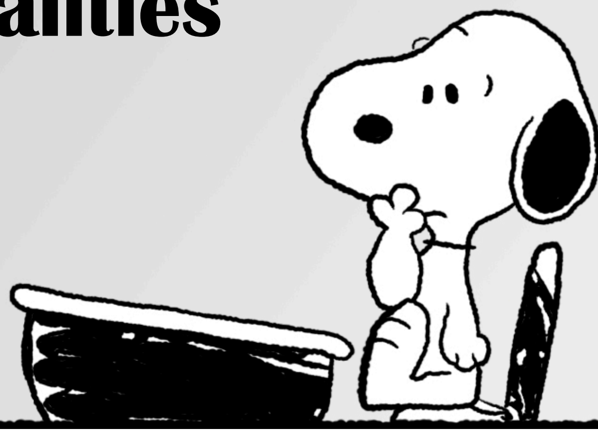
LG #17

Inequalities



Agenda:

Inequality Reference Table

Types	Describtion	Graph Line		Shading	Graph. Calc. Feature
$>$	Greater than	Broken	- - - - →	Above line	◥
$\geq$	Greater than and =	solid	——→	Above line	◥
$<$	Less than	Broken	- - - - →	Below line	◣
$\leq$	Less than and =	solid	——→	Below line	◣

Topic 1

Example 1

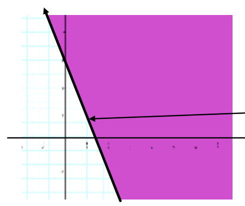
Graph a Linear Inequality

Graph $2x + y \geq 3$

The triangles above give you the correct shading. They go in front of the Y1 =. You hit the ENTER key as many times until you see the appropriate one.

Method 1: Graphing Calculator

- put into y= form ⟶ $y \geq -2x + 3$
- type ◥ Y1 = -2x + 3,
- then hit GRAPH
- hit 2nd GRAPH to get two points to plot on graph paper
- draw the <u>solid</u> line between them



The calculator will not indicate if the line is solid or broken.

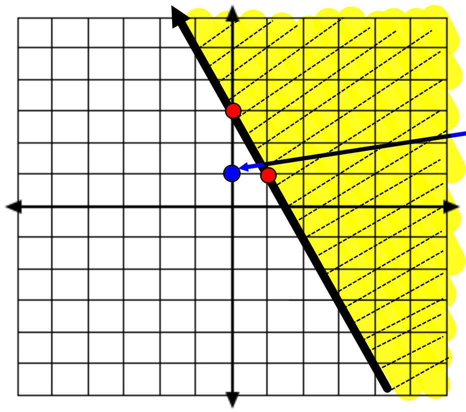
Method 2: Draw using Slope-Intercept Form

$y \geq -2x + 3$

Slope → -2

y-intercept → 3

- plot y-intercept
- now from that point, get another point by using the slope: drop 2, run right 1
- connect the two points with a solid line and **shade above the line.**



☆ b) Determine if the point (0, 1) is a part of the solution.

No. The point does not lie in the shaded region.

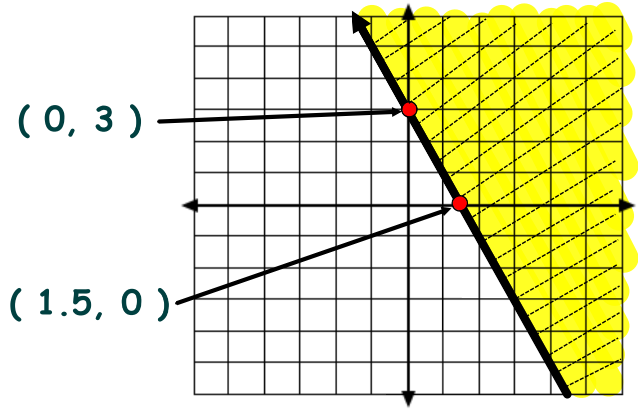
Method 3: Draw using the Intercepts

$$2x + y \geq 3$$

For x = 0
2(0) + y = 3
y = 3

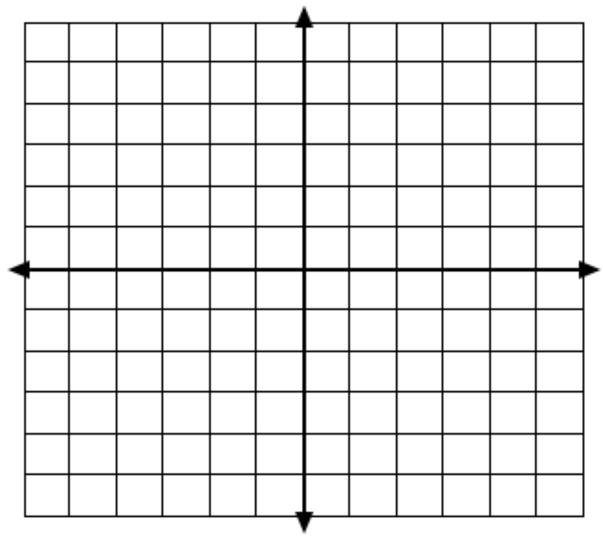
For y = 0
2x + (0) = 3
x = 1.5

- plot the points (0, 3) and (1.5, 0)
- connect the two points with a solid line and **shade above the line.**



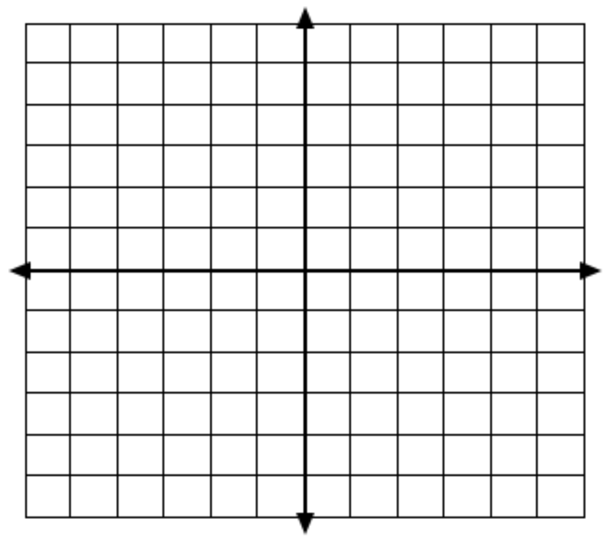
Try: 1a) Graph $4x + 2y \geq 10$

b) Determine if the point (1, 5) is a part of the solution.



2a) Graph $5x - 20y < 0$

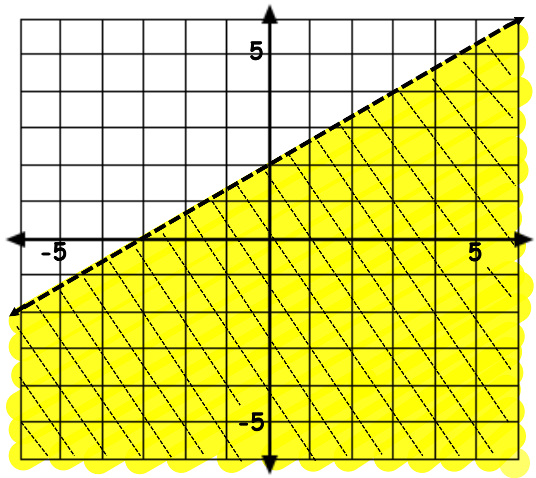
b) Determine if the point (-4, -1) is a part of the solution.



Example 2

Write an Inequality Equation Given Its Graph

Write an inequality equation to represent the graph.

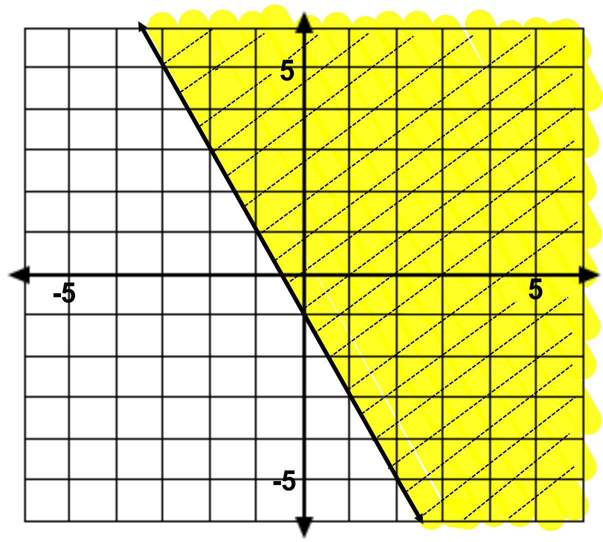


- write the equation in slope-intercept form, $y = mx + b$
- y-intercept is 2. So, $b = 2$
- from that point ⟶ use $\frac{rise}{run}$ to get slope $m = \frac{2}{3}$
- because the line is broke it's either $<$ or $>$. Since the shading is going down it's $<$.

The inequality equation is:

$$y < \frac{2}{3}x + 2$$

Try: Write an inequality equation to represent the graph.



Example 3

Write and Solve an Inequality

Suppose that you are constructing a tabletop using aluminum and glass. The most that you can spend on materials is $50. Laminated safety glass cost $60/m , and aluminum costs $1.75/ft. You can choose the dimensions of the table and the amount of each material used. Find all possible combinations of materials sufficient to make the tabletop.

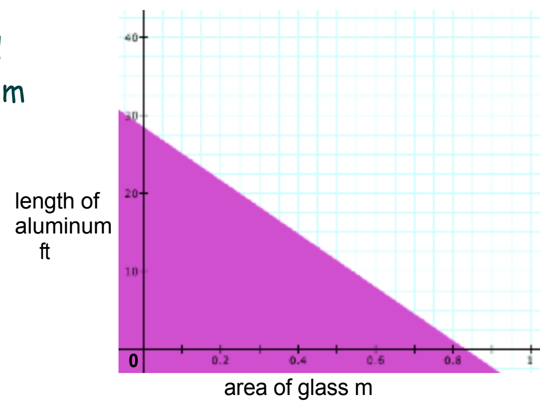
Solution

- let x represent the area of glass used and y represent the length of aluminum used. $60x + 1.75y \leq 50$
- solve for y in terms of x

$$1.75y \leq -60x + 50$$

$$y \leq \frac{-60x}{1.75} + \frac{50}{1.75}$$

- graph using your graphing calculator



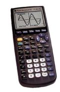
Topic 2

Example 1

Solve Quadratic Inequalities

Solve: a) $x^2 - 2x - 3 \leq 0$

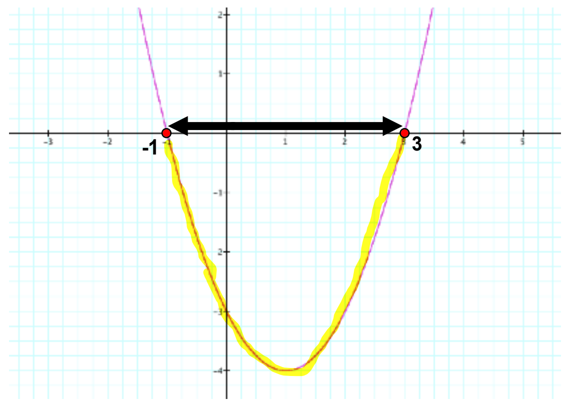
Solution:



- graph the function $f(x) = x^2 - 2x - 3$
- indicate the roots (x-intercepts).
- highlight the part(s) of the function that are below zero.

The highlighted part is between -1 and 3, thus, the solution is:

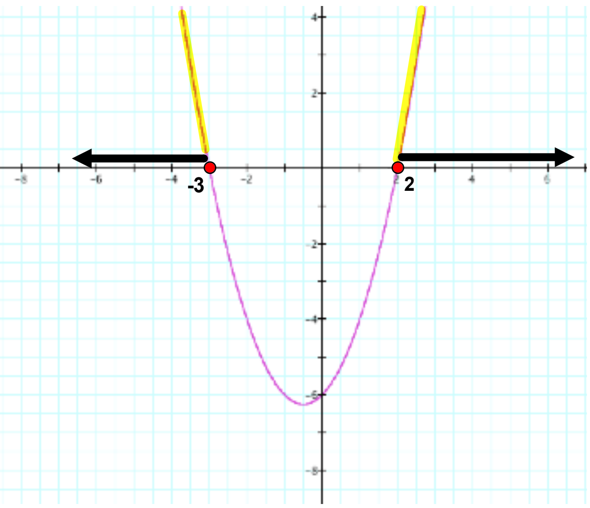
$$\{x \mid -1 \leq x \leq 3,\ x \in R\}$$



b) $x^2 + x - 6 > 0$

Solution:

- graph the function $f(x) = x^2 + x - 6$
- indicate the roots (x-intercepts).
- highlight the part(s) of the function that are below zero.



The highlighted parts are going to the lesser numbers from -3 [$x < -3$], and to the greater numbers from 2 [$x > 2$].

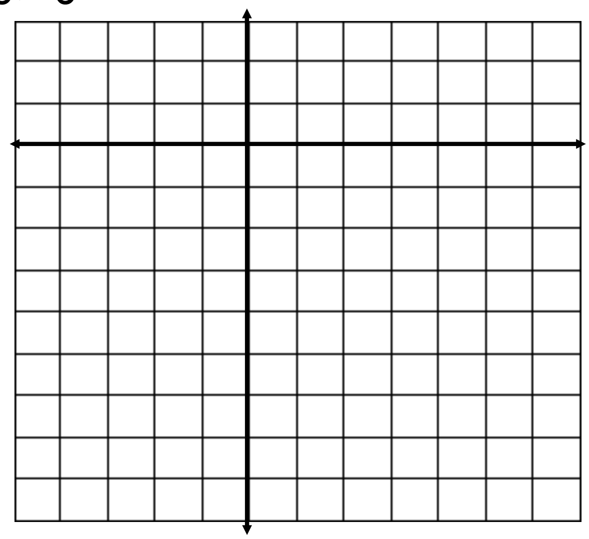
Thus, the solution is:

$$\{x \mid x < -3 \text{ or } x > 2, x \in R\}$$

c) $2x^2 - 7x > 3$

Same steps as previous two questions, however, you must move the 3 to the left side of equation so you have $f(x) > 0$. → $2x^2 - 7x - 3 > 0$

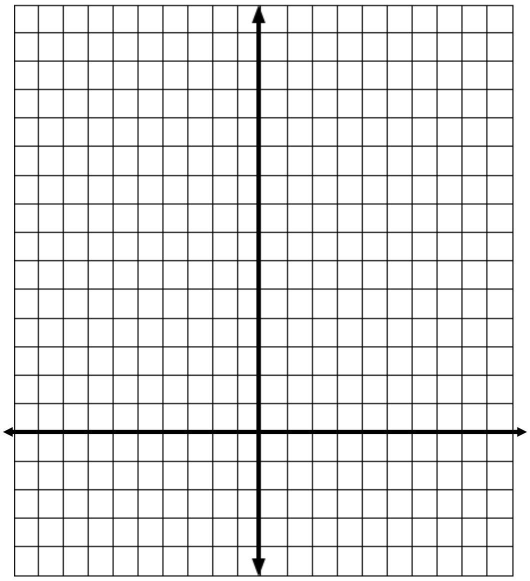
Hint: Use Graph. Calc. to find the roots.

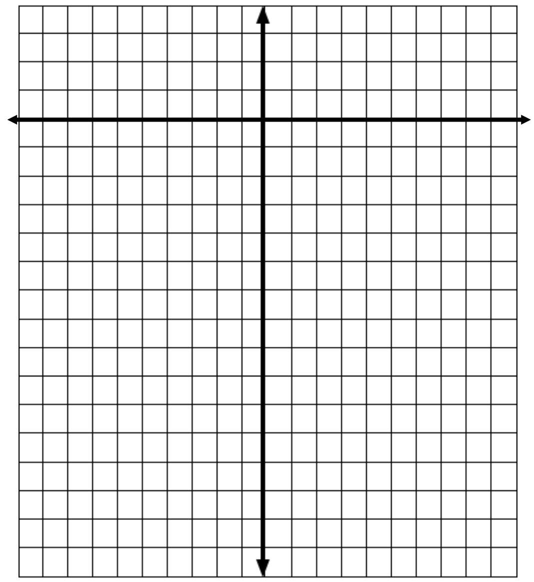


Try: **Solve:**

a) $-x + 3x + 10 < 0$

b) $x - 4x \geq 10$





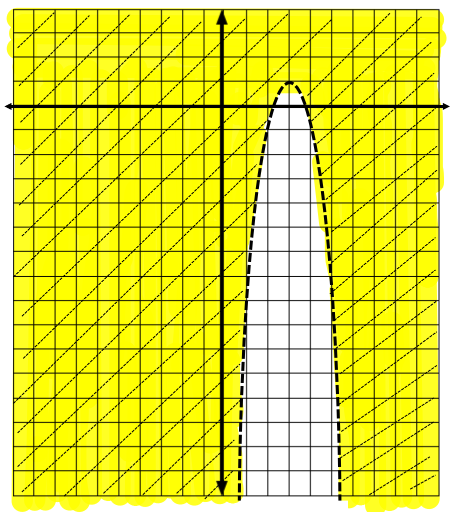
c) A baseball is thrown from a height of 1.5 m. The inequality $-4.9t^2 + 17t + 15 > 0$ models the time, t, in seconds, that the baseball is in flight. During what time interval is the baseball in flight?

Topic 3

Example 1

Graph a Quadratic Inequality in Two Variables

a) Graph $y > -2(x - 3) + 1$

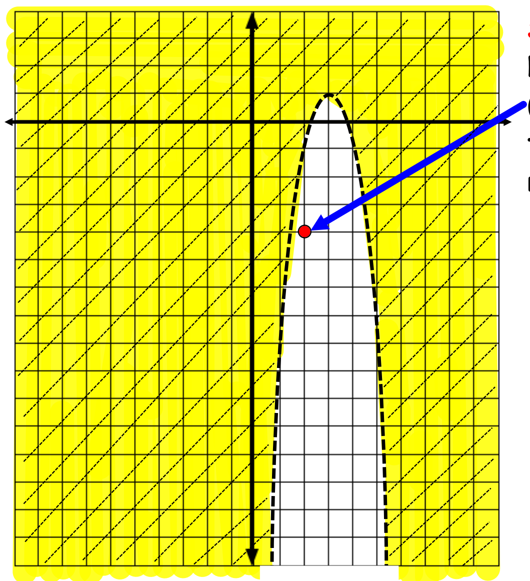


- graph the parabola
- since the inequality symbol is $>$, draw the parabola as a broken line
- test a point (0, 0) to show where the shading is - within or outside the parabola

Left Side	Right Side
y	$= -2(x - 3) + 1$
$= 0$	$= -2(0 - 3) + 1$
	$= -18 + 1$
	$= -17$

· the point (0, 0) satisfies the inequality, so shade the region outside the parabola

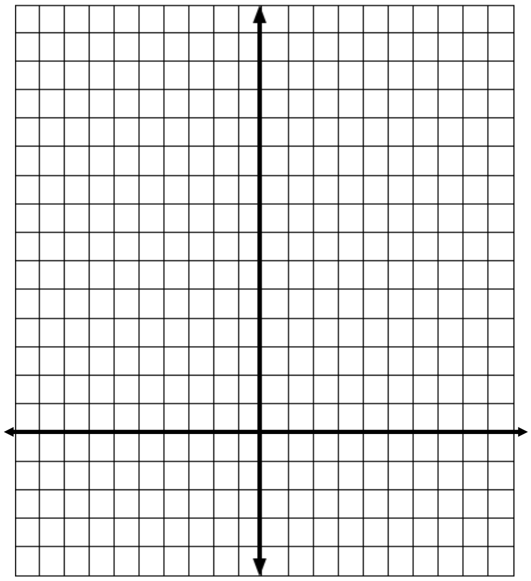
b) Determine if the point (2, -4) is a solution.



Solution:
No. The point (2,-4) is not in the shaded region.

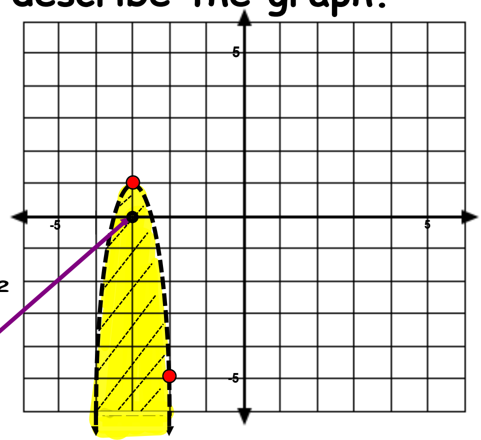
Try: a) Graph $y > (x - 4)^2 - 2$

b) Determine if the point (2, 1) is a solution.



Example 2
Write an Inequality Equation

Write an inequality equation to describe the graph.



- select two points on the parabola, the vertex (-3, 1), a point (-2, -5)

p q

- use $y = a(x - p)^2 + q$ to get the equation

$-5 = a(-2 + 3)^2 + 1$

$-5 = a + 1$

$-6 = a$

$y = -6(x + 3)^2 + 1$

- broken line indicates $<$ or $>$
- pick a point in the shaded region (-3, 0)

$y = -6(x + 3)^2 + 1$

$0 = -6(-3 + 3)^2 + 1$

$0 < 1$

This is the correct inequality sign.

Solution: $y < -6(x + 3)^2 + 1$

Try:

Write an inequality equation to describe the graph.