p. 225

2 a) $\{(x, y) \mid -x + 2y \geq -4, x \in R, y \in R\}$ Solid Shaded

$\{(x, y) \mid y \geq x, x \in R, y \in R\}$

$-x + 2y = -4$

$\frac{2y}{2} = \frac{x}{2} - \frac{4}{2}$

$\boxed{y = \frac{1}{2}x - 2}$

$\boxed{y = x}$

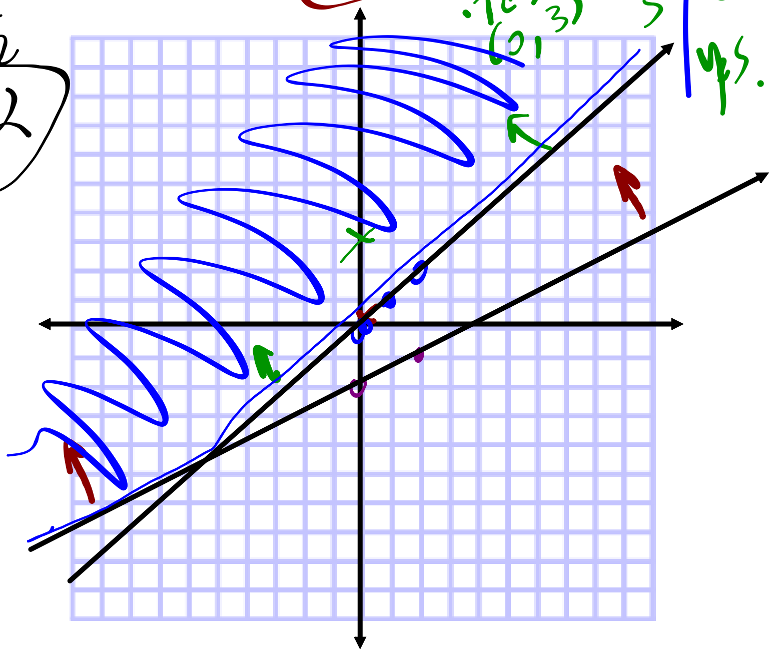
$y \geq x$

LS $\geq$ RS

Test (0, 3)

LS	RS
3	0

yes.



LS $\geq$ RS

LS	RS
$-0+2(0)$	-4
0	

Yes

LEARN ABOUT the Math

*** Can be found on p. 226

A company makes two types of boats on different assembly lines: aluminum fishing boats and fibreglass bow riders.

- When both assembly lines are running at full capacity, a maximum of 20 boats can be made in a day.
- The demand for fibreglass boats is greater than the demand for aluminum boats, so the company makes at least 5 more fibreglass boats than aluminum boats each day.

f depends on a

$x \to$ # of aluminum

$y \to$ # of fibreglass

$x \in W$ $y \in W$

$x + y \leq 20$ $y \geq x + 5$

What combinations of boats should the company make each day?

EXAMPLE 1 Solving a problem with discrete whole-number variables using a system of inequalities

Mary's Solution: Using graph paper

Let a represent the number of aluminum fishing boats.
Let f represent the number of fibreglass bow riders.

$a \in W$ and $f \in W$

> I knew I could solve this problem by representing the situation algebraically with a system of two linear inequalities and graphing the system.
>
> Since only complete boats are sold, I knew that a and f are whole numbers and the graph would consist of discrete points in the first quadrant.

The relationship between the two types of boats can be represented by this system of inequalities:
$a + f \leq 20$ ✓
$a + 5 \leq f$

> The two inequalities describe
> - a combination of boats to a maximum of 20.
> - at least 5 more fibreglass boats than aluminum boats.

$a + f = 20$

f-intercept:	a-intercept:
$0 + f = 20$	$a + 0 = 20$
$f = 20$	$a = 20$
(0, 20)	(20, 0)

$a + 5 = f$

f-intercept:	a-intercept:
$0 + 5 = f$	$a + 5 = 0$
$f = 5$	$a = -5$
(0, 5)	(−5, 0)

> To graph each linear inequality, I knew I had to graph its boundary as a stippled line, and then shade and stipple the correct half plane.
>
> To graph each boundary, I wrote each linear equation and then determined the a- and f-intercepts so I could plot and join them.

$a + 5 = f$
$(5) + 5 = f$
$10 = f$
(5, 10) is a point on this boundary.

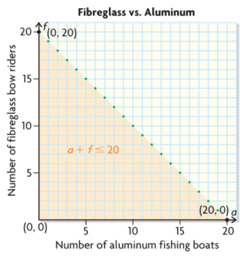
> For $a + 5 = f$, I knew (−5, 0) wasn't going to be a point on the boundary, because it's not in the first quadrant, so I chose another point by solving the equation for $a = 5$.

Test (0, 0) in $a + f \leq 20$.

LS	RS
$a + f$	20
$0 + 0$	
0	

Since $0 \leq 20$, (0, 0) is in the solution region.

> I tested point (0, 0) to determine which half plane to shade for $a + f \leq 20$.



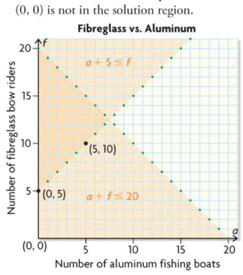
> I drew a green stippled boundary connecting (0, 20) and (20, 0) and shaded the half plane below it orange, because the solution region is discrete.

Test (0, 0) in $a + 5 \leq f$.

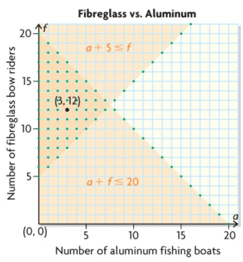
LS	RS
$a + 5$	f
$0 + 5$	0
5	

Since 5 is not less than or equal to 0, (0, 0) is not in the solution region.

> I tested (0, 0) to determine which half plane to shade for $a + 5 \leq f$.



> I plotted the points (0, 5) and (5, 10) on the same coordinate plane. I used these points to draw a green stippled boundary for $a + 5 \leq f$.
>
> I shaded the half plane above the boundary orange, since the test point (0, 0) is not a solution to the linear inequality and the solution region is discrete.
>
> I knew that the solution set for the system of linear inequalities is represented by the intersection or overlap of the solution regions of the two inequalities. This made sense since points in this region satisfy both inequalities.
>
> I knew that the triangular solution region included discrete points along its three boundaries, including the y-axis from $y = 5$ to $y = 20$.



> Since the solution set for the system contains only discrete points with whole-number coordinates, I stippled its solution region.
>
> I knew that any whole-number point in the triangular solution region is a possible solution. For example, (3, 12) is a possible solution.

$\{(a, f) \mid a + f \leq 20, a \in W, f \in W\}$
$\{(a, f) \mid a + 5 \leq f, a \in W, f \in W\}$

Any point with whole-number coordinates in the intersecting or overlapping region is an acceptable combination. For example, 3 aluminum boats and 12 fibreglass boats is an acceptable combination.

> I knew that (3, 12) worked because this gives a total of 15 boats with 9 more fibreglass boats than aluminum boats.

LEARN ABOUT the Math

*** Can be found on p. 226

f depends on a

A company makes two types of boats on different assembly lines: aluminum fishing boats and fibreglass bow riders.

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$x \to$ # of aluminum

$y \to$ # of fibreglass

$x \in W \quad y \in W$

$x + y \leq 20 \qquad y \geq x + 5$

What combinations of boats should the company make each day?

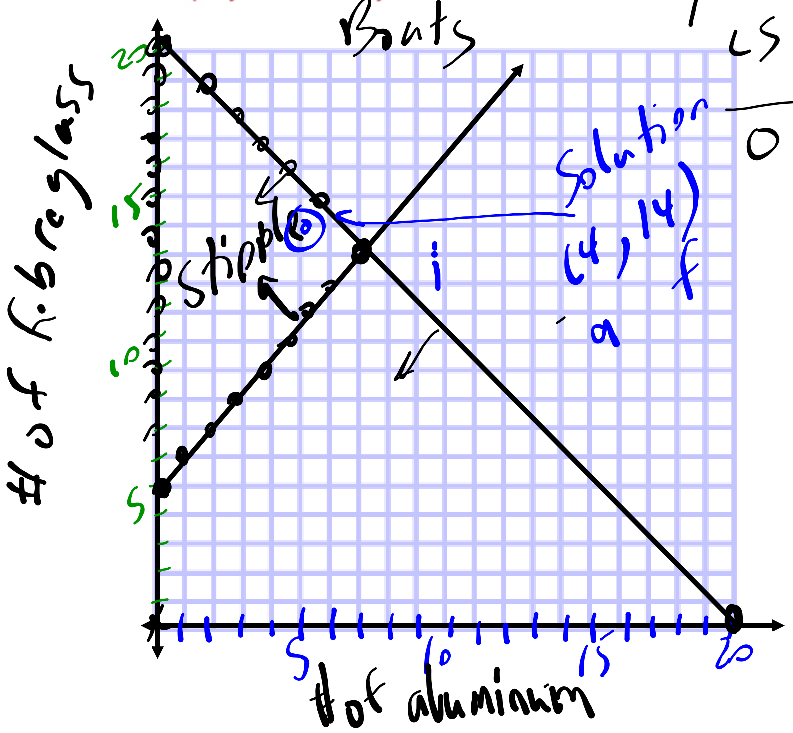
$x + y = 20$

x-int $\quad x = 20$

$(20, 0)$

y-int $\quad y = 20$

$(0, 20)$



$y = x + 5$

LS $\geq$ RS	
0	0+5
	5

No

HOMEWORK...

p. 236: #7 - 10

NOTE: Each question requires a graph to get possible solutions!