



## Designing a Winner Project Packet

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## **Our Team**

Curriki Geometry would not be possible if not for the tremendous contributions of the content contributors, editors, and reviewing team.

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# Section 1: Introduction and Project Resources

# Getting to Know the Project

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Welcome to the Designing a Winner Project. The project will require approximately six weeks to complete and will address the key Common Core State Standards (CCSS) for geometry in the following clusters:

- Understand similarity in terms of similarity transformations.
- Prove theorems involving similarity.
- Define trigonometric ratios and solve problems involving right triangles.
- Apply trigonometry to general triangles.
- Explain volume formulas and use them to solve problems.
- Understand and apply theorems about circles.

Before beginning the project, take time to review all the documents provided for this project.

The Designing a Winner Project is designed to help you learn how geometry is applied to real world design challenges. In this scenario, your local city government has decided they want to build a multipurpose arena for your community. The arena design has four constraints:

1. It is located on 20 acres.
2. It must seat 10,000 spectators.
3. It must be capable of being converted for at least two outdoor sports.
4. It must be able to serve as an entertainment venue when not in use as a sports field.

You and your team must decide which sports you would like to see in the arena, outline the dimensions of the fields, show how they can be converted for at least two sports and entertainment, and then use either hand drawings or Google SketchUp to show the dimensions and design of the arena.

You will go through a traditional design sequence of Predesign, Preliminary Drawings, and Final Drawings. At each step you should use your knowledge of geometry to lay out the drawings and find the right dimensions. At the conclusion of the project, your team will present their drawings in an attempt to 'win' the backing of city government for their design.

Project-based learning is designed to focus you on solving an open-ended problem and providing a solution to the problem through working in teams. Keeping this perspective in mind will be helpful. The new Common Core State Standards stress application and inquiry.

Your goal is to learn the fundamentals of geometry, and to think about geometry and applying geometric principles to real-world design challenges.

# Tools and Resources

[These resources](#) may be useful for all of the Curriki Geometry projects. There are also additional resources useful for specific projects.

## General Sites

Resource	Description	Best Use
<a href="#">Curriki</a>	Curriki has over 1600 searchable resources for geometry.	You can search by topic to find problems, exams, or lesson plans that fit your needs with each project. In most cases, each project identifies the Curriki resources that will be the most helpful to you.
<a href="#">Khan Academy</a>	The Khan Academy offers a one-semester course in geometry.	The course is searchable on <a href="#">Curriki</a> . Find topics and lessons that fit your needs.
<a href="#">Math for America</a>	Math for America offers resources and links to high quality math instruction and sample lessons in geometry and all other math subjects.	You can easily search lesson plans by grade and subject on this site.
<a href="#">Analyze Math</a>	This site has thousands of math problems. Solutions and detailed explanations are included. Free math tutorials and problems help your students explore and gain a deep understanding of geometry and other math topics.	Use this site for finding geometry problems that make your teaching more active and engaging to students.
<a href="#">Quizpoo</a>	This is an online quiz creator for teachers.	Use this site when you need to create quizzes.
<a href="#">Quizlet</a>	This is an online quiz creator for teachers and students.	This is a student-friendly tool that helps students design their own quizzes as study tools.
<a href="#">Visuwords</a>	This is an online tool for vocabulary building.	This is an excellent tool for extending students' knowledge of origins and relationships between words.
<a href="#">Cloze Notes</a>	The eHow.com website offers and explanation of cloze notes, a method for helping students learn and retain key ideas and vocabulary.	Cloze is useful for ensuring student participation in videos as well as shared reading.
<a href="#">Three Ring</a>	Three Ring allows teachers to photograph any work and record presentations or discussion. It also allows students to upload their work.	This supports project-based learning.

## Presentation and Communication Tools

Resource	Description	Best Use
<a href="#"><u>Prezi</u></a>	This is a flexible, creative visual presentation tool that allows students to tell detailed stories about their work.	Prezi is free, but requires students to create an account.
<a href="#"><u>Doceri</u></a>	This is an iPad interactive whiteboard and screencast recorder with sophisticated tools for hand-drawn graphics and built-in remote desktop control.	Doceri works well in a 1-to-1 classroom.
<a href="#"><u>Padlet</u></a>	Padlet is an Internet application that works like an online sheet of paper where students can put any content (e.g. images, videos, documents, text) anywhere on the page, together with anyone, from any device.	Think of it like a multimedia friendly, free-form, real-time wiki.
<a href="#"><u>Haiku Deck</u></a>	Haiku Deck is a free presentation software tool that makes it easy to integrate graphics and pictures into creative presentations.	Haiku Deck requires an iPad.
<a href="#"><u>Blogster</u></a>	This is a mainstream blogging site that students can use to create and post blogs.	This site may require monitoring.
<a href="#"><u>Google SketchUp</u></a>	This is free, downloadable software for creating 3D presentations.	This is easy to learn and is integrated with Google Maps.
<a href="#"><u>Movenote</u></a>	Movenote works with Google Drive, Microsoft mail, Gmail, and Google Docs and on any device. Students open Movenote inside their email program, prompting their camera to automatically be activated. They then add their content (from any document type) and begin recording themselves talking through the information. Free registration with an email account is required. If you are a Google Apps for Education district, there is a simple add-on available in Google Drive. There is also an app for iOS devices.	This is a wonderful tool for the flipped classroom and for having students showcase what they've learned in a particular unit of study.
<a href="#"><u>Trello</u></a>	This is the perfect tool for organizing anything, including a group project. Working on iOS, Android, Windows 8, and the web, it allows you to brainstorm ideas, set to-do lists, add photos, monitor progress, and keep everyone informed with the latest details.	It works especially well with project-based learning activities and group work.

# Student Contract Sample

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**Members:**

**Project:**

## **Task List**

Using the task list, assign all work to individual team members. An assignment may be assigned to more than one team member.

## **Team Constitution**

### **Foreword**

This contract is a binding document and governs the team until the assigned project deadline. If the team separates, or a member is fired, the basic contract laws remain intact for both parties. However, being fired may cause work responsibilities to shift.

### **Article I: Absence Policy**

**a.** If a team member will be absent on a day in which work is due, he or she must tell another team member a day in advance and have all work that he or she is responsible for turned in. All team members must stick to the provided agenda to have the assignments completed on time. If there will be an unexpected absence, the team member is to complete the work from home and email another team member to let them know he or she is gone for the day.

**b.** Team members will contact one another if they are absent for any amount of period during the time allotted for working on the projects.

**c.** Contact must be made by phone, email, or other acceptable method.

### **Article II: Work Policy**

**a.** Any member that is mentally or physically disabled and can prove that they cannot complete the work assigned to him or her alone may acquire assistance from other team

members to help complete it. This will only apply for work that is team work and not individual work, and work will only be finished by that team member; the assisting team member will not write it.

**b.** Each team member will work to the best of his or her ability, making sure to complete the work is up to standard, and that her or she completes it with punctuality.

**c.** If a team member commits plagiarism, he or she is solely responsible and will incur the punishment on his or her own.

### **Article III: Leadership**

**a.** At the beginning of the project, a leader will be voted upon democratically. If a team member is absent at the time of voting, he or she waives his or her right to participate in voting. The member who wins the most votes becomes the leader. If there is an unclear outcome (same number of votes for different members), the team will have no leader until one can be chosen by a revote.

**b.** By being elected leader, the member must perform the following duties:

- Organize team meetings.
- Create and enforce a team agenda to govern team progress.
- Organize any out-of-school project efforts.
- Provide communication between team members in order to help them work toward the project goal.

**c.** If the team leader fails to perform these duties, or another member is also carrying them out, a revote may be taken to determine whether to obtain a new leader.

### **Article IV: Work Ethics**

**a.** If a team member does not complete work he or she was assigned, the punishment for the infringement will be of detriment solely to the team member at fault. No negative grading shall be given to any other team members.

**b.** At the end of the project, 'hard workers' will be designated by means of a democratic vote. The people voted as the top two will each receive the ten bonus points. If one candidate is voted as hard worker by a margin of 75%, he or she will receive 20 points. If

there is a tie, the team will discuss and come to resolution or else no points will be granted to the disputed members.

### **Article V: Member Dismissal**

**a.** The following conducts will result in a team member being able to be dismissed;

- Incomplete or missing team work (This is non-negotiable and will be enforced by the teacher.)
- Plagiarism or any form of cheating
- If a team member decides to leave under his or her own will

**b.** Any team member leaving under his or her own will be able to submit all his or her own work, while the other team members may not. Any team member fired for breaking any of the conducts under Article V-a will have his or her work taken from his or her possession to be used at the discretion of the original team, but not for the member being fired. In addition, any fired member may not use any work completed by other team members, subject to punishment under Article II-c.

**c.** If a team member leaves under the stipulation of Article V-a, he or she retains all the work he or she has already provided for the team. The original team cannot use this work or it is subject to punishment under Article II-c.

### **Article VI: Signature**

By signing this contract, the following team members abide to the articles listed here. If any member fails to abide by the articles of this contract, he or she may be fired from the team given at least a 50% vote in favor of firing the member.

### **Project Leader**

The team has elected \_\_\_\_\_ as the project leader under Article III.

Signature



## Section 2: Logs

# Daily Learning Log: Individual

---

<b>Name:</b>			
<b>Project Name:</b>		<b>Date:</b>	

<b>Today I had the following <u>goals</u> for project work.</b>	1	
	2	
	3	
	4	
	5	

<b>Today I accomplished...</b>	1	
	2	
	3	
	4	
	5	

<b>My next steps are...</b>	1	
	2	
	3	
	4	
	5	

<b>My most important concerns, problems, or questions are...</b>	1	
	2	
	3	
	4	
	5	

# Daily Learning Log: Team

---

<b>Names:</b>			
<b>Project Name:</b>		<b>Date:</b>	

<b>Today we had the following <u>goals</u> for project work.</b>	1	
	2	
	3	
	4	
	5	

<b>Today we accomplished...</b>	1	
	2	
	3	
	4	
	5	

<b>Our next steps are...</b>	1	
	2	
	3	
	4	
	5	

<b>Our most important concerns, problems, or questions are...</b>	1	
	2	
	3	
	4	
	5	





# Section 3: Rubrics

Student: \_\_\_\_\_

Project/Unit: \_\_\_\_\_

Date: \_\_\_\_\_

# Mathematical Practices Rubric

CRITERIA	WEIGHT	Emerging (Below Standards)	Proficient (Meets Standards)	Mastery (Exceptional Performance)
<b>1. Make sense of problems and persevere in solving them.</b>	15%	<ul style="list-style-type: none"> <li>Student cannot recognize givens, constraints, relationships, and goals of a problem.</li> <li>Student does not monitor progress or adjust approach to problem.</li> <li>Student does not check solutions for errors.</li> </ul>	<ul style="list-style-type: none"> <li>Student analyzes givens, constraints, relationships, and goals of a problem.</li> <li>Student monitors and evaluates progress and changes course if necessary.</li> <li>Student checks solutions for errors.</li> <li>Student asks continually: "Does this make sense?"</li> </ul>	In addition to meeting the PROFICIENT criteria <ul style="list-style-type: none"> <li>Student quickly analyzes key aspects of a problem.</li> <li>Student easily monitors progress and adjusts approach to problem.</li> <li>Student routinely checks solutions for errors.</li> <li>Student is able to fully explain solution to others.</li> </ul>
		1-----3-----5	6-----8-----12	13-----14-----15
<b>2. Reason abstractly and quantitatively.</b>	15%	<ul style="list-style-type: none"> <li>Student cannot represent problem symbolically.</li> <li>Student shows limited ability to contextualize the problem.</li> </ul>	<ul style="list-style-type: none"> <li>Student abstracts a given situation and represents it symbolically.</li> <li>Student manipulates the representing symbols and shows ability to contextualize the problem.</li> <li>Student creates a coherent representation of the problem.</li> </ul>	In addition to meeting the PROFICIENT criteria <ul style="list-style-type: none"> <li>Student represents a problem symbolically in ways that show thorough understanding.</li> <li>Student manipulates the representing symbols in ways that clearly contextualize the problem.</li> <li>Student can explain the representation of the problem to others.</li> </ul>
		1-----3-----5	6-----8-----12	13-----14-----15
<b>3. Construct viable arguments and critique the reasoning of others.</b>	15%	<ul style="list-style-type: none"> <li>Student cannot state assumptions, definitions, and results in constructing arguments.</li> <li>Student makes limited conjectures or builds an illogical progression of statements to explore conjectures.</li> <li>Student shows limited ability to reason inductively or use logic.</li> </ul>	<ul style="list-style-type: none"> <li>Student understands and uses stated assumptions, definitions, and results in constructing arguments.</li> <li>Student makes conjectures and builds a logical progression of statements to explore conjectures.</li> <li>Student analyzes situations and can recognize and use counterexamples.</li> <li>Student reasons inductively and uses logic and reasoning.</li> </ul>	In addition to meeting the PROFICIENT criteria <ul style="list-style-type: none"> <li>Student can construct argument using stated assumptions and definitions, and results in constructing arguments.</li> <li>Student makes original conjectures and builds an elegant progression of statements to explore conjectures.</li> <li>Student quickly uses original counterexamples to explain or construct problem.</li> </ul>
		1-----3-----5	6-----8-----12	13-----14-----15

		1-----3-----5	6-----8-----12	13-----14-----15
<b>4. Model with mathematics.</b>	<b>15%</b>	<ul style="list-style-type: none"> <li>Student cannot link important quantities in a practical situation with use of tools such as diagrams, two-way tables, graphs, flowcharts, and formulas.</li> <li>Student shows limited knowledge of how mathematics applies to problems arising in everyday life, society, and the workplace.</li> </ul>	<ul style="list-style-type: none"> <li>Student identifies important quantities in a practical situation and maps his or her relationships using such tools as diagrams, two-way tables, graphs, flowcharts and formulas.</li> <li>Student applies mathematics to solve problems arising in everyday life, society, and the workplace.</li> </ul>	<p>In addition to meeting the PROFICIENT criteria</p> <ul style="list-style-type: none"> <li>Student maps complex practical situations with such tools as diagrams, two-way tables, graphs, flowcharts, and formulas.</li> <li>Student has unusual insight into how mathematics applies to solving problems arising in everyday life, society, and the workplace.</li> </ul>
<b>5. Use appropriate tools strategically.</b>	<b>10%</b>	<ul style="list-style-type: none"> <li>Student does not use the available tools when solving a mathematical problem.</li> <li>Student has limited ability to use technological tools to explore and deepen his or her understanding of concepts.</li> </ul>	<ul style="list-style-type: none"> <li>Student considers the available tools when solving a mathematical problem.</li> <li>Student is able to use technological tools to explore and deepen his or her understanding of concepts.</li> </ul>	<p>In addition to meeting the PROFICIENT criteria</p> <ul style="list-style-type: none"> <li>Student chooses the best available tools when solving a mathematical problem.</li> <li>Student is expert at using technological tools to explore and deepen his or her understanding of concepts.</li> </ul>
<b>6. Attend to precision.</b>	<b>10%</b>	<ul style="list-style-type: none"> <li>Student does not use definitions in discussion with others and in his or her own reasoning.</li> <li>Student calculates accurately and efficiently, and expresses numerical answers with a minimal of precision appropriate for the problem context.</li> </ul>	<ul style="list-style-type: none"> <li>Student uses clear definitions in discussion with others and in his or her own reasoning.</li> <li>Student calculates accurately and efficiently, and expresses numerical answers with a degree of precision appropriate for the problem context.</li> </ul>	<p>In addition to meeting the PROFICIENT criteria</p> <ul style="list-style-type: none"> <li>Student uses clear definitions in a variety of ways in discussion that helps others clarify their own reasoning.</li> <li>Student calculates accurately and efficiently, and expresses numerical answers with the exact degree of precision appropriate for the problem context.</li> </ul>
<b>7. Look for and make use of structure.</b>	<b>10%</b>	<ul style="list-style-type: none"> <li>Student cannot discern a pattern or structure without assistance.</li> </ul>	<ul style="list-style-type: none"> <li>Student looks closely to discern a pattern or structure.</li> </ul>	<p>In addition to meeting the PROFICIENT criteria</p> <ul style="list-style-type: none"> <li>Student can easily identify a pattern or structure in a wide range of natural settings or practical ways.</li> </ul>
<b>8. Look for and express regularity in repeated reasoning.</b>	<b>10%</b>	<ul style="list-style-type: none"> <li>Student overlooks calculations that are repeated, and does not look for general methods or for shortcuts.</li> </ul>	<ul style="list-style-type: none"> <li>Student notices if calculations are repeated, and looks both for general methods and for shortcuts.</li> </ul>	<p>In addition to meeting the PROFICIENT criteria</p> <ul style="list-style-type: none"> <li>Student rarely repeats calculations, and first looks both for general methods and for shortcuts when problem solving.</li> </ul>

Student: \_\_\_\_\_

Project/Unit: \_\_\_\_\_

Date: \_\_\_\_\_

# Presentation and Performance Rubric

CRITERIA	WEIGHT	Emerging (Below Standards)	Proficient (Meets Standards)	Mastery (Exceptional Performance)
<b>Structure and Organization</b> <ul style="list-style-type: none"> <li>Intro</li> <li>Main ideas</li> <li>Supporting Materials</li> <li>Conclusion</li> <li>Length requirement</li> </ul> <b>TIME:</b>	<b>30%</b>	<ul style="list-style-type: none"> <li>No formal introduction or introduction had no clear thesis statement nor offered any preview of topics to be discussed.</li> <li>Main ideas were not separated into a logical progression.</li> <li>Important ideas were not supported with references or data.</li> <li>No conclusion or conclusion did not adequately summarize presentation</li> <li>Presentation did not use time allotted.</li> </ul>	<ul style="list-style-type: none"> <li>Introduction had clear thesis statement and a preview of topics to be discussed.</li> <li>Main ideas were separated into a logical progression</li> <li>Speaker supported important ideas and viewpoints through accurate and detailed references to text or other works.</li> <li>Conclusion restated thesis statement and summarized the ideas presented</li> <li>Time requirement was met for specific assignment (neither too long nor too short).</li> </ul>	In addition to meeting the PROFICIENT criteria ... <ul style="list-style-type: none"> <li>Clever attention-getting introduction or an imaginative thesis and preview.</li> <li>Ideas connected by original transitions, logical throughout; creative pattern.</li> <li>Conclusion tied speech together and left audience with memorable message</li> <li>Speaker used logical, ethical, and emotional appeals that enhanced a specific tone and purpose.</li> </ul>
		1-----3-----5	6-----8-----12	13-----14-----15
<b>Vocal Expression</b> <ul style="list-style-type: none"> <li>Rate and Volume of Speech</li> <li>Pitch, Articulation, and Pronunciation</li> <li>Memorization</li> <li>Performance</li> </ul>	<b>25%</b>	<ul style="list-style-type: none"> <li>Speaker was hard to hear or understand.</li> <li>Voice or tone distracted from purpose of presentation.</li> <li>Excessive use of verbal fillers</li> <li>Did not memorize lines.</li> <li>Acting lacked expression.</li> </ul>	<ul style="list-style-type: none"> <li>Speaker was easy to hear and understand.</li> <li>Tone was conversational, but with purpose.</li> <li>Voice sounded natural, neither patterned nor monotone.</li> <li>Speaker pronounced words clearly, correctly, and without verbal fillers.</li> <li>Had lines memorized.</li> <li>Expressive acting.</li> </ul>	In addition to meeting the PROFICIENT criteria ... <ul style="list-style-type: none"> <li>Speaker was enjoyable to hear; used expression and emphasis.</li> <li>Speaker used voice to create an emotional response in audience.</li> <li>Knew all your lines and possessed dramatic flair.</li> </ul>
		1-----3-----5	6-----8-----12	13-----14-----15
<b>Physical Characteristics</b> <ul style="list-style-type: none"> <li>Eye Contact</li> <li>Posture</li> <li>Gestures</li> <li>Movement</li> <li>Attire</li> </ul>	<b>15%</b>	<ul style="list-style-type: none"> <li>Little eye contact with audience.</li> <li>Poor or slouchy posture.</li> <li>Movements were stiff or unnatural.</li> <li>Attire was inappropriate for audience .</li> </ul>	<ul style="list-style-type: none"> <li>Strong eye contact with entire audience.</li> <li>Posture conveyed confidence.</li> <li>Gestures and movements were natural and effective.</li> <li>Attire was appropriate for audience and purpose.</li> </ul>	In addition to meeting the PROFICIENT criteria ... <ul style="list-style-type: none"> <li>Posture was commanding and purposeful.</li> <li>Attire was chosen to enhance presentation.</li> </ul>
		1-----3-----5	6-----8-----12	13-----14-----15

<b>Appropriateness of Content and Language</b>	<b>10%</b>	<ul style="list-style-type: none"> <li>• Speaker used inappropriate language, content, or examples for this audience.</li> <li>• Speaker did not demonstrate a clear understanding of the assignment or purpose of presentation.</li> </ul>	<ul style="list-style-type: none"> <li>• Speaker obviously considered the audience and used appropriate language and examples.</li> <li>• Speaker displayed a clear understanding of assignment requirements and content.</li> <li>• Speaker understood purpose of presentation.</li> </ul>	<p>In addition to meeting the PROFICIENT criteria ...</p> <ul style="list-style-type: none"> <li>• Examples and words were creative and well chosen for target audience.</li> </ul>
		1-----3-----5	6-----8-----12	13-----14-----15
<b>Overall Impact</b> <ul style="list-style-type: none"> <li>• Energy</li> <li>• Enthusiasm</li> <li>• Sincerity</li> <li>• Originality/ Creativity</li> </ul>	<b>10%</b>	<ul style="list-style-type: none"> <li>• Speaker appeared bored by the message or presented without conviction.</li> </ul>	<ul style="list-style-type: none"> <li>• Speaker appeared to believe strongly in message and demonstrated desire to have audience listen, understand, and remember.</li> </ul>	<p>In addition to meeting the PROFICIENT criteria ...</p> <ul style="list-style-type: none"> <li>• Overall presentation was creative and exciting.</li> </ul>
		1-----3-----5	6-----8-----12	13-----14-----15
<b>Features</b> <ul style="list-style-type: none"> <li>• Multimedia</li> <li>• Visuals</li> <li>• Audio</li> </ul>	<b>10%</b>	<ul style="list-style-type: none"> <li>• Materials detracted from content or purpose of presentation or were of such low quality as to discredit speaker.</li> </ul>	<ul style="list-style-type: none"> <li>• Materials added, did not detract from presentation</li> <li>• Materials used were quality products; easy to see and hear.</li> </ul>	<p>In addition to meeting the PROFICIENT criteria</p> <ul style="list-style-type: none"> <li>• Speaker creatively integrated a variety of objects, charts, and graphs to amplify the message.</li> </ul>
		1-----3-----5	6-----8-----12	13-----14-----15
<b>BREAKTHROUGH Evidence for exceptional or creative performance beyond mastery.</b>	The evidence for breakthrough is:			

Student: \_\_\_\_\_

Project/Unit: \_\_\_\_\_

Date: \_\_\_\_\_

## Teamwork Rubric

CRITERIA	Emerging (Below Standards)	Proficient (Meets Standards)	Mastery (Exceptional Performance)
<b>Cohesion and Purpose</b>	<ul style="list-style-type: none"> <li>Team establishes no norms or weak norms.</li> <li>Team does not delegate or assign tasks.</li> <li>Majority of team members disengaged.</li> <li>Team shows little engagement in problem solving</li> <li>Team is unable to resolve conflicts.</li> </ul> <p>1-----3-----5</p>	<ul style="list-style-type: none"> <li>Team quickly establishes norms.</li> <li>Team assigns and delegates tasks.</li> <li>Team engages all members.</li> <li>Team shows purposeful engagement.</li> <li>Team listens and plans together.</li> <li>Team members show attentive posture and eye contact.</li> <li>Team demonstrates ability to resolve conflicts.</li> <li>Team demonstrates ability to look at issues from multiple points of view.</li> </ul> <p>6-----8-----12</p>	<ul style="list-style-type: none"> <li>Team quickly establishes thoughtful norms.</li> <li>Team assigns and delegates tasks based on thorough discussion of team strengths.</li> <li>Team immediately and deeply engaged in problem solving.</li> <li>Team overcomes conflicts immediately.</li> <li>Team uses listening and communication strategies to include all viewpoints.</li> </ul> <p>13-----14-----15</p>
<b>Organization</b>	<ul style="list-style-type: none"> <li>Team unable to generate ideas.</li> <li>Team does not focus on task or cannot prioritize.</li> <li>Team misses or does not establish deadlines.</li> <li>Team does not develop a realistic project schedule.</li> <li>Team cannot find resources.</li> </ul> <p>1-----3-----5</p>	<ul style="list-style-type: none"> <li>Team easily generates ideas.</li> <li>Team focuses on task and develops agenda.</li> <li>Team operates on time and meets deadlines.</li> <li>Team develops a project schedule.</li> <li>Team monitors their progress.</li> <li>Team accepts changes in task or focus.</li> <li>Team shows resourcefulness in finding information.</li> </ul> <p>6-----8-----12</p>	<ul style="list-style-type: none"> <li>Team uses techniques to brainstorm high quality ideas.</li> <li>Team develops a comprehensive, realistic agenda.</li> <li>Team meets or exceeds deadlines.</li> <li>Team monitors progress and adapts new schedules based on feedback.</li> <li>Team welcomes and feels challenged by changes in task focus.</li> <li>Team is unusually resourceful</li> </ul> <p>13-----14-----15</p>
<b>Inquiry and Problem Solving</b>	<ul style="list-style-type: none"> <li>Team cannot brainstorm solutions.</li> <li>Team does not use thinking strategies.</li> <li>Team does not pursue or demonstrate background knowledge for problem solving.</li> <li>Team shows little conceptual understanding of the problem or question.</li> <li>Team does not use the conventions and terms of the discipline in discussions.</li> </ul> <p>1-----3-----5</p>	<ul style="list-style-type: none"> <li>Team often brainstorms solutions.</li> <li>Team demonstrates use of thinking strategies.</li> <li>Team demonstrates use of background knowledge.</li> <li>Team shows conceptual understanding of problem.</li> <li>Team demonstrates knowledge of criteria for judgment of solutions.</li> <li>Team uses conventions and terms of the discipline.</li> </ul> <p>6-----8-----12</p>	<ul style="list-style-type: none"> <li>Team brainstorming leads to new solutions or fresh thinking.</li> <li>Team routinely uses thinking strategies.</li> <li>Team shows deep background knowledge.</li> <li>Team shows deep conceptual understanding of the problem or question.</li> <li>Team able to easily use the conventions and terms of the discipline.</li> </ul> <p>13-----14-----15</p>

**BREAKTHROUGH**  
Evidence for  
exceptional or creative  
performance beyond  
mastery.

The evidence for breakthrough is:

Student: \_\_\_\_\_

Project/Unit: \_\_\_\_\_

Date: \_\_\_\_\_

# Designing a Winner Rubric

CRITERIA	Emerging (Below Standards)	Proficient (Meets Standards)	Mastery (Exceptional Performance)
<b>Geometric Practices</b> <ul style="list-style-type: none"> <li>Student demonstrates proficiency below 70% on tests and quizzes throughout the project.</li> <li>Student demonstrates minimum proficiency in use of geometric practices throughout the project.</li> </ul>	1-----3-----5	6-----8-----12	13-----14-----15
<b>Mathematical Practices</b> <ul style="list-style-type: none"> <li>Student does not demonstrate proficiency on elements 1, 6, and 7 of the Mathematical Practices Rubric.</li> </ul>	1-----3-----5	6-----8-----12	13-----14-----15
<b>Vocabulary, Terms, and Definitions</b> <ul style="list-style-type: none"> <li>Student demonstrates proficiency below 70% on tests and quizzes throughout the project.</li> <li>Student demonstrates minimum proficiency in use of geometric terms throughout the project.</li> </ul>	1-----3-----5	6-----8-----12	13-----14-----15
<b>Teamwork and Collaboration</b> <ul style="list-style-type: none"> <li>Student does not meet the criteria for an effective team member.</li> <li>Student scores on the Emerging level on the Teamwork Rubric.</li> </ul>	1-----3-----5	6-----8-----12	13-----14-----15
<b>Presentation and Preparation of Final Drawings</b> <ul style="list-style-type: none"> <li>Project does not meet constraints or specifications.</li> <li>Geometric information presented, though not always accurately.</li> <li>Design is unclear or inappropriate.</li> <li>Model or drawings omit key details.</li> </ul>	1-----3-----5	6-----8-----12	Meets all proficient criteria. In addition, the project: <ul style="list-style-type: none"> <li>Demonstrates meets constraints and expectations in thoughtful manner.</li> <li>Presents accurate geometric information in innovative fashion.</li> <li>Shows strong use of geometric knowledge.</li> </ul> 13-----14-----15

**BREAKTHROUGH**  
Evidence for  
exceptional or creative  
performance beyond  
mastery.

The evidence for breakthrough is:



# Section 4: Designing a Winner Project

# Designing a Winner Overview

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## Unit Focus

Designing a Winner is an introductory project that addresses priority CCSS for Units 1, 2, 3, and 5 in Traditional Geometry and Units 5 and 6, Integrated Math Pathways.

It also focuses on Practices 3, 6, and 7 of the [Mathematical Practices](#) established in the CCSS, and on practicing two key 21st Century skills: teamwork and communication.

**Timeline & Duration**  
6 weeks, based on approximately  
5 hours of class time per week  
**Project Rating:** Proficient

You can explore the CCSS [here](#).

In addition, you will practice using online technologies and other resources for geometry.

## Critical Areas

Unit 2 (Traditional): You will apply your earlier experience with dilations and proportional reasoning to build a formal understanding of similarity. You 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. You develop the Laws of Sines and Cosines in order to find missing measures of general (not necessarily right) triangles. You are able to distinguish whether three given measures (angles or sides) define 0, 1, 2, or infinitely many triangles.

Unit 3 (Traditional): Your experience with two-dimensional and three-dimensional objects is extended to include informal explanations of circumference, area, and volume formulas. Additionally, you apply your knowledge of two-dimensional shapes to consider the shapes of cross-sections and the result of rotating a two-dimensional object about a line.

Unit 4 (Traditional): Building on your work with the Pythagorean theorem in 8th grade to find distances, you use a rectangular coordinate system to verify geometric relationships, including properties of special triangles and quadrilaterals and slopes of parallel and perpendicular lines. You continue your study of quadratics by connecting the geometric and algebraic definitions of the parabola.

## Overview of Designing a Winner

This project allows you to apply the geometric principles of triangles, volume, and coordinates to the mapping and design of a multipurpose arena in a limited area. The arena must serve as a venue that can be easily converted for use by two sports, plus serve as a

concert venue if needed. You will form design teams to create a map showing how the arena can be converted for the two sports. The map will be accompanied by a hand-built model or a digital design using Google SketchUp. In the final presentations, the map and design ideas will be presented to the local City Council.



## **The Scenario and Challenge**

*The local City Council has expressed interest in building a multipurpose arena/stadium on 20-acres at the edge of town. This is rather a small piece of land for the purpose, but it can be configured in various ways and need not be a rectangle. In addition, in your town people enjoy a variety of sports and activities, including basketball, baseball, football, soccer, hockey, Motocross, and horsemanship. The town has also expressed great interest in having a venue for music concerts. The City Council cannot decide which sports to emphasize, nor are they sure how the arena would also accommodate concerts. However, they have decided that the arena must be able to accommodate at least 10,000 spectators. Fortunately, an adjacent parcel provides ample parking. But the City Council would like to hear preliminary proposals from citizens for a multipurpose arena with a field or court for one sport, but which can also be easily adapted for a second sport and a concert.*

*Your team has chosen one sport that you would like to see in the new arena. You have six weeks to create a map showing the exact dimensions of the arena and the field or court for your sport, including how the arena will be placed on the 20 acre site and where the field/court will be located in the arena. The map must also show the location of the bleachers or seats, and the access routes from the adjacent parking area into the arena. You must also show how your design can easily be adapted for a second sport and a concert when necessary. You must also be able to show how 10,000 spectators can be seated to view any event, including the use of moveable bleachers.*

*Your map will be accompanied by either a hand-built scale model or a Google SketchUp model of the arena and the field/court area.*

## **The Driving Question**

*How can we, as a team of local citizens, propose a winning design for a multipurpose arena for our favorite sport?*

## Common Core State Standards for Designing a Winner

Selling Geometry addresses the following [Common Core State Standards](#) in High School Geometry.

Priority Standards	
<b>G.MG.1</b>	Use geometric shapes, their measures, and their properties to describe objects (e.g. modeling a tree trunk or a human torso as a cylinder).
<b>G.MG.2</b>	Apply concepts of density based on area and volume in modeling situations (e.g. persons per square mile, BTU's per cubic foot).
<b>G.MG.3</b>	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).
<b>G.GMD.3</b>	Use volume formulas for cylinders, pyramids, cones, and spheres to solve problems.
<b>G.SRT.5</b>	Use congruence and similarity criteria for triangles to solve problems and to prove relationships in geometric figures.
<b>G.SRT.7</b>	Explain and use the relationship between the sine and cosine of complementary angles.
<b>G.SRT.8</b>	Use trigonometric ratios and the Pythagorean theorem to solve right triangles in applied problems.
Supporting Standards	
<b>G.GPE.4</b>	Use coordinates to prove simple geometric theorems algebraically. <i>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 <math>(1, \sqrt{3})</math> lies on the circle centered at the origin and containing the point <math>(0, 2)</math>.</i>
<b>G.SRT.2</b>	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.
<b>G.SRT.3</b>	Use the properties of similarity transformations to establish the AA criterion for two triangles to be similar.
<b>G.SRT.6</b>	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.
<b>G.GPE.7</b>	Use coordinates to compute perimeters of polygons and areas of triangles and rectangles, e.g., using the distance formula.

# Suggested Sequence of Designing a Winner

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## Launching the Project

- 1 Project introduction
- 2 Team formation and identification of areas of interest

## Managing the Project

- 3 Instruction
- 4 Team activity
- 5 Maps, coordinates, and shapes
- 6 Maps, coordinates, and shapes, continued
- 7 Predesign work
- 8 Maps, coordinates, and shapes, continued
- 9 Predesign complete, Preliminary Design phase begins
- 10 Similarity
- 11 Similarity, continued
- 12 Preliminary Design complete
- 13 Tangent ratio
- 14 Sine and cosine ratios
- 15 Laws of sines and cosines
- 16 Quiz and Summation Day
- 17 Evaluation on team performance
- 18 Volume
- 19 Final Drawings begin
- 20 Circumference and area

- 21** Circumference and area, continued
- 22** Second draft of Final Drawings
- 23** Exam preparation and critique of Final Drawings
- 24** Exam Day
- 25** Final Drawings complete
- 26** Presentation practice
- 27** Presentation Days
- Assessing the Project**
- 28** Reflection Day



# Section 5: Glossary

# Curriki Geometry Glossary

The following terms are used throughout the Curriki Geometry projects and represent the core vocabulary and concepts that students should know to meet Common Core State Standards.

Term	Definition
Acute triangle	A triangle for which all interior angles are acute, or less than 90 degrees. (see also <i>obtuse triangle</i> , <i>right triangle</i> )
Alternate exterior angles	Exterior angles on alternate sides of the transversal (not on the same parallel line)
Alternate interior angles	Interior angles on alternate sides of the transversal (not on the same parallel line)
Altitude of a triangle	A straight line through a vertex and perpendicular to (i.e. forming a right angle with) a line containing the base (the opposite side) of a triangle
Angle bisector theorem	Concerned with the relative lengths of the two segments that a triangle's side is divided into by a line that bisects the opposite angle. It equates their relative lengths to the relative lengths of the other two sides of the triangle.
Angle bisector theorem, converse	If a point is equidistant from the sides of an angle, then it is on the angle bisector.
Angle	Formed by two rays, called the sides of the angle, sharing a common endpoint, called the vertex of the angle
Arc	A closed segment (symbol: $\frown$ ) of a differentiable curve in the two-dimensional plane
Area	Any particular extent of space or surface
Bisector	A line that divides something into two equal parts
Center of a polygon	In a rotation, the point that does not move. The rest of the plane rotates around this one fixed point.
Centroid of a triangle	The point where the three medians of the triangle intersect
Circumcenter of a triangle	The point where the three perpendicular bisectors of a triangle meet
Circumference (circles)	A complete circular arc; also the distance around the outside of a circle
Circumscribed	A geometric figure that is drawn around another geometric figure so as to touch all its vertices
Combination	A way of selecting several things out of a larger group, where (unlike permutations) order does not matter.
Common parts	Informal language that describes similarities, differences, parts (e.g., number of sides and vertices/"corners") and other attributes (e.g., having sides of equal length) of two- and three-dimensional shapes, in different sizes and orientations
Compass	An instrument for drawing circles and arcs and measuring distances between points, consisting of two arms linked by a movable joint.
Complement probability	In probability theory, the complement of any event A is the event [not A], i.e. the event that A does not occur. (see also <i>conditional probability</i> , <i>experimental probability</i> , <i>probability</i> , <i>theoretical probability</i> )
Complementary angle	Two angles that add up to 90 degrees (ie they form a right angle)

Composition	The combining of distinct parts or elements to form a whole
Compound event	An event whose probability of occurrence depends upon the probability of occurrence of two or more independent events
Compression	To reduce a shape in size while retaining proportions
Conditional probability	The probability that an event will occur, when another event is known to occur or to have occurred (see also <i>complement probability</i> , <i>experimental probability</i> , <i>probability</i> , <i>theoretical probability</i> )
Conditional probability formula	The conditional probability of A given B is denoted by $P(A B)$ and defined by the formula $P(A B) = \frac{P(AB)}{P(B)}$ , provided $P(B) > 0$ . (see also <i>probability formula</i> )
Congruency by AAS, ASA, SAS, SSS	Triangles are congruent if any pair of corresponding sides and their included angles are equal in both triangles.
Congruent	Identical in form; coinciding exactly when superimposed
Construction	The drawing of various shapes using only a compass and straightedge or ruler. No measurement of lengths or angles is allowed.
Coordinates	On the coordinate plane, the pair of numbers giving the location of a point (ordered pair). In three-dimensional coordinates, the triple of numbers giving the location of a point (ordered triple). In $n$ -dimensional space, a sequence of $n$ numbers written in parentheses.
Corresponding angles	The angles in matching corners when two lines are crossed by another line (which is called the transversal)
Dependent events	When the outcome of one event affects the outcome of another (see also <i>independent events</i> , <i>mutually exclusive events</i> )
Dilation	A transformation that grows or shrinks a polygon by a given proportion about a center point
Equidistant	Distant by equal amounts from two or more places
Endpoint	Either of two points marking the end of a line segment (see also <i>midpoint</i> )
Events	A set of outcomes of an experiment (a subset of the sample space) to which a probability is assigned
Experimental probability	The ratio of the number of times the event occurs to the total number of trials (see also <i>complement probability</i> , <i>conditional probability</i> , <i>probability</i> , <i>theoretical probability</i> )
Exterior angle	The angle between any side of a polygon and an extended adjacent side (see also <i>interior angle</i> )
Frequency table	Lists items and uses tally marks to record and show the number of times they occur
Fundamental counting principle	When there are $m$ ways to do one thing, and $n$ ways to do another, then there are $m \times n$ ways of doing both.
Glide reflection	A transformation in which a graph or geometric figure is picked up and moved to another location without any change in size or orientation (see also <i>reflection</i> ).
Glide reflectional symmetry	The symmetry that a figure has if it can be made to fit exactly onto the original when it is translated a given distance at a given direction and then reflected over a line. (see also <i>reflectional symmetry</i> , <i>rotational symmetry</i> , <i>symmetry</i> )
Horizontal line	A constructive line, either drawn or imagined, which passes through the point of sight, and is the chief line in the projection upon which all verticals are fixed, and upon which all vanishing points are found
Hypotenuse	The longest side of a right-angled triangle; the side opposite of the right angle
Hypotenuse-leg theorem (HL theorem)	If the hypotenuse and leg of a right triangle are congruent to the hypotenuse and leg of another right triangle, then the triangles are congruent.

Image	An optically formed duplicate, counterpart, or other representative reproduction of an object, especially an optical reproduction formed by a lens or mirror
Incenter of a triangle	The point where the three angle bisectors of a triangle meet
Included angle	The angle made by two lines with a common vertex
Independent events	When the outcome of one event does not influence the outcome of the second event (see also <i>dependent events</i> , <i>mutually exclusive events</i> )
Inscribed in (the triangle)	Drawing one shape inside a triangle so that it just touches the sides of the triangle
Interior angle	Any of the four angles formed between two straight lines intersected by a third straight line (see also <i>exterior angle</i> )
Intersection	The probability that events A and B both will occur
Isometry	A transformation that is invariant with respect to distance. That is, the distance between any two points in the pre-image must be the same as the distance between the images of the two points.
Isosceles triangle theorem	The angles opposite the two equal sides of an isosceles triangle are equal.
Isosceles triangle theorem, converse	If two angles of an isosceles triangle are congruent, the sides opposite them are congruent.
Leg	Either of the sides in a right triangle opposite an acute angle
Line of symmetry	The line of symmetry of a two-dimensional figure is a line such that, for each perpendicular constructed, if the perpendicular intersects the figure at a distance $d$ from the axis along the perpendicular, then there exists another intersection of the figure and the perpendicular, at the same distance $d$ from the axis, in the opposite direction along the perpendicular. (see also <i>point of symmetry</i> )
Median of a triangle	A line segment joining a vertex of a triangle to the midpoint of the opposing side
Midpoint	A point at or near the middle of, or equidistant from, both ends, as of a line, the midpoint of a boundary (see also <i>endpoint</i> )
Midpoint formula in the coordinate plane	The point halfway between the endpoints of a line segment is called the midpoint. A midpoint divides a line segment into two equal segments.
Midsegment of a triangle	The segment joining the midpoints of two sides of a triangle
Mutually exclusive events	Two events that cannot occur at the same time (see also <i>dependent events</i> , <i>independent events</i> )
$n$ factorial	The factorial of a natural number $n$ is the product of the positive integers less than or equal to $n$ .
Non-included angle	The side of a triangle that is not included by two given angles
Obtuse triangle	A triangle which has an obtuse angle (an angle greater than 90 degrees but less than 180 degrees) as one of its interior angles (see also <i>acute triangle</i> , <i>right triangle</i> )
Ordered pair	Two numbers written in the form $(x, y)$ (see also <i>ordered triple</i> , <i>n-tuple</i> )
Ordered triple	Three numbers written in the form $(x, y, z)$ (see also <i>ordered pair</i> , <i>n-tuple</i> )
$n$ -tuple	$n$ numbers written in the form $(x_1, x_2, x_3, \dots, x_n)$ (see also <i>ordered pair</i> , <i>ordered triple</i> )
Orthocenter of a triangle	The point where the three altitudes of a triangle intersect
Outcome	The result of an experiment in probability theory
Overlap	Similar triangles in which one triangle is on top of (overlapping) another triangle
Parallel	Two lines on a plane that never meet. They are always the same distance

	apart.
Permutation	All possible arrangements of a collection of things, where the order is important
Perpendicular	A straight line at an angle of 90 degrees to a given line, plane, or surface
Perpendicular bisector	A line or a ray that cuts another line segment into two equal parts at 90 degrees
Perpendicular bisector theorem	The perpendicular bisector of a line segment is the locus of all points that are equidistant from its endpoints.
Perpendicular bisector theorem, converse	If a point is equidistant from the endpoints of a segment, then it is on the perpendicular bisector of the segment.
Point of concurrency	The point where three or more lines intersect
Point of symmetry	A special center point for certain kinds of symmetric figures or graphs. If a figure or graph can be rotated $180^\circ$ about a point $P$ and end up looking identical to the original, then $P$ is a point of symmetry. (see also <i>line of symmetry</i> )
Polygon angle-sum theorem	The sum of the measures of the angles of an $n$ -gon is $(n-2)180$
Polygon angle-sum theorem, corollary	The measure of each interior angle of a regular $n$ -gon is $180*(n-2)/n$
Polygon exterior angle-sum theorem	If a polygon is convex, then the sum of the measures of the exterior angles, one at each vertex, is 360.
Preimage	The original figure prior to a transformation.
Probability	The chance that something will happen or how likely it is that some event will happen (see also <i>complement probability, conditional probability, experimental probability, theoretical probability</i> )
Probability distribution	A graph, table, or formula that gives the probability for each value of the random variable
Probability formula	The number of ways an event can occur divided by the total number of possible outcomes (see also <i>conditional probability formula</i> )
Isosceles triangle	A triangle with two equal sides and two equal angles
Proportions	Comparative relation between things or magnitudes as to size, quantity, number, etc.
Pythagorean theorem	An equation relating the lengths of the sides of a right triangle. The sum of the squares of the legs of a right triangle is equal to the square of the hypotenuse. The formula is $a^2 + b^2 = c^2$ .
Ratios	The result of dividing one number or expression by another. Sometimes a ratio is written as a proportion, such as 3:2 (three to two). More often, though, ratios are simplified according to the standard rules for simplifying fractions or rational expressions.  Note: The word <i>rational</i> indicates that a ratio (in the second sense) is involved. The word <i>rate</i> also indicates a ratio is involved, as in instantaneous rate of change or average rate of change.
Ray	A part of a line that begins at a particular point (called the endpoint) and extends endlessly in one direction
Reflection	A transformation that creates a mirror image of a shape (see also <i>glide reflection</i> ).
Reflectional symmetry	The descriptive term for an object or figure that is indistinguishable from its transformed image (see also <i>glide reflectional symmetry, rotational symmetry, symmetry</i> )
Reflexive property of equality	Anything is equal to itself
Relative frequency	The ratio of the actual number of favorable events to the total possible

	number of events; often taken as an estimate of probability
Remote interior angles	The two angles of a triangle that are not adjacent to the exterior angle, which is drawn by extending one of the sides.
Right triangle	A triangle which has a right (90 degree) interior angle (see also <i>acute triangle</i> , <i>obtuse triangle</i> )
Rigid motion	The variance in position and orientation when a rigid body moves
Rotation	A transformation in which a plane figure turns around a fixed center point. In other words, one point on the plane, the center of rotation, is fixed and everything else on the plane rotates about that point by a given angle.
Rotational symmetry	When an object that looks the same after a certain amount of rotation (see also <i>glide reflectional symmetry</i> , <i>reflectional symmetry</i> , <i>symmetry</i> )
Same-side exterior angles	Exterior angles are created where a transversal crosses two (usually parallel) lines. Each pair of these angles is outside the parallel lines, and on the same side of the transversal.
Same-side interior angles	When two parallel lines are intersected by a transversal, one type of angle formed is same-side interior angles. Same side interior angles are pairs of angles that are found on the same side of the transversal.
Sample space	In probability theory, the set of all possible outcomes or results of an experiment
Segments	A line segment is a part of a line that is bounded by two distinct end points, and contains every point on the line between its end points.
Slope	The tangent of the angle between a given straight line and the x-axis of a system of Cartesian coordinates
Straightedge	A bar or piece of material (wood, metal, plastic, etc) with a straight edge for testing straight lines and surfaces or for cutting along or drawing straight lines
Supplementary angles	Two angles that add up to 180 degrees
Symmetry	Illustrated by a geometric figure or a graph consisting of two parts that are congruent to each other (see also <i>glide reflectional symmetry</i> , <i>reflectional symmetry</i> , <i>rotational symmetry</i> )
Tessellation	A plane with identically shaped pieces that do not overlap or leave blank spaces. The pieces do not have to be oriented identically. A tessellation may use tiles of one, two, three, or any finite number of shapes.
Theoretical probability	The likelihood of an event happening based on all the possible outcomes (see also <i>complement probability</i> , <i>conditional probability</i> , <i>experimental probability</i> , <i>probability</i> )
Transformation	Operations that alter the form of a figure. The standard transformations are translations, reflections, dilations (stretches), compressions (contractions or shrinks), and rotations.
Translation	A transformation in which a graph or geometric figure is picked up and moved to another location without any change in size or orientation
Transversal	A line intersecting two or more lines
Tree diagram	A representation of a tree structure in which the probability of each branch is written on the branch and the outcome is written at the end of the branch
Triangles	A closed plane figure having three sides and three angles
Vertex	The point about which an angle is measured
Vertical angles	One of two opposite and equal angles formed by the intersection of two lines
Volume (prisms, cylinders, pyramids, cones, spheres)	The total amount of space enclosed in a solid