

Maximizing Your Efforts

ID: 8209

Time required
30 minutes

Activity Overview

In this activity, students first write an objective function for the profit from selling two types of game players. They then write a system of inequalities to represent the constraints in the problem situation, graph the system of inequalities, find the vertices of the feasible region and substitute their coordinates into the objective function to find the maximum profit.

Topic: Linear Systems

- *Graph a linear inequality in two variables; identify the regions into which it divides the plane.*
- *Graph a system of linear inequalities and identify the solution set.*

Teacher Preparation and Notes

This activity is designed to be used in an Algebra 2 or Precalculus classroom.

- *Prior to beginning the activity, students have experience writing, solving, and graphing linear inequalities in two variables.*
- *This activity is designed to have students explore **individually and in pairs**. However, an alternate approach would be to use the activity in a whole-class format. By using the computer software and the questions found in the student .tns file, you can lead an interactive class discussion on the location of points in a plane.*

Associated Materials

- *Alg2Week19_MaxYourEfforts_worksheet_TI-84.doc*

Suggested Related Activities

To download any activity listed, go to education.ti.com/exchange and enter the number in the quick search box.

- *Border Patrol (TI-84 Plus) — 11602*
- *Linear Inequalities (TI-Nspire Technology) — 8770*
- *Testing for Truth (TI-84 Plus) — 12175*
- *How Many? (TI-84 Plus) — 10255*

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In this activity we will:

- Write an objective function for the profit from selling two types of game players.
- Write a system of inequalities to represent the constraints in the problem situation.
- Graph the system of inequalities.
- Find the vertices of the feasible region and substitute their coordinates into the objective function to find the maximum profit.

Games and More, Co. is a company that produces both video and DVD game players. The video player, Gamer Gallery, requires 1.5 hours for assembly and 0.25 hours for testing. The DVD player, Major Player, requires 1 hour for assembly and 0.5 hours for testing.

Each month, the Games and More manufacturing facility has 45,000 available hours for product assembly and 20,000 available hours for product testing.

Games and More earns \$60 profit from each Gamer Gallery and \$75 profit from each Major Player that it sells.

How many of each type of player should the Games and More, Co. produce in order to obtain the greatest monthly profit?

You can use linear programming to solve this manufacturing problem. Let x represent the number of Gamer Gallery players, and let y represent the number of Major Players. Write an expression that represents the profit earned from selling Major Player and Gamer Gallery players. This is called an objective function.

$$P(x,y) = 60x + 75y$$

Determine the profit that would be earned if 50 Gamer Gallery and 100 Major Player players were sold.

$$\begin{aligned} P(50, 100) &= \\ 60(50) + 75(100) &= \\ \$10,500 \end{aligned}$$

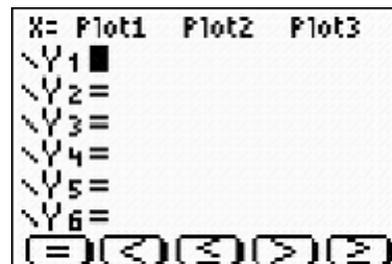
Write a system of inequalities that represents the restrictions (or constraints) for the problem situation. Write an inequality that represents the assembly time constraint, one for the testing time constraint, and write inequalities that show that they cannot produce a negative number of Gamer Gallery or Major Player gamers.

$$\begin{aligned} 1.5x + 1y &\leq 45000 \\ 0.25x + 0.5y &\leq 20000 \\ x \geq 0; y &\geq 0 \end{aligned}$$

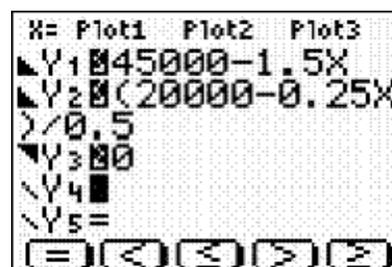
Turn on the Inequality Graphing Application. Press **[APPS]** **[ALPHA]** **[x²]** to skip to the I's, then press **[ENTER]**.



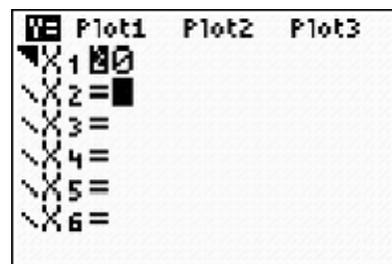
Press any key to continue. This will take you to a modified **[Y=]** screen. The five symbols along the bottom can be accessed by pressing **[ALPHA]** followed by the appropriate function key. To enter an inequality in terms of x arrow to the top (**X=**) and press **[ENTER]**.



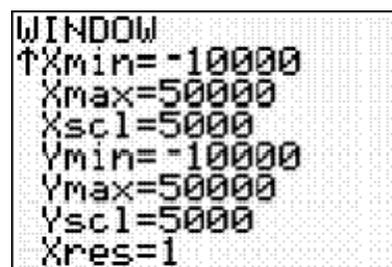
Enter the four inequalities in linear function form. Three can be entered on the **Y=** screen.



Use **[↔]** to highlight **X=** in the top left corner. Press **[ENTER]** and enter the final inequality.



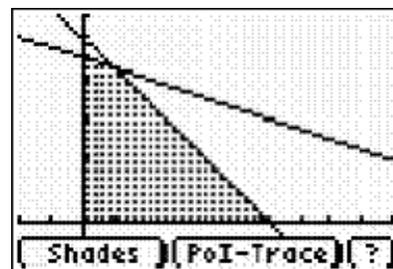
Press **[WINDOW]** and set the settings as shown.



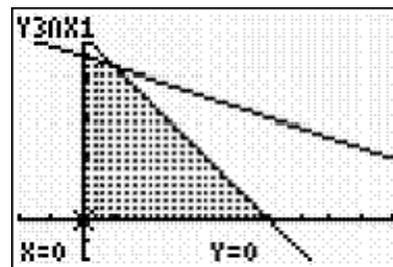
Press **[GRAPH]**.



Find the vertices of the feasible region. Use the **Shading** feature to show the feasible region. Press **[ALPHA]** **[F1]** and select **Ineq Intersection**.



Use the Point-of-Intersection Trace (**PoI-Trace**) to find the coordinates of the vertices. Press **[ALPHA]** **[F4]** and use the arrows to move the cursor. Record the vertices in coordinate pair form.



Substitute the coordinates for each vertex into the profit expression (objective function) to find the maximum profit. Based on these results, how many of each type of player results in the maximum monthly profit for Games and More Company? What is the maximum possible monthly profit?

| Vertex | P(g, m) |
|---------------|-------------|
| (0, 0) | \$0 |
| (30000, 0) | \$1,800,000 |
| (0, 40000) | \$3,000,000 |
| (5000, 37500) | \$3,112,500 |

To turn off the Inequality Graphing application, press **[APPS]** **[ALPHA]** **[x²]** to skip to the I's, then press **[ENTER]**. Select **2: Quit Inequal**.

