Unit 1, Geometric Structure

Content Area: **Math**
Course(s): **Geometry**
Time Period:
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Title Section

Department of Curriculum and Instruction

Belleville Public Schools

Curriculum Guide

Geometry A

Unit 1 Geometric Structure

Belleville Board of Education

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Unit Overview

In this unit students will explore fundamental concepts of Geometry. Mathematical modeling, definitions, constructions, angle relationships, and logical reasoning will be explored throughout this unit. Tools of geometry including protractors, compasses and rulers, as well as paper folding, and geometry software will be used to build an understanding of geometric concepts, model situations and complete geometric constructions. Students will apply inductive reasoning and conjecturing to arrive at valid conclusions. They will express mathematical ideas orally and in writing while acquiring an understanding of geometric concepts. Learners will explore, investigate, construct logical arguments, and make connections to real life situations.

Enduring Understanding

Comprehend and apply basic geometric terms are important for future theorems and postulates.

Students will understand the relationship between geometry and real life situations.

Everything is built from points, lines and planes and follows strict and organized rules.

Geometry provides us with common understanding to measure and describe relationships on a plane and in space.

Geometric ideas can be communicated using a variety of representations.

Constructions are done without measuring.

Geometry helps us to understand the structure of space and the spatial relations around us.

Specific angle relationships are formed when two or more lines are intersected by a transversal.

Essential Questions

Why are points, lines, planes, and angles important in the real world?

How are points, lines, and planes represented in real-life objects?

Why is the coordinate system important?

How does finding the midpoint and distance connect algebra to geometry?

How are angle relationships used to find missing angle measurements?

Why are proofs important in the development of geometry concepts?

How does inductive reasoning and conjecturing help you arrive at valid conclusions?

How does If-then statements help you understand (determine) the validity of conclusions?

How are the relationships between lines and planes used in the real world?

What areas, in the real world, are properties of parallel lines important?

Exit Skills

Identifying and modeling points, lines and planes.

Identifying collinear and coplanar points, intersecting lines and planes in space.

Measuring segments and determining the accuracy of their measurements.

Computing with measures.

Finding the distance between two points.

Finding the midpoint of a segment.

Measuring and classifying angles.

Identifying and using congruent angles and the bisector of an angle.

Identifying and using special pairs of angles.

Identifying perpendicular lines.

Identifying three-dimensional figures.

Writing and analyzing conditional, converse, inverse and contrapositive.

Applying algebraic properties in geometry.

Using the Laws of Detachment.

Writing two-column proofs or paragraph proofs.

Naming angles formed by a pair of lines and a transversal.

Using properties of parallel lines to determine congruent angles.

Using algebra to find angle measures.

Finding slopes of lines.

Using slopes to identify parallel and perpendicular lines.

Writing equations of a line given information about its graph.

Solving problems by writing equations.

Recognizing angle conditions that occur with parallel lines.

Proving that two lines are parallel based on given angle relationships.

Finding the distance between a point and a line.

Finding the distance between parallel lines.

New Jersey Student Learning Standards (NJSLS)

MA.K-12.1	Make sense of problems and persevere in solving them.
MA.G-CO.A.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.
MA.G-CO.A.3	Given a rectangle, parallelogram, trapezoid, or regular polygon, describe the rotations and reflections that carry it onto itself.
MA.K-12.3	Construct viable arguments and critique the reasoning of others.
MA.K-12.4	Model with mathematics.
MA.K-12.5	Use appropriate tools strategically.
MA.K-12.7	Look for and make use of structure.
MA.G-CO.C.9	Prove theorems about lines and angles.
MA.G-CO.C.10	Prove theorems about triangles.
MA.G-CO.C.11	Prove theorems about parallelograms.
MA.G-CO.D.12	Make formal geometric constructions with a variety of tools and methods (compass and straightedge, string, reflective devices, paper folding, dynamic geometric software, etc.).
MA.G-CO.D.13	Construct an equilateral triangle, a square, and a regular hexagon inscribed in a circle.
MA.G-SRT.B.4	Prove theorems about triangles.
MA.G-SRT.B.5	Use congruence and similarity criteria for triangles to solve problems and to prove relationships in geometric figures.
MA.G-GPE.B.4	Use coordinates to prove simple geometric theorems algebraically.
MA.G-GPE.B.6	Find the point on a directed line segment between two given points that partitions the segment in a given ratio.
MA.G-GMD.B.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.

MA.G-MG.A.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).

Interdisciplinary Connections

9.3.12.FN.1	Utilize mathematical concepts, skills and problem solving to obtain necessary information for decision making in the finance industry.
9.3.ST-ET.1	Use STEM concepts and processes to solve problems involving design and/or production.
9.3.ST-SM.2	Apply science and mathematics concepts to the development of plans, processes and projects that address real world problems.
LA.9-10.W.9-10.1	Write arguments to support claims in an analysis of substantive topics or texts, using valid reasoning and relevant and sufficient evidence. Introduce precise claim(s), distinguish the claim(s) from alternate or opposing claims, and create an organization that establishes clear relationships among claim(s), counterclaims, reasons, and evidence.
9-12.HS-PS1-4.2	Modeling in 9–12 builds on K–8 and progresses to using, synthesizing, and developing models to predict and show relationships among variables between systems and their components in the natural and designed worlds.
9-12.HS-PS1-3.3	Planning and Carrying Out Investigations
9-12.HS-PS2-4.5	Mathematical and computational thinking at the 9–12 level builds on K–8 and progresses to using algebraic thinking and analysis, a range of linear and nonlinear functions including trigonometric functions, exponentials and logarithms, and computational tools for statistical analysis to analyze, represent, and model data. Simple computational simulations are created and used based on mathematical models of basic assumptions.

Learning Objectives

Students will:

Understand the precise definition of line segment and circle, based on the undefined terms (point, line and plane)

Identify collinear and coplanar points, intersecting lines and planes in space.

Measure segments and determe the accuracy of their measurements.

Compute with measures.

Determine the distance between two points.

Determine the midpoint of a segment.

Measure and classify angles.

Identify and use congruent angles and the bisector of an angle.

Identify and using special pairs of angles.

Identify perpendicular lines.

Identify three-dimensional figures.

Create and analyze conditional statements, converse, inverse and contrapositive.

Apply algebraic properties in geometry.

Use the Laws of Detachment.

Create two-column proofs or paragraph proofs.

Name angles formed by a pair of lines and a transversal.

Understand the precise definition of parallel lines and investigate relationships between these lines and the angles that they form.

Use properties of parallel lines to determine congruent angles.

Use algebra to find angle measures.

Determine slopes of lines.

Use slopes to identify parallel and perpendicular lines.

Write equations of a line given information about its graph.

Solve problems by writing equations.

Recognize angle conditions that occur with parallel lines.

Prove that two lines are parallel based on given angle relationships.

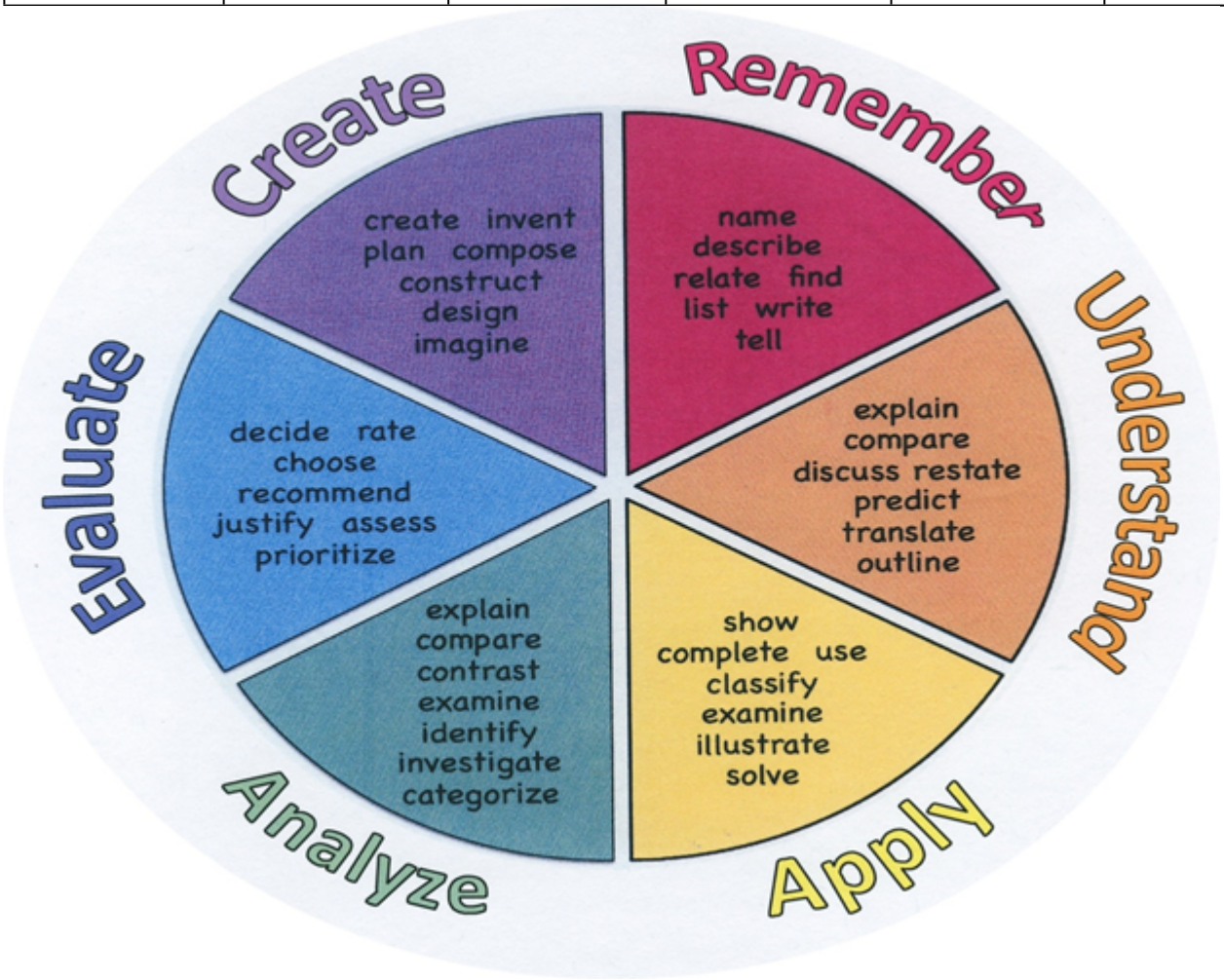
Determine the distance between a point and a line.

Determine the distance between parallel lines.

Action Verbs: Below are examples of action verbs associated with each level of the Revised Bloom's Taxonomy.

Remember	Understand	Apply	Analyze	Evaluate	Create
Choose	Classify	Choose	Categorize	Appraise	Combine
Describe	Defend	Dramatize	Classify	Judge	Compose
Define	Demonstrate	Explain	Compare	Criticize	Construct
Label	Distinguish	Generalize	Differentiate	Defend	Design
List	Explain	Judge	Distinguish	Compare	Develop
Locate	Express	Organize	Identify	Assess	Formulate
Match	Extend	Paint	Infer	Conclude	Hypothesize
Memorize	Give Examples	Prepare	Point out	Contrast	Invent
Name	Illustrate	Produce	Select	Critique	Make

Omit	Indicate	Select	Subdivide	Determine	Originate
Recite	Interrelate	Show	Survey	Grade	Organize
Select	Interpret	Sketch	Arrange	Justify	Plan
State	Infer	Solve	Breakdown	Measure	Produce
Count	Match	Use	Combine	Rank	Role Play
Draw	Paraphrase	Add	Detect	Rate	Drive
Outline	Represent	Calculate	Diagram	Support	Devise
Point	Restate	Change	Discriminate	Test	Generate
Quote	Rewrite	Classify	Illustrate		Integrate
Recall	Select	Complete	Outline		Prescribe
Recognize	Show	Compute	Point out		Propose
Repeat	Summarize	Discover	Separate		Reconstruct
Reproduce	Tell	Divide			Revise
	Translate	Examine			Rewrite
	Associate	Graph			Transform
	Compute	Interpolate			
	Convert	Manipulate			
	Discuss	Modify			
	Estimate	Operate			
	Extrapolate	Subtract			
	Generalize				
	Predict				



Suggested Activities & Best Practices

Textbook, eAssessment, supplemental materials:

https://my.mheducation.com/login

AI Assessment and Learning System:

https://www.aleks.com/

Mindset:

https://www.youtube.com/watch?v=3icoSeGqQtY

http://www.youcubed.org/wp-content/uploads/Positive-Classroom-Norms2.pdf

Coaching Corner:

https://sites.google.com/belleville.k12.nj.us/thecoachingcorner/home

Videos:

https://www.mathantics.com/

https://mashupmath.com/high-school-math-lessons

Constructions:

http://www.mathopenref.com/tocs/constructionstoc.html

Geometry Activities:

https://math.rice.edu/~lanius/Geom/

Geogebra:

https://www.geogebra.org/a/7?lang=en

Desmos:

https://teacher.desmos.com/activitybuilder/custom/5664e067eb08d9501576caa0

Kahoot:

https://create.kahoot.it/details/parallel-lines-and-transversals/1a9e9216-8747-4b0e-911a-79c07f479b3a

Assessment Evidence - Checking for Understanding (CFU)

Glencoe McGraw Hill : Chapter Asssessments, Midchapter Assessments (Summative) - https://connected.mcgraw-hill.com/c2j/assetBuckets.assess.do?bookId=DFRTR2RBH9YT25W7OSMM6J3XM1&selectedCategoryId=3KTMO6D7VZ6SJ4YD3XNOQB3O44

EAssessment test generator (Summative): https://assess.k12.mhedu.com/Instructor/TestGenerator.aspx

Edulastic Formative Assessments (Formative): https://app.edulastic.com/#renderResource/close/Mjk0MjE2ODUwOA%3D%3D

Common benchmarks on OnCourse (Benchmark)

"Do Now/Exit Ticket" Activity (Formative)

- Admit Tickets
- Anticipation Guide
- Common Benchmarks
- Compare & Contrast

- Create a Multimedia Poster
- DBQ's
- Define
- Describe
- Evaluate
- Evaluation rubrics
- Exit Tickets
- Explaining
- Fist- to-Five or Thumb-Ometer
- Illustration
- Journals
- KWL Chart
- Learning Center Activities
- Multimedia Reports
- Newspaper Headline
- Outline
- Question Stems
- Quickwrite
- Quizzes
- Red Light, Green Light
- Self- assessments
- Socratic Seminar
- Study Guide
- Surveys
- Teacher Observation Checklist
- Think, Pair, Share
- Think, Write, Pair, Share
- Top 10 List
- Unit review/Test prep
- Unit tests
- Web-Based Assessments
- Written Reports

Primary Resources & Materials

Glencoe McGraw-Hill Geometry 2014

Practice Glencoe Geometry

Study Guide Glencoe Geometry

Ancillary Resources

ALEKS

The Glencoe Personal Tutor Plus

The Glencoe Personal Tutor Plus(Spanish)

Kutasoftware Geometry

Technology Infusion

Create and have students complete exit tickets using Edulastic { https://app.edulastic.com/#renderResource/close/Mjk0MjE2ODUwOA%3D%3D } or Google forms

Create classes on Google classroom and post assignments, monitor student progress, and offer feedback.

Use geogebra to model problems.

Technology that may be infused into this unit to enhance learning

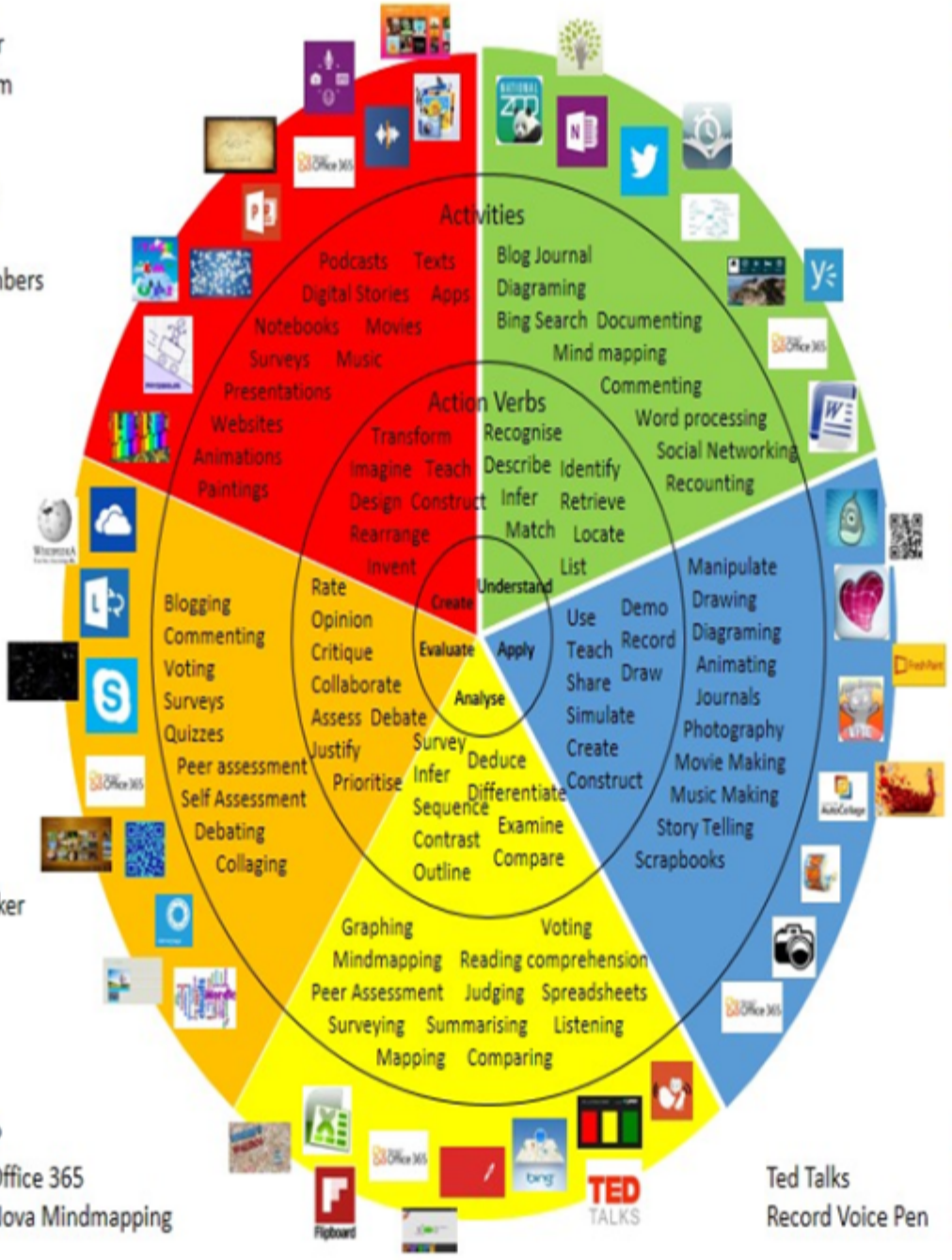
- Youtube
- Khan academy
- Google Classroom
- GSuite
- Kutasoftware
- PodCasts
- Skype
- Twitter
- Ted Talks

- ALEKS
- QR Barcode Generator
- Calculator/Graphing calculator
- Flipgrid
- Peardeck
- Edulastic
- McGraw-Hill Education
- Desmos.com
- Geogebra.org

Win 8.1 Apps/Tools Pedagogy Wheel

Podcasts
Photostory 3
Kid Story Builder
Music Maker Jam
Paint A Story
Office 365
MS PowerPoint
Stack 'Em Up
NqSquared Numbers
Physamajig
Xylophone 8

Wikipedia
Skydrive
Lync
SkyMap
Skype
Office 365
Puzzle Touch
Easy QR
Memorylage
Life Moments
Word Cloud Maker



Where's Waldo?
MS Excel Office 365
Flipboard Nova Mindmapping

Ted Talks
Record Voice Pen

Originally taken from http://www.coetail.com/vzimmer/files/2013/02/iPadagogy-Wheel.001.jpg
And adapted for Windows 8.1 devices by Charlotte Beckhurst @CharBeckhurst

Alignment to 21st Century Skills & Technology

Develop mathematical thinking using real world problems in the Glencoe Interactive Student Guide Workbook https://catalog.mcgraw-hill.com/repository/private_data/DOC/50001167/94/30.pdf

Mastery and infusion of **21st Century Skills & Technology** and their Alignment to the core content areas is essential to student learning. The core content areas include:

- English Language Arts;
- Mathematics;
- Science and Scientific Inquiry (Next Generation);
- World languages;
- Technology;
- Visual and Performing Arts.

CRP.K-12.CRP2	Apply appropriate academic and technical skills.
CRP.K-12.CRP4	Communicate clearly and effectively and with reason.
CRP.K-12.CRP7	Employ valid and reliable research strategies.
CRP.K-12.CRP8	Utilize critical thinking to make sense of problems and persevere in solving them.
CRP.K-12.CRP11	Use technology to enhance productivity.
CAEP.9.2.12.C.2	Modify Personalized Student Learning Plans to support declared career goals.
TECH.8.1.12.A.3	Collaborate in online courses, learning communities, social networks or virtual worlds to discuss a resolution to a problem or issue.
TECH.8.1.12.F.CS1	Identify and define authentic problems and significant questions for investigation.

21st Century Skills/Interdisciplinary Themes

Glencoe -McGrawHill Resources:

Chapter Projects - Map Your Town, Scientific Method,Function of Lines in Construction, Classifying Triangles, Architecture:Triangular Design, Game Time, Picture This Photography &Tesselations, Graduation Planning, Time or Rebound

- Communication and Collaboration
- Creativity and Innovation

- Critical thinking and Problem Solving
- ICT (Information, Communications and Technology) Literacy
- Information Literacy
- Life and Career Skills
- Media Literacy

21st Century Skills

- Civic Literacy
- Environmental Literacy
- Financial, Economic, Business and Entrepreneurial Literacy
- Global Awareness
- Health Literacy

Differentiation

Glencoe-McGrawHill Resources:

Chapter Openers Animation

Student Anticipation Guide

Student Anticipation Guide(Spanish)

Teaching with Foldables

Math Triumphs: Foundations for Geometry

Interactive Student Guide

Personal Tutor

Personal Tutuor (Spanish)

Kutasoftware Geometry

Differentiations:

- Small group instruction
- Small group assignments
- Extra time to complete assignments
- Pairing oral instruction with visuals

- Repeat directions
- Use manipulatives
- Center-based instruction
- Token economy
- Study guides
- Teacher reads assessments allowed
- Scheduled breaks
- Rephrase written directions
- Multisensory approaches
- Additional time
- Preview vocabulary
- Preview content & concepts
- Story guides
- Behavior management plan
- Highlight text
- Student(s) work with assigned partner
- Visual presentation
- Assistive technology
- Auditory presentations
- Large print edition
- Dictation to scribe
- Small group setting

Hi-Prep Differentiations:

- Alternative formative and summative assessments
- Choice boards
- Games and tournaments
- Group investigations
- Guided Reading
- Independent research and projects
- Interest groups
- Learning contracts
- Leveled rubrics
- Literature circles
- Multiple intelligence options
- Multiple texts
- Personal agendas
- Project-based learning
- Problem-based learning
- Stations/centers
- Think-Tac-Toes
- Tiered activities/assignments
- Tiered products
- Varying organizers for instructions

Lo-Prep Differentiations

- Choice of books or activities
- Cubing activities
- Exploration by interest
- Flexible grouping
- Goal setting with students

- Jigsaw
- Mini workshops to re-teach or extend skills
- Open-ended activities
- Think-Pair-Share
- Reading buddies
- Varied journal prompts
- Varied supplemental materials

Special Education Learning (IEP's & 504's)

Glencoe-McGrawHill Resources:

Chapter Openers Animation

Student Anticipation Guide

Teaching with Foldables

Math Triumphs: Foundations for Geometry

Personal Tutor

Kutasoftware Geometry

Interactive Student Notebooks

- printed copy of board work/notes provided
- additional time for skill mastery
- assistive technology
- behavior management plan
- Center-Based Instruction
- check work frequently for understanding
- computer or electronic device utilizes
- extended time on tests/ quizzes
- have student repeat directions to check for understanding
- highlighted text visual presentation
- modified assignment format

- modified test content
- modified test format
- modified test length
- multi-sensory presentation
- multiple test sessions
- preferential seating
- preview of content, concepts, and vocabulary
- Provide modifications as dictated in the student's IEP/504 plan
- reduced/shortened reading assignments
- Reduced/shortened written assignments
- secure attention before giving instruction/directions
- shortened assignments
- student working with an assigned partner
- teacher initiated weekly assignment sheet
- Use open book, study guides, test prototypes

English Language Learning (ELL)

Glencoe-McGrawHill Resources:

Chapter Openers Animation

Student Anticipation Guide(English & Spanish)

Teaching with Foldables

Math Triumphs: Foundations for Geometry

Interactive Student Guide

Personal Tutuor (English and Spanish)

Kutasoftware Geometry

Khan Academy - Geometria Spanish Website

https://es.khanacademy.org/math/geometry-home

- teaching key aspects of a topic. Eliminate nonessential information

- using videos, illustrations, pictures, and drawings to explain or clarif
- allowing products (projects, timelines, demonstrations, models, drawings, dioramas, poster boards, charts, graphs, slide shows, videos, etc.) to demonstrate student's learning;
- allowing students to correct errors (looking for understanding)
- allowing the use of note cards or open-book during testing
- decreasing the amount of workpresented or required
- having peers take notes or providing a copy of the teacher's notes
- modifying tests to reflect selected objectives
- providing study guides
- reducing or omitting lengthy outside reading assignments
- reducing the number of answer choices on a multiple choice test
- tutoring by peers
- using computer word processing spell check and grammar check features
- using true/false, matching, or fill in the blank tests in lieu of essay tests

At Risk

Glencoe-McGrawHill Resources:

Chapter Projects

Chapter Openers Animation

Student Anticipation Guide

Student Anticipation Guide(Spanish)

Teaching with Foldables

Math Triumphs: Foundations for Geometry

Interactive Student Guide

Personal Tutor

Personal Tutuor (Spanish)

Kutasoftware Geometry

Khan Academy Geometry Lessons

- allowing students to correct errors (looking for understanding)
- teaching key aspects of a topic. Eliminate nonessential information
- allowing products (projects, timelines, demonstrations, models, drawings, dioramas, poster boards, charts, graphs, slide shows, videos, etc.) to demonstrate student's learning
- allowing students to select from given choices
- allowing the use of note cards or open-book during testing
- collaborating (general education teacher and specialist) to modify vocabulary, omit or modify items to reflect objectives for the student, eliminate sections of the test, and determine how the grade will be determined prior to giving the test.
- decreasing the amount of workpresented or required
- having peers take notes or providing a copy of the teacher's notes
- marking students' correct and acceptable work, not the mistakes
- modifying tests to reflect selected objectives
- providing study guides
- reducing or omitting lengthy outside reading assignments
- reducing the number of answer choices on a multiple choice test
- tutoring by peers
- using authentic assessments with real-life problem-solving
- using true/false, matching, or fill in the blank tests in lieu of essay tests
- using videos, illustrations, pictures, and drawings to explain or clarify

Talented and Gifted Learning (T&G)

Glencoe-McGrawHill Resources:

Chapter Openers Animation

Student Anticipation Guide

Student Anticipation Guide(Spanish)

Teaching with Foldables

Interactive Student Guide

Personal Tutor

Personal Tutuor (Spanish)

Math Forum

Kutasoftware Geometry

Khan Academy Lessons

SAT/ACT practice problems

- Above grade level placement option for qualified students
- Advanced problem-solving
- Allow students to work at a faster pace
- Cluster grouping
- Complete activities aligned with above grade level text using Benchmark results
- Create a blog or social media page about their unit
- Create a plan to solve an issue presented in the class or in a text
- Debate issues with research to support arguments
- Flexible skill grouping within a class or across grade level for rigor
- Higher order, critical & creative thinking skills, and discovery
- Multi-disciplinary unit and/or project
- Teacher-selected instructional strategies that are focused to provide challenge, engagement, and growth opportunities
- Utilize exploratory connections to higher-grade concepts
- Utilize project-based learning for greater depth of knowledge

Sample Lesson

Unit Name: Geometric Structure

NJSLS: MA.9-12.G-CO.A.4

Interdisciplinary Connection: Architecture, ELA

Statement of Objective: Students will explore the relationship among angles formed by a transversal and a system of two lines and consider what happens when the two lines are parallel vs when they are not.

Anticipatory Set/Do Now: https://www.youtube.com/watch?v=xw_ImMm_uhc, WHat if lines were not parallel

or SAT practice - Geom review

Learning Activity: In groups

https://teacher.desmos.com/activitybuilder/custom/56fd6cb1bfa5cb4206f88f5f

if you have two lines cut by a transversal, how many angles can be formed? What do you notice about the corresponding angles? What do you notice about the alternate interior angles? What do you notice about the alternate exterior angles? What do you notice about vertical angles? Do you think this would be true if the two lines were not parallel? Why?

Develop student literacy and content learning:

Triple-Entry Vocabulary Journal - give students a template with the page split into three columns labeled Word in Context, Definition in My Own Words, and Picture, Memory Aid, Phrase.

Model entering Parallel lines in Vocab Journal, have students for transversal , alt int, ext, corr angles

Students will continue to add vocab throughout unit.

Student Assessment/CFU's: https://app.edulastic.com/#renderResource/close/MjkyMTQ1OTExOQ%3D%3D

Materials: chromebook, graphic organizer(table), pencils,

21st Century Themes and Skills: Communication and collaboration, technology

Differentiation/Modifications:
Anticipation guide, thinkpairshare, flexible grouping, goal setting (vary number of vocab terms)
Integration of Technology: https://teacher.desmos.com/activitybuilder/custom/56fd6cb1bfa5cb4206f88f5f

https://www.geogebra.org/m/DPU35bWR

MA.G-CO.A.4	Develop definitions of rotations, reflections, and translations in terms of angles, circles, perpendicular lines, parallel lines, and line segments.
MA.G-CO.C.9	Prove theorems about lines and angles.