required common assessments with an \**

Tests/Quizzes  
 Clickers  
 Communicators  
 Benchmarks (Quarterly and Midterm/Final Exams)  
 Journaling  
 Project

**Teaching and Learning Activities**

<i>Activities</i>	<b><u>Instructional Strategies</u></b>
<i>Differentiation Strategies</i>	Applets, software, and graphing calculators will be used throughout the course. Students will work independently and collaboratively
<i>Honors</i>	Honors level course.

**Resources**

**Instructional Resources/Tools**

TI-83/84 and TI emulator  
[www.ExploreLearning.com](http://www.ExploreLearning.com)



NCTM Navigating through Data Analysis 9-12.

**Wayne School District  
Curriculum Format**

<b>Content Area/ Grade Level/ Course:</b>	Mathematics 9 Unified Mathematics 3- Honors
<b>Unit Plan Title:</b>	Unit 7: Trigonometry
<b>Time Frame</b>	20 days
<b>Anchor Standards/Domain*</b>	<b>*i.e: ELA: reading, writing i.e.: Math: Algebra</b>
	G.SRT: Geometry – Similarity, Right Triangles, and Trigonometry
<b>Unit Overview</b>	
	Define trigonometric ratios of sine, cosine and tangent

Solve problems involving right triangles

Use angle angles of elevation and depression to find real world measures

**Standard Number(s) \* i.e: Math: F.LE.A.4 i.e.: NJLSA.R4.**

- G.SRT.6 Understand that by similarity, side ratios in right triangles are properties of the angles in the triangle, leading to definitions of trigonometric ratios for acute angles.
- G.SRT.7 Explain and use the relationship between the sine and cosine of complementary angles.
- G.SRT.8 Use trigonometric ratios and the Pythagorean Theorem to solve right triangles in applied problems.
- CRP2. Apply appropriate academic and technical skills.
- CRP4. Communicate clearly and effectively and with reason.
- CRP8. Utilize critical thinking to make sense of problems and persevere in solving them.
- CRP11. Use technology to enhance productivity.
- CRP12. Work productively in teams while using cultural global competence.
- 8.1.12.DA.5: Create data visualizations from large data sets to summarize, communicate, and support different interpretations of real-world phenomena.
- 8.1.12.DA.6: Create and refine computational models to better represent the relationships among different elements of data collected from a phenomenon or process.
- 8.1.12.AP.1: Design algorithms to solve computational problems using a combination of original and existing algorithms.
- 9.1.12.PB.2: Prioritize financial decisions by considering alternatives and possible consequences.
- 9.2.12.CAP.4: Evaluate different careers and develop various plans (e.g., costs of public, private, training schools) and timetables for achieving them, including educational/training requirements, costs, loans, and debt repayment.
- 9.4.12.CI.1: Demonstrate the ability to reflect, analyze, and use creative skills and ideas (e.g., 1.1.12prof.CR3a).
- 9.4.12.CT.2: Explain the potential benefits of collaborating to enhance critical thinking and problem solving (e.g., 1.3E.12 prof.CR3.a)
- 9.4.12.IML.3: Analyze data using tools and models to make valid and reliable claims, or to determine optimal design solutions (e.g., S-ID.B.6a., 8.1.12.DA.5, 7.1.IH.IPRET.8)
- 9.4.12.TL.1: Assess digital tools based on features such as accessibility options, capacities, and utility for accomplishing a specified task (e.g., W.11-12.6.).
- RST.9-10.3./RST.11-12.3. Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks, attending to special cases or exceptions defined in the text.
- RST.9-10.7. Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words.
- RST.9-10.4. Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 9-10 texts and topics.

**Intended Outcomes - {Essential Questions}**

- Why do the trigonometric ratios apply to any right triangle, regardless of its size?
- How are trigonometric inverses used to help find measures in a right triangle?
- How do trigonometric ratios relate to similar right triangles?

## Enduring Understandings

- Students will know the special relationships between the sides and angles of right triangles.
- Students will be able to recognize that trigonometry is a useful and necessary mathematical practice that can be applied to many real world circumstances.

## In this unit plan, the following 21<sup>st</sup> Century themes and skills are addressed.

Check all that apply. 21 <sup>st</sup> Century Themes		Indicate whether these skills are E-Encouraged, T-Taught, or A-Assessed in this unit by marking E, T, A on the line before the appropriate skill. 21 <sup>st</sup> Century Skills	
X	Global Awareness	A, T,E	Creativity and Innovation
X	Environmental Literacy	A, T,E	Critical Thinking and Problem Solving
	Health Literacy	E,T	Communication
	Civic Literacy	E,T	Collaboration
	Financial, Economic, Business, and Entrepreneurial Literacy		

## Student Learning Targets/Objectives (Students will know/Students will understand)

- How do trigonometric ratios relate to similar right triangles?
- Students will simplify radicals
- Students will understand how to solve right triangles
- Students will apply knowledge to real life situations involving angles of elevation and depression.
- Students will apply Pythagorean identities

## Assessments (Pre, Formative, Summative, Other)

*Denote required common assessments with an \**

Tests/Quizzes

Clickers

Communicators

Benchmarks (Quarterly and Midterm/Final Exams)

Journaling

\*Flagpole Project – Students will craft a clinometer and use it to approximate the height of several tall objects around the school.

## Teaching and Learning Activities

*Activities*

### Instructional Strategies

Students will use clinometers to approximate the height of real life objects around the school. They will use both trigonometry and similar triangles to solve problems.

- Right triangle trigonometry

<http://www.explorelearning.com/index.cfm?method=cResource.dspResourcesForCourse&CourseID=261>

Gizmos on Trigonometric Ratios (Sine and Cosine Ratios, Tangent Ratio)

<i>Differentiation Strategies</i>	Applets, software, and graphing calculators will be used throughout the course. Students will work independently and collaboratively.
<i>Honors</i>	Honors level course.
<b>Resources</b>	
<b><u>Instructional Resources/Tools</u></b> TI-83/84 and TI emulator Geometer's Sketchpad, Google Sketch Up	

**Wayne School District  
Curriculum Format**

<b>Content Area/ Grade Level/ Course:</b>	Mathematics 9 Unified Mathematics 3- Honors
<b>Unit Plan Title:</b>	Unit 8: Circles
<b>Time Frame</b>	20 days
<b>Anchor Standards/Domain*    *i.e: ELA: reading, writing i.e.: Math: Algebra</b>	
G.C – Geometry : Circles G.CO – Geometry: Congruence	
<b>Unit Overview</b>	
Understand and apply theorems about circles Area and Circumference Revise geometric probability	
<b>Standard Number(s)    * i.e: Math: F.LE.A.4    i.e.: NJSLSA.R4.</b>	
<ul style="list-style-type: none"> <li>● G.CO.1 Know precise definitions of angle, circle, perpendicular line, parallel line, and line segment, based on the undefined notions of point, line, distance along a line, and distance around a circular arc.</li> <li>● G.C.1 Prove that all circles are similar</li> <li>● G.C.2 Identify and describe relationships among inscribed angles, radii, and chords. Include the relationship between central, inscribed, and circumscribed angles; inscribed angles on a diameter are right angles; the radius of a circle is perpendicular to the tangent where the radius intersects the circle.</li> <li>● G.C.3 Construct the inscribed and circumscribed circles of a triangle, and prove properties of angles for a quadrilateral inscribed in a circle</li> <li>● G.C.4 Construct a tangent line from a point outside a given circle to the circle.</li> <li>● G.GPE.1 Derive the equation of a circle of given center and radius using the Pythagorean Theorem; complete the square to find the center and radius of a circle given by an equation.</li> <li>● 8.1.12.DA.5: Create data visualizations from large data sets to summarize, communicate, and support different interpretations of real-world phenomena.</li> <li>● 8.1.12.DA.6: Create and refine computational models to better represent the relationships among</li> </ul>	

- different elements of data collected from a phenomenon or process.
- 8.1.12.AP.1: Design algorithms to solve computational problems using a combination of original and existing algorithms.
- 9.1.12.PB.2: Prioritize financial decisions by considering alternatives and possible consequences.
- 9.2.12.CAP.4: Evaluate different careers and develop various plans (e.g., costs of public, private, training schools) and timetables for achieving them, including educational/training requirements, costs, loans, and debt repayment.
- 9.4.12.CI.1: Demonstrate the ability to reflect, analyze, and use creative skills and ideas (e.g., 1.1.12prof.CR3a).
- 9.4.12.CT.2: Explain the potential benefits of collaborating to enhance critical thinking and problem solving (e.g., 1.3E.12 prof.CR3.a)
- 9.4.12.IML.3: Analyze data using tools and models to make valid and reliable claims, or to determine optimal design solutions (e.g., S-ID.B.6a., 8.1.12.DA.5, 7.1.IH.IPRET.8)
- 9.4.12.TL.1: Assess digital tools based on features such as accessibility options, capacities, and utility for accomplishing a specified task (e.g., W.11-12.6.).
- RST.9-10.3./RST.11-12.3. Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks, attending to special cases or exceptions defined in the text.
- RST.9-10.7. Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words.
- RST.9-10.4. Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 9-10 texts and topics.
- CRP2. Apply appropriate academic and technical skills.
- CRP4. Communicate clearly and effectively and with reason.
- CRP8. Utilize critical thinking to make sense of problems and persevere in solving them.
- CRP11. Use technology to enhance productivity.
- CRP12. Work productively in teams while using cultural global competence.

### Intended Outcomes - {Essential Questions}

- What relationships are there between angles and arcs?
- What does it mean for a line to be tangent to a circle?
- How can the distance formula be used to derive the equation for a circle?
- How can the area and circumference formulas be used to find the area of a sector and length of an arc?

### Enduring Understandings

- All circles are similar
- Phenomena represented by circles have common properties and characteristics

In this unit plan, the following 21<sup>st</sup> Century themes and skills are addressed.

Check all that apply. <b>21<sup>st</sup> Century Themes</b>		Indicate whether these skills are <b>E-Encouraged</b> , <b>T-Taught</b> , or <b>A-Assessed</b> in this unit by marking <b>E, T, A</b> on the line before the appropriate skill. <b>21<sup>st</sup> Century Skills</b>	
	Global Awareness	E,T, A	Creativity and Innovation
X	Environmental Literacy	E,T, A	Critical Thinking and Problem Solving
	Health Literacy	E,T	Communication
	Civic Literacy	E,T, A	Collaboration
	Financial, Economic, Business, and Entrepreneurial Literacy		
Student Learning Targets/Objectives (Students will know/Students will understand)			
<ul style="list-style-type: none"> <li>Students will understand that all circles are similar.</li> <li>Students will understand that the distance from the center of a circle to any point on the circle is a fixed distance called the radius.</li> <li>Students will be able to find area and circumference of a circle.</li> <li>Students will be able to find the geometric probability of shaded regions involving circles.</li> <li>Students will apply properties of circles to solve problems.</li> </ul>			
Assessments (Pre, Formative, Summative, Other)		Denote required common assessments with an *	
Tests/Quizzes Clickers Communicators Benchmarks (Quarterly and Midterm/Final Exams) Journaling Project			
Teaching and Learning Activities			
Activities	Geometer's Sketchpad should be used throughout this unit.		
Differentiation Strategies	Applets, software, and graphing calculators will be used throughout the course. Students will work independently and collaboratively.		
Honors	Honors level course.		
Resources			
<b>Instructional Resources/Tools</b> TI-83/84 and TI emulator Geometer's Sketchpad Google Sketch up			

**Wayne School District  
Curriculum Format**

<b>Content Area/ Grade Level/ Course:</b>	Mathematics 9 Unified Mathematics 3- Honors
<b>Unit Plan Title:</b>	Unit 9: Solids
<b>Time Frame</b>	20 days
<b>Anchor Standards/Domain*    *i.e: ELA: reading, writing i.e.: Math: Algebra</b>	
<ul style="list-style-type: none"> <li>● G-GMD.1, 3, 4 Geometric Measurement and Dimension</li> <li>● G-MG.1, 2 Modeling with Geometry</li> </ul>	
<b>Unit Overview</b>	
<p>The unit will begin by reviewing formulas for two dimensional shapes. Visualization of the relationships between two-dimensional and three-dimensional objects will be achieved by rotating the two dimensional shape to form three dimensional solids. The formulas for the three dimensional solids will be explained and then used to solve problems of various types. The unit will explore and define many three-dimensional solids, discover volume formulas for prisms, pyramids, cylinders, cones and spheres and surface area of a sphere.</p>	
<b>Standard Number(s)    * i.e: Math: F.LE.A.4    i.e.: NJLSA.R4.</b>	
<ul style="list-style-type: none"> <li>● G.GMD.1 Give an informal argument for the formulas for the circumference of a circle, area of a circle, volume of a cylinder, pyramid, and cone. <i>Use dissection arguments, Cavalieri's principle, and informal limit arguments.</i></li> </ul>	



- G.GMD.3 Use volume formulas for cylinders, pyramids, cones, and spheres to solve problems.
- G.GMD.4 Identify the shapes of two-dimensional cross-sections of three-dimensional objects, and identify three-dimensional objects generated by rotations of two-dimensional objects.
- G.MG.1 Use geometric shapes, their measures, and their properties to describe objects (e.g., modeling a tree trunk or a human torso as a cylinder).
- G.MG.2 Apply concepts of density based on area and volume in modeling situations (e.g., persons per square mile, BTUs per cubic foot).
- G.MG.3 Apply geometric methods to solve design problems (e.g., designing an object or structure to satisfy physical constraints or minimize cost; working with typographic grid systems based on ratios).
- 8.1.12.DA.5: Create data visualizations from large data sets to summarize, communicate, and support different interpretations of real-world phenomena.
- 8.1.12.DA.6: Create and refine computational models to better represent the relationships among different elements of data collected from a phenomenon or process.
- 8.1.12.AP.1: Design algorithms to solve computational problems using a combination of original and existing algorithms.
- 9.1.12.PB.2: Prioritize financial decisions by considering alternatives and possible consequences.
- 9.2.12.CAP.4: Evaluate different careers and develop various plans (e.g., costs of public, private, training schools) and timetables for achieving them, including educational/training requirements, costs, loans, and debt repayment.
- 9.4.12.CI.1: Demonstrate the ability to reflect, analyze, and use creative skills and ideas (e.g., 1.1.12prof.CR3a).
- 9.4.12.CT.2: Explain the potential benefits of collaborating to enhance critical thinking and problem solving (e.g., 1.3E.12 prof.CR3.a)
- 9.4.12.IML.3: Analyze data using tools and models to make valid and reliable claims, or to determine optimal design solutions (e.g., S-ID.B.6a., 8.1.12.DA.5, 7.1.IH.IPRET.8)
- 9.4.12.TL.1: Assess digital tools based on features such as accessibility options, capacities, and utility for accomplishing a specified task (e.g., W.11-12.6.).
- RST.9-10.3./RST.11-12.3. Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks, attending to special cases or exceptions defined in the text.
- RST.9-10.7. Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words.
- RST.9-10.4. Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 9-10 texts and topics.
- CRP2. Apply appropriate academic and technical skills.
- CRP4. Communicate clearly and effectively and with reason.
- CRP8. Utilize critical thinking to make sense of problems and persevere in solving them.
- CRP11. Use technology to enhance productivity.
- CRP12. Work productively in teams while using cultural global competence.

### Intended Outcomes - {Essential Questions}

- How can three dimensional figures be described using the words vertices, edges and faces?
- How does the base of a three dimensional figure relate to its volume?
- How can concepts of volume and surface area influence producers and consumers in the real world?

### Enduring Understandings

**Students will understand...**

- The surface area of a three-dimensional object is the sum of the areas of all its faces.
- The volume of a three-dimensional object is the number of unit cubes that would fill the object.
- Geometry and spatial sense offer ways to interpret and reflect on our physical environment
- Analyzing geometric relationships develops reasoning and justification skills.
- Reasoning and/or proof can be used to verify or refute conjectures or theorems in geometry.
- Solid geometry studies the surface of a three-dimensional figure and the space it encloses.
- Different characteristics create different categories of solids, and that these characteristics create different formulas for three-dimensional figures.
- There is a direct connection between the base area of many solids and its volume
- Density is a measure that allows us to relate mass and volume of a figure.

**In this unit plan, the following 21<sup>st</sup> Century themes and skills are addressed.**

<i>Check all that apply.</i> <b>21<sup>st</sup> Century Themes</b>		<i>Indicate whether these skills are E-Encouraged, T-Taught, or A-Assessed in this unit by marking E, T, A on the line before the appropriate skill.</i> <b>21<sup>st</sup> Century Skills</b>	
<input type="checkbox"/>	<b>Global Awareness</b>	<input type="checkbox"/> ET <input type="checkbox"/> A	<b>Creativity and Innovation</b>
<input checked="" type="checkbox"/>	<b>Environmental Literacy</b>	<input type="checkbox"/> ET <input type="checkbox"/> A	<b>Critical Thinking and Problem Solving</b>
<input type="checkbox"/>	<b>Health Literacy</b>	<input type="checkbox"/> ET	<b>Communication</b>
<input type="checkbox"/>	<b>Civic Literacy</b>	<input type="checkbox"/> ET	<b>Collaboration</b>
<input type="checkbox"/>	<b>Financial, Economic, Business, and Entrepreneurial Literacy</b>		

**Student Learning Targets/Objectives (Students will know/Students will understand)**

- Students will be able to identify the shape of a figure's cross-section.
- Students will find surface area and volume of basic three-dimensional figures.
- Students will be able to estimate surface areas and volumes of real life objects
- Classify three-dimensional figures
- Identify parts of three-dimensional figures
- Calculate volume of irregular figures based upon displacement
- Use displacement to determine what type of material a solid is made of.
- Using Cavalieri's principle, develop formulas for finding the surface area and volume of figures with constant width and non-constant width, along with spheres

**Assessments (Pre, Formative, Summative, Other)**

*Denote required common assessments with an \**

- Tests/Quizzes
- Clickers
- Communicators
- Benchmarks (Quarterly and Midterm/Final Exams)
- Journaling
- Project

## Teaching and Learning Activities

### Activities

### Instructional Strategies

- Revisit formulas  $C=\pi d$  and  $C=2\pi r$ . Observe that the circumference is a little more than three times the diameter of the circle. Briefly discuss the history of this number and attempts to compute its value.
- Use alternative ways to derive the formula for the area of the circle  $A=\pi r^2$ . For example, cut a cardboard circular disk into 6 congruent sectors and rearrange the pieces to form a shape that looks like a parallelogram with two scalloped edges. Repeat the process with 12 sectors and note how the edges of the parallelogram look "straighter." Discuss what would happen in the case as the number of sectors becomes infinitely large. Then calculate the area of a parallelogram with base  $\frac{1}{2} C$  and altitude  $r$  to derive the formula  $A=\pi r^2$
- Wind a piece of string or rope to form a circular disk and cut it along a radial line. Stack the pieces to form a triangular shape with base  $C$  and altitude  $r$ . Again discuss what would happen if the string became thinner and thinner so that the number of pieces in the stack became infinitely large. Then calculate the area of the triangle to derive the formula  $A=\pi r^2$
- Introduce Cavalieri's principle using a concrete model, such as a deck of cards. Use Cavalieri's principle with cross sections of cylinders, pyramids, and cones to justify their volume formulas
- For pyramids and cones, the factor  $1/3$  will need some explanation. An informal demonstration can be done using a volume relationship set of plastic shapes that permit one to pour liquid or sand from one shape into another. Another way to do this for pyramids is with Geoblocks. The set includes three pyramids with equal bases and altitudes that will stack to form a cube. An algebraic approach involves the formula for the sum of squares  $(1^2 + 2^2 + \dots + n^2)$ .
- After the coefficient  $1/3$  has been justified for the formula of the volume of the pyramid ( $A = 1/3Bh$ ), one can argue that it must also apply to the formula of the volume of the cone by considering a cone to be a pyramid that has a base with infinitely many sides.
- The formulas for volumes of cylinders, pyramids, cones and spheres can be applied to a wide variety of problems such as finding the capacity of a pipeline; comparing the amount of food in cans of various shapes; comparing capacities of cylindrical, conical and spherical storage tanks; using pyramids and cones in architecture; etc. Use a combination of concrete models and formal reasoning to develop conceptual understanding of the volume formulas.
- Review vocabulary for names of solids (e.g., right prism, cylinder, cone, sphere, etc.).
- Slice various solids to illustrate their cross sections. For example, cross sections of a cube can be triangles, quadrilaterals or hexagons. Rubber bands may also be stretched around a solid to show a cross section.
- Cut a half-inch slit in the end of a drinking straw, and insert a cardboard cutout shape. Rotate the straw and observe the three-dimensional solid of revolution generated by the two-dimensional cutout.
- Java applets on some web sites can also be used to illustrate cross sections or solids of revolution
- Encourage students to create three-dimensional models to be sliced and cardboard cutouts to be rotated. Students can also make three-dimensional models out of modeling clay and slice through them with a plastic knife
- Concrete models of solids such as cubes, pyramids, cylinders, and spheres. Include some models that can be sliced, such as those made from Styrofoam.
- Cavalieri's principle can also be applied to obtain the volume of a sphere, using an argument similar to that employed by Archimedes more than 2000 years ago. In this demonstration, cross sections of a sphere of radius  $R$  and a cone having radius  $2R$  and altitude  $2R$  are balanced against cross sections of a cylinder having radius  $2R$  and altitude  $2R$ .

<i>Differentiation Strategies</i>	Applets, software, and graphing calculators will be used throughout the course. Students will work independently and collaboratively.
<i>Honors</i>	Honors Level Course
<b>Resources</b>	
<b><u>Instructional Resources/Tools</u></b> TI-83/84 and TI emulator Geometer's Sketchpad Google Sketch up <a href="http://www.ExploreLearning.com">www.ExploreLearning.com</a>	