

## Sample Lesson: Equations and Graphs of Parallel and Perpendicular Lines

*Subject:* Equations and graphs of parallel and perpendicular lines

*Overview of Unit:* The lesson described below is part of a unit on Functions and Graphing. Toward the end of the chapter about Linear Graphs, one lesson pertains to parallel and perpendicular lines. It ends with applications in geometry.

*Grade Level:* This lesson is taught at the Pre-algebra level (5<sup>th</sup> to 7<sup>th</sup> grade) and revisited in Algebra 1 (typically 6<sup>th</sup> to 8<sup>th</sup> grade depending on the section). It may take one to two class periods depending on the level of students.

*Objective:* Students will develop an understanding of, and the applications for, parallel and perpendicular lines and their graphical displays.

*Materials:*

Graph paper and rulers

*Instruction:*

*Warm-up (about 5 minutes)*

- A. Students are asked to list what they already know about linear graphs and equations.
- B. A few minutes later, the class gets together and answers are listed on the board. Standard form, slope-intercept form, and possibly point-slope form (Algebra 1) are discussed again. Students explain the names and when to use one or the other.
- C. An equation is given in point-slope and students are asked to rewrite it in slope-intercept and in standard form or vice-versa. We can now start working on the new lesson.

*Parallel lines (about 20 minutes)*

- A. Several equations are given, not necessarily in the same form. They have the same slope, though. Students are asked to graph them and to make up an equation for a line parallel to them.

Conclusion: Lines with the same slope are parallel.

Extension: Vertical lines are also parallel even though the slope is undefined.

- B. Students are given the equation of a linear graph in slope-intercept form and the coordinates of a point. They have to find the equation passing through the point and parallel to the given graph.
- C. This activity is repeated with an equation in standard form (and after, in point-slope form) and another point.
- D. Application in Geometry: Various quadrilaterals are drawn on a coordinate plane. The coordinates of vertices are given. Students determine algebraically whether two sides are parallel.

*Perpendicular Lines (about 20 minutes)*

- A. Perpendicular linear graphs are given to students who compare the slopes and conclude that two lines are perpendicular when the product of their slopes is  $-1$ . We also restate it by saying that one slope is the negative reciprocal of the other.

- B. Students write down several pairs of equations and ask a peer to find out whether the lines are perpendicular, parallel or none of the above.  
Students are asked
- To write the slope-intercept form for an equation of the line that passes through a point (coordinates are given) and is perpendicular to a certain graph.
  - To write the slope-intercept form of an equation of a line perpendicular to a certain graph and passes through the x-intercept of the graph.
- C. Application in Geometry: a kite is drawn on a coordinate plane. The coordinates of vertices are given. Students determine algebraically whether the two diagonals are perpendicular.

*Ticket to leave:*

We “go around” to wrap up today’s lesson. Each student says one thing we need to remember about parallel and perpendicular graphs.

*Assessment:*

When students have shown that they understand the concepts, homework is assigned.

When correcting homework, we will look for different levels of mastery and address issues of confusion and strengthen skills.

*Extension:*

If additional time is available, or the unit is extended, students will be shown examples of parallel and perpendicular lines in architecture and art.

Students will write a journal entry that demonstrates their understanding of the concepts learned. Additionally, students will record in their math journals several examples of parallel and perpendicular lines that can be found in the world around them.