

Points Lining Up in the Plane

Activity Notes

Objective: Students find sets of points that satisfy algebraic rules and write algebraic rules to describe sets of points. This connection leads to a better understanding of coordinates, graphs, and equations (which they practice writing in the Explore More section).

Student Audience: Pre-algebra/Algebra 1

Prerequisites: Familiarity with the Cartesian plane. The term *absolute value* is used and briefly defined, but it isn't a major focus of the activity.

Sketchpad Level: Easy. Students construct points and measure their coordinates.

Activity Time: 25–35 minutes

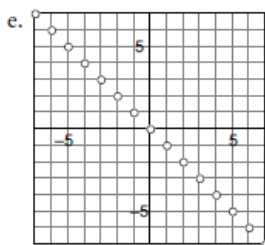
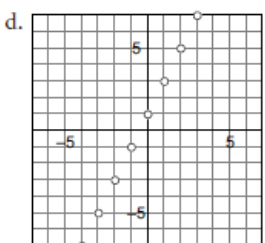
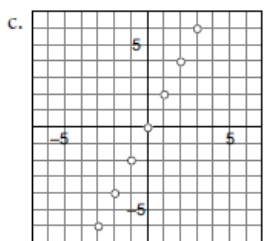
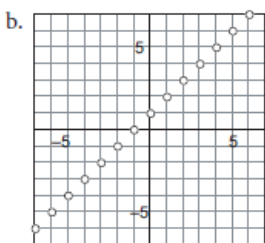
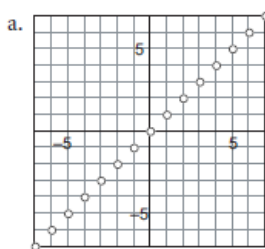
Setting: Paired/Individual Activity (use **Points Line Up.gsp**) or Whole-Class Demonstration (use **Points Line Up Present.gsp**)

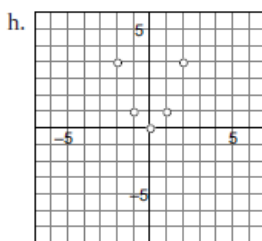
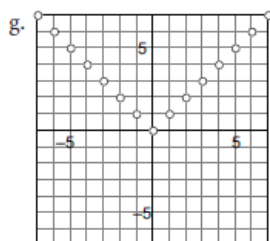
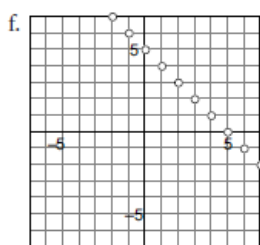
The purpose of this activity is to give students an informal and experiential introduction to the relationship between descriptions of coordinate patterns and graphs in the Cartesian plane. Too often, students don't really get the connection between an equation and its graph. It's important for them to understand that graphs depict the set of points whose coordinates satisfy an equation. This activity helps foster that understanding.

To deepen the experience, conduct a class or group discussion that encourages students to ponder this relationship. Ask, "Why do the points 'line up' in such regular ways? If you could plot not just five, but every point that satisfies the description, what would that look like?"

SKETCH AND INVESTIGATE

- Q1** In each case, the answer shown depicts all possible answers with integer coordinates on the grid provided. The question asks for five answers, so any five of the points shown is a correct response (not to mention the infinite number of correct responses outside the grid!).





- a. The y -coordinate equals the x -coordinate.
- b. The y -coordinate is one less than the x -coordinate.
- c. The y -coordinate is twice the x -coordinate. (Or, the x -coordinate is one-half the y -coordinate.)
- d. The y -coordinate is two less than twice the x -coordinate.
- e. The y -coordinate is one-third the x -coordinate. (Or, the x -coordinate is three times the y -coordinate.)
- f. The y -coordinate is always -1 (regardless of the value of the x -coordinate).
- g. The y -coordinate is the opposite of the absolute value of the x -coordinate. (An acceptable alternate answer for students not familiar with the term *absolute value* might be “The y -coordinate is the ‘negative value’ of the x -coordinate, regardless of whether the x -coordinate is positive or negative.”)

- h. The product of the y -coordinate and the x -coordinate is 6.

EXPLORE MORE

Q3 Equations from Q1:

- a. $y = x$ b. $y = x + 1$ c. $y = 2x$
d. $y = 2x + 1$ e. $y = -x$ f. $x + y = 5$
g. $y = |x|$ h. $y = x^2$

Equations from Q2:

- a. $y = x$ b. $y = x - 1$ c. $y = 2x$
d. $y = 2x - 2$ e. $y = (1/3)x$ or $x = 3y$
f. $y = -1$ g. $y = -|x|$ h. $xy = 6$

Q4 Answers will vary.

Here's how to set up the Movement button (more detailed instructions are on page 2 of **Points Line Up.gsp**): Plot the eight destination points using the **Plot Points** command. Select all 16 points in the sketch in the following order: point P , point P 's destination, point Q , point Q 's destination, point R , point R 's destination, . . . , point W , point W 's destination. Now choose **Edit | Action Buttons | Movement**. Change the speed and label (on the Label panel), and then click OK. Now hide the eight destination points (using **Display | Hide**).

Q5 Answers will vary, but should line up with answers to Q1 and satisfy the rule.

WHOLE-CLASS PRESENTATION

Students connect verbal and graphical representations of points by using a verbal rule about coordinates to position points and by observing a pattern of points to formulate a verbal rule about their coordinates.

Use the sketch **Points Line Up Present.gsp** in conjunction with the Presenter Notes to present this activity to the whole class.