

Mathematics Lessons for Grades 9-12

“Systems of Linear Equations and Chess”

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Discipline: Mathematics

Grade: 9 to 10

Standards

Analyze functions of one variable by investigating rates of change, intercepts, zeros, asymptotes, and local and global behavior.

Understand relations and functions and select, convert flexibly among, and use various representations for them.

Identify essential quantitative relationships in a situation and determine the class or classes of functions the might model the relationships.

Draw reasonable conclusions about a situation being modeled

Purpose/Goal

By the end of the lesson students should:

Gain an intuitive understanding of what is meant by the solution of a linear system.

Understand that a linear system can be applied to a physical setting.

Realize that lines can be used to model a tangible problem and that the intersection point has an underlying meaning associated with this problem.

Gain a degree of comfort with the concept of a linear system.

Context

Students commonly have difficulty connecting concepts of lines and intersections with something tangible.

Thus, a common misconception is that systems of linear equations cannot be used to model physical behavior.

Also, students usually misunderstand the concept of a “solution” to system of equations. Graphically, they can see it is the point of intersection but often are not able to relate this visual to a particular meaning.

Preparation

Before performing this lesson, students need an understanding of the general slope-intercept form of a line, the ability to model basic situations in the form of lines, a familiarity with a system of two or more lines, and the ability to solve for the intersection point between two or more lines. This lesson fits in after students have learned about graphing linear equations and inequalities. They then move to systems of equations and learn about the three solution techniques (substitution, elimination, and graphic) prior to this lesson. The teacher needs only an activity sheet ahead of time. The lesson is self-contained and only lightly relies on a familiarity with the game of chess.

Websites

None

Motivation

One can briefly discuss the game of chess by asking whether there are students who have played the game, then present some interesting facts about the game (number of possible moves, etc.). Next, give the students the impression they can help determine the number of moves using the solution of the linear system modeling this game.

Description

This is a lesson (activity) that combines the natural attraction students have toward Chess with the concept of systems of linear equations. In the first part of the lesson, students are presented with two chess situations, each consisting of both a black and white piece. The students are asked to graphically draw the lines that correspond to these “systems” which represent the possible trajectories each piece can make on the chess

board. The equation for each move is determined and a solution is found graphically. Finally, the students are asked about what the solution represents.

In part two of the lesson, students are presented with two equations corresponding to a chess situation between opposing pieces. They are asked to determine the solution algebraically, then to graph the equations on a graphical representation of a chess board. Finally, they are to compare the algebraically determined solution with the graphical intersection point.

In the third and final part of the lesson, students are given a one-step chess end game and are asked to determine the relevant linear system with corresponding solution.

Assessment

We suggest presenting a pretest/posttest to the students regarding linear systems of equations before and after the lesson. It would also be useful to present a posttest after a sufficient time period in order to assess student retention of relevant material.

Follow-Up Activities

We would like to incorporate the "Knight's Tour" exercise within this activity. This has students graphically attempt to reach each point on the chess board using only the knight piece.