

Mathematics
Algebra 1
Grades 7AB and 8



Lesson Plans

"Up and Down with Slopes"

Subject:

Mathematics: Algebra I

Level:

Grades 7 - 8

Abstract:

Students will begin the lesson by finding the slope, x-intercept, and y-intercept of linear equations, by hand. The students will graph linear equations, also by hand. When they grasp these concepts, they will then use the computer, and Microsoft Excel, to find the slope, x-intercept, and y-intercept of linear equations. The students will graph linear equations, using Microsoft Excel. After students have verified that their spreadsheets are working correctly, they will investigate the relationship between parallel and perpendicular lines. This will be done by graphing pairs of parallel and perpendicular lines and examining the slopes and graphs. Finally, students will write a report detailing their findings on parallel and perpendicular lines, importing their Microsoft Excel graphs into a Word document.

Invitation:

Have you ever looked down a set of railroad tracks? Have you ever watched a football game? Have you ever read and played a piece of music? If you have, you have seen examples of parallel lines. Can you think of other places where you have seen parallel lines?

Have you looked at a map? Have you ever used a square in carpentry? Have you been in a room with straight walls? If you have, you have seen examples of perpendicular lines. If you have ever been in a building that leans, then you have seen an example of walls and floors that are not perpendicular. Can you think of other places where you have seen perpendicular lines?

How do you know for sure when lines are parallel or perpendicular? Can you tell from looking at the equation of lines? In this lesson you will investigate parallel and perpendicular lines to answer these questions.

Situations:

Where: The lesson will take place at school on computers in the classroom or computer lab. Some of the work may take place outside the school if students have access to a computer.

When: This lesson will take place during Algebra class when the students are learning about and graphing linear equations. The students should have prior knowledge on finding the intercepts and slope of a linear equation, as well as graphing linear equations.

How Long: This lesson will require 6–8 days to complete.

Tasks:

Task 1:

As a class, students will discuss the ideas of slope, parallel, and perpendicular. Students should have an understanding of these terms and be able to give examples of parallel and perpendicular lines.

Task 2:

Each student will find the slope and intercepts of a linear equation, and then graph the linear equation. This practice reinforces the main concepts to the students before moving onto using the computer. (See the “Worksheet: Finding the Slope and Intercepts of a Linear Equation” attachment.)

Task 3:

Students, individually or with a partner, will create an Excel spreadsheet to find the slope and intercepts of a linear equation and to graph the linear equation. (See the “Step Sheet: Slope and Intercepts” attachment.) After setting up the spreadsheet, students should redo the problems from the “Worksheet: Finding the Slope and Intercepts of a Linear Equation” attachment. This will verify that their spreadsheet is working correctly and it will also check the work done in Task 2.

Task 4:

Students, individually or with a partner, will create an Excel spreadsheet to graph and find the slopes of pairs of linear equations. (See the “Step Sheet: Graphing Pairs of Linear Equations” attachment.)

Task 5:

Students, individually or with a partner, will use their Excel spreadsheet from Task 4 to graph and find the slopes of pairs of linear equations to discover the relationships between parallel and perpendicular lines. (See the “Worksheet: When are Lines Parallel or Perpendicular?” attachment.)

Task 6:

Each student will write a report in Word detailing their findings about slope and intercepts. They will give the relationships between slopes of parallel and perpendicular lines along with an example of each. (See the “Worksheet: Student Report” attachment.) For help with writing a Word

document see the "Step Sheet: Creating a New Document" attachment. The graphs of the lines will be drawn using the spreadsheets developed in Tasks 3 and 4. The graphs will be pasted into the student's Word document. (See the "Step Sheet: Importing Graphs from Excel into Word Documents" attachment.)

Interactions:

Full Class: Teacher will initiate full-class discussions and indicate whether tasks will be discussed using a brainstorm or discussion style.

Partners: Partners will develop and use Excel in one or two tasks to graph linear equations and investigate the relationships between the slopes of parallel and perpendicular lines.

Individual: Each student will find the slopes and intercepts of linear equations and graph the equations by hand. Each student will write a report detailing his or her findings.

Standards:

Grade Seven: Algebra and Functions

3.3 Graph linear functions, noting that the vertical change (change in y value) per unit of horizontal change (change in x-value) is always the same and know that the ratio ("rise over run") is called the slope of a graph.

Grade 8 – 12: Mathematics: Algebra I

Symbolic reasoning and calculations with symbols are central in algebra. Through the study of algebra, a student develops an understanding of the symbolic language of mathematics and the sciences. In addition, algebraic skills and concepts are developed and used in a wide variety of problem-solving situations.

6.0 Students graph a linear equation and compute the x- and y-intercepts (e.g., graph $2x + 6y = 4$). They are also able to sketch the region defined by linear inequality (e.g., they sketch the region defined by $2x + 6y < 4$).

8.0 Students understand the concepts of parallel lines and perpendicular lines and how those slopes are related. Students are able to find the equation of a line perpendicular to a given line that passes through a given point.

Assessment:

- "Worksheet Solutions: Finding the Slope and Intercepts of a Linear Equation:" Solution to worksheet to aid teacher in assessing the students' knowledge of slopes and intercepts of linear equations and graphing linear equations.

- "Worksheet Solutions: When are Lines Parallel or Perpendicular?: " Solution to worksheet to aid teacher in assessing the students' knowledge of parallel and perpendicular lines and the relationship of the slopes between those lines.
- "Student Report Rubric:" Rubric filled out by teacher that assesses the students' results and knowledge in "Worksheet: Student Report."

Tools:

- Microsoft Excel
- Microsoft Word
- Graph Paper
- Rulers

Project Tips and Alternatives:

Tip #1:

Small groups can be used instead of partners if the dynamic of the class or availability of technology necessitates it.

Tip #2:

During the full-class discussion in Task 1, you may want to show the students an example of an optical illusion that demonstrates that you can't always believe your eyes. The tendency is to say lines are parallel because they look parallel. An optical illusion can demonstrate that you cannot tell by just looking if lines are parallel. This necessitates the need for a mathematical method of determining if lines are parallel. A website with many optical illusions that would be useful here is:

Run-Down: Optical Illusions Gallery

<http://run-down.com/illusions.php>

Tip #3:

Discuss as a class the solution to the general equation in Worksheet 1 problem #6. This is the basis for the Excel spreadsheet.

Tip#4:

Depending on whether your students have had prior experience with Microsoft Excel, you may want to walk through the Step Sheet with them the first time.

Tip #5:

You may want the students to present their findings orally. Students can use Microsoft PowerPoint if they are familiar with it. The decision to do a written or oral presentation of findings may be left up to each student.

Attachments:

- "Worksheet: Finding the Slope and Intercepts of a Linear Equation"
- "Worksheet Solutions: Finding the Slope and Intercepts of a Linear Equation"
- "Step Sheet: Slope and Intercepts"
- "Step Sheet: Creating a Graph in Excel"
- "Step Sheet: Graphing Pairs of Linear Equations"
- "Step Sheet: Graphing Pairs of Lines in Excel"
- "Worksheet: When are Lines Parallel or Perpendicular?"
- "Worksheet Solutions: When are Lines Parallel or Perpendicular?"
- "Sample: Graphing a Linear Equation"
- "Sample: Graphing Pairs of Lines"
- "Worksheet: Student Report"
- "Student Report Rubric"
- "Step Sheet: Creating a New Document"
- "Step Sheet: Importing Graphs from Excel into Word Documents"

Web Resources – Content:

A list of [linked web resources](#) related to the content of this lesson can be found on the Lesson Page.

Web Resources – Excel:

A list of [linked web resources for Excel](#) can be found on the Excel Resources page.

Assistive Technology:

Please refer to the [Assistive Technology section](#) for information on methods and devices to help ensure that all students have access to the curricula in the least restrictive environment.