

Official SAT Practice

Lesson Plans

for Teachers by Teachers

LESSON 5 (5 OF 5 FOR HEART OF ALGEBRA)

The Relationships Among Linear Equations, Lines in the Coordinate Plane, and the Contexts They Describe

Subscore: [Heart of Algebra](#)**Focus:** The connection between the algebraic, graphical, and contextual representations of linear equations

Objectives:

Students will

- solve systems of linear equations using graphing and algebraic methods to show how solutions are the same regardless of method used for solving.
- solve systems of linear equations that have infinitely many solutions or no solutions and describe what these solution sets mean graphically and algebraically.
- make connections between the equation of a line and its graph and use the relationships between the slopes of parallel and perpendicular lines to answer questions.
- use understanding of slope and y -intercept to interpret equations and graphs that represent contextual situations.

Before the Lesson:

- Review the Teacher Notes.
- Make sure you have a way to share the example problems with students.

Class Discussion | 15 minutes

- Have students solve this example problem:

$$2y + 6x = 3$$

$$y + 3x = 2$$

How many solutions (x, y) are there to the system of equations above?

- A. Zero
 - B. One
 - C. Two
 - D. More than two
- Review with students the concepts they needed to know in order to be able to solve the example problem:
 - ♦ The point of intersection gives the solution to the system.
 - ♦ If the equations in a system of two linear equations in two variables are graphed, each graph will be a line. There are three possibilities:
 - The lines intersect in one point. In this case, the system has a unique solution.
 - The lines are parallel. In this case, the system has no solution.
 - The lines are identical. In this case, every point on the line is a solution, and so the system has infinitely many solutions.
- Ask students which method they used to solve the example problem. Have students display the various approaches to solving this system: graphing, substitution, and elimination so they can see that the solution is the same regardless of the approach used to solve.
- Ask students what other connections they know about equations of lines and their graphs. If necessary, probe using “slope”, “ y -intercept”, “parallel”, “perpendicular.”
 - ♦ It may help students to practice rearranging equations into $y=mx+b$ form and graphing them in the coordinate plane.
 - ♦ Two lines are parallel if they have the same slope.
 - ♦ Two lines are perpendicular if the product of their slopes is -1 .
 - ♦ For contextual situations, the slope is the rate of change, and the y -intercept is often the starting point.

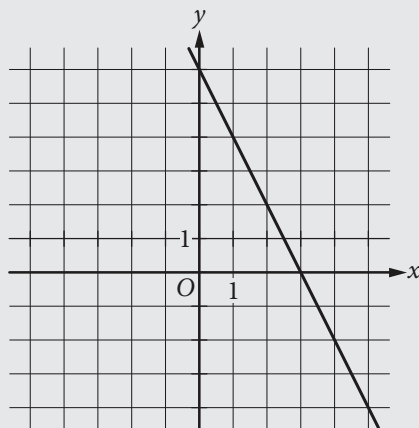
Class Work | 25 minutes

- Have students work through these example problems with a partner. Discuss the solutions and any questions students have.

1. $3s - 2t = a$
 $-15s + bt = -7$

In the system of equations above, a and b are constants. If the system has infinitely many solutions, what is the value of a ?

2.



The graph of line k is shown in the xy -plane above. Which of the following is an equation of a line that is perpendicular to line k ?

- A) $y = -2x + 1$
- B) $y = -\frac{1}{2}x + 2$
- C) $y = \frac{1}{2}x + 3$
- D) $y = 2x + 4$
3. A voter registration drive was held in Town Y. The number of voters, V , registered T days after the drive began can be estimated by the equation $V = 3,450 + 65T$. What is the best interpretation of the number 65 in this equation?
- A. The number of registered voters at the beginning of the registration drive
- B. The number of registered voters at the end of the registration drive
- C. The total number of voters registered during the drive
- D. The number of voters registered each day during the drive
4. $9x - 14y = -3$;
 $2x - ay = -6$
- What value of a will result in a system with no solutions?

Teacher Notes

- See pages 206–208 in [Chapter 16 of the SAT Study Guide for Students](#) for solutions and explanations for numbers 1–3.
- #4 is the Harder Example from “Solving systems of linear equations” on Khan Academy’s Official SAT® Math Practice.

Wrap-Up: For your term book or word wall | 5 minutes

- Parallel
- Perpendicular
- Infinitely many solutions
- No solution
- Slope
- y -intercept

Homework | 20 minutes

Complete practice problems in Official SAT Practice on Khan Academy® in these skill areas:

- ◆ Solving linear equations and inequalities
- ◆ Solving systems of linear equations
- ◆ Graphing linear equations