Name:______________________________________ Band:_________

Algebra II | Packer Collegiate Institute | 2008-2009

2D Quadratic Inequalities: Part II

QUADRATIC INEQUALITIES: RECAP

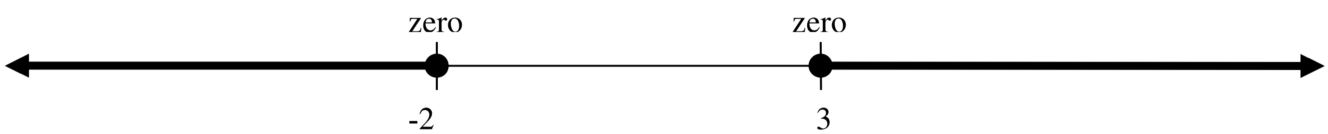
Until now, you've learned how to solve inequalities like $x^2 - x - 6 \geq 0$. When you solve it, you are answering the question:

"what x values make the inequality true?"

For example, we could test a few numbers like $x = 10$ or $x = -1$ to see if the inequality holds true. Let's try it!

$x = 10$: 84 $\geq$ 0 (so $x = 10$ satisfies the inequality)
$x = -1$: -4 $\ngeq$ 0 (so $x = -1$ doesn't satisfy the inequality)

But we didn't want to test every number, so we made a number line and saw when $x^2 - x - 6$ was positive or zero.



And our answer is: $(-\infty, -2] \cup [3, \infty)$

OUR GOAL

Our goal for today is to understand how to solve inequalities like $x^2 - x - 6 \geq y$. Note the difference between this inequality and the inequality we just solved. When you solve our new equation, you are answering the question:

"what (x, y) points make the inequality true?"

Let's try a few points. What about $(2,3)$ and $(-2,-5)$

$(2,3)$: -4 $\ngeq$ 3 (so the point $(2,3)$ doesn't satisfy the inequality)
$(-2,-5)$: $0 \geq -5$ (so the point $(-2,5)$ satisfies the inequality)

But we don't want to try *every* point. So we're going to have to come up with some other way to solve this. Like we did above, with the number line. Before we face quadratic inequalities, let's make things are bit easier – and start with linear inequalities.

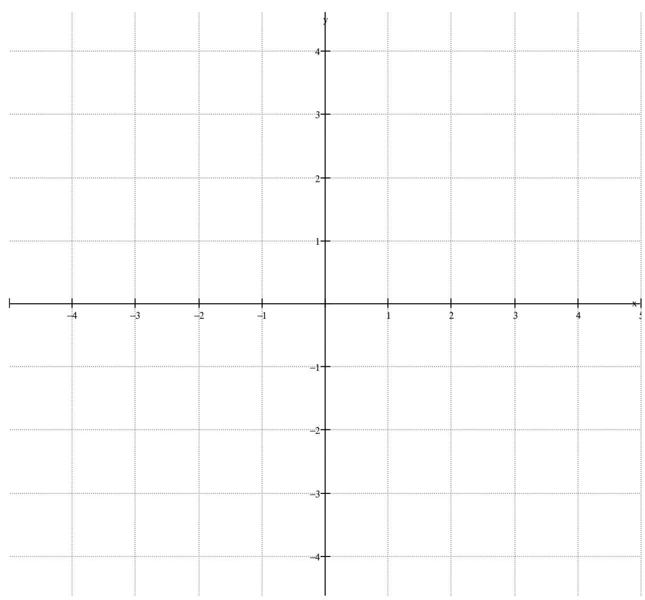
2-D LINEAR INEQUALITIES

Let's try to solve the inequality: $y \geq 2x+1$

Let's try some points. Write YES if the inequality is satisfied and NO if the inequality is not satisfied.

Name	Point	YES/NO
Eden	(0,0) (0,-4)	
Julia	(0,2) (2,-2)	
Marina	(0,4) (2,-4)	
Ellie	(2,0) (4,-2)	
Symone	(2,2) (4,-4)	
Eric	(2.4) (-2,-2)	
Kelly	(4,0) (-2,-4)	
Siena	(4.2) (-4,-2)	

Name	Point	YES/NO
August	(4,4) (-4,-4)	
Paul	(-2,0) (0,1)	
Elizabeth	(-2,2) (1,3)	
Akiem	(-2,4) (-1,-1)	
Henry	(-4,0) (-2,-3)	
Skylar	(-4,2) (1,1)	
Sophie	(-4,4) (1,-1)	
Mr. Shah	(0,-2) (1,4)	



What do you notice?

If our inequality was $y > 2x+1$, would anything change?

SOLVING LINEAR INEQUALITIES

Step 1: If necessary, put each inequality in slope-intercept form. Reminder: If you multiply or divide by a negative number you have to change the sign!

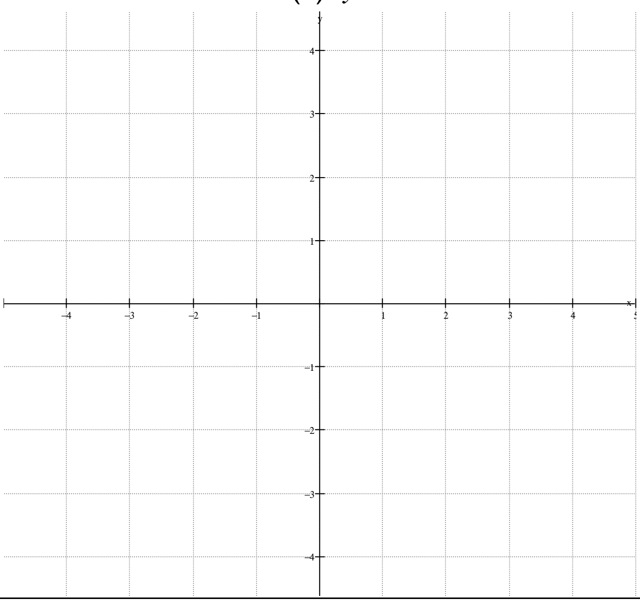
Step 2: Graph each inequality.

- If the inequality sign is ≥ or ≤ use a solid line to connect your points.
- If the inequality sign is > or < use a dashed line to connect your points.

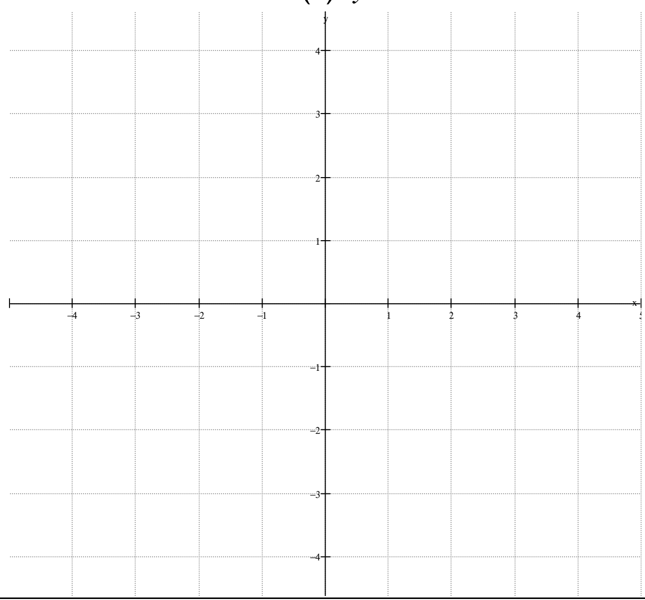
Step 3: Shade the solution set.

Step 4: Check your solution set.

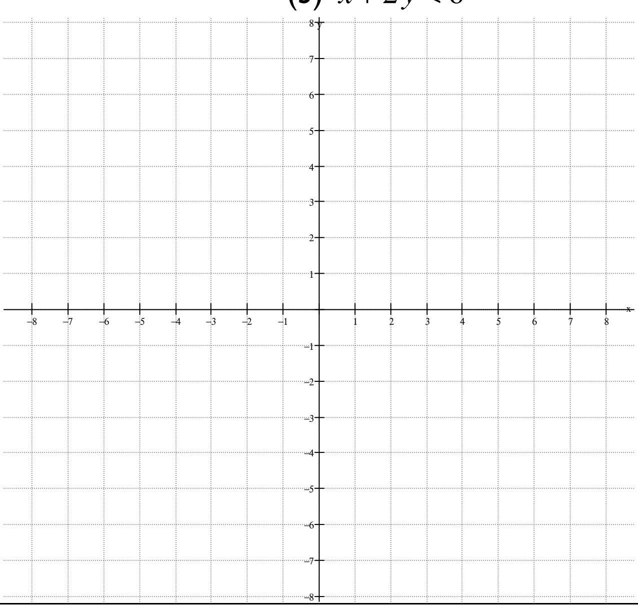
(1) $y \geq 2x+1$



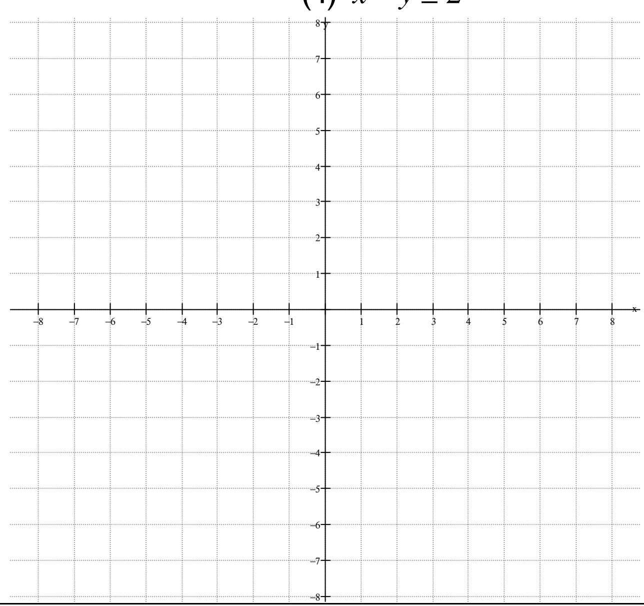
(2) $y < 2x+1$



(3) $x+2y < 6$



(4) $x-y \geq 2$



ANY POINT IN THE SHADED REGION SATISFIES THE INEQUALITY!

2-D QUADRATIC INEQUALITIES

Solving quadratic inequalities is almost the same as solving linear inequalities! Let's return to our original example: $x^2 - x - 6 \geq y$

Step 1: Find the vertex of the quadratic.

Step 2: Graph the quadratic accurately. Make sure your vertex is correct.

- If the inequality sign is ≥ or ≤ use a solid line to connect your points.
- If the inequality sign is > or < use a dashed line to connect your points.

Step 3: Shade the solution set.

Step 4: Check your solution set.

STEP 1:

$$y = x^2 - x - 6$$

$$y + 6 = x^2 - x$$

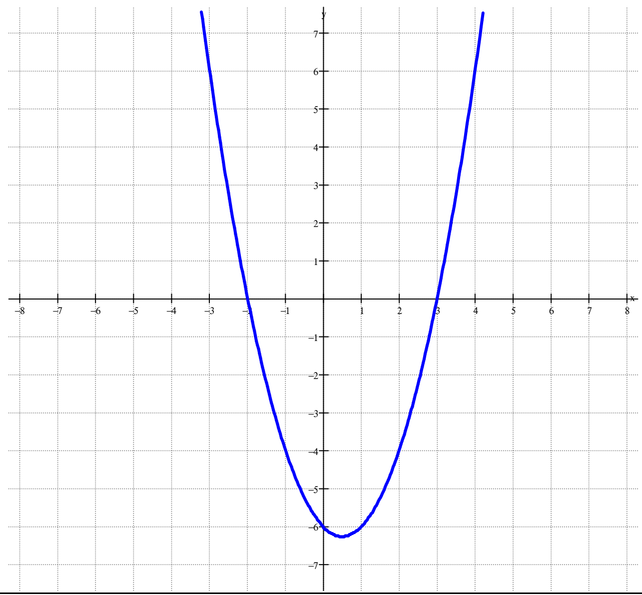
$$y + 6 + \frac{1}{4} = x^2 - x - \frac{1}{4}$$

$$y + \frac{25}{4} = (x - \frac{1}{2})^2$$

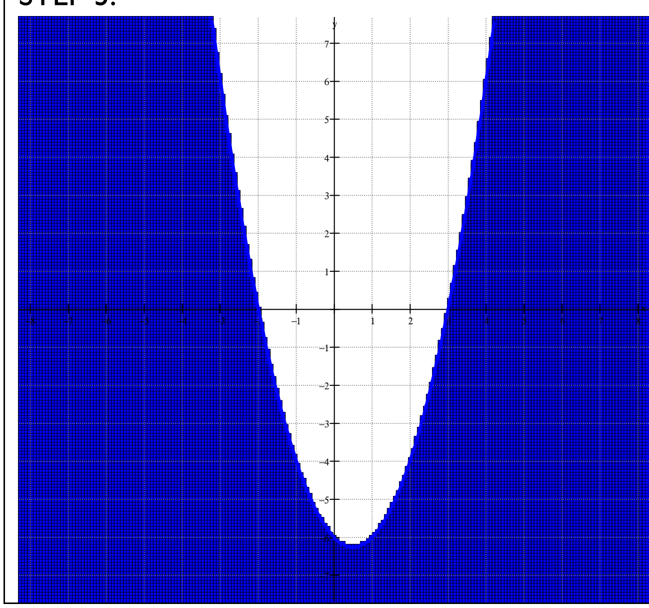
$$y = (x - \frac{1}{2})^2 - \frac{25}{4}$$

Vertex: $(\frac{1}{2}, -\frac{25}{4})$

STEP 2:



STEP 3:



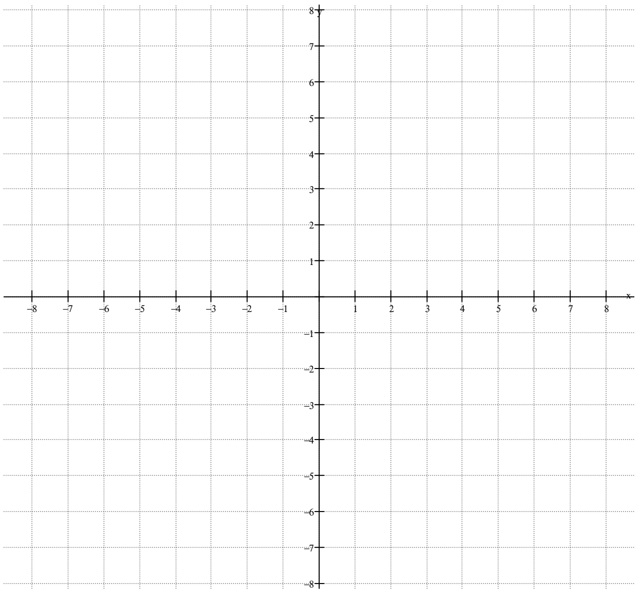
STEP 4:

Check a point like (0,0) with your original inequality $x^2 - x - 6 \geq y$

$-6 \not\geq 0$, so it shouldn't be shaded

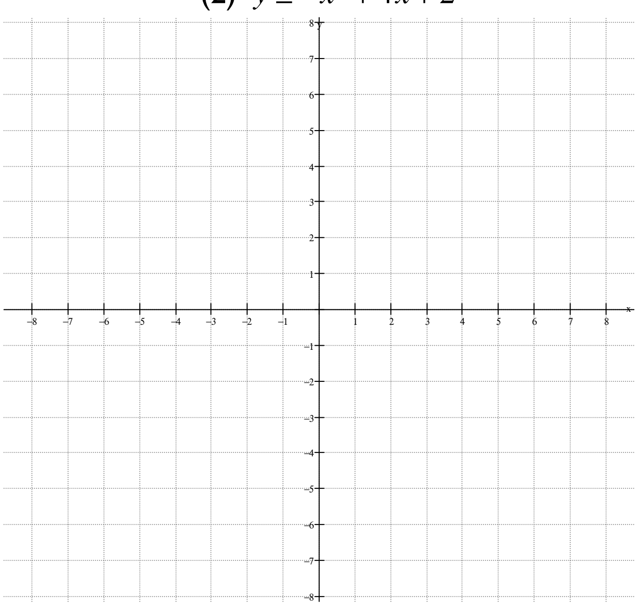
CHECK YOURSELF!

(1) $y > x^2 + 2x$



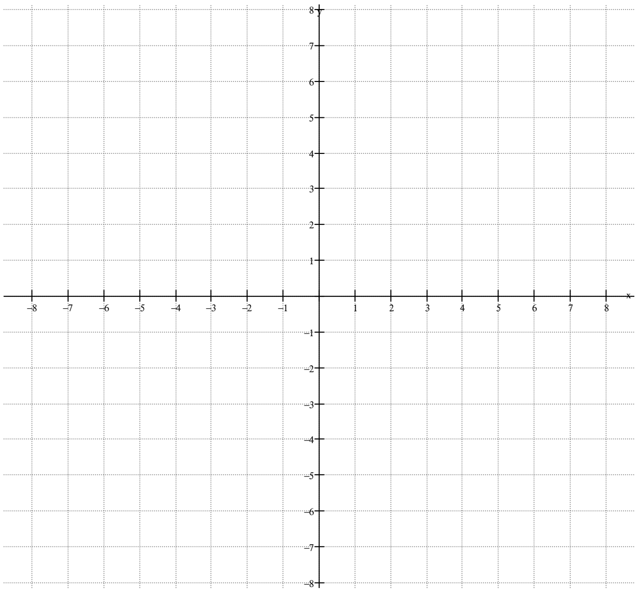
Work:

(2) $y \leq -x^2 + 4x + 2$



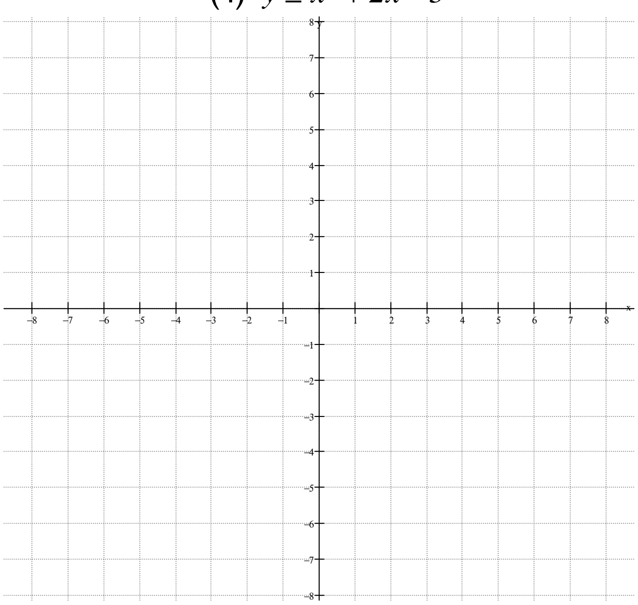
Work:

(3) $y < x^2 - 2x + 2$



Work:

(4) $y \geq x^2 + 2x - 3$



Work: