Graphing Linear Inequalities

Grade Level and Content

8th or 9th Grade Algebra

Big Idea

Students recall graphing inequalities on a number line and relate that process to graphing linear inequalities. An introductory activity engages students in graphing four different equations each in a quarter portion of a folded sheet of paper to compare and contrast linear inequalities where the direction of the inequality and/or the sign of the slope differ. Students practice graphing solutions to these linear inequalities using a test point to determine which half-plane to shade. Students see the logical connection between an open circle for a boundary point and a dashed line for a boundary line for strictly greater than and less than inequalities.

Objectives

Students will be able to …

1. Correctly graph and solve linear inequalities in two variables 8 out of 10 times.
2. Correctly demonstrate an understanding of the vocabulary *linear inequality* and *solution of a linear inequality* 8 out of 10 times.

PA State Standards

Anchor Descriptor - A1.1.3.2 Write, solve and/or graph systems of linear inequalities using various methods.

Eligible Content - A1.1.3.2.1 Write and/or solve a system of linear inequalities using graphing (limit systems to 2 linear inequalities).

Common Core Standards

CC.2.2.HS.D.7 - Create and graph equations or inequalities to describe numbers or relationships.

CC.2.2.HS.D.9 - Use reasoning to solve equations and justify the solution method.

CC.2.2.HS.D.10 - Represent, solve, and interpret equations/inequalities and systems of equations/inequalities algebraically and graphically.

Rationale for Students

Many real world scenarios can be modeled with linear inequalities. This lesson begins with a few examples of these scenarios to promote interest among students and to foster motivation. Lessons following this one will engage students in solving these life-application word problems.

Materials

- 1 smart board and computer with lesson files
- 1 copy: Graphing Linear Inequalities Pattern Activity
- 24 copies: Graphing Linear Inequalities Pattern Activity Worksheet
- Colored Pencils
- 12 copies: Graphing Linear Inequalities Partnership Solution Worksheet OR iPad/laptop
- 24 copies: Graphing Linear Inequalities Homework Choice Board

Differentiation

This lesson consists of several differentiated tasks to engage students from various ability levels:

During the introductory activity, students create a foldable that illustrates the pattern of shading of four linear inequalities that differ in direction and/or in the sign of the slope. Students can use this visual guide to help them graph linear inequalities as they work with partners during the next part and as they complete the homework.

During the collaborative group work, students work with a partner to solve a linear inequality and together present their solution to the class. Partners will be strategically selected to ensure that 1) two different ability levels are represented within each partnership and 2) the ability levels of each student in any partnership are not so extremely different to inhibit the learning of either or both students.

Homework consists of a choice board with problems from three levels of difficulty: basic, moderate, and hard. Point values are 3, 5 and 7, respectively. Students select problems to accumulate 25 points. There are 6 basic problems, 6 moderate, and 4 hard problems from which to choose. The distribution of problems requires students to choose at least two moderate or one hard problem to reach or exceed 25 points.

Technology

The smart board will be used to present the lesson and enables the teacher and the students to work out solutions together. Students have access to online tutorials for each section so they can review concepts and have guided practice at home. All assignments will be posted on the class website so students who miss class won't fall behind. Any work completed using technology will also be posted for reference. Lessons following this one will engage students in using the calculator to graph linear inequalities.

Anticipatory Set   5 minutes

Students activate prior knowledge necessary for this lesson by graphing inequalities on a number line and by graphing linear equations. This lesson combines concepts from both of these procedures.

Procedure   30 minutes

Part 1: Instruction and Activity

Recall graphing inequalities…

There are two decisions to make when graphing an inequality. You have to choose an open or closed **boundary point**, and you have to decide **which direction to shade**. There are two decisions to make when graphing linear inequalities as well…

Our goal is to graph the **boundary line** and to **shade the proper portion of the graph**.

Start with inequalities $\leq$ and $\geq$ …Graph with a solid line.

To graph linear inequalities, begin by graphing the equation as if it were a linear equality and then decide which direction to shade.

Demonstrate how to graph linear inequalities with a foldable activity…See *Graphing Linear Inequalities Pattern Activity*.

Demonstrate five more examples with varying levels of difficulty, including "strictly greater than" and "strictly less than" problems. Recall inequalities that are "strictly greater than" or "strictly less than" are graphed with an open circle. Ask students how a "strictly greater than" or "strictly less than" linear inequality might be represented. (dotted line)

Part 2: Collaborative group work

Students work together with a partner to solve one linear inequality on a large paper with a coordinate plane. Students outline the steps they take and explain their decisions. Students could also submit an image file from a drawing program used to sketch their solutions and outline their steps. The teacher can project the image on the smart board and post the file on the class website for reference.

Exit Activity   10 minutes

Students take turns taping their solution to the board and sharing their steps with the class. Each person in the partnership must participate by orally sharing steps and reasons for their decisions. If students used technology to sketch their solution in a drawing program, they can submit the solution and outline of their steps by inserting the image file and text into a shared presentation file. The teacher can project the presentation as the groups present the work. This file can also be posted to the class website for later reference.

Homework

   📇 Choice Board Worksheet – complete problems such that the value sums to 25 points