HOMEWORK... Questions?

p. 221: #1, #2, #4 and #6

None

Applications...Apply your skills to a context

EXAMPLE #2: HANDOUT - Application of a Linear Inequality.docx

Malia and Lainey are competing in a spelling quiz. Malia gets a point for every word she spells correctly. Lainey is younger than Malia, so she gets 3 points for every word she spells correctly plus one bonus point. What combination of correctly spelled words for Malia and Lainey result in Malia spelling more? Choose two combinations that make sense and explain why.

Step 1: Declare variables

$x \to$ # of correct words for Malia
$y \to$ # of correct words for Lainey

Step 2: State restrictions

* Number Set

$x \in W$
$y \in W$
Graph in quad I

Step 3: Develop the inequation

$1x > 3y + 1$

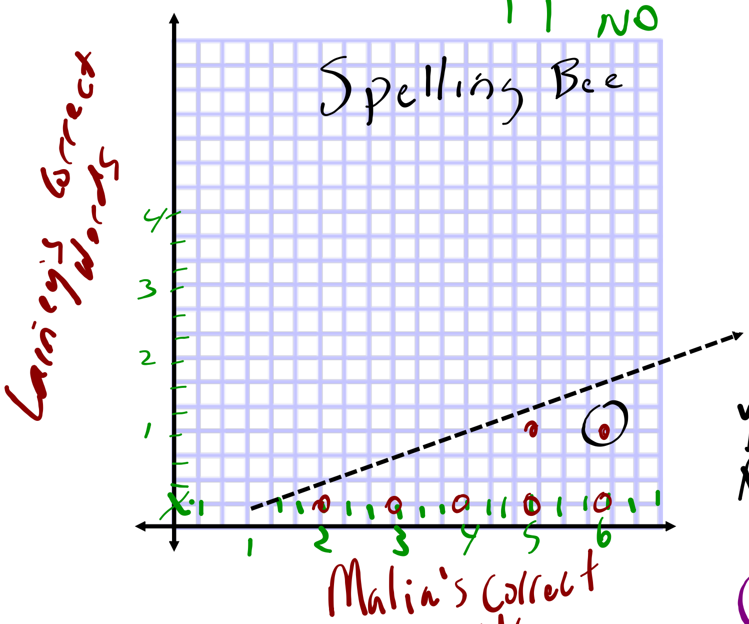
Step 4: Graph the solution set (MUST include labels/scales)

Test $(0,0)$ → $x > 3y + 1$

LS > RS

LS	RS
0	3(0) + 1
	1

NO



$x = 3y + 1$

$\frac{x}{3} - \frac{1}{3} = \frac{\cancel{3}y}{\cancel{3}}$

$\frac{1}{3}x - \frac{1}{3} = y$

$y = \frac{1}{3}x - \frac{1}{3}$

	x	y
y int	0	-1/3
x int	1	0
	4	1
	7	2

$y = \frac{1}{3}(4) - \frac{1}{3}$

$y = \frac{4}{3} - \frac{1}{3}$

$y = 3/3$

Combinations...

① Malia → 2
Lainey → 0

② Malia → 6
Lainey → 1

~~Words~~ Points

2
1

6
4

EXAMPLE 3 p. 218 — Solving a real-world problem by graphing a linear inequality with discrete whole-number solutions

A sports store has a net revenue of $100 on every pair of downhill skis sold and $120 on every snowboard sold. The manager's goal is to have a net revenue of more than $600 a day from the sales of these two items. What combinations of ski and snowboard sales will meet or exceed this daily sales goal? Choose two combinations that make sense, and explain your choices.

$x \rightarrow$ # of skis sold

$y \rightarrow$ # of snowboards sold

Step 1: Declare variables

Step 2: State restrictions

$x \in W$

$y \in W$

Step 3: Develop the inequation

$100x + 120y \geq 600$

LS	$\geq$	RS
$0 + 0 = 0$		600

NO

Step 4: Graph the solution set (MUST include labels/scales)

$100x + 120y = 600$

x-int

$100x + \cancel{120(0)} = 600$

$\frac{100x}{100} = \frac{600}{100}$

$x = 6$

$(6, 0)$

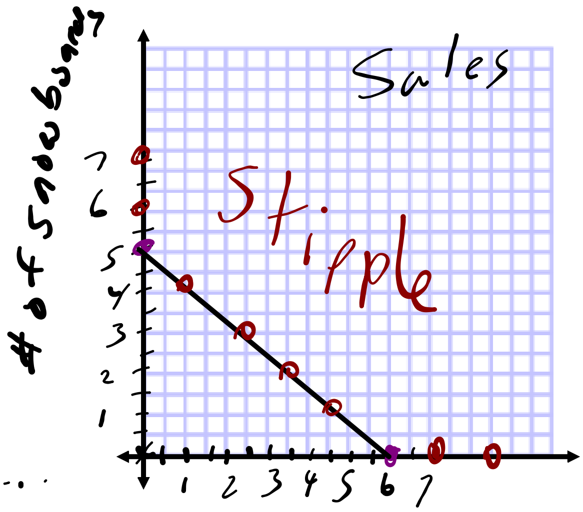
y-int

$\cancel{100(0)} + 120y = 600$

$\frac{120y}{120} = \frac{600}{120}$

$y = 5$

$(0, 5)$



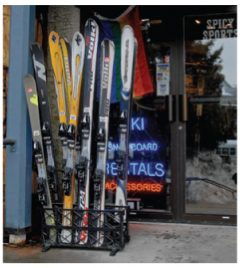
Possible...

① (10, 10)

② (6, 0)

EXAMPLE 3 p. 218 — **Solving a real-world problem by graphing a linear inequality with discrete whole-number solutions**

A sports store has a net revenue of \$100 on every pair of downhill skis sold and \$120 on every snowboard sold. The manager's goal is to have a net revenue of more than \$600 a day from the sales of these two items. What combinations of ski and snowboard sales will meet or exceed this daily sales goal? Choose two combinations that make sense, and explain your choices.



Jerry's Solution

The relationship between the number of pairs of skis, x, the number of snowboards, y, and the daily sales can be represented by the following linear inequality:

$100x + 120y > 600$

> I defined the variables in this situation and wrote a linear inequality to represent the problem.

The variables represent whole numbers.

$x \in \mathbb{W}$ and $y \in \mathbb{W}$

> I knew that only whole numbers are possible for x and y, since stores don't sell parts of skis or snowboards.
>
> Because the domain and range are restricted to the set of whole numbers, I knew that the solution set is discrete.
>
> I also knew that my graph would occur only in the first quadrant.

$$
\begin{aligned}
100x + 120y &> 600 \\
120y &> 600 - 100x \\
\frac{120y}{120} &> \frac{600 - 100x}{120} \\
y &> \frac{600}{120} - \frac{100x}{120} \\
y &> 5 - \frac{5x}{6} \\
y &> -\frac{5x}{6} + 5
\end{aligned}
$$

> I isolated y so I could enter the inequality into my graphing calculator.

> I adjusted the calculator window to show only the first quadrant, since the domain and range are both the set of whole numbers.
>
> The boundary is a dashed line, which means that the solution set does not include values on the line.

$\{(x, y) \mid 100x + 120y > 600, x \in \mathbb{W}, y \in \mathbb{W}\}$

Test (0, 0) in $100x + 120y > 600$.

LS	RS
100(0) + 120(0)	600
0	

Since 0 is not greater than 600, (0, 0) is not in the solution region.

> I used the test point (0, 0) to verify that the correct half plane was shaded.
>
> Since (0, 0) is not a solution to the linear inequality, I knew that the half plane that did not include this point should be shaded. This was done correctly.

> When I interpreted the graph, I considered the context of the problem. I knew that
> - only discrete points with whole-number coordinates in the solution region made sense.
> - points along the dashed boundary are not part of the solution region.
> - points with whole-number coordinates along the x-axis and y-axis boundaries are part of the solution region.

Test (4, 4) in $100x + 120y > 600$.

LS	RS
100(4) + 120(4)	600
400 + 480	
880	

Since 880 > 600, (4, 4) is a solution.

> I picked two points in the solution region, (4, 4) and (5, 3), as possible solutions to the problem. I verified that each point is a solution to the linear inequality.

Test (5, 3) in $100x + 120y > 600$.

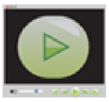
LS	RS
100(5) + 120(3)	600
500 + 360	
860	

Since 860 > 600, (5, 3) is a solution.

Sales of four pairs of skis and four snowboards or sales of five pairs of skis and three snowboards will exceed the manager's net revenue goal of more than \$600 a day.

> Some points in the solution region are more reasonable than others. For example, the point (1000, 1000) is a valid solution, but it might be an unrealistic sales goal.

Your Turn



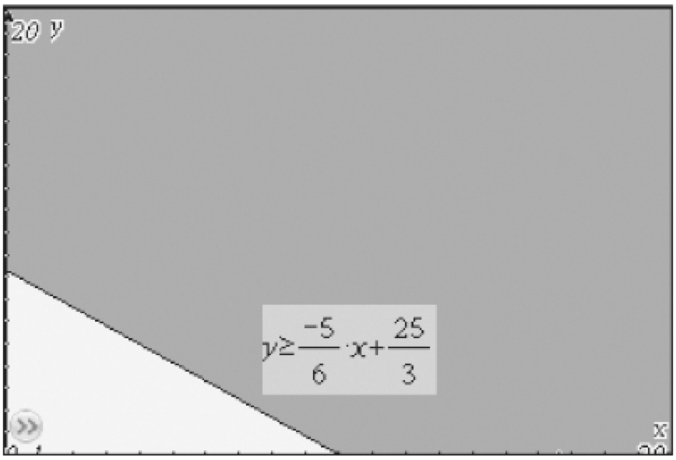
a) Would raising the daily sales goal to at least $1000 change the graph that models this situation? Explain.

b) State two combinations of ski and snowboard sales that would meet or exceed this new daily sales goal.

$\geq$

Answers

a) The boundary would be farther from the origin with a different y-intercept, but the slope would be the same. The graph would still show a shaded region above the boundary.



b) For example, 8 pairs of skis and 7 snowboards; 6 pairs of skis and 9 snowboards.

In Summary p. 220

Key Idea

- When a linear inequality in two variables is represented graphically, its boundary divides the Cartesian plane into two half planes. One of these half planes represents the solution set of the linear inequality, which may or may not include points on the boundary itself.

Need to Know

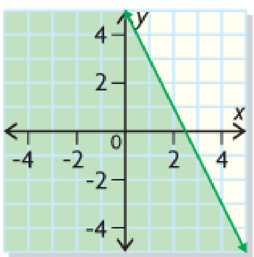
- To graph a linear inequality in two variables, follow these steps:

  Step 1. Graph the boundary of the solution region.
  - If the linear inequality includes the possibility of equality ($\leq$ or $\geq$), and the solution set is continuous, draw a solid green line to show that all points on the boundary are included.
  - If the linear inequality includes the possibility of equality ($\leq$ or $\geq$), and the solution set is discrete, stipple the boundary with green points.
  - If the linear inequality excludes the possibility of equality ($<$ or $>$), draw a dashed line to show that the points on the boundary are not included.
    - Use a dashed green line for continuous solution sets.
    - Use a dashed orange line for discrete solution sets.

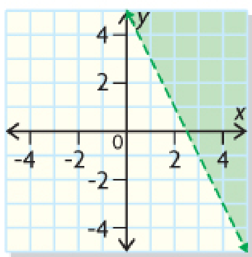
  Step 2. Choose a test point that is on one side of the boundary.
  - Substitute the coordinates of the test point into the linear inequality.
  - If possible, use the origin, (0, 0), to simplify your calculations.
  - If the test point is a solution to the linear inequality, shade the half plane that contains this point. Otherwise, shade the other half plane.
    - Use green shading for continuous solution sets.
    - Use orange shading with green stippling for discrete solution sets.

  For example,

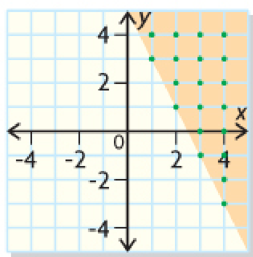
  $\{(x, y) \mid y \leq -2x + 5, x \in \mathrm{R}, y \in \mathrm{R}\}$



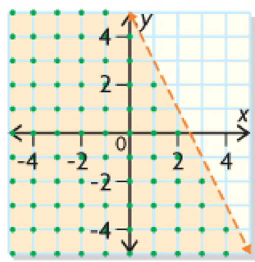
  $\{(x, y) \mid y > -2x + 5, x \in \mathrm{R}, y \in \mathrm{R}\}$



  $\{(x, y) \mid y \geq -2x + 5, x \in \mathrm{I}, y \in \mathrm{I}\}$



  $\{(x, y) \mid y < -2x + 5, x \in \mathrm{I}, y \in \mathrm{I}\}$



- When interpreting the solution region for a linear inequality, consider the restrictions on the domain and range of the variables.
  - If the solution set is continuous, all the points in the solution region are in the solution set.
  - If the solution set is discrete, only specific points in the solution region are in the solution set. This is represented graphically by stippling.
  - Some solution sets may be restricted to specific quadrants. For example, most linear inequalities representing real-world problem situations have graphs that are restricted to the first quadrant.

HOMEWORK...

p. 221: #3, 7, 8, 9, 10

1) Declare variables
2) State restrictions
3) Develop inequation
4) Graph solution set

Attachments

Example - Application of a Linear Inequality.docx

6Ws1e3.mp4