Math-I 110 4.4 Inequalities in Two Variables

Example: Determine $(-3,2)$ and $(6,-7)$ are solutions to the inequality $5x - 4y > 13$

$(-3,2)$: $5(-3) - 4(2) > 13 \Rightarrow -15 - 8 > 13$

$\Rightarrow -23 > 13 \Rightarrow$ False

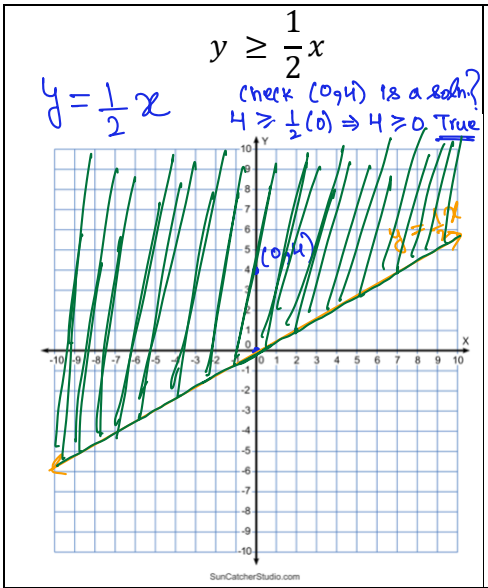
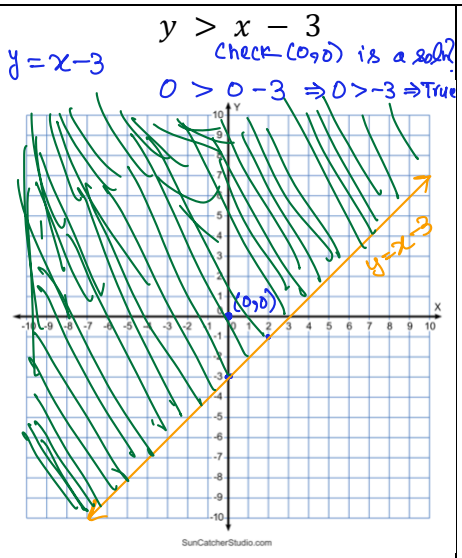
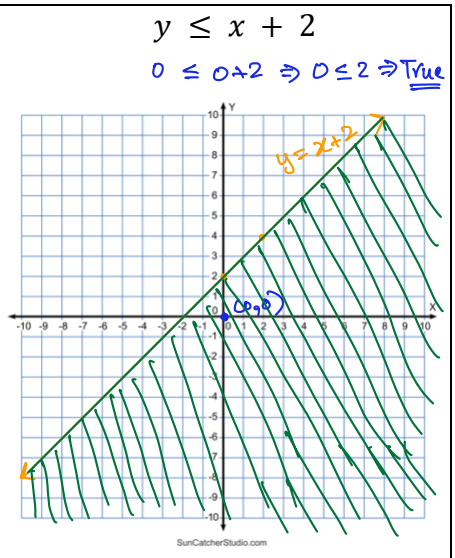
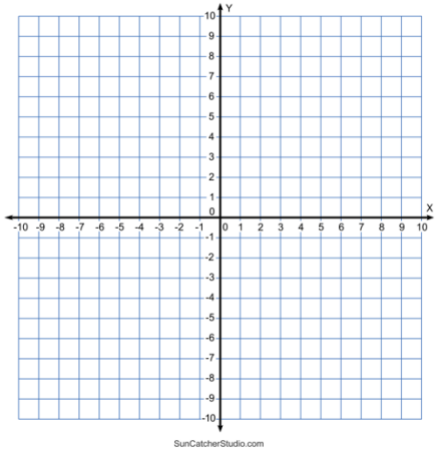
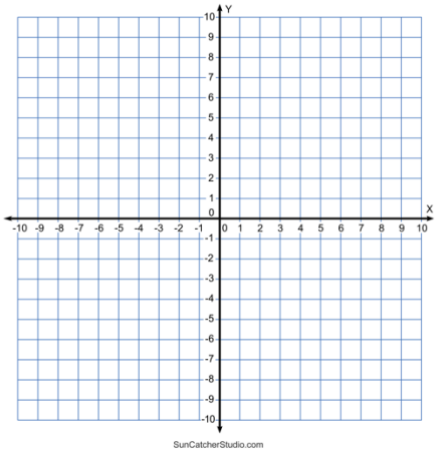
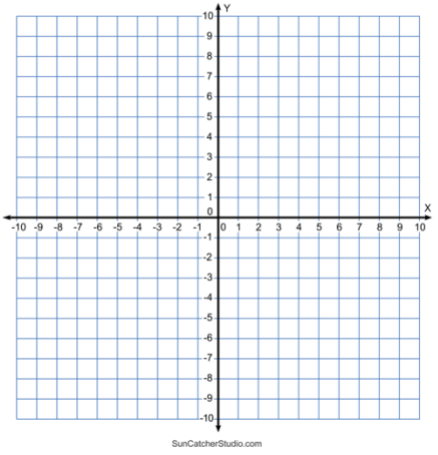
→ Not a solution

$(6,-7)$: $5(6) - 4(-7) > 13 \Rightarrow 30 + 28 > 13 \Rightarrow 58 > 13$

$\Rightarrow$ True

→ Is a solution.

Graph the following inequalities

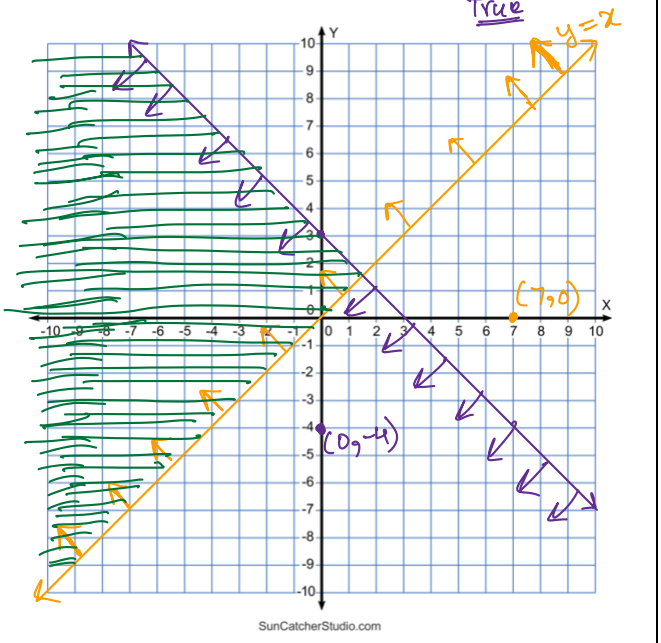
$y \geq \frac{1}{2}x$ 	$y > x - 3$ 	$y \leq x + 2$ 
$x - y \leq 4$ 	$2x + 3y < 6$ 	$2y - x \leq 4$ 

Graph.

$y = x$ $\quad y > x \quad (7,0) \Rightarrow 0 > 7 \Rightarrow$ False

$y = -x + 3$ $\quad y < -x + 3$

$(0,-4) \Rightarrow -4 < 0 + 3 \Rightarrow -4 < 3$ True



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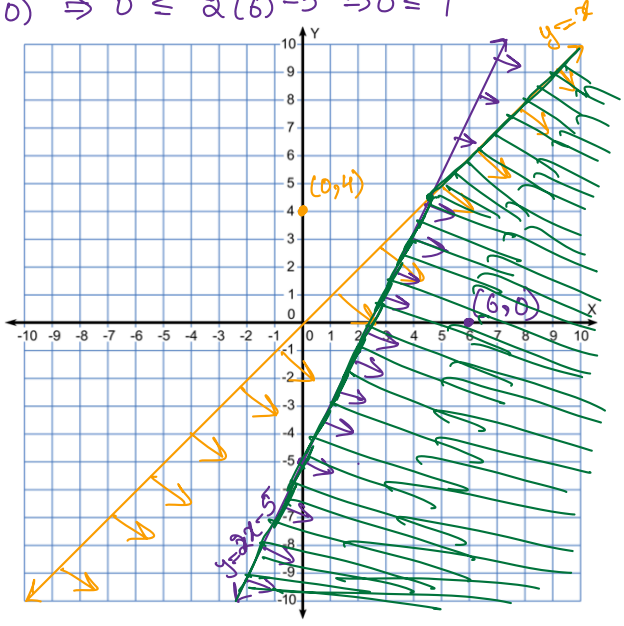
$(0,4)$ $\quad y \leq x$

$4 \leq 0$ False $\quad y \leq 2x - 5$

$(6,0) \Rightarrow 0 \leq 2(6) - 5 \Rightarrow 0 \leq 7 \Rightarrow$ True



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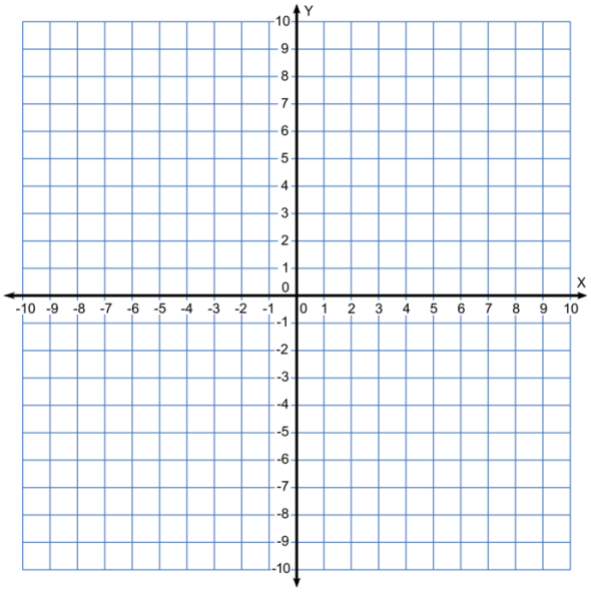
$x > -4$

$y < -2x + 3$



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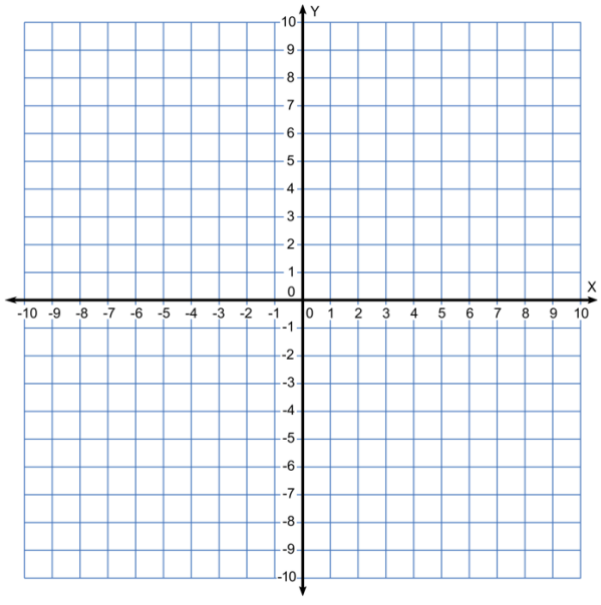
$y \leq 5$

$y \geq -x + 4$



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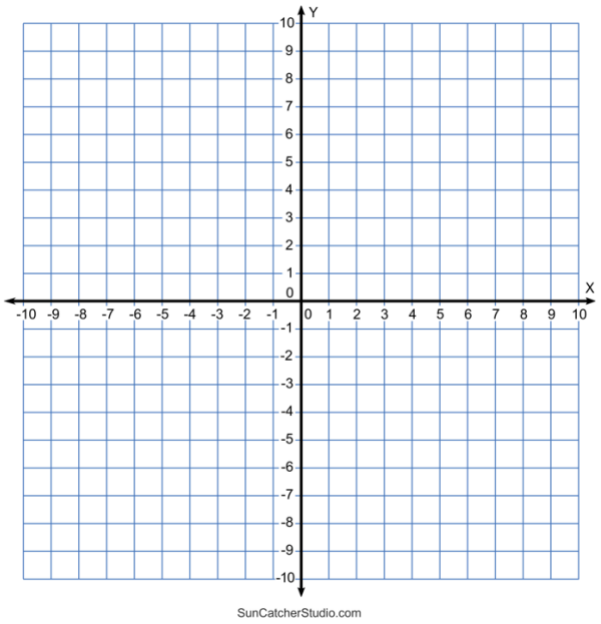
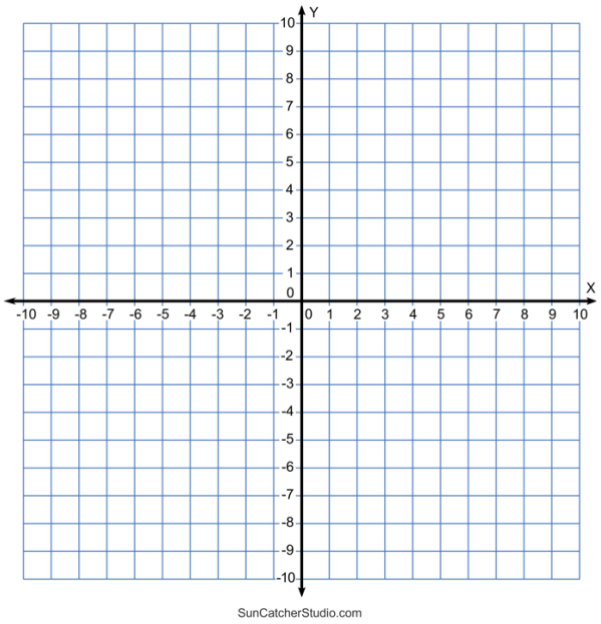
$y \leq -3$
$x \geq -1$



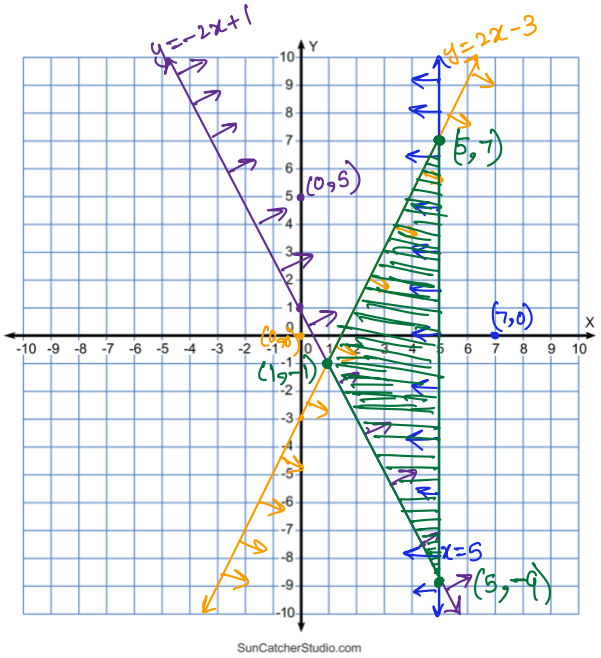
$x + y \leq 6$
$x - y \leq 4$



Graph each system of inequalities. Find the coordinates of any vertices formed.

$y \leq 2x - 3$, $0 \leq 2(0) - 3$, $0 \leq -3$ False
$y \geq -2x + 1$,
$x \leq 5$ $7 \leq 5$ False

$5 \geq -2(0) + 1$
$5 \geq 1$ True

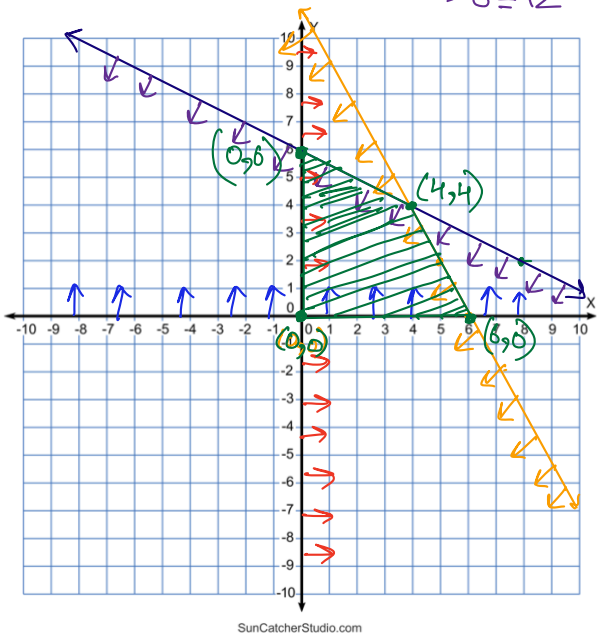


$x + 2y \leq 12$, $0 + 2(0) \leq 12$, $\Rightarrow 0 \leq 12$ True
$2x + y \leq 12$,
$x \geq 0$,
$y \geq 0$

$2x + y = 12$
$(6,0), (5,2)$

$x + 2y = 12$
$(8,2), (0,6)$

$2(0) + 0 \leq 12$
$\Rightarrow 0 \leq 12$

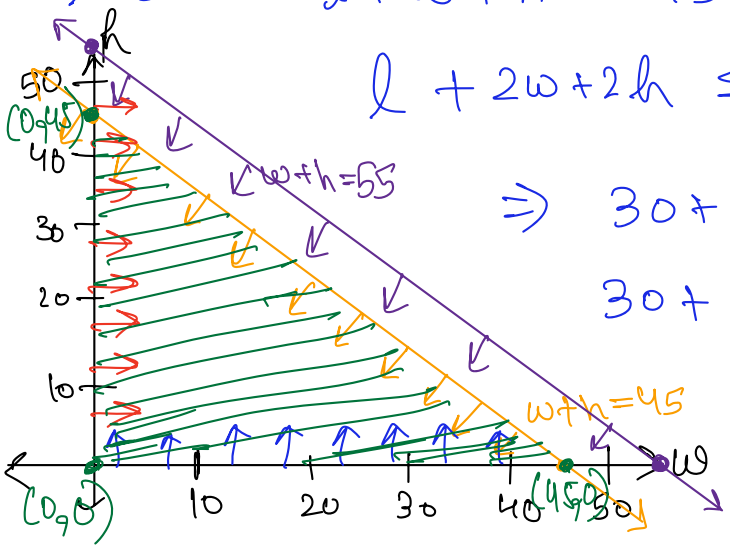


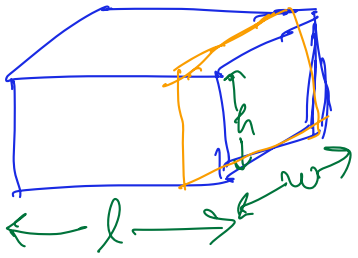
Example: Unless an additional fee is paid, some airlines will not check any luggage for which the sum of the item's length, width, and height exceeds 75 inches. A shipping company will ship a package only if the sum of the package's length and girth (distance around its midsection) does not exceed 140 inches. A promotion company is ordering several 30-inch-long cases that will be both mailed and checked as luggage. Using w and h for the width and height (in inches), respectively, write and graph an inequality that represents all acceptable combinations of width and height.

$l = 30$

$l + w + h \leq 75$

$l + 2w + 2h \leq 140$





$\Rightarrow 30 + w + h \leq 75 \Rightarrow w + h \leq 45$

$30 + 2w + 2h \leq 140 \Rightarrow 2w + 2h \leq 110$

$\Rightarrow 2(w + h) \leq 110$

$\Rightarrow w + h \leq 55$

$w \geq 0$

$h \geq 0$

Example: Many elevators have a capacity of 1 metric ton (1000 kg). Suppose c children each weighing 40 kg, and a adult each weighing 73 kg, are on an elevator. Find and graph an inequality that asserts that the elevator is overloaded.

$40(0) + 73(0) > 1000 \Rightarrow 0 > 1000$ → False

$40c + 73a > 1000$

$c \geq 0, a \geq 0$

x-int: $a = 0$

$\Rightarrow 40c = 1000$

$\Rightarrow c = 25$

$(25, 0)$

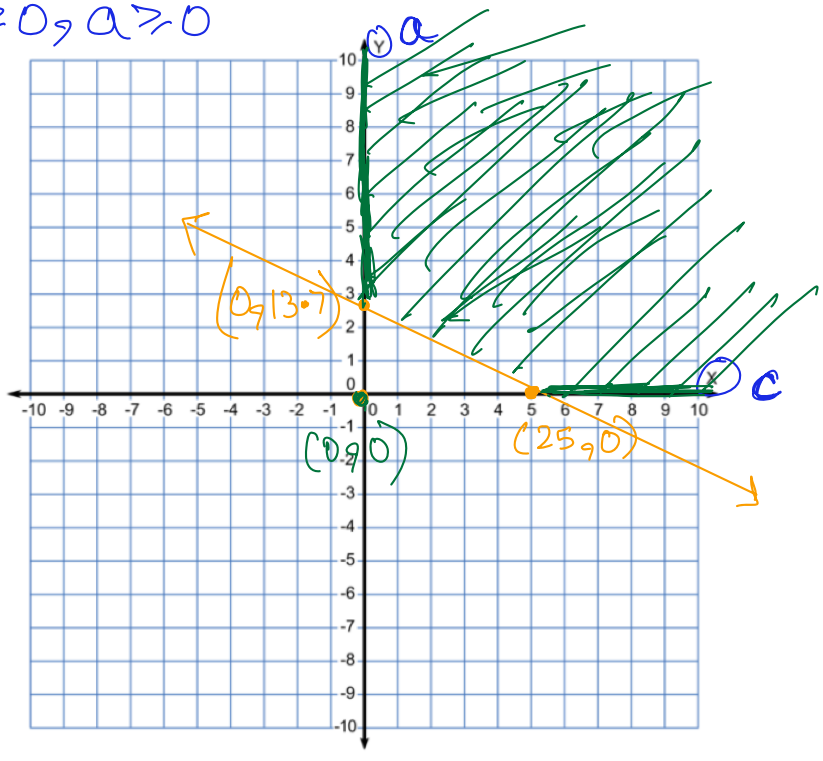
y-int:

$c = 0$

$73a = 1000$

$a = \frac{1000}{73}$

$= 13.7$



1 unit = 5 units

↓

- on x-axis
  5 children / unit
- on y-axis
  5 adults / units