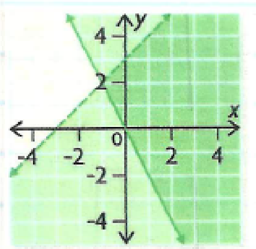
SOLUTIONS ⇒ 5.2 Exploring Graphs of Systems of Linear Inequalities

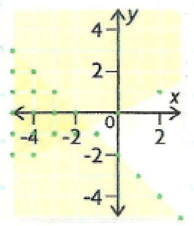
1. Three systems of linear inequalities have been graphed below. For each system, describe what you can infer from the graph about the restrictions on the domain and range.

a) $y \geq -2x$
$-3 < x - y$



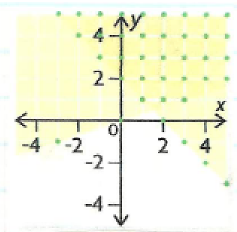
You can infer from this graph that for this system of inequalities ⇒ $x \in R$, $y \in R$.

b) $x+3y \geq 0$
$x+y \geq 2$



You can infer from this graph that for this system of inequalities $\Rightarrow x \in I, y \in I$

c) $x+y \leq -2$
$2y \geq x$



You can infer from this graph that for this system of inequalities $\Rightarrow x \in I, y \in I$.

2. Graph each system of linear inequalities. Justify your representation of the solution set.

a) $\{(x,y) \mid \underbrace{-x+2y \geq -4}_{\text{Solid Line}}, \underbrace{x \in R, y \in R}_{\to \text{* Continuous}}\}$

$\{(x,y) \mid \underbrace{y \geq x}_{\text{Solid Line}}, \underbrace{x \in R, y \in R}_{\to \text{* Continuous}}\}$

① Equations of the boundaries:

↳ $-x+2y=-4$

↳ $y=x$

② Two points on each boundary (x-int & y-int):

↳ $-x+2y=-4$

For $x=0$,
$0+2y=-4$
$\frac{\cancel{2}y}{\cancel{2}}=\frac{-4}{2}$
$y=-2$
y-int ⇒ -2

For $y=0$,
$-x+2(0)=-4$
$\frac{-x}{-1}=\frac{-4}{-1}$
$x=4$
x-int ⇒ 4.

↳ $y=x$ (O.K)
* Diagonal line which passes through $(-1,-1)$, $(0,0)$, $(1,1)$ etc.

③ Test Point (0,0):

L.S.	R.S
$-x+2y$	-4
$0+2(0)$	
$0+0$	
0	

Since $0 \geq 4$, (0,0) is located in the solution region.

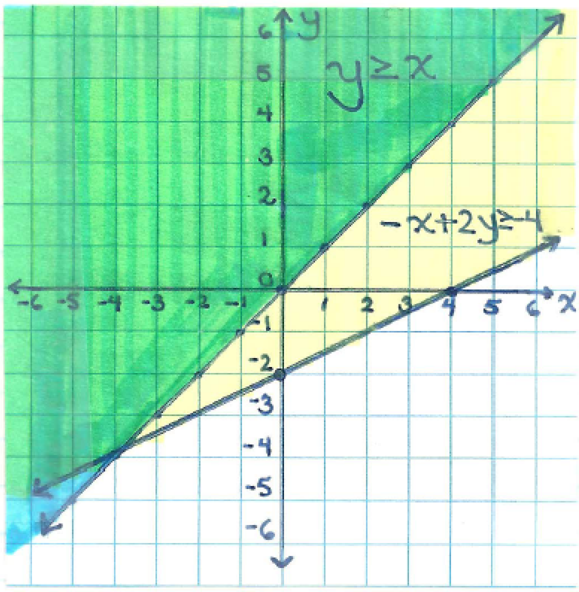
*Since (0,0) is on the line

Test Point (0,1):

L.S	R.S
y	x
1	0

Since $1>0$, (0,1) is located in the solution region

4 Graph:



b) $\{(x,y) \mid 2x+3y \leq 9, x \in I, y \in I\}$ * Discrete (Stippled)

Solid line

$\{(x,y) \mid y-6x \geq 1, x \in I, y \in I\}$ * Discrete (Stippled)

Solid line

① Equations of the boundaries:

↳ $2x+3y=9$ ↳ $y-6x=1$

② Two points on each boundary (x-int & y-int):

↳ $2x+3y=9$

For $x=0$,
$2(0)+3y=9$
$0+3y=9$
$\frac{\cancel{3}y}{\cancel{3}}=\frac{9}{3}$
$y=3$
y-int => 3

For $y=0$,
$2x+3(0)=9$
$\frac{\cancel{2}x}{\cancel{2}}=\frac{9}{2}$
$x=4.5$
x-int => 4.5

↳ $y-6x=1$

For $x=0$,
$y-6(0)=1$
$y-0=1$
$y=1$
y-int => 1

For $y=0$,
$0-6x=1$
$\frac{-\cancel{6}x}{-\cancel{6}}=\frac{1}{-6}$
$x=-0.17$
x-int => -0.17

③ Test Point (0,0):

L.S	R.S
$2x+3y$	9
$2(0)+3(0)$	
$0+0$	
0	

Since $0 \le 9$, (0,0) is located in the solution region.

Test Point (0,0):

L.S	R.S.
$y-6x$	1
$0-6(0)$	
$0-0$	
0	

$0<1$, therefore (0,0) is not located in the solution region.

④ Graph: