Unit: The Coordinate Plane
Sequential Math 1 Regents
Grades 9/10

Investigating Linear Equations:
Slope and Y-Intercept
5-Day Lesson Plan
Using the Geometer’s Sketchpad

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UNIT OBJECTIVES

The students will be able to:

- understand the concept of “slope” as it refers to a linear equation by investigating the slopes of different lines using the Geometer’s Sketchpad.
- determine slopes and y-intercepts by investigating linear equations and their graphs using the Geometer’s Sketchpad.
- find slope and y-intercept from given equations.
- determine whether lines are parallel or perpendicular by investigation using the Geometer’s Sketchpad.
- find slope given two points on a line.

This unit will address the NCTM Geometry standards, which state that students will be able use Cartesian coordinates and other coordinate systems, such as navigational, polar, or spherical systems, to analyze geometric situations; and that students will be able to specify locations and describe spatial relationships using coordinate geometry and other representational systems (NCTM Principles and Standards for School Mathematics, Chapter 7 “Standards for Grades 9-12”.

RESOURCES USED


Key Curriculum Press, Exploring Geometry with the Geometer’s Sketchpad, by Dan Bennett, Chapter 1, pages 20-24, copyright 1999.

MATERIALS AND EQUIPMENT NEEDED

- Computers with Geometer’s Sketchpad software
- Overhead projector or board (chalk or dry erase)
- Integrated Mathematics Course 1 textbook
- Rulers
- Graph paper
UNIT OVERVIEW

- **DAY 1:** Students will investigate the slopes of lines using Geometer’s Sketchpad.
- **DAY 2:** Students will investigate the slopes and y-intercepts of linear equations using Geometer’s Sketchpad.
- **DAY 3:** Students will be solving linear equations for y and finding the slopes and y-intercepts of these equations.
- **DAY 4:** Students will investigate the slopes of parallel and perpendicular lines using Geometer’s Sketchpad.
- **DAY 5:** Students will be using the slope formula to find the slopes of lines if given two points on the line.
DAY 1

Objective: Students will be able to understand the concept of “slope” as it refers to a linear equation by investigating the slopes of different lines using the Geometer’s Sketchpad.

Required Materials: Students will need their computers with the Geometer’s Sketchpad software loaded on. Teachers will need their computers with the Geometer’s Sketchpad loaded on and with proper hookup to the classroom’s television monitor, as well as the handouts necessary for today’s activity.


- Students should be ready with their computers on and Geometer’s Sketchpad on their screens. Each student will be given a handout of pages 20-21 with today’s activity.
- Teacher will go through the steps on the “Sketch and Investigate” activity on page 20 on the computer, while students watch on the TV monitor and then perform the same steps on their own computers.
- Teacher will then lead a discussion based on Q1 a-d on page 20.
- Teacher will go through the “Slope Game” activity on page 21 once while the students watch on the monitor. The students will then pair off and play several games per pair, recording their findings. Teacher will float about the room checking on students’ progress.
- Last 5-10 minutes of class, teacher will lead a discussion based on each pair’s findings, for closure.

Homework: None.
Objective: Students will be able to determine slopes and $y$-intercepts by investigating linear equations and their graphs using the Geometer’s Sketchpad.

Required Materials: Same as DAY 1, plus students will need their textbooks.

Activity: The “Equations of Lines” activity from Exploring Geometry with the Geometer’s Sketchpad, pages 22-23.

- Students should be ready with their computers on and Geometer’s Sketchpad on their screens. Each student will be given a handout of pages 22-23 with today’s activity.

- Teacher will go through the steps on the “Sketch and Investigate” activity on page 22 on the computer, while students watch on the TV monitor and then perform the same steps on their own computers.

- Teacher will then lead a discussion on Q1 before moving on to Q2.

- Teacher will go through the steps in Q2 on page 23 on the computer, while students watch on the TV monitor and then perform the same steps several times on their own, recording their findings.

- Teacher will go through step 13 on page 23, then will lead a discussion on Q3.

Homework: From Integrated Mathematics Course 1, by Amsco:
Section 17-8, page 598, exercises 1-9 and 16-23.
DAY 3

Objective: Students will be able to find slope and y-intercept from given equations.

Required Materials: Same as DAY 1, plus overhead projector or board (chalk or dry erase).

Activity: Continue with the activity from DAY 2, using the same handout sheet, specifically, page 23 “Explore More” section.

• Students should be ready with their computers on and Geometer’s Sketchpad on their screens. Each student will be given a handout of pages 22-23 with today’s activity.

• Teacher will go through Q1 under the “Explore More” section on page 23 on the computer while students watch on the TV monitor, then students will work in pairs investigating the same question, recording their findings. This should last about 10 minutes.

• Teacher will go through Q2 under the “Explore More” section on page 23 on the computer while students watch on the TV monitor, then students will work in pairs investigating the same question, recording their findings. This should last about 10 minutes.

• Teacher should float around the classroom checking on the students’ progress during Q1 and Q2.

• Now, without the computer (either at the board or using the overhead projector), review slope, y-intercept, the slope-intercept form of a line (y=mx+b), and solving equations for y. Discuss the following examples:

What is the slope and y-intercept of the following?
1. x – y = 5
2. y = 0.5x – 1
3. 2x + y = 6
4. y = 5
5. y = 5x

Homework: Worksheet on finding the slope and y-intercept of given equations.
Objective: Students will be able to determine whether lines are parallel or perpendicular by investigation using the Geometer’s Sketchpad.

Required Materials: Same as DAY 2.


- Students should be ready with their computers on and Geometer’s Sketchpad on their screens. Each student will be given a handout of page 24 with today’s activity.

- Teacher will go through the “Sketch and Investigate” activity, steps 1-5 while students watch on the TV monitor, then the students will try this activity several times on their own, recording their findings.

- Teacher will lead a discussion about Q1, Q2, and Q3.

- Teacher will go through the “Sketch and Investigate” activity, steps 6-7 while students watch on the TV monitor, then the students will try this activity several times on their own, recording their findings.

- Teacher will lead a discussion about Q4, Q5, and Q6.

Objective: Students will be able to find slope given two points on a line.

Required Materials: Students will need their textbooks, rulers, and graph paper. Teachers will need an overhead projector or board (chalk or dry erase), a ruler, and the handouts necessary for today’s activity.

Activity: Using the teacher-generated worksheet on the “slope formula”, teacher will do the following:

- Discuss the slope formula: \( \Delta y/\Delta x \), otherwise known as “rise over run”

- Teacher will show how to use the slope formula to find the slope of a line given any two points on the line.

- Teacher will lead the students through the nine examples on the handout sheet. (Teacher should have a transparency ready for use on an overhead projector).

Homework: From Integrated Mathematics Course 1, by Amsco: Section 17-6, page 592-593, exercises 8-24 evens. Graph paper will be needed to complete this assignment.
DAY 2 Homework Answer Key

Page 598 exercises 1-9, 16-23

Find the slope and y-intercept of the line that is the graph of the equation.
1. \( y = 3x + 1 \) \( m = 3 \) \( b = 1 \)
2. \( y = x - 3 \) \( m = 1 \) \( b = -3 \)
3. \( y = 2x \) \( m = 2 \) \( b = 0 \)
4. \( y = x \) \( m = 1 \) \( b = 0 \)
5. \( y = \_ \_ x + 5 \) \( m = \_ \) \( b = 5 \)
6. \( y = -2x + 3 \) \( m = -2 \) \( b = 3 \)
7. \( y = -3x \) \( m = -3 \) \( b = 0 \)
8. \( y = -2 \) \( m = 0 \) \( b = -2 \)
9. \( y = -2/3 x + 4 \) \( m = -2/3 \) \( b = 4 \)

Write an equation of the line whose slope and y-intercept are respectively:
16. 2 and 7 \( y = 2x + 7 \)
17. -1 and -3 \( y = -x - 3 \)
18. 0 and -5 \( y = -5 \)
19. -3 and 0 \( y = -3x \)
20. 2/3 and 1 \( y = 2/3 x + 1 \)
21. \_ and 0 \( y = \_ x \)
22. -1/3 and 2 \( y = -1/3 x + 2 \)
23. -3/2 and 0 \( y = -3/2 x \)
DAY 4 Homework Answer Key

Pages 598-599 exercises 10-15, 24-37.

Find the slope and y-intercept of the line that is the graph of the equation:
10. \( y - 3x = 7 \) \( y = 3x - 7 \) \( m = 3 \) \( b = -7 \)

11. \( 2x + y = 5 \) \( y = -2x + 5 \) \( m = -2 \) \( b = 5 \)

12. \( 3y = 6x + 9 \) \( y = 2x + 3 \) \( m = 2 \) \( b = 3 \)

13. \( 2y = 5x - 4 \) \( y = 5/2 x - 2 \) \( m = 5/2 \) \( b = -2 \)

14. _x + _ = 1/3 y \( y = 3/2 x + 9/4 \) \( m = 3/2 \) \( b = 9/4 \)

15. \( 4x - 3y = 0 \) \( y = 4/3 x \) \( m = 4/3 \) \( b = 0 \)

24. Write equations for three lines so that the slope of each line is 2. (Check students’ answers)

25. Write equations for three lines so that the y-intercept of each line is –4. (Check students’ answers)

26. What do the graphs of the equations \( y = 4x \), \( y = 4x + 2 \), and \( y = 4x - 2 \) all have in common?
   Same slope

27. How are the graphs of \( y = mx + b \) affected when \( m \) is always replaced by the same number and \( b \) is replaced by different numbers?
   Parallel lines with different y-intercepts

28. What do the lines that are the graphs of the equations \( y = 2x + 1 \), \( y = 3x + 1 \), and \( y = -4x + 1 \) all have in common?
   Same y-intercept

29. How are the graphs of \( y = mx + b \) affected when \( b \) is always replaced by the same number and \( m \) is replaced by different numbers?
   Many lines intersecting at the same y-intercept

30. If two lines are parallel, how are their slopes related?
   Same slope

31. What will be true of two lines whose slopes are equal?
   They will be parallel
State whether or not the lines are parallel:

32. \( y = 3x + 2, y = 3x - 5 \) yes

33. \( y = -2x - 6, y = 2x + 6 \) no

34. \( y = 4x - 8, y - 4x = 3 \) yes

35. \( y = 2x, 2y - 4x = 9 \) yes

36. Which of the following statements is true of the graph of the equation \( y = -3x \)?
   (3) Its slope is \(-3\)

37. Which of the following statements is true of the graph of the equation \( y = 8 \)?
   (1) It is parallel to the x-axis