

THE 2016 ROSENTHAL PRIZE for Innovation in Math Teaching

Blacktop Coordinate Plane

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Lesson Plan Grades 7-8



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Lesson Overview

In this activity, students work together in teams to plot the points of a linear equation and ultimately derive the equation of the line from the points given. The added twist to this activity is that students are working on a life-sized coordinate plane. Racing against other teams in a relay-race format, each team must plot all of the given points, and then use the points to determine the equation of the resulting line joining those points.

Prerequisite Knowledge

To give each student a reasonable expectation of success, they should be able to

- Accurately plot points in the coordinate plane;
- Calculate the slope of a line given two points;
- Derive the equation of a line given it's slope and y-intercept.

Lesson Goals

The purpose of the lesson is for students to be able to

- Demonstrate their understanding of slope;
- Understand that the coordinates on a line must satisfy the equation;
- Communicate their mathematical thinking to their peers;
- Test their thinking and that of their peers for reasonableness.

The Common Core State Standards for Mathematics

<u>CCSS.8.EE.B.5:</u> Graph proportional relationships, interpreting the unit rate as the slope of the graph. Compare two different proportional relationships represented in different ways. For example, compare a distance-time graph to a distance-time equation to determine which of two moving objects has greater speed.

<u>CCSS.8.EE.B.6</u>: Use similar triangles to explain why the slope m is the same between any two distinct points on a non-vertical line in the coordinate plane; derive the equation y = mx for a line through the origin and the equation y = mx + b for a line intercepting the vertical axis.



Activity Details

Materials

- 3-inch wide masking tape (50 yards)
- Sidewalk chalk
- Multi-color pack of Post-its
- Dry erase marker
- Yard stick or measuring tape

Preparation [15-20 minutes]

The activity can be conducted indoors in a space like a gym or outside on a blacktop. Use the tape measure or yardstick to measure 10 yards in each direction. Use the masking tape to create the x- and y-axes. Make hash markings at approximately one yaard intervals to mark integer points along the axis.

You will want to divide your students into teams (Team A, Team B, etc.).

Prepare equations for each team. For those equations, chose five points that lie on the line, and write the coordinates for each point on a separate post-it. One of the chosen points should be the *y*-intercept. The post-its should be color-coordinated, if possible (Team A can get green, Team B, orange, etc.).

Tip: Use existing lines, such as basketball-court boundaries or tennis-court markings to help assure right angles. Outdoors, use sidewalk chalk to mark the integer coordinates on the x- and y-axis. Indoors you can use the Post-its or dry erase marker to label the axes.



Activity: Blacktop Relay [45 minutes]

- Divide students into groups of three to five (this can be done in class the day before the actual activity to save time when starting the activity). Line up teams along the "bottom" of the coordinate plane, standing just below the negative coordinates on the *y*-axis so that the positive section of the *x*-axis is on the right and the negative section of the *x*-axis is on the left. This will help students orient themselves as they search for their points.
- 2. Label each team alphabetically (Team A, Team B, etc.). Next, assign each team a corresponding linear equation (Equation A, Equation B, etc.) but don't reveal the equations to the students!
- 3. Distribute one post-it with coordinates to each student on the team. Students should not reveal their points to the other members of the team.
- 4. When the teacher says "Go!!" the first player on each team runs to the coordinate grid and plots the point on his or her post-it. In a gym or other indoor space, students can plot their point by placing their post-it directly on the floor. Outdoors, students can use sidewalk chalk to plot points.
- 5. After the first member of each team plots the point, he or she return to the team's line and tag the next person on the team. Then, that student plots the assigned point, and so on until all the assigned points have been plotted.
- 6. After all the points have been plotted, the members of each team work together to find the equation of their line. A winner is only awarded when the complete equation has been derived.

Activity Extensions

- As an added incentive, once a team has derived the team's equation, they can "steal" another team's points if they can determine the other's team's equation before the other team has finished.
- As an added challenge, you can include rational coordinates for selected students
- Algebra classes can extend the lesson to include graphs of parabolas or other appropriate functions. After all points have been plotted, students can use graphing calculators to derive the actual equations.