# Unit 06 Relationships with Triangles

Content Area: **Mathematics**
Course(s):
Time Period: **Marking Period 3**
Length: **2 weeks**
Status: **Published**

## Brief Summary of Unit

Students will prove theorems about lines, angles and triangles. Students will also construct the inscribed and circumscribed circles of a triangle. Students will explore special relationships within triangles including perpendicular bisectors, angle bisectors, medians, altitudes, and midsegments.

**Revision Date:** July 2024

## Standards

Students will analyze geometric designs which connects to various cultures. Embracing the diversity within society incorporates the following:

Amistad Commission

This unit also reflects the goals of the Department of Education and the Amistad Commission including the infusion of the history of Africans and African-Americans into the curriculum in order to provide an accurate, complete, and inclusive history regarding the importance of of African-Americans to the growth and development of American society in a global context.

Asian American and Pacific Islander History Law

This unit includes instructional materials that highlight the history and contributions of Asian Americans and Pacific Islanders in accordance with the New Jersey Student Learning Standards in Social Studies.

New Jersey Diversity and Inclusion Law

In accordance with New Jersey's Chapter 32 Diversity and Inclusion Law, this unit includes instructional materials that highlight and promote diversity, including:

economic diversity, equity, inclusion, tolerance, and belonging in connection with gender and

sexual orientation, race and ethnicity, disabilities, and religious tolerance.

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| ELA.K-12.2 | Adapting Communication: Adapting communication in response to the varying demands of audience, task, purpose, and discipline. |
| ELA.K-12.3 | Valuing Evidence in Argumentation: Constructing viable claims and evaluating, defending, challenging, and qualifying the arguments of others. |
| MATH.9-12.G.C.A.3 | Construct the inscribed and circumscribed circles of a triangle, and prove properties of angles for a quadrilateral inscribed in a circle. |
| MATH.9-12.G.CO.C.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. |
| MATH.9-12.G.CO.C.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. |
| CS.K-12.3.a | Identify complex, interdisciplinary, real-world problems that can be solved computationally. |
| CS.K-12.3.b | Decompose complex real-world problems into manageable sub-problems that could integrate existing solutions or procedures. |
| TEC.K-12.8.1 | All students will use computer applications to gather and organize information and to solve problems. |
| TEC.K-12.8.2 | All students will develop an understanding of the nature and impact of technology, engineering, technological design, and the designed world as they relate to the individual society, and the environment. |
| WORK.K-12.9.1 | All students will develop career awareness and planning, employability skills and foundational knowledge necessary for success in the workplace. |
| WORK.K-12.9.2 | All students will develop career awareness and planning, employability skills and foundational knowledge necessary for success in the workplace. |

## Essential Questions

- How are altitudes in right triangles different than in other types of triangles?
- How do I compare angles and sides of triangles?
- What happens when three lines intersect within a triangle?

## Enduring Understandings

- A triangle's three medians are always concurrent
- There are many geometric relationships within triangles and points of concurrency.
- There is a special relationship between the points on the perpendicular bisector of a segment and the endpoints of a segment
- When you draw the altitude to the hypotenuse of a right triangle, you form three pairs of similar right triangles

## Students Will Know

- How to compare measures within triangles and between two triagles.
- How to identify and use perpendicular and angle bisectors of triangles.
- How to identify properties of medians and altitudes of a triangle.
- How to use medians and altitudes of triangles to solve problems.

## Students Will Be Skilled At

- Circumscribing a circle about a triangle.
- Determining possible side lengths of triangles.
- Drawing medians and altitudes of triangles.
- Finding circumcenter and incenter about a triangle.
- Finding the centroid of a triangle.
- Finding the orthocenter of a trinagle.
- Identifying a perpendicular bisector and an angle bisector.
- Inscribing a circle within a triangle.
- Manipulating the properties of altitudes and medians in a triangle.
- Ordering the angles of a triangle given the side lengths.
- Ordering the side lengths of a triangle given the angle measures.
- Solving for midsegments, perpendicular bisectors, and angles bisectors using a variety of theorems.
- Using theorems about bisectors to find measures in figures.
- Writing equations of perpendicular bisectors.

## Evidence/Performance Tasks

Assessments

- Formative: Daily assessments using examples from class notes, NJSLA test bank problems, and/or Albert/AP Classroom assessments
- Summative: Teacher-created assessments, NJSLA test bank problems, Big Ideas Math online platform problems, Albert/AP Classroom and/or Big Ideas Math unit assessments
- Benchmark: IXL or teacher created diagnostic assessments in addition to unit assessments from Big Ideas Math
- Alternative Assessments: Student-centered activities such as scavenger hunts, various projects involving real world applications, and differentiated learning tasks in Khan Academy, DeltaMath, and IXL

- Answer essential questions
- Class discussion of daily topic
- Classwork and homework that assess the essential questions
- Provide alternative means of assessments for certain students
- Teacher Observation
- Tests and quizzes that assess the essential questions
- Written assignments that assess the essential questions that involves providing explanations

## Learning Plan

Unit 6: Chapter 6, Relationships with Triangles (1-2 days per topic, 1 days practice, 1 days review, 1 days assessment for 9 days)

- Perpendicular and Angle Bisectors 6.1
    - Perpendicular Bisector Theorem and its Converse
    - Using the Perpendicular Bisector Theorem
    - Angle Bisector Theorem and its Converse
    - Using the Angle Bisector Theorem
- Bisectors of Triangles 6.2
    - Define Point of Concurrency, Circumcenter (perpendicular bisectors)
    - Present Acute, Right and Obtuse Triangles whose Circumcenters are inside, on and outside of the triangle
    - Construct a circle that is circumscribed about a triangle**
    - Define Incenter (angle bisectors); always inside the triangle
    - Construct a circle that is inscribed within a triangle**
- Medians and Altitudes of Triangles 6.3
    - Definition of Median, Centroid
    - Construct the median of a triangle
    - Using Centroid to find missing values
    - Finding Centroid on coordinate plane; midpoint review
    - Define Altitude of a Triangle, Orthocenter

- Discuss location of Orthocenter and type of Triangle

These sections can be efficiently taught using summaries of four points of concurrencies as well as online dynamic resources that illustrate the associated properties. (Example, Centroid)

- Inequalities in One Triangle 6.5
  - Relate sides and angles of a triangle
  - Triangle longer side theorem
  - Triangle larger angle theorem
  - Triangle Inequality theorem; given two sides, find possible lengths of third side
  - Decide if three lengths could form a triangle

## Materials

Core instructional materials: Core Book List including Big Ideas Math Common Core Geometry

Supplemental materials: Khan Academy, Edia, DeltaMath

- District approved textbook and ancillary materials
- Online resources: Khan Academy, IXL, Delta Math, Edia, Geogebra
- Teacher created activiites
- Teacher created notes

## Suggested Strategies for Modifications

Possible accommodations/modification for Geometry CP.