
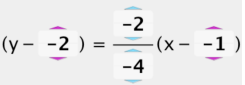
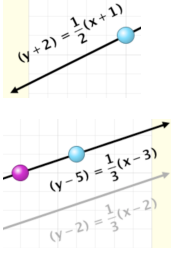


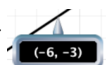
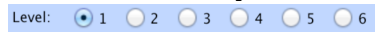
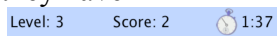




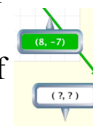
Tips for controls:

- Try all the different tabs at the top of the simulation.  The **Slope, Slope-Intercept, and Point-Slope** tabs are designed for students to explore the parameters of these equations and how modifying each affects the graph (or, how modifying the graph affects the equation). The **Line Game** tab is described more below.
- Each tab features *interactive equations* in which parameters (e.g., (x_1, y_1) , m , and b) can be varied by clicking the green, blue and purple up and down arrows. 
- Graphed lines are interactive and can be modified by moving the green (slope tab only) and purple point buttons, blue slope button, or by changing these values in the interactive equations using the up and down arrows.
- The sim does not simplify interactive equations, so a “double negative” caused by subtracting negative values is not simplified to “plus a positive”. Similarly, slopes are not simplified when the numerator and denominator contain common multiples. These simplifications *do* occur when the equation for the line is labeled on the graph itself. 
- The Save Lines feature allows users to make multiple lines on the same graph. This facilitates comparing lines and allows for discussion on, for example, how slopes of parallel lines are equivalent. The Erase Lines feature erases all saved lines. 
- The Hide lines feature can be useful during teacher facilitation of class discussions to encourage students to make predictions.
- Leaving the slope option checked Slope displays the slope rise and run on the graph; unchecking removes the slope rise and run on the graph. 
- returns all options in that tab to default.
- Point tools will highlight when displaying a point through which the line passes. 

Information regarding the Line Game tab:

- Students can choose to work on any level of the game. There are 6 levels with 6 challenges each.  The student's score and how long they have been playing that level is displayed at the bottom of the screen. 
- Sound and timer can be turned on/off on the level selection screen. 
- There are three main types of challenges. The first asks students to graph a line given the equation. The second asks students to write an equation given the graphed line. The third asks students to place three points so that they lie on the line whose equation is given.
- Description of game levels:
 - **Level 1:** Slope *or* point can be manipulated, “easy” positive slopes (e.g., halves, thirds, quarters, fifths), same sign for x_1 and y_1
 - **Level 2:** Slope *or* point can be manipulated, positive and negative slopes, more difficult slopes (e.g., sevenths, improper fractions)
 - **Level 3:** Slope *and* point can be manipulated
 - **Level 4:** Slope *and* point can be manipulated. In Graph the Line challenges, placement of the point on the graph and the limits of the graph range forces the user to move in a nonstandard direction from one point to graph the second point. E.g., given slope $\frac{1}{2}$, user places one point on the graph and must go “down 1 and left 2” (rather than “up 1, right 2”) in order to place the second point.
 - **Level 5:** Slope *and* point can be manipulated, “Place the Points” challenge is introduced, Make the Equation challenge includes horizontal lines (zero slope)

- **Level 6:** Slope *and* point can be manipulated, more “Place the Points” challenges, mapping between different line forms required (e.g., given point-slope equation with slope and intercept tools)
- Students may have difficulty with the game, particularly Set the Equation challenges, if they do not use the point tools.
- Selecting  starts the game over.

**Suggestions for sim use:**

- For tips on using PhET sims with your students see: [Guidelines for Inquiry Contributions](#) and [Using PhET Sims](#)
- The simulations have been used successfully with homework, lectures, in-class activities, or lab activities. Use them for introduction to concepts, learning new concepts, reinforcement of concepts, as visual aids for interactive demonstrations, or with in-class clicker questions. To read more, see [Teaching Physics using PhET Simulations](#)
- For activities and lesson plans written by the PhET team and other teachers, see: [Teacher Ideas & Activities](#)