

Systems of Inequalities

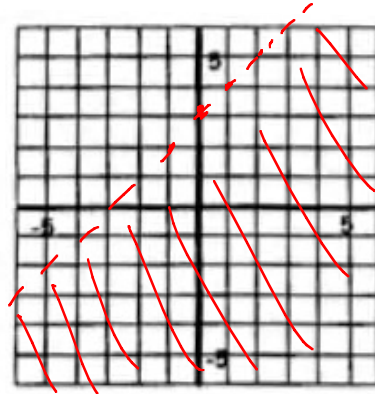
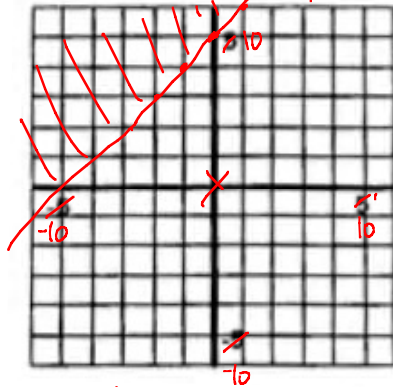
\geq above \leq below

Example 1: Graph the following inequalities on the grid provided.

a) $y - x \geq 10$

$y \geq x + 10$

(b) $y < x + 3$



$0 - 0 > 10$ $0 > 10$ F

Example 2: Consider the graph of the inequality $x - 2y < 7$. Determine which of the following points are in the solution region.

x	y	
$(-1, 0)$	$(2, 4)$	$(-3, -10)$
$-1 - 2(0) < 7$	$2 - 2(4) < 7$	$-3 - 2(-10) < 7$
$-1 < 7$	$-6 < 7$	$17 < 7$
Yes	Yes	No

Example 3: Hailey and Caitlin make and sell bracelets to raise money for their school social committee. Beaded bracelets sell for \$10 each, and rubber band bracelets sell for \$2 each. In one day, they raised at least \$278. Define variables for this situation and write a linear inequality to represent the situation.

let $x = \#$ beaded bracelets $y = \#$ rubber band bracelets

$x \geq 0$

$y \geq 0$

$10x + 2y \geq 278$

Example 4: A local animal shelter is preparing pamphlets and letters to raise awareness of the shelter and to solicit donations.

- No more than 250 of each type of correspondence are needed.
- No more than 500 pamphlets and letters in total will be printed.
- Pamphlets cost 45 cents each to print, and letters cost 20 cents each to print.

Let p represent the number of pamphlets to be printed and l represent the number of letters. Write a system of linear inequalities that models the situation.

$$\begin{aligned}
 p &\leq 250 \\
 l &\leq 250 \\
 p + l &\leq 500 \\
 p \geq 0, l \geq 0 &\leftarrow \text{implicit constraints}
 \end{aligned}
 \qquad
 \begin{aligned}
 0.45p + 0.20l &= C \\
 &\text{(objective function)}
 \end{aligned}$$

Example 5:

a) What are the vertices of the feasible region of the graph?

$$(-2, -3.5) \quad (-2, 4) \quad (4, -2)$$

b) Which point in the model would result in the maximum value of the objective function $W = y + 4x$? Which point in the model would result in the minimum value of the objective function?

$$\begin{aligned}
 W &= -3.5 + 4(-2) = -11.5 && \text{max value is } 4 \text{ at } (4, -2) \\
 W &= 4 + 4(-2) = -4 && \text{min value is } -11.5 \text{ at } (-2, -3.5) \\
 W &= -2 + 4(4) = 14
 \end{aligned}$$

Example 6: Yanni collects stamps and baseball cards.

- He has at most 100 stamps and at most 75 cards, but at least one of each.
- There were no more than 150 items, in total.

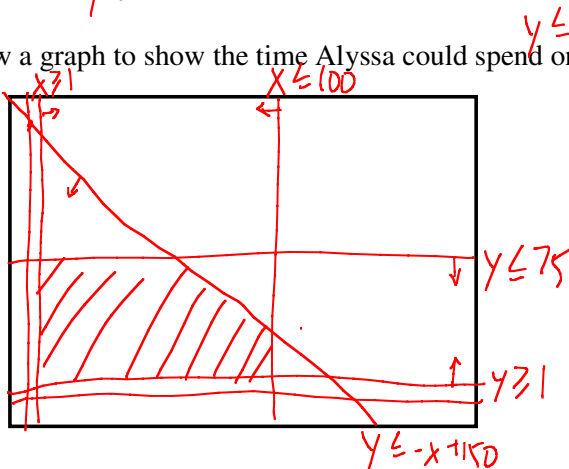
a) Define variables x and y for this problem.

$x = \# \text{ of stamps}$ $y = \# \text{ of cards}$

b) Write a system of inequalities to represent the constraints in this problem, including implicit constraints.

up and down $\rightarrow x \leq 100$ $x + y \leq 150$
 flat $\rightarrow y \leq 75$
 $x \geq 1$
 $y \geq 1$

c) Draw a graph to show the time Alyssa could spend on each activity in one week.



Xmin = 0
 Xmax = 200
 Xscl = 20
 Ymin = 0
 Ymax = 200
 Yscl = 20