Remember: For inequalities, you must switch the symbol when you mult/divide the variable by a negative number.

6.7 Graph Linear Inequalities in Two Variables

Goal • Graph linear inequalities in two variables.

Your Notes

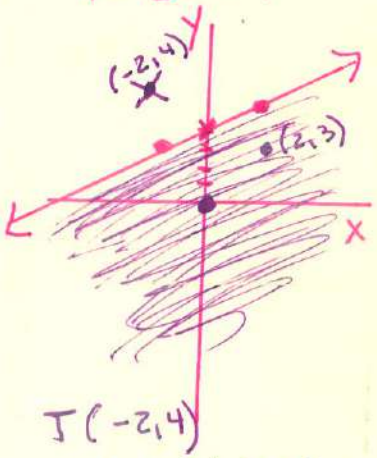
VOCABULARY

Linear inequality in two variables are the same as Linear equations but have inequality symbols ($>, <, \geq, \leq$)

Graph of an inequality in two variables

← Graph the linear equation and shade all the solutions for the inequality

$y \leq \frac{1}{2}x + 4$



T(-2,4)
$4 \leq \frac{1}{2}(-2) + 4$
$4 \leq 3$ N.S

T(2,3)
$3 \leq \frac{1}{2}(2) + 4$
$3 \leq 5$ Sol.

T(0,0)
$0 \leq 4$ Sol.

Example 1 *Check solutions of a linear inequality*

Tell whether the ordered pair is a solution of $3x - 4y > 9$.

(x, y)

a. Test (2, 0):

$3x - 4y > 9$ Write inequality.

$3(2) - 4(0) > 9$ Substitute 2 for x and 0 for y.

$6 > 9$ (F) Simplify.

(2, 0) IS NOT a solution.

b. Test (2, −1):

$3x - 4y > 9$ Write inequality.

$3(2) - 4(-1) > 9$ Substitute 2 for x and −1 for y.

$6 + 4 > 9$

$10 > 9$ (T) Simplify.

(2, −1) IS a solution.

(C) Test the origin (0,0)

$3(0) - 4(0) > 9$

$0 > 9$

The origin is not a solution

Your Notes

GRAPH USING ANY METHOD

① Create a table

x	y

* pick 3 easy pts
  $x = -1, 0, 1$
* $y = \frac{1}{3}x + 5$
  USE MULTIPLES OF DEN. (3)
  $x = -3, 0, 3$

② Graph using $y = mx + b$

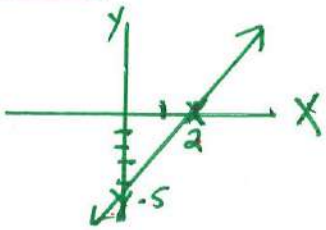
* plot y-intercept (b) (0, b)
* use slope to find additional points
  $m = \frac{\text{Rise}}{\text{Run}}$

③ Graph using x and y intercepts

Ex/ $5x - 2y = 10$

SET y=0 → x: 2 (2, 0)

SET x=0 → y: -5 (0, -5)



GRAPHING A LINEAR INEQUALITY IN TWO VARIABLES

Step 1 Graph the boundary line (the line). Use a dashed line for < or >, and use a solid line for ≤ or ≥.

Step 2 Test a point not on the line by checking whether the ordered pair is a solution of the inequality. Using (0, 0) is the easiest point to test.

Step 3 Shade the half plane containing the point if the ordered pair is a solution of the inequality. Shade the other half plane if the ordered pair IS NOT a solution.

Example 2 *Graph a linear inequality in two variables*

Graph the inequality $y < -\frac{1}{2}x + 4$.

Solution

1. **Graph** the equation $y = -\frac{1}{2}x + 4$. The inequality is <, so use a dashed line.

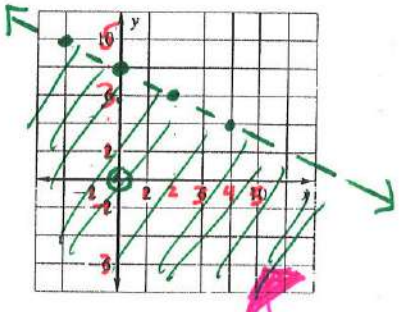
   $m = \frac{-1}{2}$ $B = 4$

2. **Test** (0, 0) in $y < -\frac{1}{2}x + 4$.

   $0 < -\frac{1}{2}(0) + 4$

   $0 < 4$ TRUE

3. Shade the half-plane that contains (0, 0) because (0, 0) IS a solution of the inequality.



Changed the units to 1

SOLUTIONS ARE ALL THE POINTS IN THIS HALFPLANE.

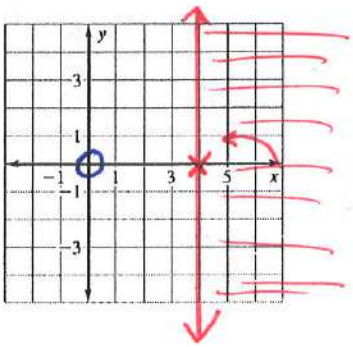
Your Notes

Example 3 *Graph a linear inequality in one variable*

Graph the inequality $x \geq 4$. ← VERTICAL LINE

Solution

1. Graph the equation $x = 4$. The inequality is $\geq$, so use a SOLID line.
2. Test (0, 0) in $x \geq 4$. You only substitute the X-coordinate because the inequality does not have the variable y.
   $0 \geq 4$ FALSE
3. Shade the half-plane that does not contain (0, 0), because (0, 0) IS NOT a solution of the inequality.



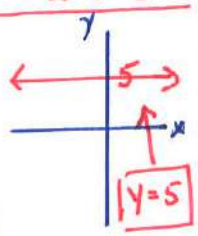
Review

Horizontal Lines

EQ $y = b$

SLOPE

$M = \frac{\text{Rise}}{\text{Run}} = \frac{0}{\#}$ $M = 0$



VERTICAL LINES

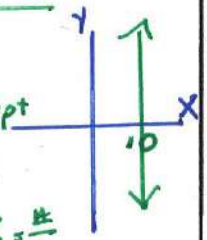
EQ $x = a$

a = x intercept

y int – NONE

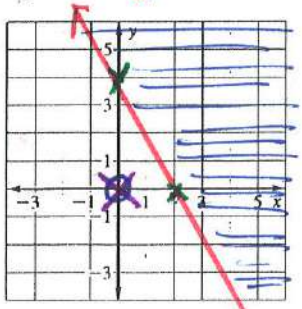
slope $= \frac{\text{Rise}}{\text{Run}} = \frac{\#}{0}$

M = UNDEFINED



Checkpoint Graph the inequality.

1. $2y + 4x \geq 8$ ← change to =

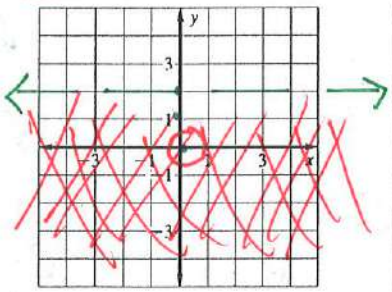


① EASIEST METHOD TO GRAPH:
X: 2
Y: 4

② USE A SOLID LINE FOR ≥, ≤

③ What side to shade?
Pick a pt (0,0)
$2(0) + 4(0) \geq 8$
$0 \geq 8$ (F)
Shade the top half

2. $y < 2$ ← HORIZONTAL LINE



T(0,0)
0 < 2 (T)

Remember:
$y < 2$
can also be written:
$y < 0x + 2$

Homework

Fix # 13, 15

LESSON 6.7

Practice

For use with pages 404–412

Tell whether the ordered pair is a solution of the inequality.

1. $x + y > -9$; $(0, 0)$

$0 + 0 > -9$

$0 > -9$

SOLUTION

2. $x - y \geq 8$; $(14, 9)$

$14 - 9 \geq 8$

$5 \geq 8$

NOT A SOLUTION

3. $2x - y > 4$; $(-6, -15)$

$2(-6) - (-15) > 4$

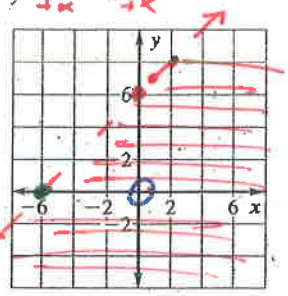
$-12 + 15 > 4$

$3 > 4$

NOT A SOLUTION

Graph the inequality.

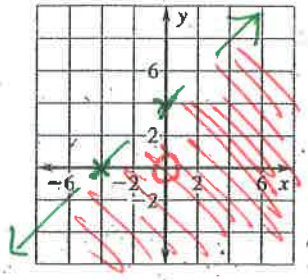
10. $y < x + 6$



$y < x + 6$ x: -6 y: 6

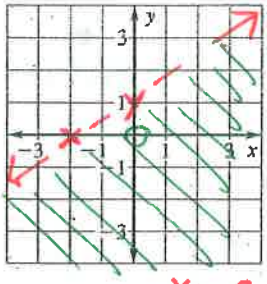
$b = 6$ $m = 1/1$ T(0,0) $0 < 6$ T

11. $x - y > -4$



X: -4 y: 4 T: $0 > -4$ ✓

12. $2y - x < 2$



X: -2 y: 1 T(0,0) $0 < 2$ ✓

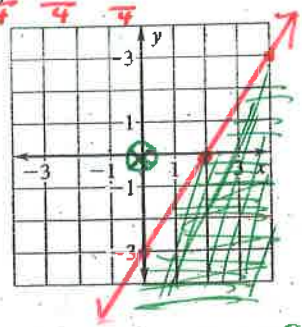
*13. $4y \leq 6x - 12$

$\frac{4y}{4} \leq \frac{6x}{4} - \frac{12}{4}$

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

$b = -3$

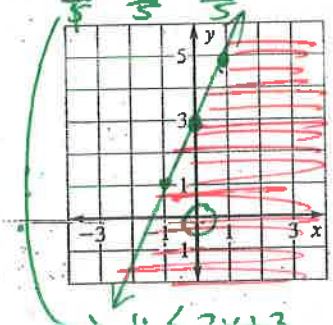
$m = 3/2$



Test (0,0) $0 \leq -12$ (F)

14. $5y \leq 10x + 15$

$\frac{5y}{5} \leq \frac{10x}{5} + \frac{15}{5}$



$y \leq 2x + 3$

$M = 2/1$

$B = 3$

Test (0,0) $0 \leq 15$ (T)

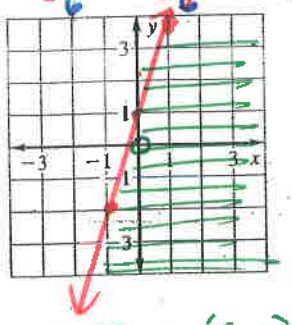
*15. $-6y + 6 \geq -18x$

$-6 \quad -6$

$\frac{-6y}{-6} \geq \frac{-18x}{-6} - \frac{6}{-6}$

$y \leq 3x + 1$

$M = 3$ $b = 1$

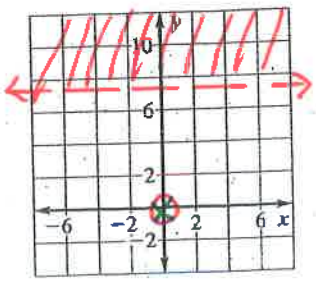


Test (0, 0)

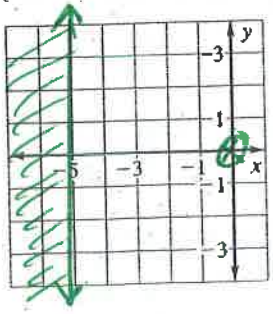
$-6(0) + 6 \geq -18(0)$

$6 \geq 0$

19. $y > 7$ $0 > 7$ (F)



20. $x \leq -5$ $0 \leq -5$ (F)



LESSON 6.7

Practice

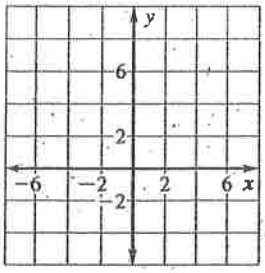
For use with pages 404–412

Tell whether the ordered pair is a solution of the inequality.

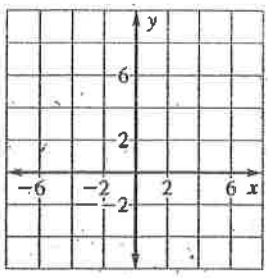
1. $x + y > -9$; $(0, 0)$
2. $x - y \geq 8$; $(14, 9)$
3. $2x - y > 4$; $(-6, -15)$

Graph the inequality.

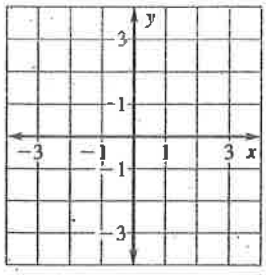
10. $y - x < 6$



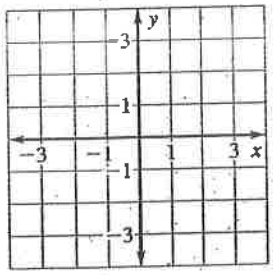
11. $x - y > -4$



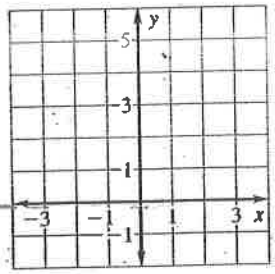
12. $2y - x < 2$



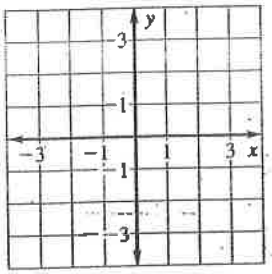
13. $4y \leq 6x - 12$



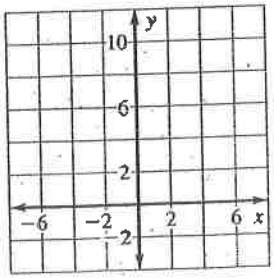
14. $5y \leq 10x + 15$



15. $-6y + 6 \geq -18x$



19. $y > 7$



20. $x \leq -5$