13-430

Algebra 2 4.8

Graph quadratic inequalities (in two variables) "

Solve quadratic inequalities (in one variable) "

related function

test point

quadratic

quadratic inequality

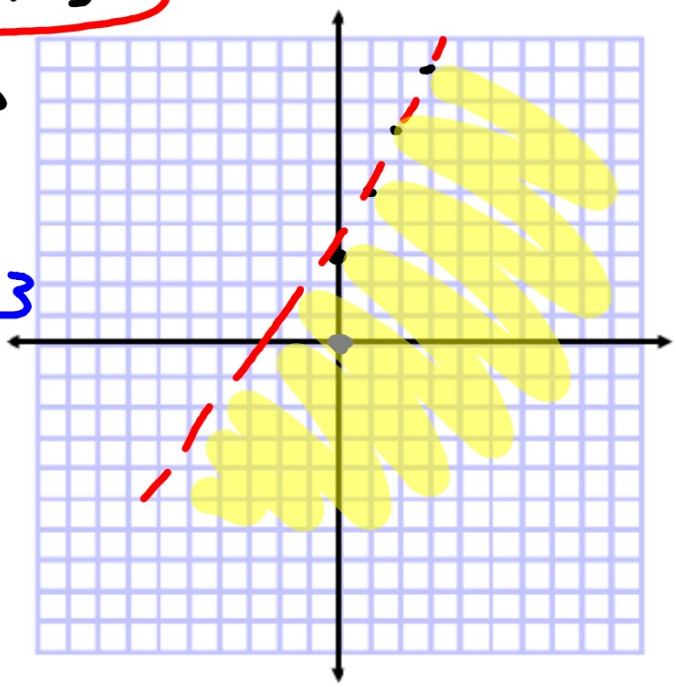
$y < 2x + 3$

$y = \frac{2}{1}x + 3$

Shade T

$0 < 2 \cdot 0 + 3$

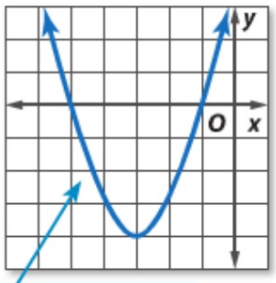
$0 < 3$



1 Graph Quadratic Inequalities

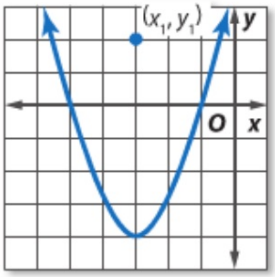
You can graph **quadratic inequalities** in two variables by using the same techniques used to graph linear inequalities in two variables.

Step 1 Graph the related function.



Should the parabola be solid or dashed?

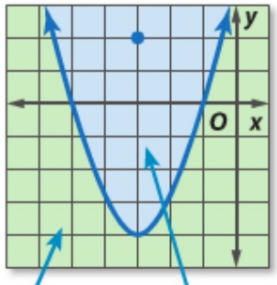
Step 2 Test a point not on the parabola.



$y_1 \geq a(x_1)^2 + b(x_1) + c$

Is (x_1, y_1) a solution?

Step 3 Shade accordingly.



(x_1, y_1) is a solution.

(x_1, y_1) is not a solution.

GuidedPractice

$0 \leq 4$

Graph each inequality.

1A. $y \leq x^2 + 2x + 4$

$0 \leq 0^2 + 0 + 4$

$y = x^2 + 2x + 4$

$-4 \quad -4$

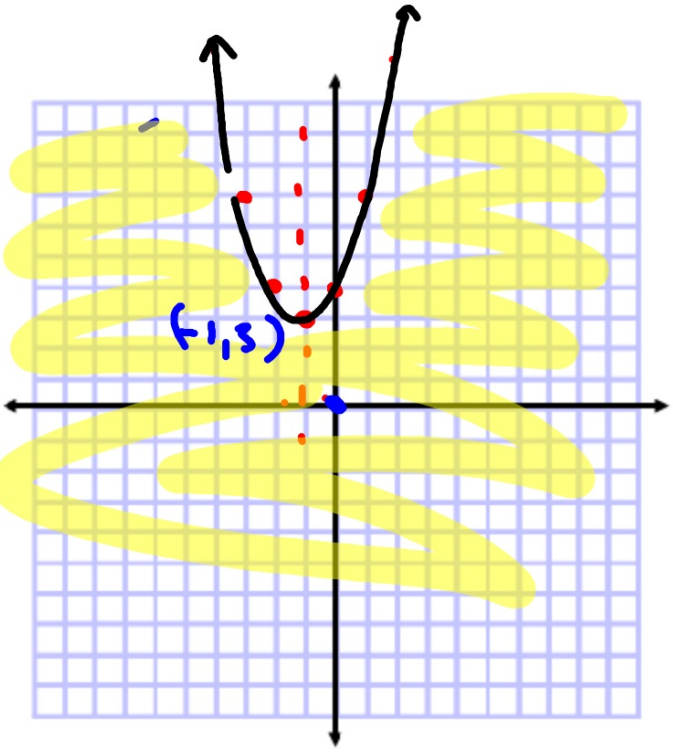
$y - 4 = x^2 + 2x + 1$

$+1 \quad +1$

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

$+3 \quad +3$

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



1B. $y < -2x^2 + 3x + 5$

$0 < -2 \cdot 0 + 3 \cdot 0 + 5$

$0 < 5$

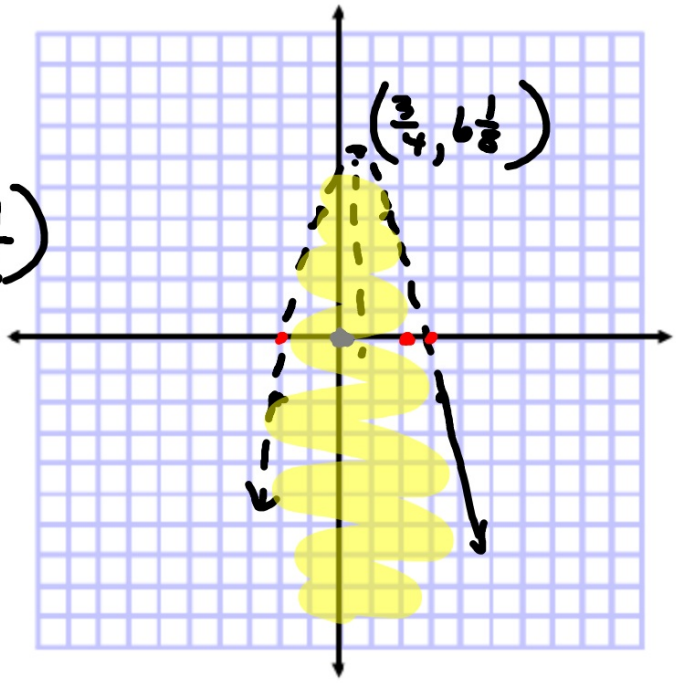
$y - 5 = -2\left(x^2 - \frac{3}{2}x + \frac{9}{16}\right)$

$-\frac{18}{16}$ $\quad \frac{3}{2} \cdot \frac{1}{2}$ $\quad \frac{3}{4} \cdot \frac{3}{4}$

$y - 6\frac{1}{8} = -2\left(x - \frac{3}{4}\right)^2$

$+6\frac{1}{8}$ $\quad +6\frac{1}{8}$

$y = -2\left(x - \frac{3}{4}\right)^2 + 6\frac{1}{8}$



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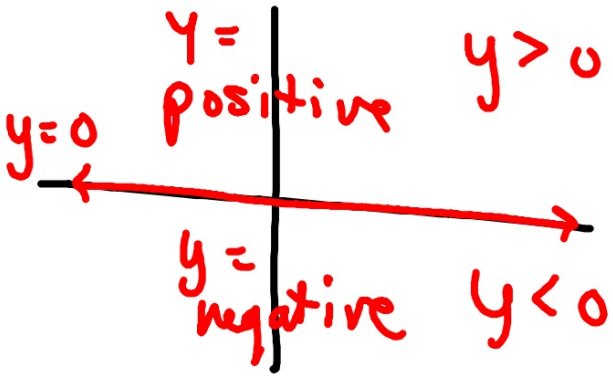
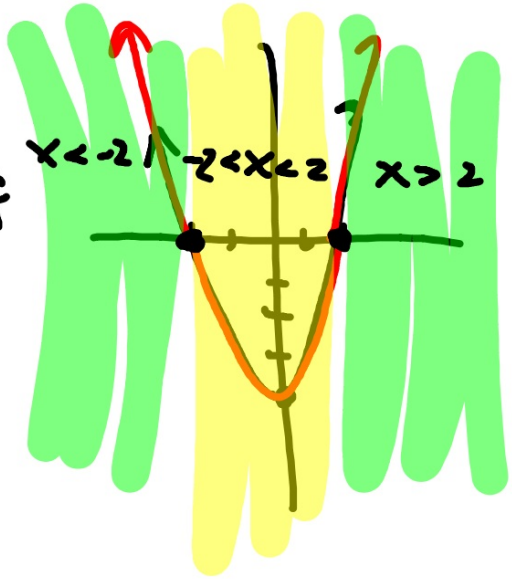
What is the graph of y=0 ?
So...
if you are above that line...

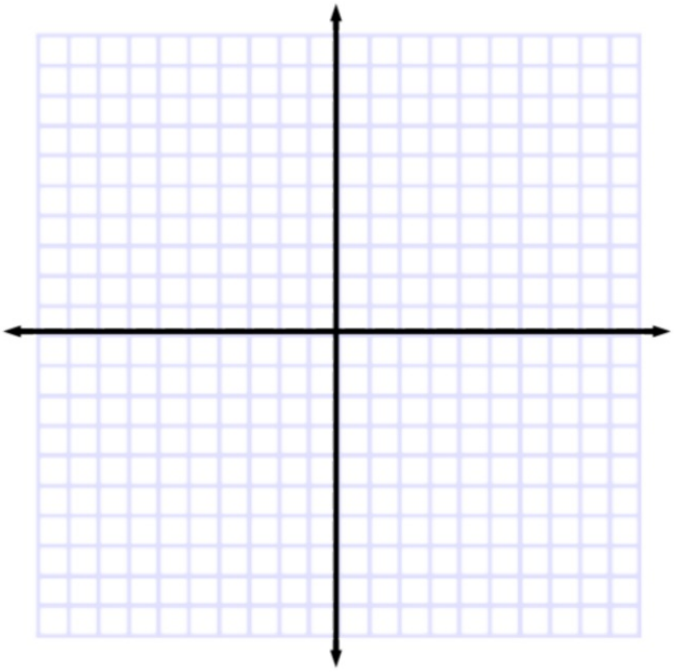


Equation solutions	related function	x-int
$x+6=0$	$y=x+6$	
$2x-8=0$	$y=2x-8$	
$x^2-4=0$	$y=x^2-4$	



Where is the parabola above the x-axis? (y is positive) >0

Where is the parabola below the x-axis? (y is negative) <0



Shade between or shade outside…

2 Solve Quadratic Inequalities

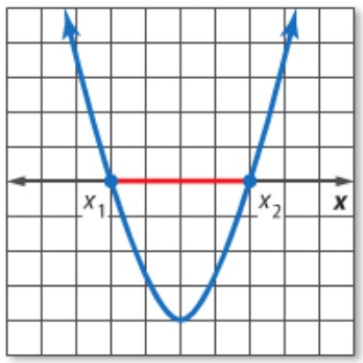
Quadratic inequalities in one variable can be solved using the graphs of the related quadratic functions.

$ax^2 + bx + c < 0$

Graph $y = ax^2 + bx + c$ and identify the x-values for which the graph lies *below* the x-axis.

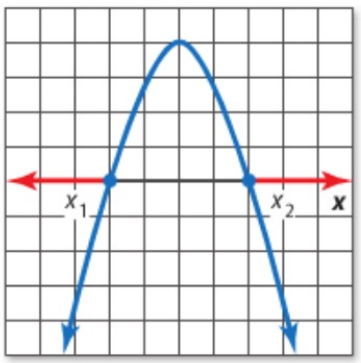
For $\leq$, include the x-intercepts in the solution.

$a > 0$



$\{x \mid x_1 < x < x_2\}$

$a < 0$

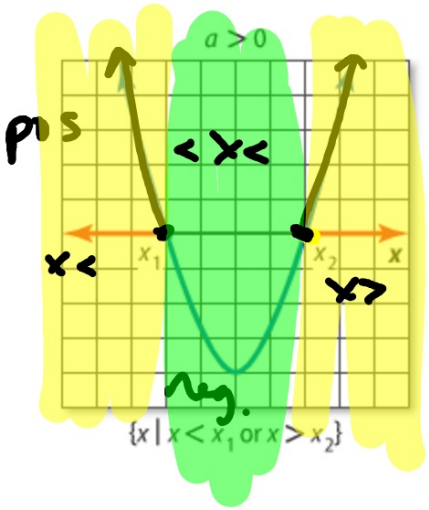


$\{x \mid x < x_1 \text{ or } x > x_2\}$

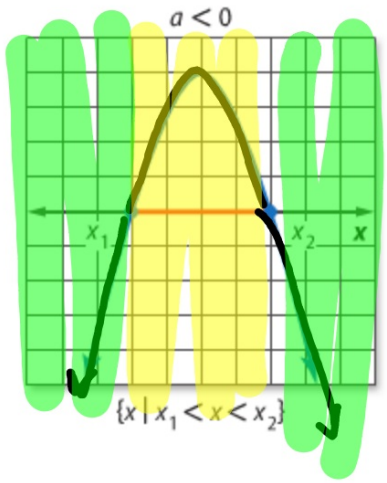
$ax^2 + bx + c > 0$

Graph $y = ax^2 + bx + c$ and identify the x-values for which the graph lies *above* the x-axis.

For $\geq$, include the x-intercepts in the solution.



Where is y positive?
negative?



Where is y positive?
negative?

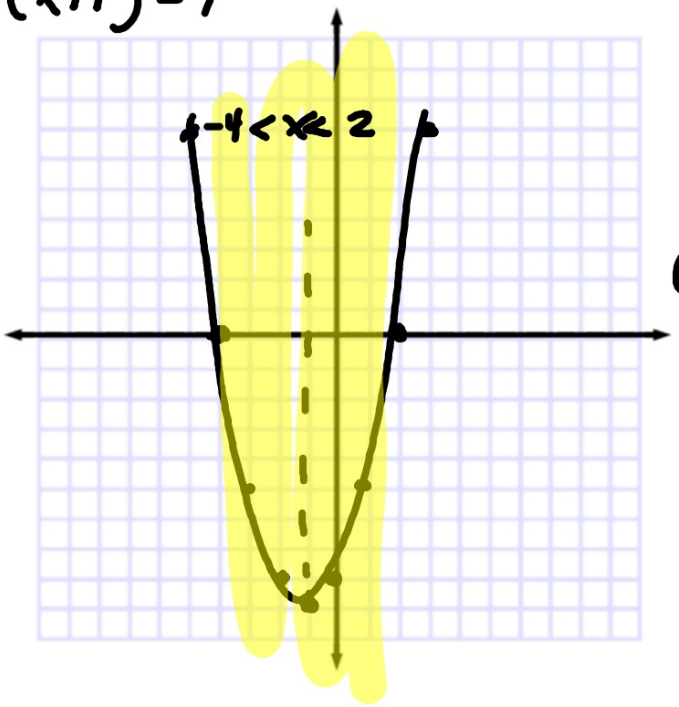
How is this equation different?

Example 2 Solve $ax^2 + bx + c < 0$ by Graphing

Solve $x^2 + 2x - 8 < 0$ by graphing.

Where neg?

$y = (x+1)^2 - 9$



$y = x^2 + 2x - 8$

$+8 \quad +8$

$y + 8 = x^2 + 2x + 1$

$y + 9 = (x+1)^2$

-9

vertex
roots= x-int (crossing points)
direction
above/below (when x is...)
answer the question
(your answer is only about x)

GuidedPractice

Solve each inequality by graphing.

2A. $x^2 + 5x - 6 < 0$, where neg?

vertex
roots (x-int)
direction
above/below "when x is..."
answer the question

$y = x^2 + 5x - 6$

$y + 6 = x^2 + 5x + \frac{25}{4}$

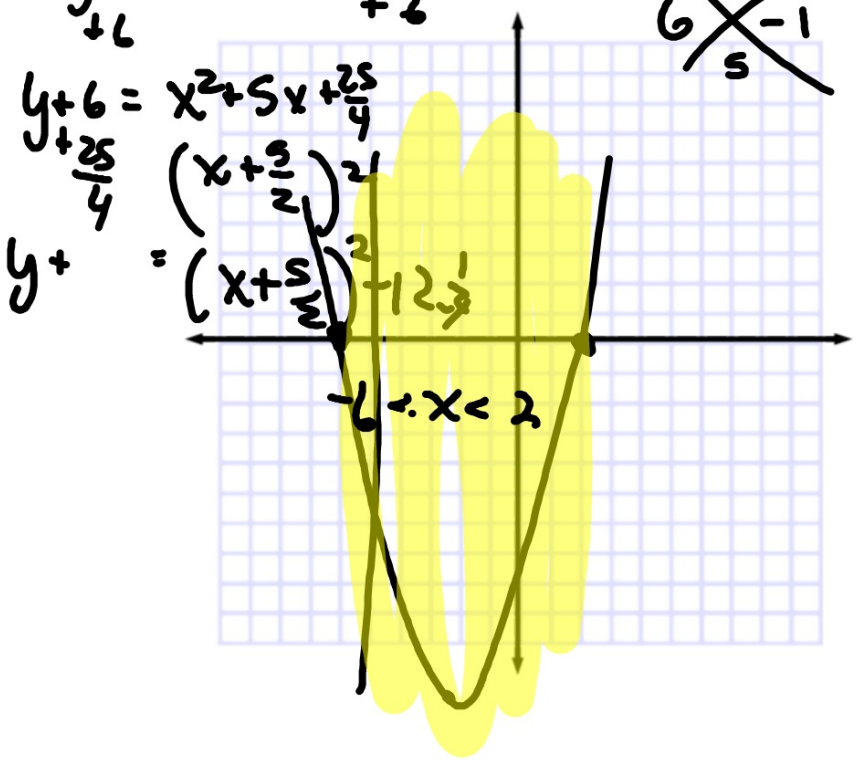
$y + \frac{25}{4} = \left(x + \frac{5}{2}\right)^2$

$y + \frac{24}{4} = \left(x + \frac{5}{2}\right)^2$

$y + 6 = \left(x + \frac{5}{2}\right)^2$

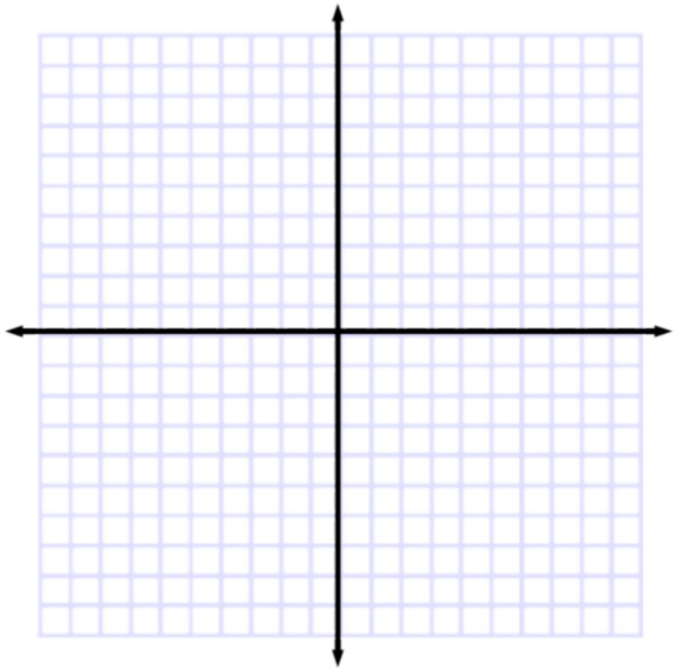
$-6 \cdot -1 = 6$, $-6 + -1 = -5$

$(x+6)(x-1)$



$-6 < x < 2$

2B. $-x^2 + 3x + 10 \leq 0$



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CCSS **SENSE-MAKING** **Solve each inequality by graphing.**

4. $0 < x^2 - 5x + 4$

5. $x^2 + 8x + 15 < 0$