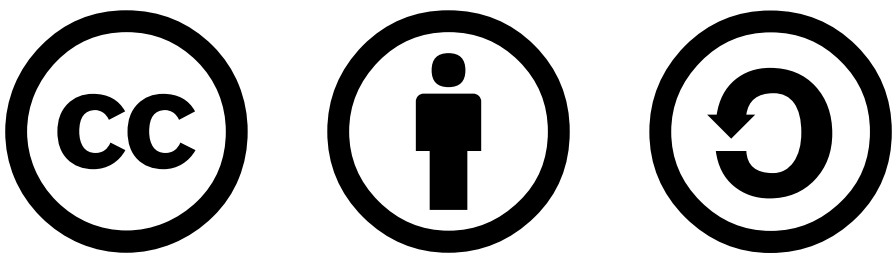


Algebra Lecture 8

Crista Moreno

December 18, 2016

Topics for today

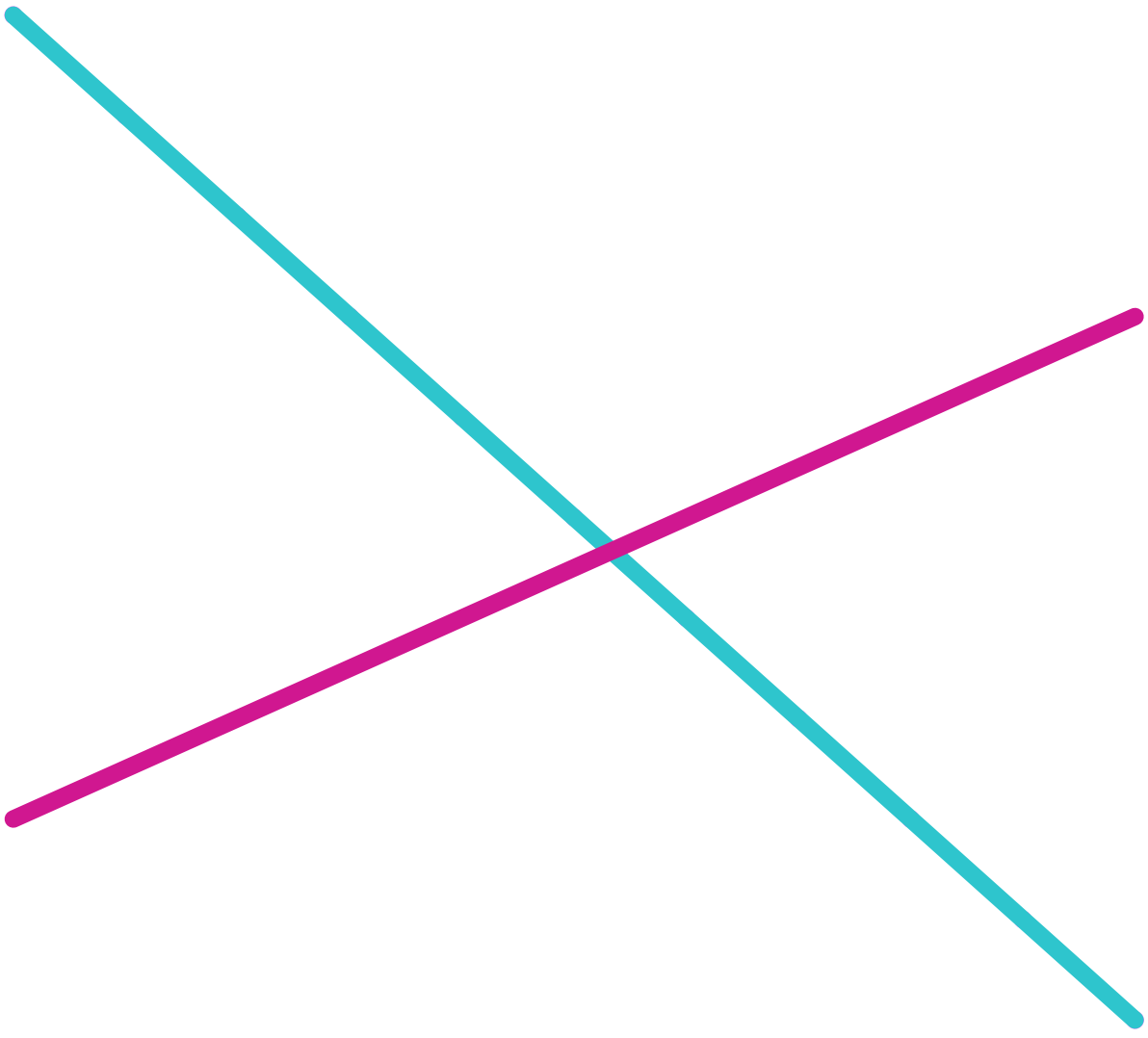
1. Solving Linear Inequalities
2. Inequalities on the Real Number Line $\mathbb{R}^1$

What is a Linear Inequality?

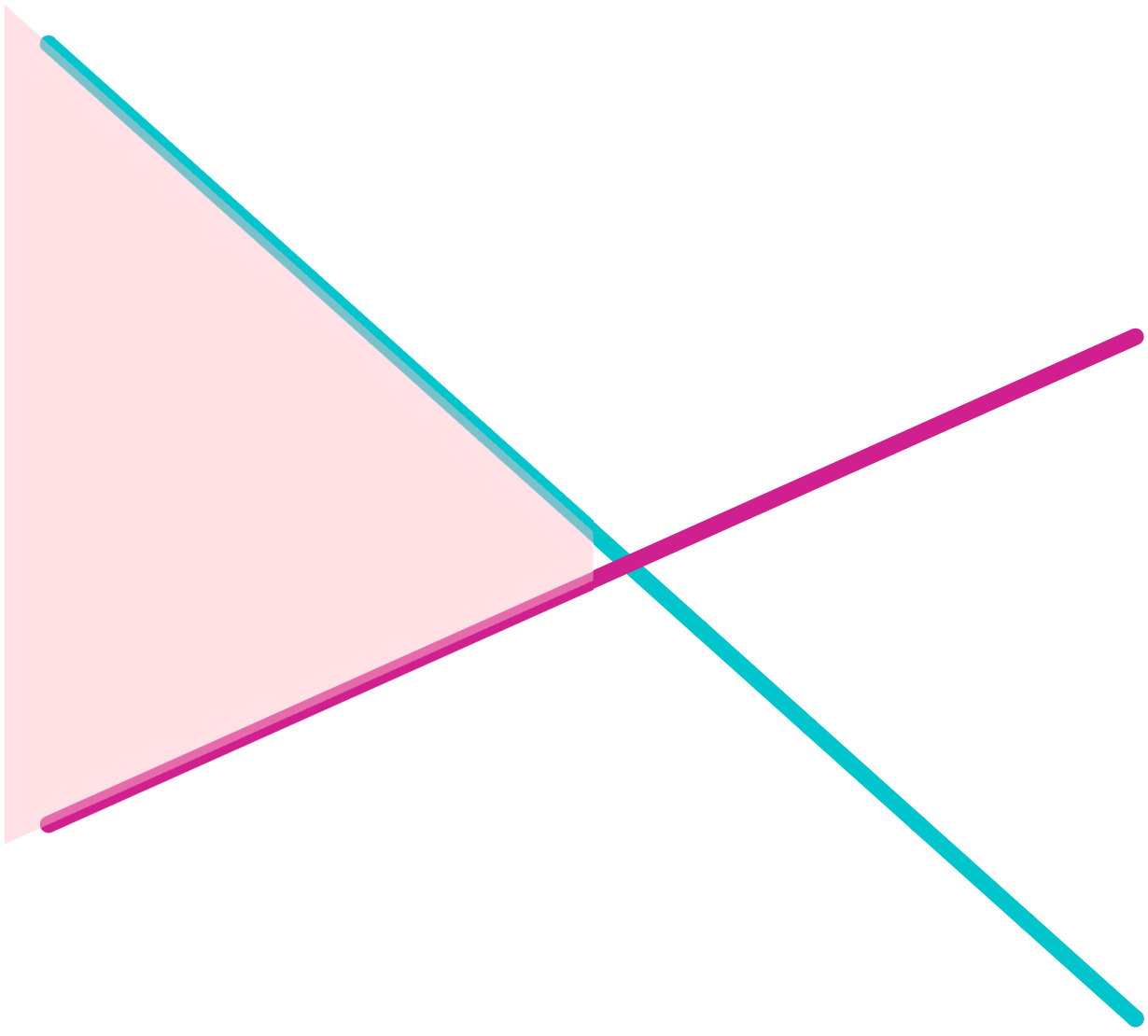
It is an inequality involving lines.

What are the possible things that can happen with two lines in the plane $\mathbb{R}^2$?

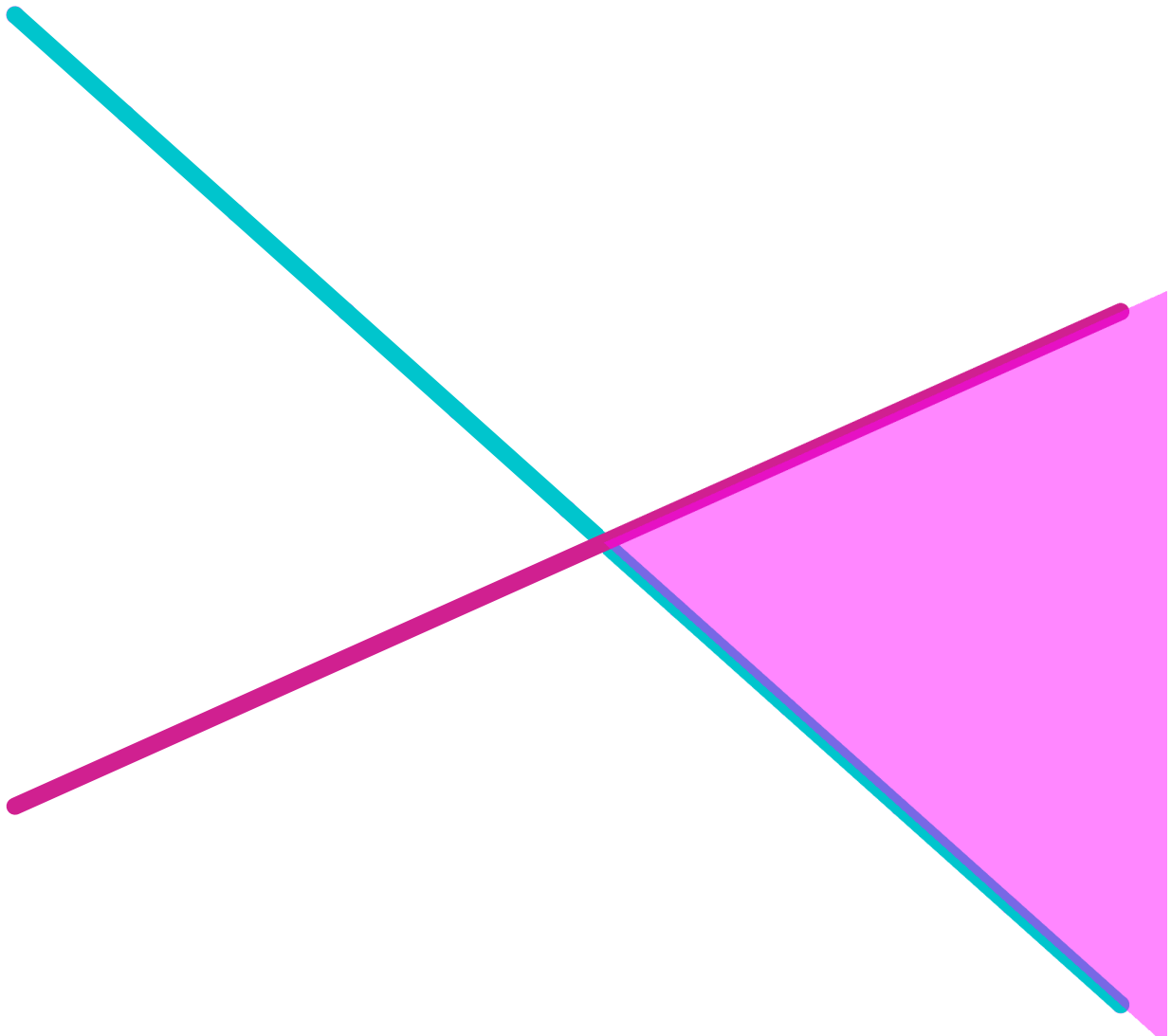
One Possibility



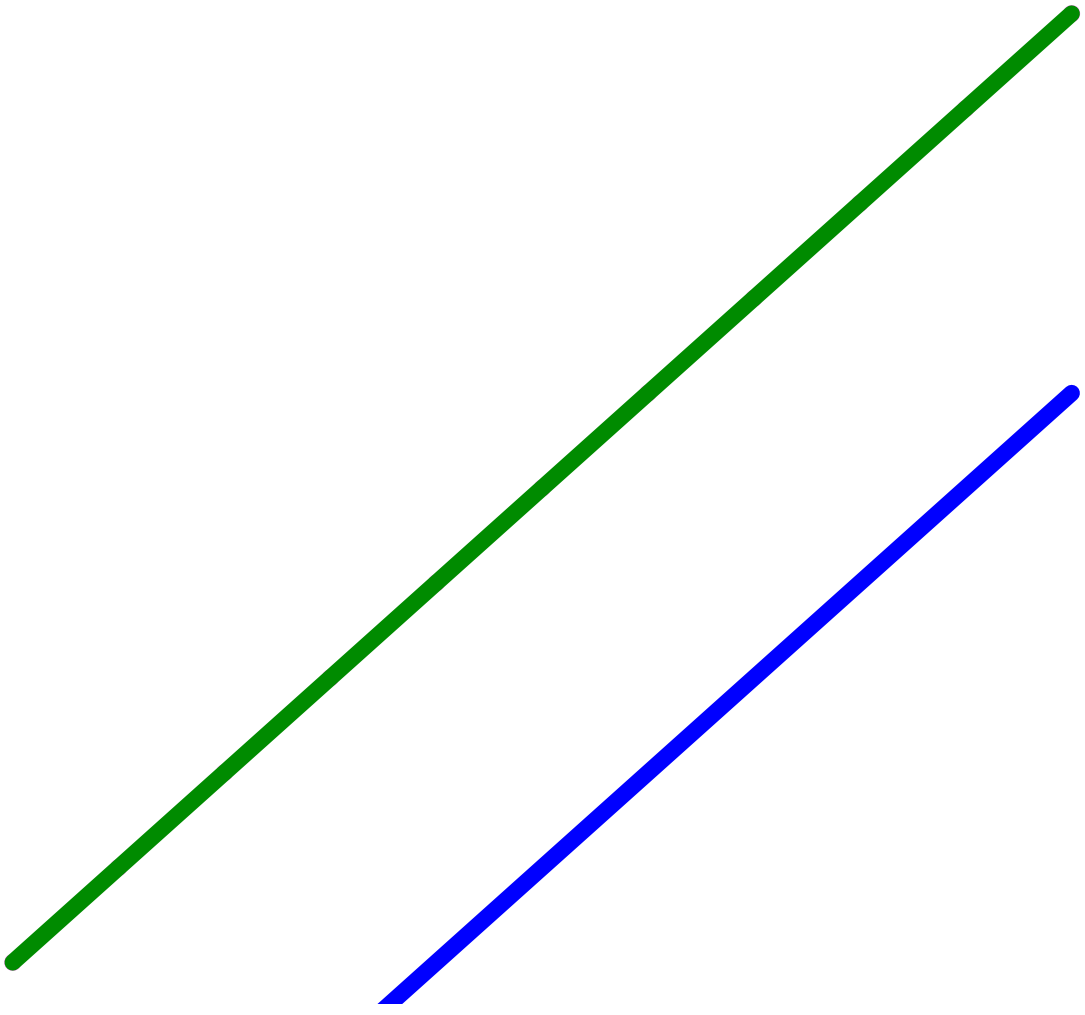
One Possibility



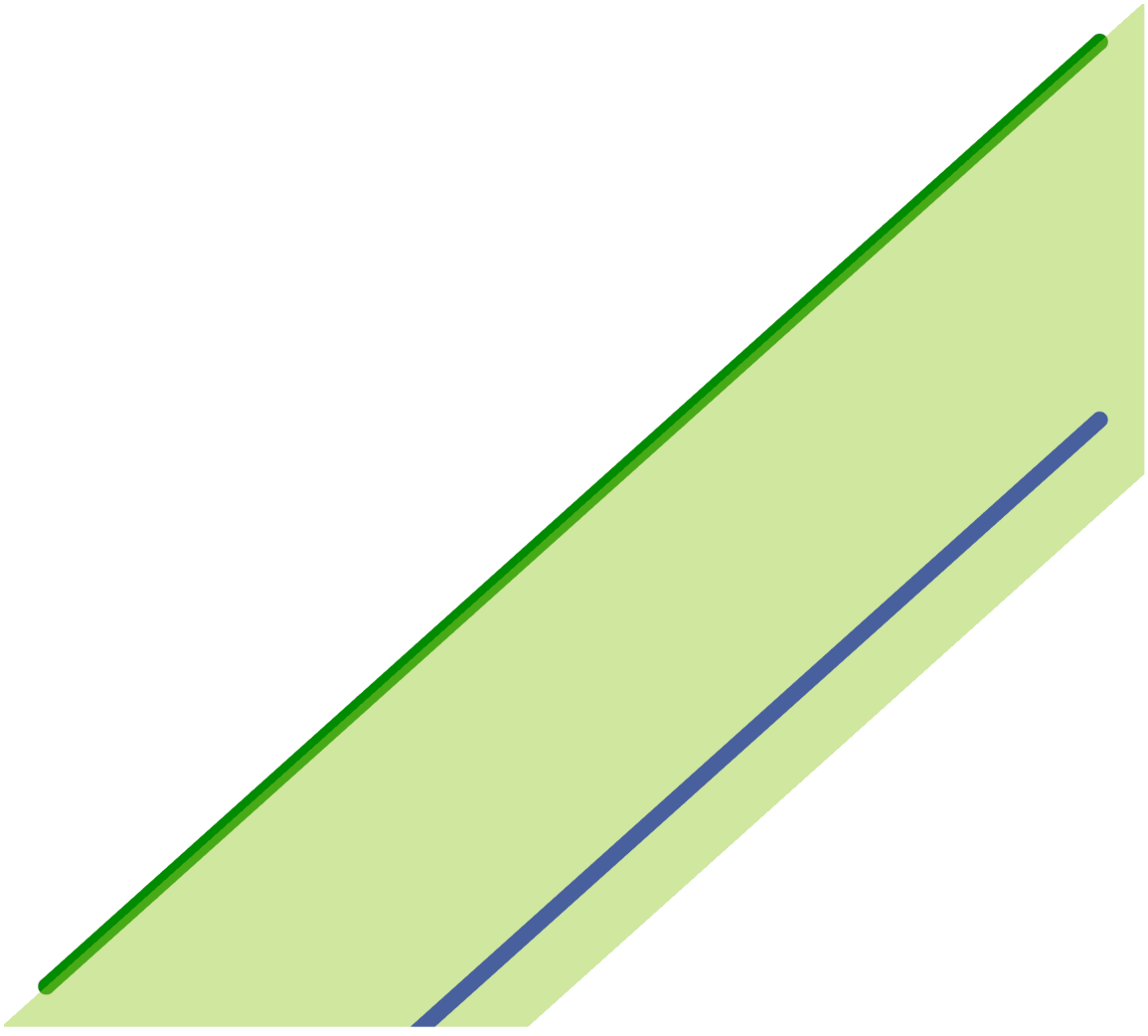
One Possibility



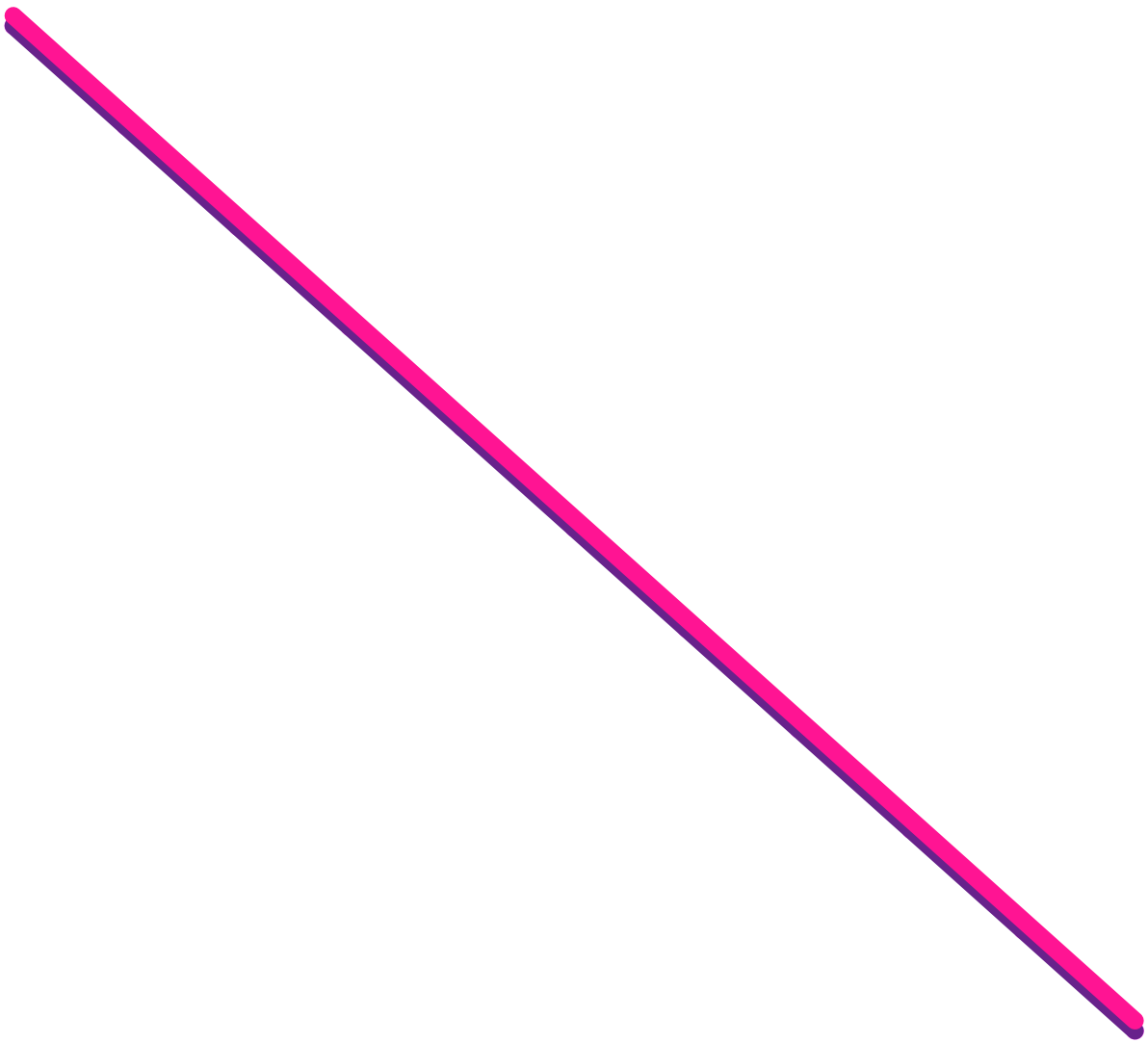
Another Possibility



Another Possibility



Yet Another Possibility



Examples

Solve the following linear inequality

$$\frac{3}{2}x - \frac{1}{2} \leq 1 - x$$

$$\frac{3}{2}x - \frac{1}{2} \leq 1 - x$$

$$\frac{3}{2}x - \frac{1}{2} \leq 1 - x$$

$$3x - 1 \leq 2 - 2x$$

$$\frac{3}{2}x - \frac{1}{2} \leq 1 - x$$

$$3x - 1 \leq 2 - 2x$$

$$3x + 2x - 1 \leq 2$$

$$\frac{3}{2}x - \frac{1}{2} \leq 1 - x$$

$$3x - 1 \leq 2 - 2x$$

$$3x + 2x - 1 \leq 2$$

$$5x \leq 3$$

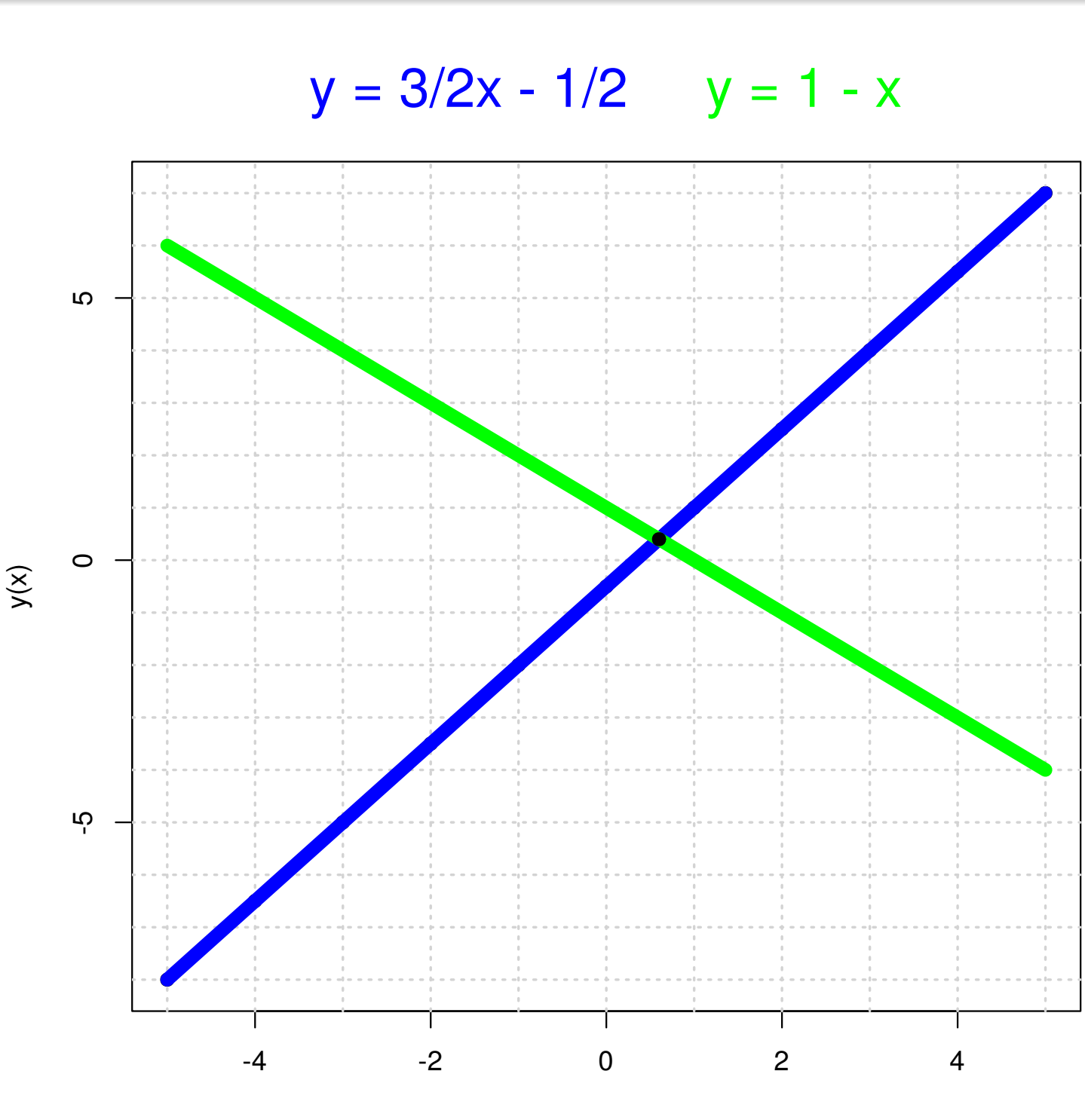
$$\frac{3}{2}x - \frac{1}{2} \leq 1 - x$$

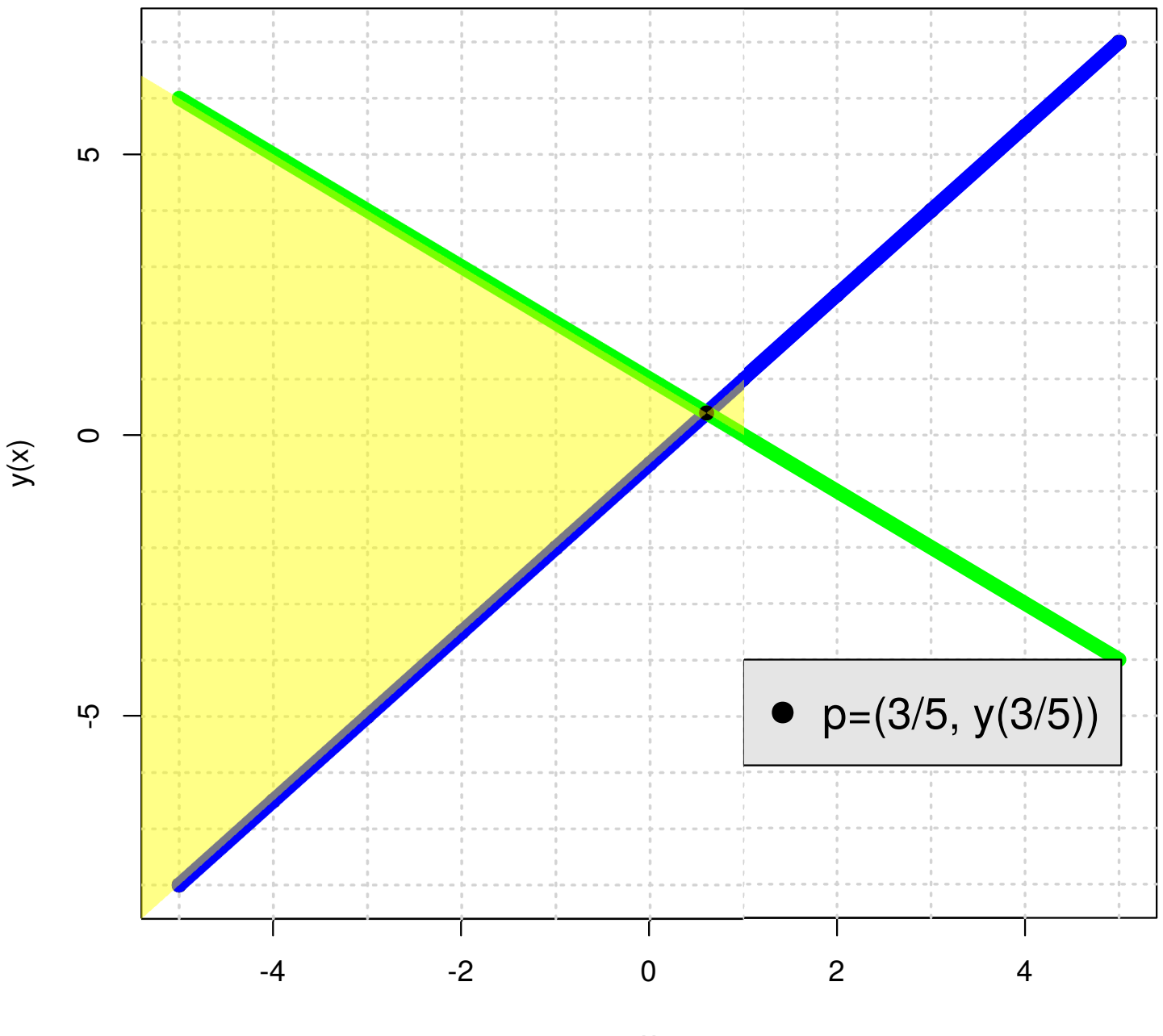
$$3x - 1 \leq 2 - 2x$$

$$3x + 2x - 1 \leq 2$$

$$5x \leq 3$$

$$\boxed{x \leq \frac{3}{5}}$$


y = 3/2x - 1/2
y = 1 - x
y(x)
5
0
-5
-4
-2
0
2
4


y = 3/2x - 1/2
y = 1 - x
y(x)
5
0
-5
-4
-2
0
2
4
p=(3/5, y(3/5))

Solve the following linear inequality

$$-2x + 1 \geq x$$

$$-2x + 1 \geq x$$

$$-2x + 1 \geq x$$

$$1 \geq x + 2x$$

$$-2x + 1 \geq x$$

$$1 \geq x + 2x$$

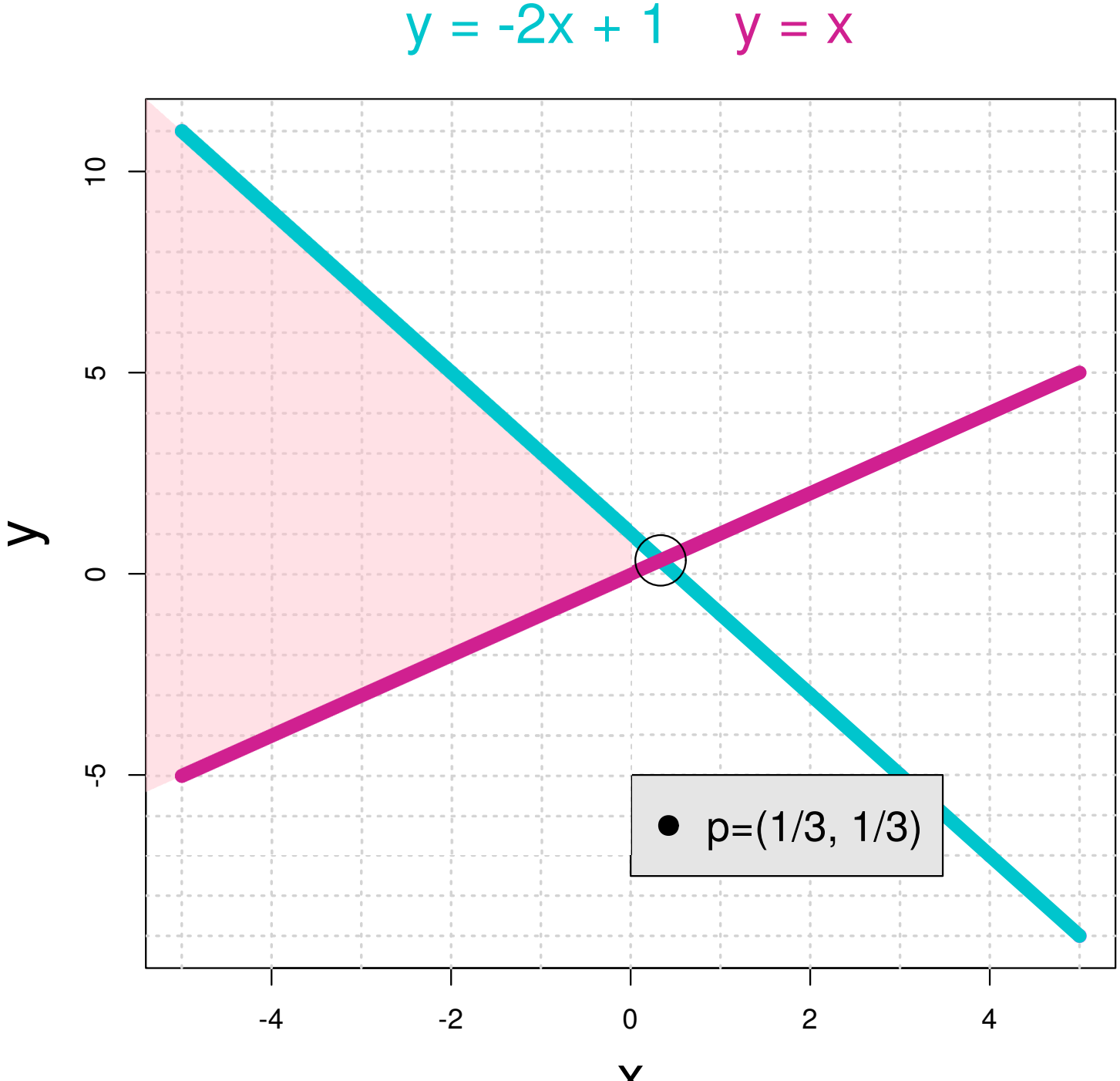
$$1 \geq 3x$$

$$-2x + 1 \geq x$$

$$1 \geq x + 2x$$

$$1 \geq 3x$$

$$\boxed{\frac{1}{3} \geq x}$$


y = -2x + 1
y = x
y
10
5
0
-5
-4
-2
0
2
4
x
p=(1/3, 1/3)

Solve the following linear inequality

$$\frac{4}{3}x - \frac{2}{3} \leq -1$$

$$\frac{4}{3}x - \frac{2}{3} \leq -1$$

$$\frac{4}{3}x - \frac{2}{3} \leq -1$$

$$4x - 2 \leq -3$$

$$\frac{4}{3}x - \frac{2}{3} \leq -1$$

$$4x - 2 \leq -3$$

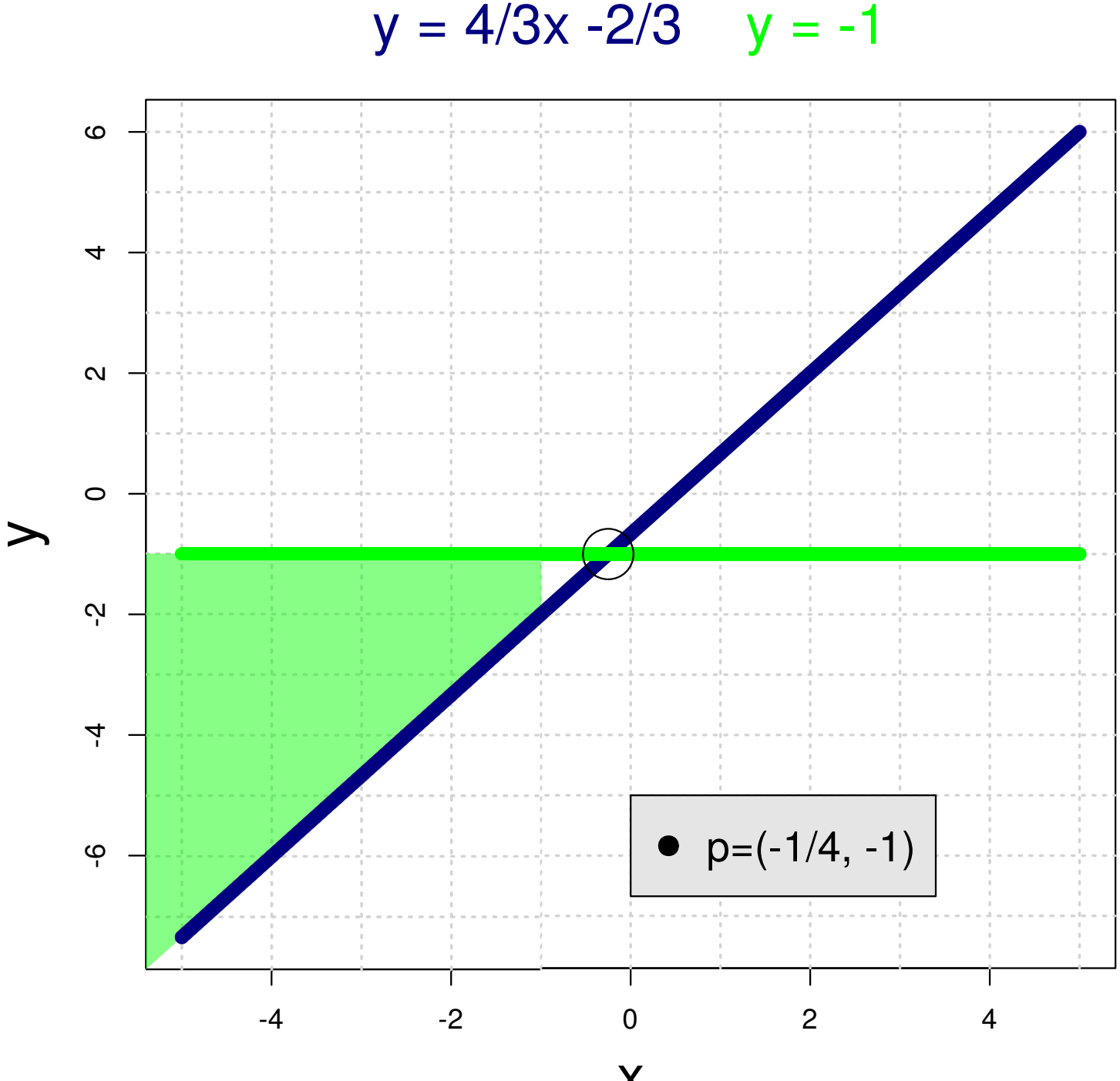
$$4x \leq -1$$

$$\frac{4}{3}x - \frac{2}{3} \leq -1$$

$$4x - 2 \leq -3$$

$$4x \leq -1$$

$$\boxed{x \leq \frac{-1}{4}}$$


y = 4/3x -2/3
y = -1
y
x
6
4
2
0
-2
-4
-6
-4
-2
0
2
4
p=(-1/4, -1)

Solve the following linear inequality

$$\frac{-2}{3} \geq 4 - 3x$$

$$\frac{-2}{3} \geq 4 - 3x$$

$$\frac{-2}{3} \geq 4 - 3x$$

$$-2 \geq 12 - 9x$$

$$\frac{-2}{3} \geq 4 - 3x$$

$$-2 \geq 12 - 9x$$

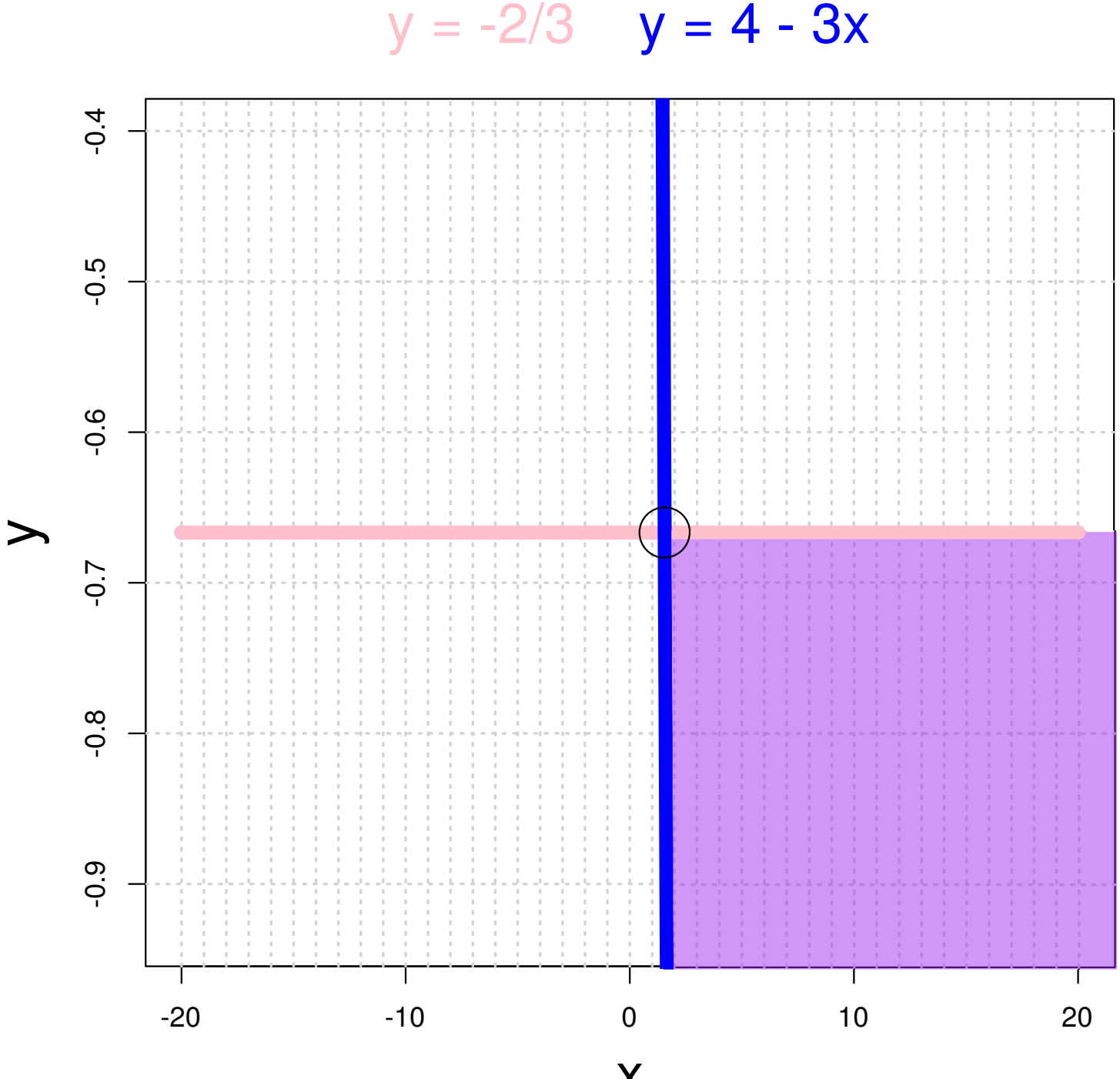
$$-14 \geq -9x$$

$$\frac{-2}{3} \geq 4 - 3x$$

$$-2 \geq 12 - 9x$$

$$-14 \geq -9x$$

$$\boxed{\frac{14}{9} \leq x}$$


y = -2/3
y = 4 - 3x
-0.4
-0.5
-0.6
-0.7
-0.8
-0.9
y
-20
-10
0
10
20
x

Solve the following linear inequality

$$\frac{-3}{4}(2x-1) \leq \frac{1}{2}(5x-3)+1$$

Solve the following linear inequality

$$\frac{5-2x}{2} > \frac{2x+1}{4}$$

Inequalities on the Real Number Line

$$\mathbb{R}^1$$

Symbols

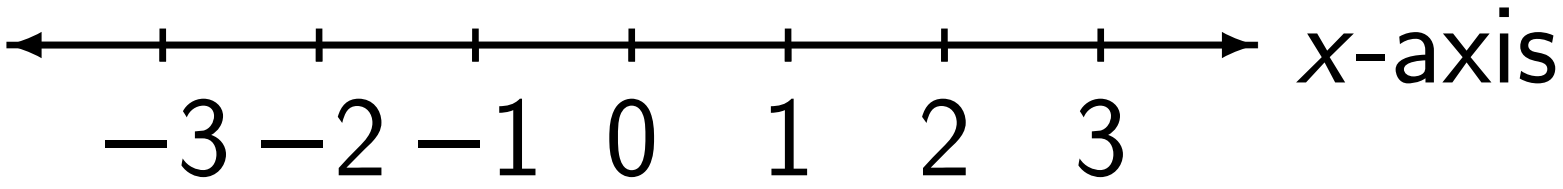
$()$	$<, >$	exclude endpoints
$[]$	$\leq, \geq$	include endpoints

or means union $\cup$

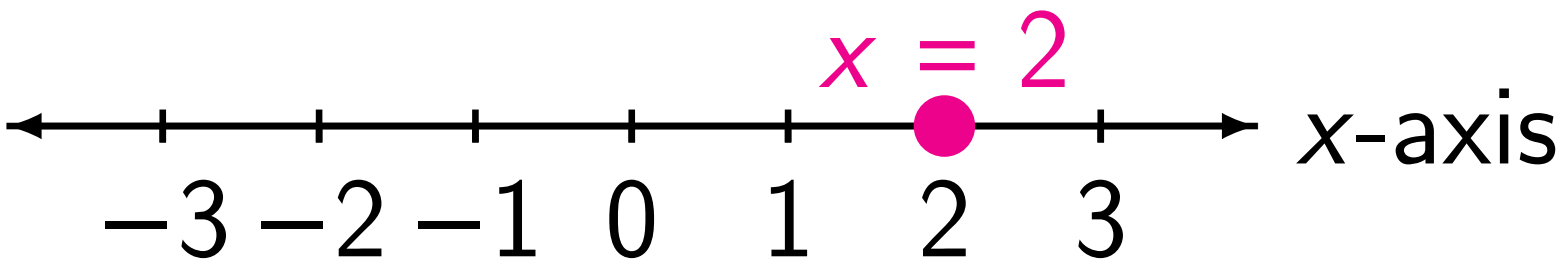
and means intersection $\cap$

Examples

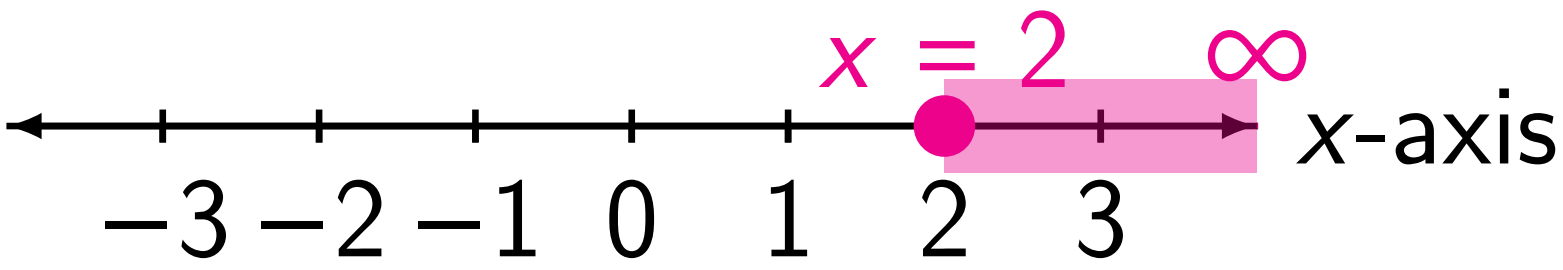
$x \geq 2$ $\quad [2, \infty)$



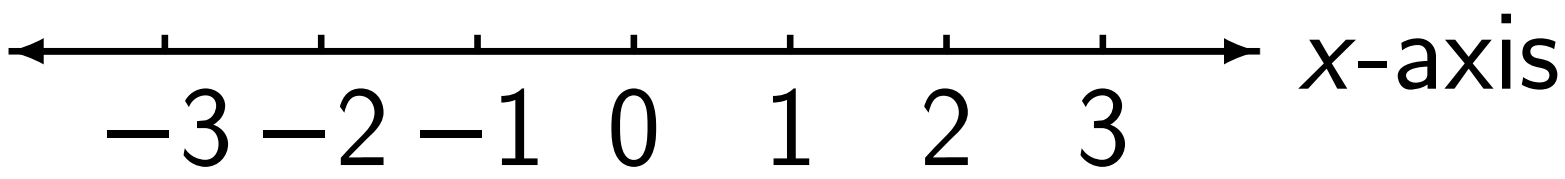
$x \geq 2$ $\quad [2, \infty)$



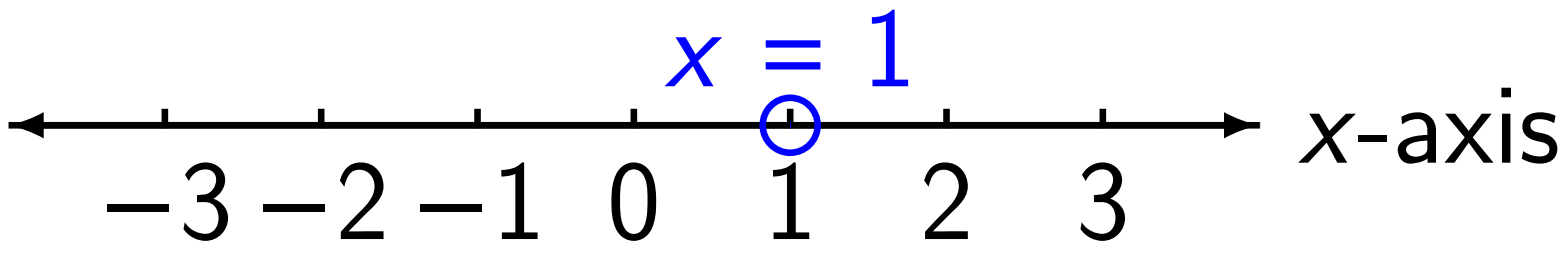
$x \geq 2$ $\quad [2, \infty)$



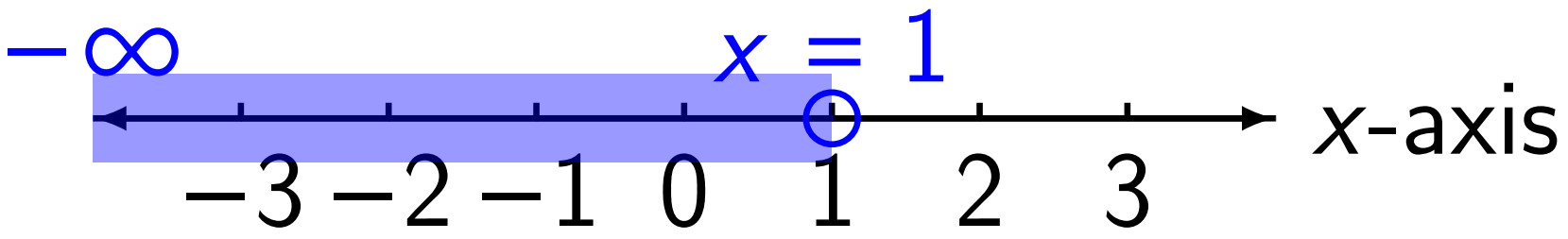
$x < 1$ $(-\infty, 1)$



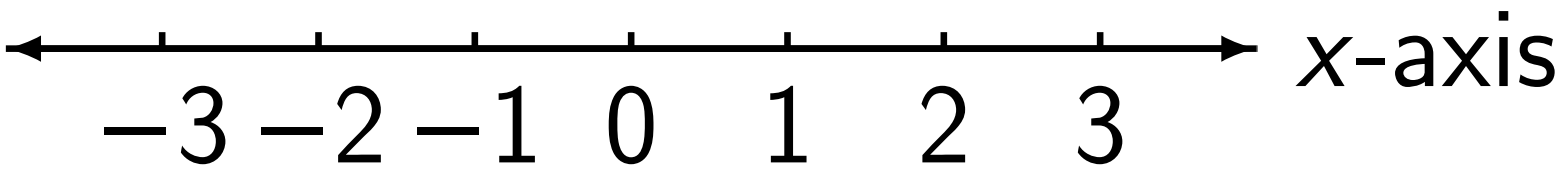
$x < 1$ $\quad (-\infty, 1)$



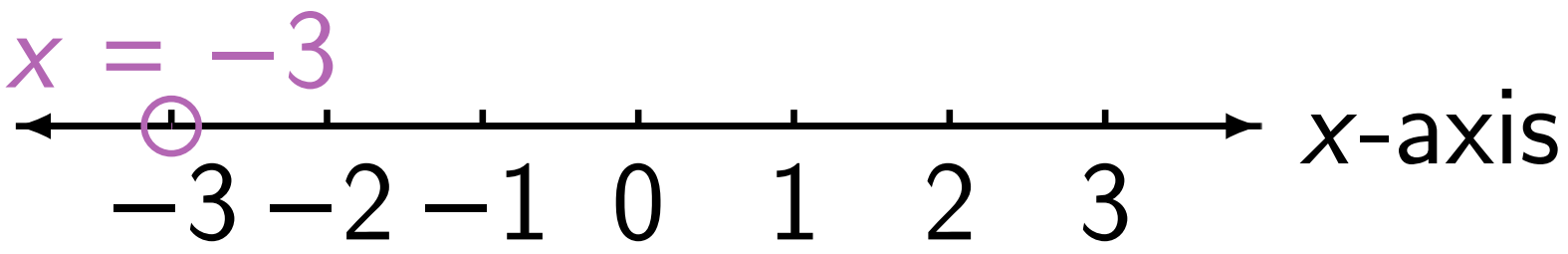
$x < 1$ $\quad (-\infty, 1)$



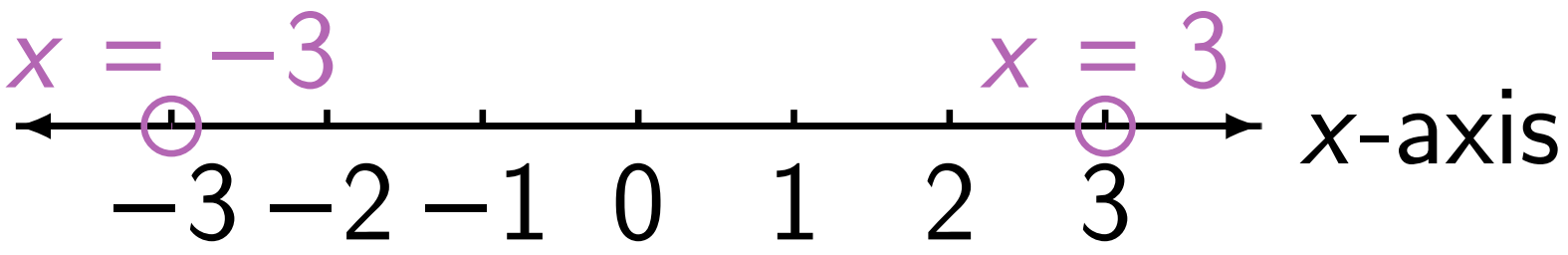
$-3 < x < 3$ $(-3, 3)$



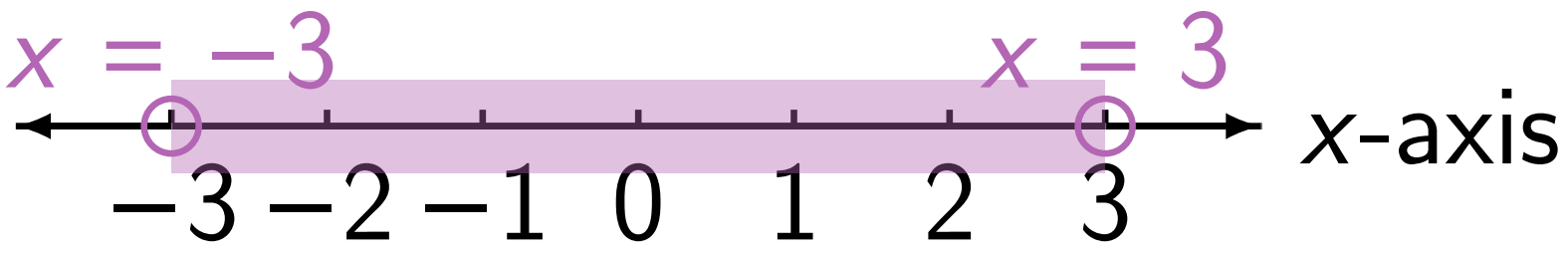
$-3 < x < 3$ $(-3, 3)$



$-3 < x < 3$ $(-3, 3)$

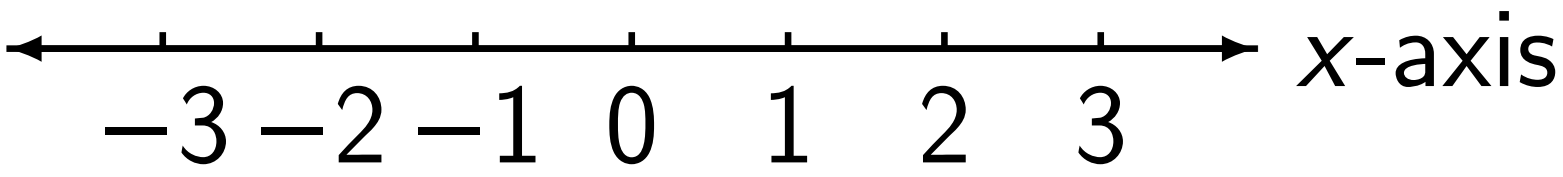


$-3 < x < 3$ $(-3, 3)$

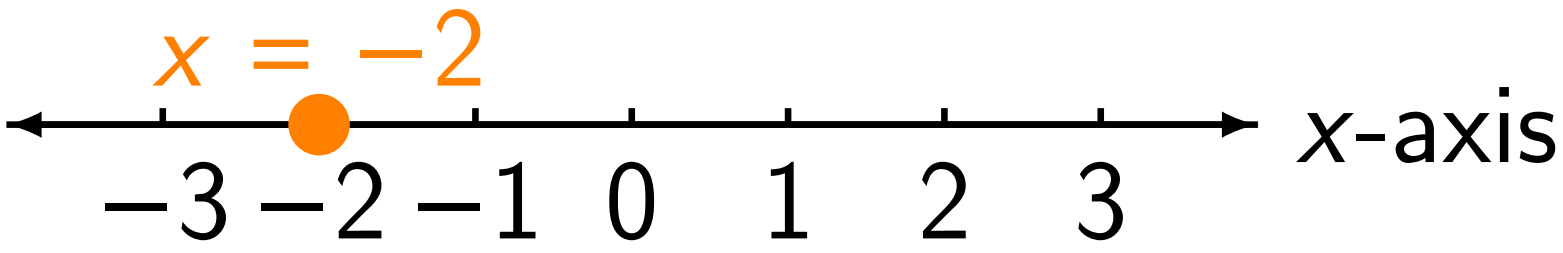


$-2 \leq x < 4$ $[-2, 4)$

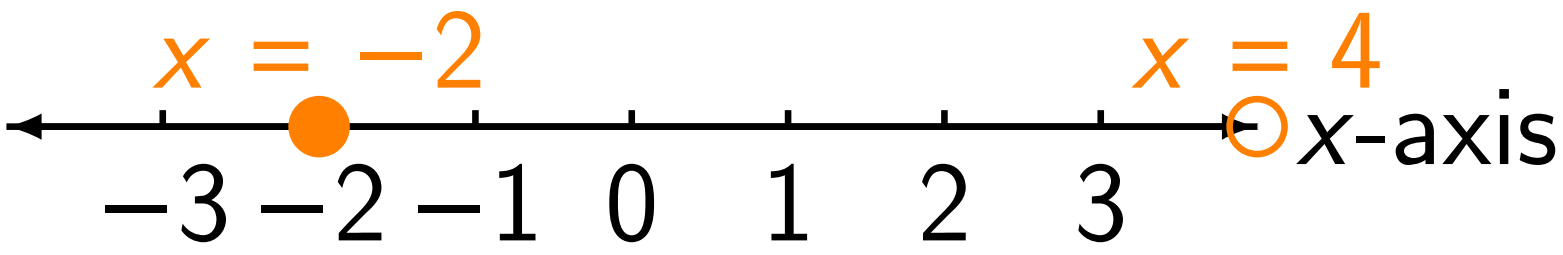
$-2 \leq x < 4$ $\quad [-2, 4)$



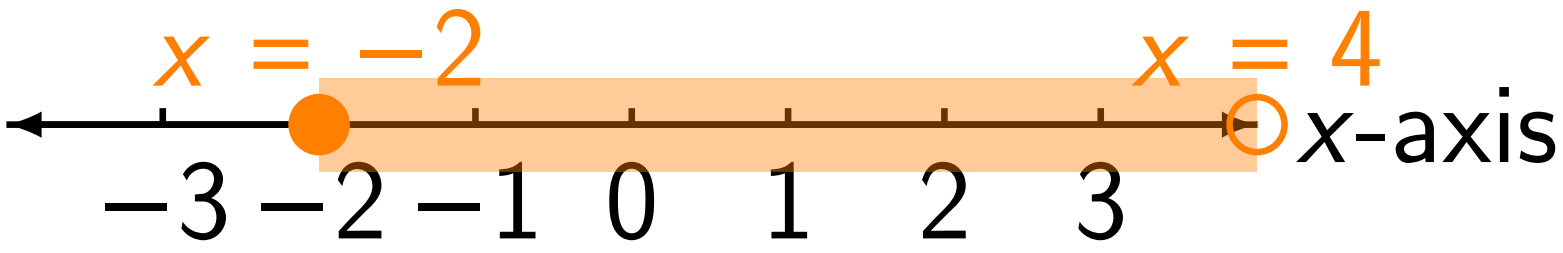
$-2 \leq x < 4$ $\quad [-2, 4)$



$-2 \leq x < 4$ $\quad [-2, 4)$

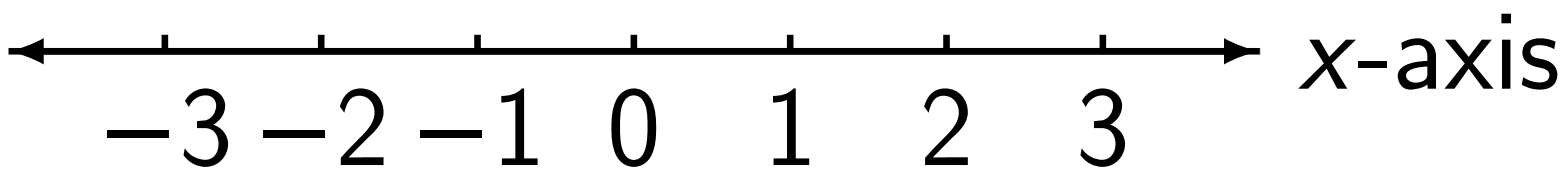


$-2 \leq x < 4$ $[-2, 4)$

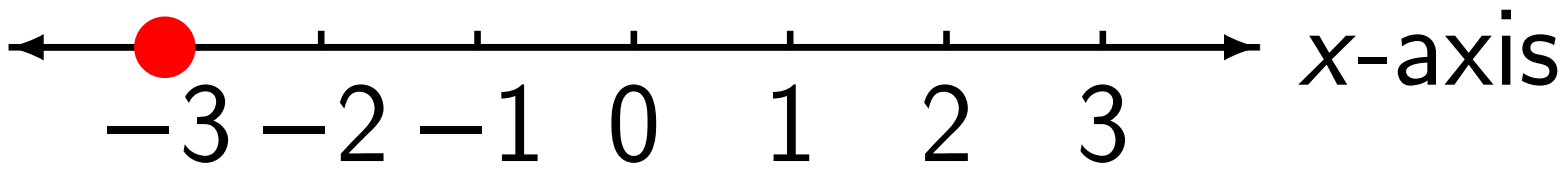


$x \leq -3$ or $x \geq 0$ $\quad$ $(-\infty, -3] \cup [0, \infty)$

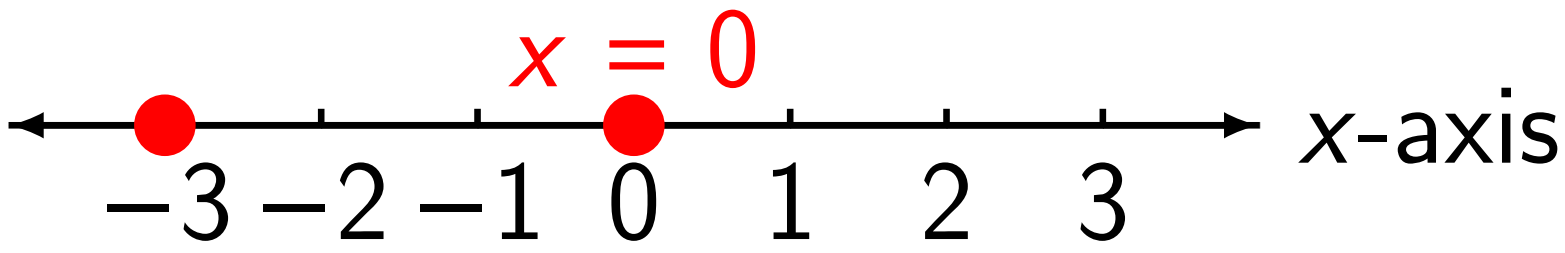
$x \leq -3$ or $x \geq 0$ $\quad (-\infty, -3] \cup [0, \infty)$



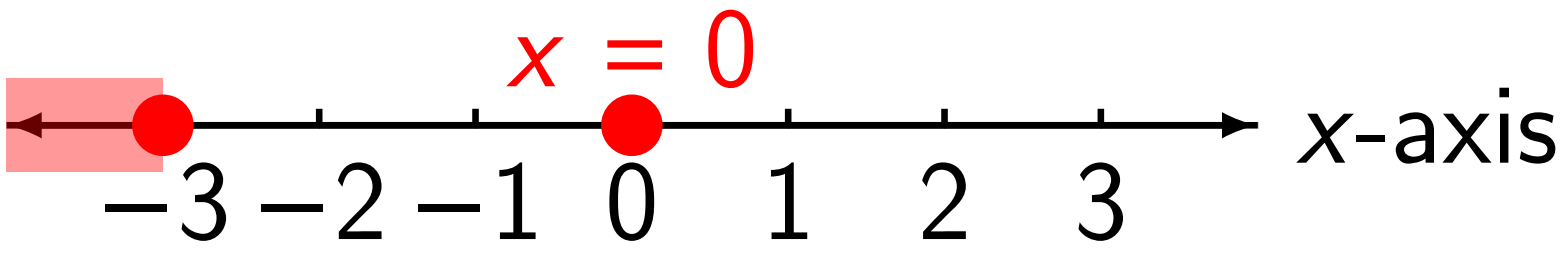
$x \leq -3$ or $x \geq 0$ $\quad (-\infty, -3] \cup [0, \infty)$



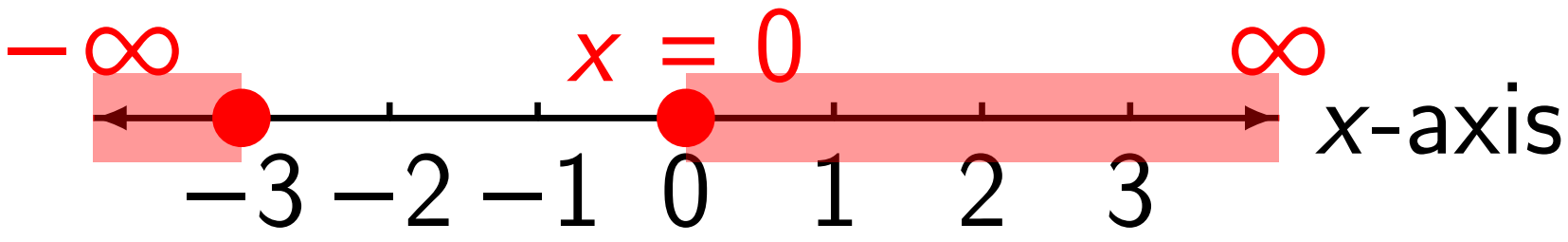
$x \leq -3$ or $x \geq 0$ $\quad\quad$ $(-\infty, -3] \cup [0, \infty)$



$x \leq -3$ or $x \geq 0$ $\quad (-\infty, -3] \cup [0, \infty)$



$x \leq -3$ or $x \geq 0$ $\quad (-\infty, -3] \cup [0, \infty)$



Graph the Following Inequality

$$2x \geq -10 \text{ and } x + 1 \leq 5$$

Graph the Following Inequality

$$2x \geq -10 \text{ and } x + 1 \leq 5$$

$$x \geq -5 \text{ and } x + 1 \leq 5$$

Graph the Following Inequality

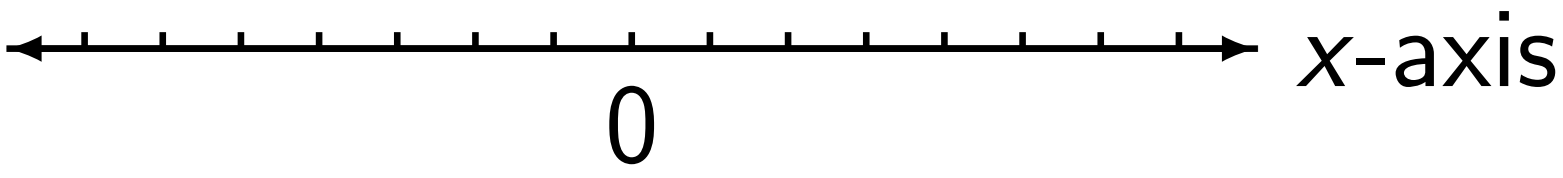
$$2x \geq -10 \text{ and } x + 1 \leq 5$$

$$x \geq -5 \text{ and } x + 1 \leq 5$$

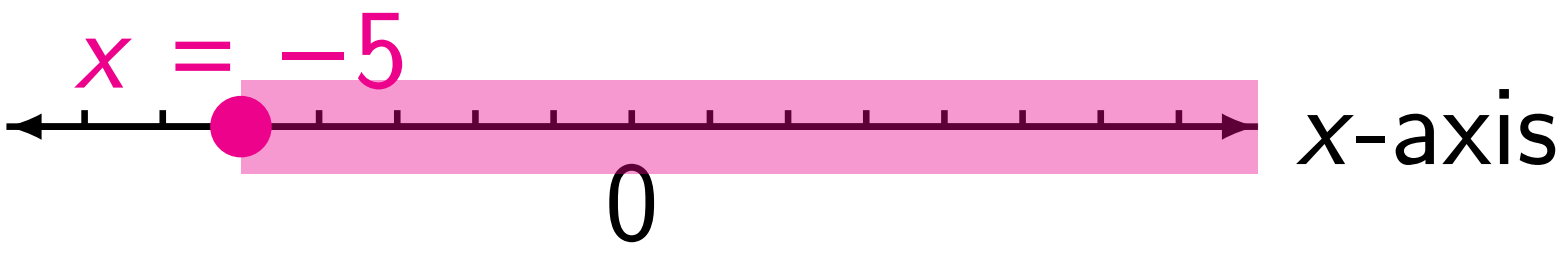
$$\boxed{x \geq -5 \text{ and } x \leq 4}$$

$x \geq -5$ and $x \leq 4$

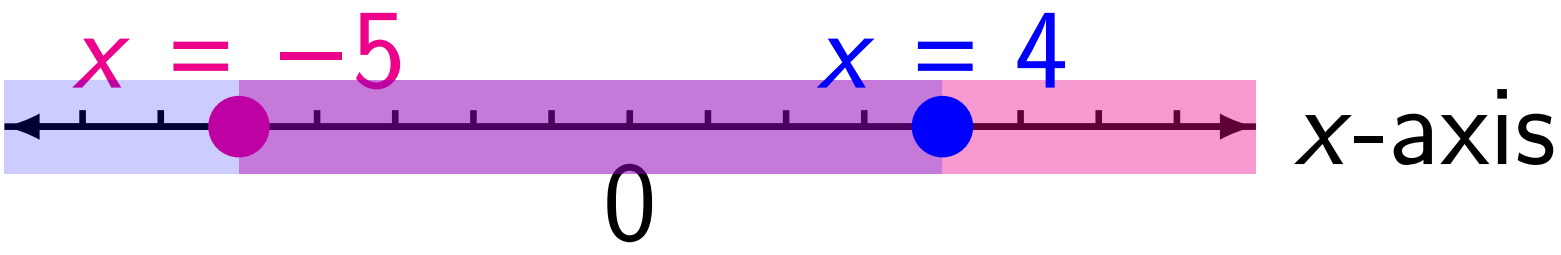
$x \geq -5$ and $x \leq 4$



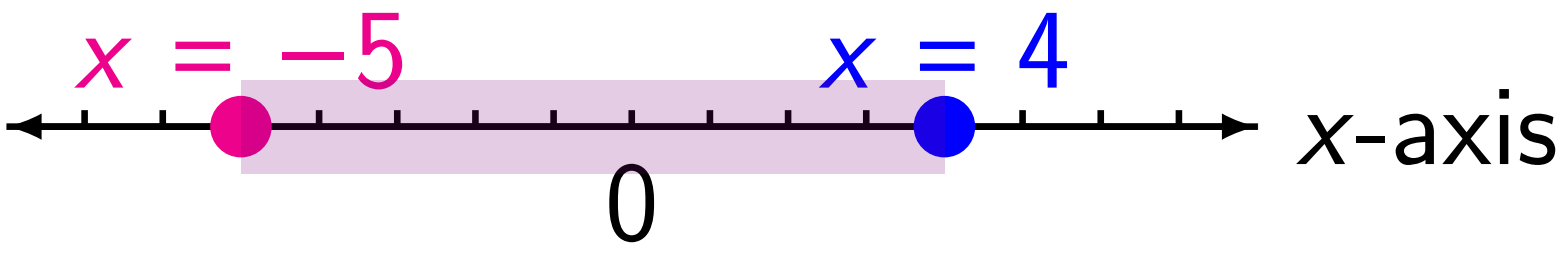
$x \geq -5$ and $x \leq 4$



$x \geq -5$ and $x \leq 4$



$x \geq -5$ and $x \leq 4$



Word Problems

Given a rectangle whose **length** is **three feet more** than the **width**. Find the values for the width such that the perimeter of the rectangle is less than 86 feet.

Given a rectangle whose length is $5x$ feet and width is $x + 4$ feet, find the values for x for which the perimeter of the rectangle would range from 50 to 80 feet.

$$50 \leq 2(x + 4) + 2(5x) \leq 80$$

$$50 \leq 2(x + 4) + 2(5x) \leq 80$$

$$50 \leq 2x + 8 + 10x \leq 80$$

$$50 \leq 2(x + 4) + 2(5x) \leq 80$$

$$50 \leq 2x + 8 + 10x \leq 80$$

$$50 \leq 12x + 8 \leq 80$$

$$50 \leq 2(x + 4) + 2(5x) \leq 80$$

$$50 \leq 2x + 8 + 10x \leq 80$$

$$50 \leq 12x + 8 \leq 80$$

$$42 \leq 12x \leq 72$$

$$50 \leq 2(x+4) + 2(5x) \leq 80$$

$$50 \leq 2x + 8 + 10x \leq 80$$

$$50 \leq 12x + 8 \leq 80$$

$$42 \leq 12x \leq 72$$

$$\frac{42}{12} \leq x \leq 6$$

$$50 \leq 2(x+4) + 2(5x) \leq 80$$

$$50 \leq 2x + 8 + 10x \leq 80$$

$$50 \leq 12x + 8 \leq 80$$

$$42 \leq 12x \leq 72$$

$$\frac{42}{12} \leq x \leq 6$$

$$\boxed{3.5 \leq x \leq 6}$$

Next Time

Systems of Linear Equations