9.1 Linear Inequalities in 2 Variables

Concept #15 - To solve a linear inequality with two variables with and without a situational problem

To solve linear inequalities in two variables.

The solution to a problem may be not a single value, but a range of values. A chemical engineer may need a reaction to occur within a certain time frame in order to reduce undesired pollutants. An architect may design a building to deflect less than a given distance in a strong wing. A doctor may chose a dose of medication so that a safe but effective level remains in the body after a specified time.

These situations illustrate the importance of inequalities. While there may be many acceptable values in each of the scenarios above, in each case there is a lower acceptable limit, and upper acceptable limit, or both. Even though many solutions exist, we still need accurate mathematical models and methods to obtain the solutions.

REVIEW: Methods to graph linear equations

1. Slope/Intercept Method ($y = mx + b$)
2. Find the x and y intercepts. (x-intercept: let y = 0, y-intercept: let x = 0)
3. Table of values (very tedious)

To graph inequalities: 1. Graph the **boundary line.**

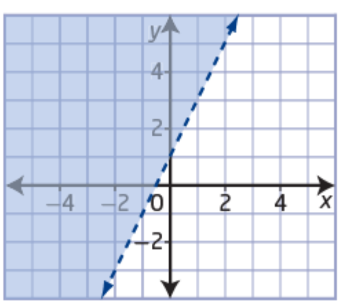
- the line is *solid* if ___________________________
- the line is *dashed/dotted* if ________________________

2. Choose a **check point**…a point that does *not* lie on the boundary line. If that point satisfies the equation, **shade** the portion which includes the check point. If the check point does not satisfy the equation, **shade** on the other side of the boundary line. (Note: Typically a good check point is ( ) except when

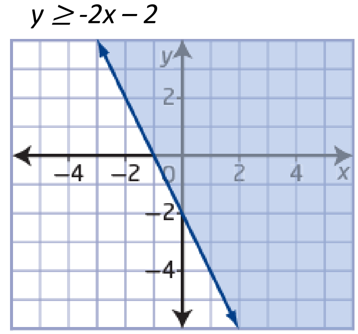
____

Examples of Solution Regions and Boundary Lines

$y > 2x + 1$



$y \geq -2x - 2$



The boundary line is y = 2x + 1

The line is _____________ because _______

Test Pt:

The boundary line is y = -2x – 2

The line is ____________ because _______

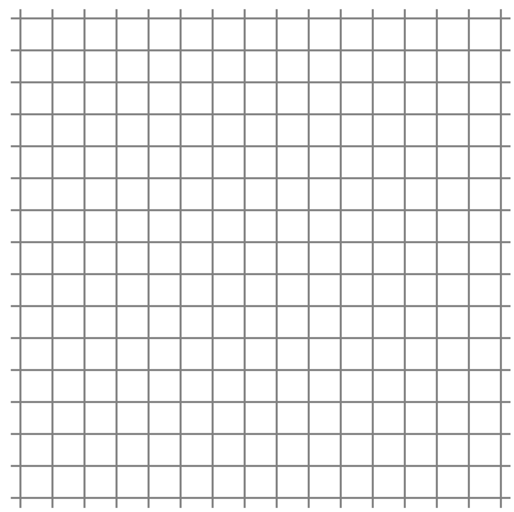
Test Pt:

Reminder: When multiplying or dividing both sides of an inequality by a negative value, you **must**

____.

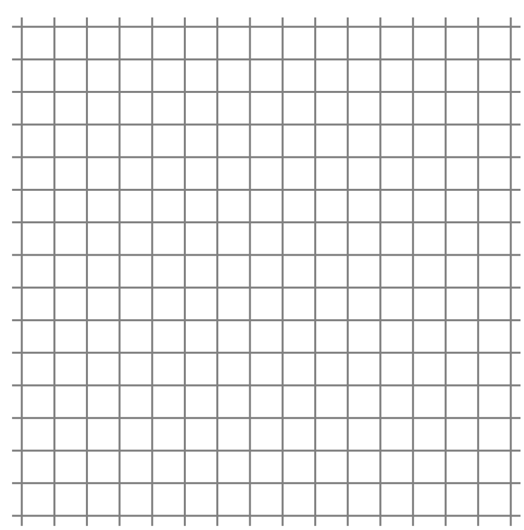
example: Given $x - 5y > 15$, solve for "y".

Example 1: Graph $4x + 2y \geq 10$. Is (1, 3) part of the solution?

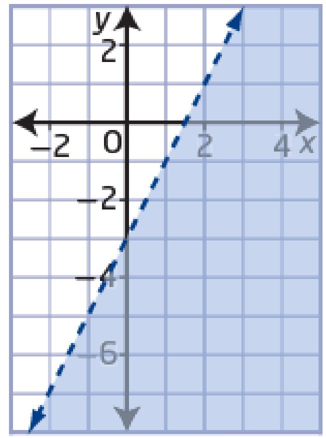


Example 2: Is (2,3) a solution to $-x + y \leq -5$? Solve algebraically without graphing.

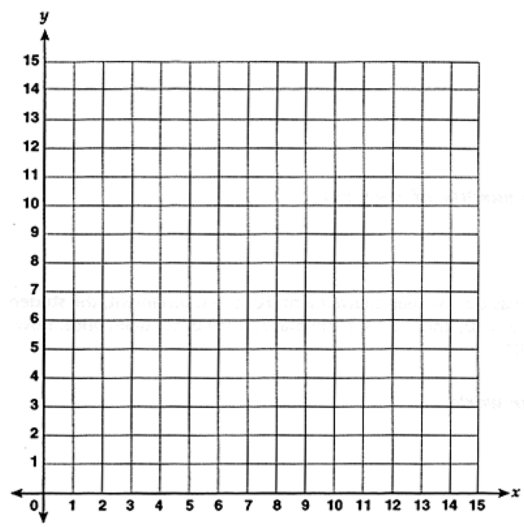
Example 3: a)Graph $5x - 20y < 0$. b) Use a test point to determine what should be shaded.



Example 4: Write an inequality to represent the graph at right.



Example 5: Janelle has a budget of $120 for entertainment each month. She usually spends the money on a combination of movies and meals. Movie admission, with popcorn, is $15, while a meal costs $10. **a) Write an inequality to represent the number of movies and meals that Janelle can afford with her entertainment budget. b) Graph the solution c) Interpret your answer. Explain how the solution to the inequality relates to Janelle's situation**



9.1 Assignment: Page 472 #1bc,2ac, 3ace, 4 bc ,8ce (no need to explain) , 9 , 11abc, 12ab, 13 Extension : #20

9.3 Quadratic Inequalities in Two Variables

Concept #16 - To solve a quadratic inequality with two variables with and without a situational problem

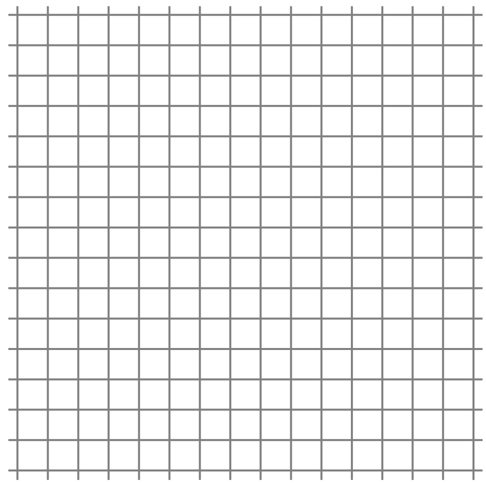
Graphically these inequalities represent a solution region and a **PARABOLIC BOUNDARY CURVE**

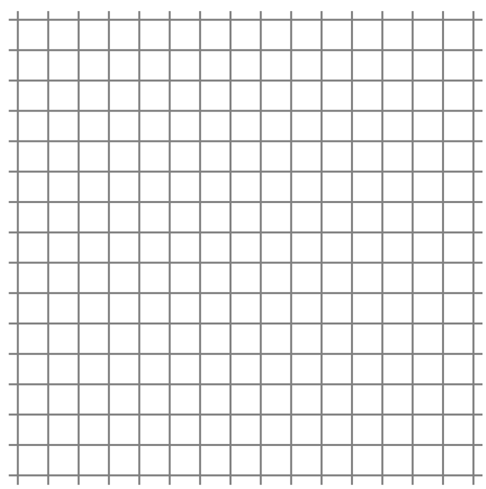
Steps to graph a Quadratic Inequalitiy: 1. Graph the quadratic equation (parabola)

2. Decide if the boundary is solid ($\leq$, $\geq$) or dashed ($<$, $>$)

3. Use a test point to determine which region is the solution. Shade either ***inside*** the parabola or ***outside*** of the parabola.

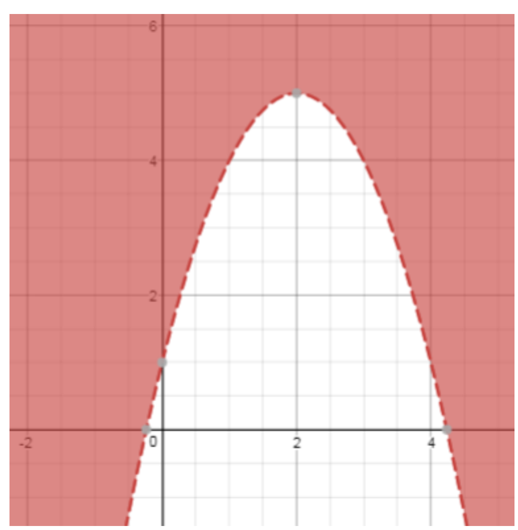
Example#1: Graph $y < -2(x - 3)^2 + 8$. Determine if (2, -4) is a solution graphically and algebraically.





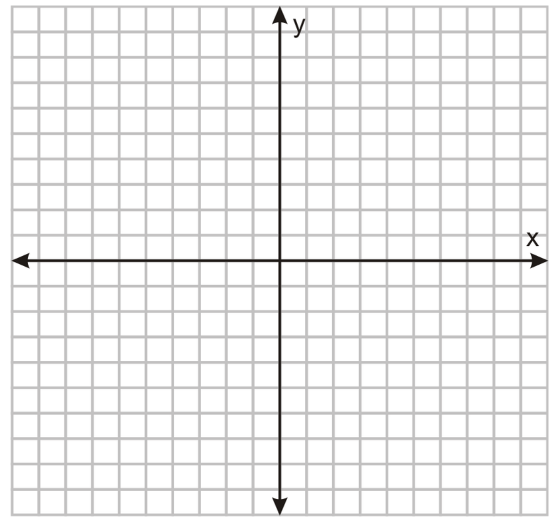
Example#2 : Graph $y \leq x^2 - 4x - 5$. Identify one ordered pair that is a solution.

Example #3: Write the inequality that describes the following graph



Example #4: Graph the following quadratic inequality to sketch the boundary parabola.

$$y > \frac{1}{2}(x-3)^2 + 8$$



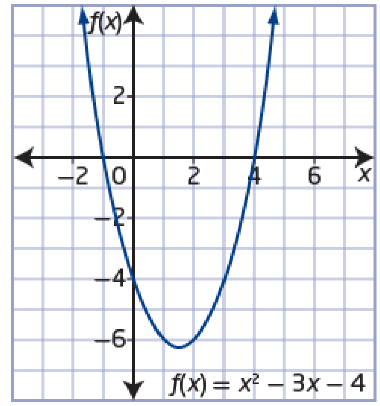
Example #5: A satellite dish is 60cm in diameter and 20cm deep. The dish has a parabolic cross section. Locate the vertex of the parabolic cross- section at the origin, and sketch the parabola that represents the dish. Determine an inequality that shows the region from which the dish can receive a signal. (Show how to graph inequalities on graphing calculator)

9.3 Assignment Pg 497 #1b,2a,3,4cd,5a,6abd,8,9 Pg 505 #9

9.2 Quadratic Inequalities in 1 variable

Concept #17- To develop, generalize, explain, and apply strategies, such as case analysis, graphing, roots and test points, or sign analysis, to solve one-variable quadratic inequalities.

Example #1: Given $f(x) = x^2 - 3x - 4$ (graphed at right):



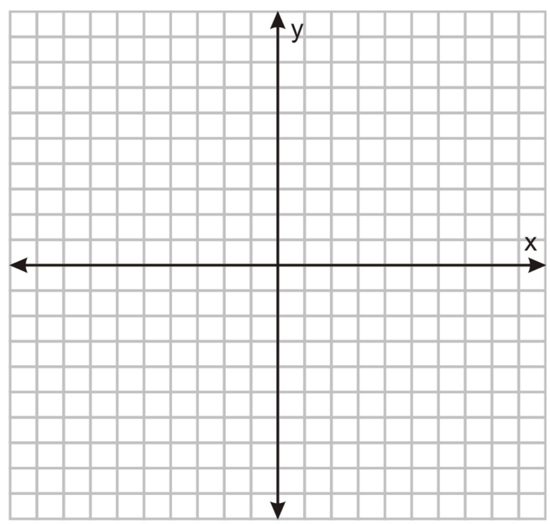
a) what are the ***zeroes*** of this function?
(what are the x-intercepts?)

b) for what values of x will $x^2 - 3x - 4 > 0$?
(where is the graph greater than 0?)

c) for what values of x will $x^2 - 3x - 4 < 0$
(where is the graph less than 0?)

d) for what values of x will $x^3 - 3x - 4 \leq 0$

Example #2: Solve $-x^2 + x + 12 < 0$ by graphing.



Example#4: Solve $2x^2 - 5x > 12$ using sign analysis. Write your solution using set notation and Union of intervals notation.

Steps: 1) Rewrite the inequality with 0 on one side
2) Factor (make sure that factors have a positive *x coefficient*)
3) Draw a number line with ***all*** the roots listed
4) Decide which values make the factor 0, + and –
5) Multiply the signs together
6) Write a solution using proper notation

Example #5: Solve using sign analysis. Write your solution in set or as Union of intervals.

$-x^2 + 2x + 3 \leq 0$

<u>Concept #18</u> -To solve situational problems involving quadratics with one variable

<u>Example #6:</u> Suppose a baseball is thrown from a height of 1.5m. The inequality $-4.9t^2 + 17t + 1.5 > 0$ models the time , t, in seconds, that the baseball is in flight. During what time interval is the baseball in flight?

9.2 Assignment (Look at #2c together) pg 484 #1,2,3,5,7(Graph by hand), 9bcd,10

If time permits look at #14 and 17 together