# Unit 03 - Parallel & Perpendicular Lines

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

## Brief Summary of Unit

In this chapter, students will achieve and exhibit with excellence how to prove theorems about parallel and perpendicular lines, use properties of parallel and perpendicular lines to find angle measures, determine whether two lines are parallel or perpendicular, use parallel and perpendicular lines to prove a theorem about triangles, and find measures of angles of triangles.

**Revision Date**: July 2024

## Standards

Students will analyze geometric designs which connect 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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| 9.2.12.CAP.3 | Investigate how continuing education contributes to one's career and personal growth. |
| L.KL.9–10.2.A | Acquire and use accurately general academic and domain-specific words and phrases, sufficient for reading, writing, speaking, and listening at the college and career readiness level. |
| 9.2.12.CAP.6 | Identify transferable skills in career choices and design alternative career plans based on those skills. |
| 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. |
| 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. |
| 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.). 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.GPE.B.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.B.6 | Find the point on a directed line segment between two given points that partitions the segment in a given ratio. |
| SL.PE.11–12.1.A | Come to discussions prepared, having read and researched material under study; explicitly draw on that preparation by referring to evidence from texts and other research on the topic or issue to stimulate a thoughtful, well-reasoned exchange of ideas. |

## Essential Questions

- How can you prove lines parallel based on given angles?
- How do you construct parallel lines? How do you construct perpendicular lines?
- What is a skew line, and how does it compare to the relationship parallel and perpendicular?
- What theorems can be proven using perpendicular lines?
- What types of angels are formed by a transversal and parallel lines? What special relationships are created?

## Enduring Understandings

- If a point lies on the angle bisector of an angle, then it is equidistant from the sides of the angle.
- Partition a directed line segments and understand slopes of parallel and perpendicular lines.
- Prove and use theorems about parallel lines and transversals.
- Prove and use theorems about perpendicular lines.

- Understand the relationship between various types of lines, planes, and pairs of angles.

## Students Will Know

- Angle relationships formed by parallel lines and a transversal.
- How to identify lines and angles.
- How to prove theorems involving parallel and perpendicular lines.
- How to write equations of parallel and perpendicular lines.

## Students Will Be Skilled At

- Constructing parallel lines.
- Constructing perpendicular lines and perpendicular bisectors.
- Executing angle relationships involving parallel lines, as well as perpendicular lines.
- Finding the distance from a point to a line.
- Finding the distance from a point to a line.
- Identifying lines and planes.
- Identifying pairs of angles formed by transversals.
- Identifying parallel and perpendicular lines.
- Partitioning directed line segments using slope.
- Proving theorems about identifying parallel lines.
- Proving theorems about parallel lines.
- Proving theorems about perpendicular lines.
- Using properties of parallel lines to find angle measures.
- Using slopes to identify parallel and perpendicular lines.
- Using theorems to identify parallel lines.
- Writing equations of parallel and perpendicular lines.

## 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: DeltaMath 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, and

DeltaMath

- 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

The following list is meant to create a day-to-day plan. Teachers are encouraged to slow down or condense days as appropriate to the student population in the class. Assessment(s) should be given when appropriate.

- Begin by extending the idea of parallel lines and planes to skew lines. Have students determine if planes can be skew. Recall knowledge of perpendicular lines. Apply parallel, perpendicular, and skew line concepts to a 3D shape. Introduce angle relationships formed by a transversal connecting two other lines.
- Students will likely need additional time to practice identifying the relationships of lines and angles.
- Take time to construct parallel lines and perpendicular lines. If time allows, discuss how to specifically construct a perpendicular bisector.
- Remind students that previously a transversal was connecting any two lines. Now, specify the special angle relationships formed by parallel lines cut by a transversal. If possible, allow students the use of a protractor to determine these relationships on their own. Formalize these conclusions with proper theorem names.
- Apply these new theorems in proofs.
- Students will likely need additional time to practice solving algebraic equations using these angle theorems, as well as applying these theorems in proofs.
- Remind students that SOME theorems do have converses. Extend this to the angle theorems most recently discussed. Use the new converse theorems to solve algebraic equations and in proofs.
- Shifting gears from parallel lines, have students "brain dump" everything they previously known about perpendicular lines and what has been discovered so far in this class. Reinforce the vocabulary where needed. Introduce perpendicular theorems that can be applied in proofs.
- If time allows, use the known slopes of lines to determine if they are parallel, perpendicular, or neither. Students would also be encouraged at this point to write the equation of parallel/perpendicular lines given one line's equation and another point. Finally, students can find the distance between a given point and a given line by first determine what line is perpendicular to the given line and also goes through the given point.

## Materials

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

Supplemental materials: Khan Academy, Edia, DeltaMath

- District approved textbook
- Khan Academy
- SMART Board
- Teacher created activiites
- Teacher created notes
- Whiteboard tables

## Suggested Strategies for Modifications

Possible accommodations/modification for Geometry