



Topic B:

Perpendicular and Parallel Lines in the Cartesian Plane

G-GPE.B.4, G-GPE.B.5

Focus Standard:	G-GPE.B.4	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 $(1, \sqrt{3})$ lies on the circle centered at the origin and containing the point $(0, 2)$.</i>
	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).
Instructional Days:	4	
	Lesson 5:	Criterion for Perpendicularity (P) ¹
	Lesson 6:	Segments That Meet at Right Angles (P)
	Lesson 7:	Equations for Lines Using Normal Segments (S)
	Lesson 8:	Parallel and Perpendicular Lines (P)

The challenge of programming robot motion along segments parallel or perpendicular to a given segment leads to an analysis of slopes of parallel and perpendicular lines and the need to prove results about these quantities (**G-GPE.B.5**). MP.3 is highlighted in this topic as students engage in proving criteria and then extending that knowledge to reason about lines and segments. This work highlights the role of the converse of the Pythagorean theorem in the identification of perpendicular directions of motion (**G-GPE.B.4**). In Lesson 5, students explain the connection between the Pythagorean theorem and the criterion for perpendicularity studied in Module 2 (**G-GPE.B.4**). Lesson 6 extends that study by generalizing the criterion for perpendicularity to any two segments and applying this criterion to determine if segments are perpendicular. In Lesson 7, students learn a new format for a line, $a_1x + a_2y = c$, and recognize the segment from $(0, 0)$ to (a_1, a_2) as normal with a slope of $-\frac{a_2}{a_1}$. Lesson 8 concludes Topic B when students recognize parallel and

¹ Lesson Structure Key: **P**-Problem Set Lesson, **M**-Modeling Cycle Lesson, **E**-Exploration Lesson, **S**-Socratic Lesson

perpendicular lines from their slopes and create equations for parallel and perpendicular lines. The criterion for parallel and perpendicular lines and the work from this topic with the distance formula will be extended in the last two topics of this module as students use these foundations to determine perimeter and area of polygonal regions in the coordinate plane defined by systems of inequalities. Additionally, students will study the proportionality of segments formed by diagonals of polygons.