9.3 Quadratic Inequalities in Two Variables

Ch 9 : linear inequalities, 1 variable

$2x+3<5$

$2x<2$

$x<1$

answer is inequality.

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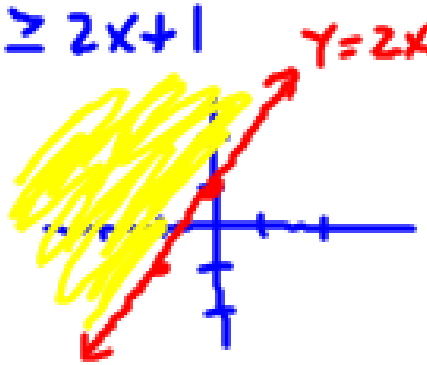
linear inequalities, 2 variables

↓

graph

$y \geq 2x+1$



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quadratic inequalities, 1 variable

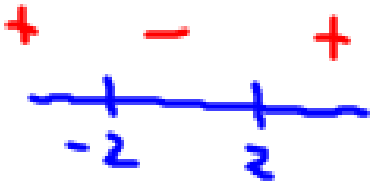
↓

inequalities

$x^2-4 < 0$

$(x-2)(x+2)<0$

$x=2 \quad -2$



$-2<x<2$

$(-2,2)$

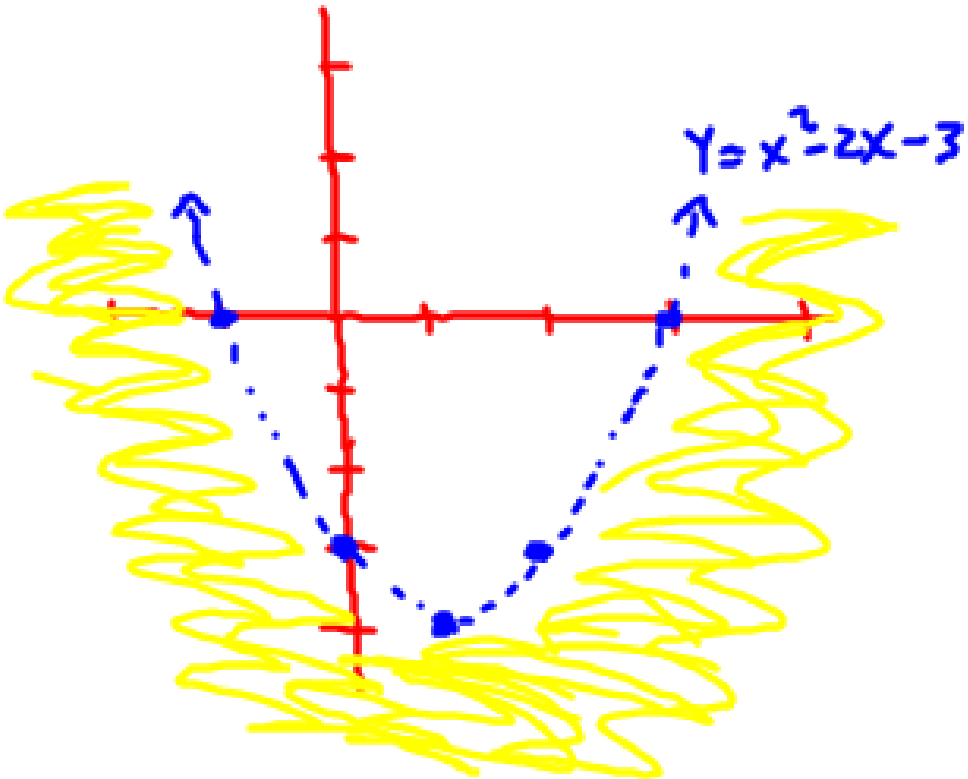
quadratic inequality with 2 variables...
answer is a graph

ex1 $y < x^2 - 2x - 3$

boundary $y = x^2 - 2x - 3$ (dotted)

vertex $(1, -4)$ $x = \frac{-b}{2a}$

y int $(0, -3)$



point check $(0,0)$

$0 < -3$

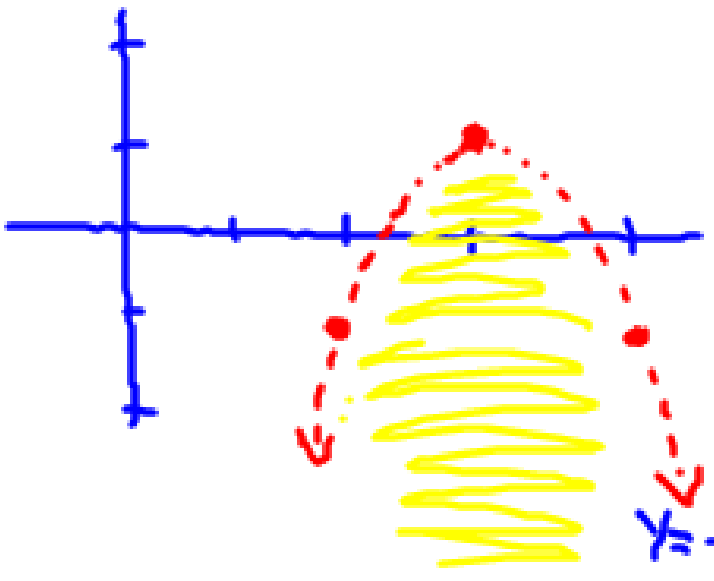
not true

$\therefore (0,0)$ not in region

ex1 pg490 $y < -2(x-3)^2 + 1$

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

vertex (3, 1)



check (3, 0)

$0 < 1$ ✓

∴ (3, 0) is in region.

check (0, 0)

$0 < -17$ no

ex 2 pg 492 $y \geq x^2 - 4x - 5$

boundary $y = x^2 - 4x - 5$ (solid)

vertex $(2, -9)$ $x = \frac{-b}{2a}$

y int $(0, -5)$

check $(1, 0)$

$0 \geq -8$ yes.

$\therefore (1, 0)$ in region

Practise

1. Which of the ordered pairs are solutions to the inequality?

a) $y < x^2 + 3$,
$\{(2, 6), (4, 20), (-1, 3), (-3, 12)\}$

$(2,6)$? $6 < 2^2+3$ $6 < 7$ (solution)

$(4,20)$? $20 < 4^2+3$ $20 < 19$ (not solution)

$(-1,3)$? $3 < (-1)^2+3$ $3 < 4$ (solution)

$(-3,12)$? $12 < (-3)^2+3$ $12 < 12$ (not solution)

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2. Which of the ordered pairs are *not* solutions to the inequality?

a) $y \geq 2(x-1)^2 + 1$,

$\{(0, 1), (1, 0), (3, 6), (-2, 15)\}$

$(0,1)$? $\quad 1 \geq 2(0-1)^2 + 1 \quad 1 \geq 3$ not a solution

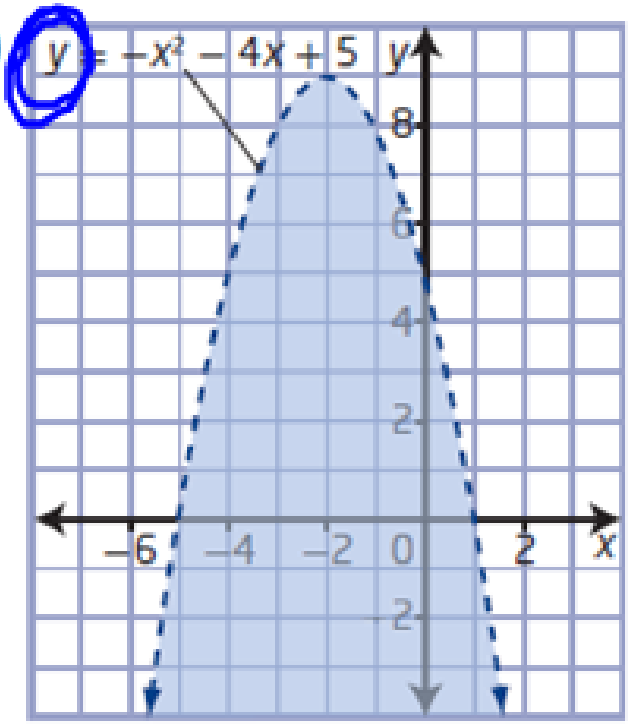
$(1,0) \quad 0 \geq 2(1-1)^2 + 1 \quad 0 \geq 1$ not a solution

$(3,6) \quad 6 \geq 2(3-1)^2 + 1 \quad 6 \geq 9$ not a solution

$(-2,15) \quad 15 \geq 2(-2-1)^2 + 1 \quad 15 \geq 19$ not a solution

3. Write an inequality to describe each graph, given the function defining the boundary parabola.

a)



either $y < -x^2 - 4x + 5$

OR

$y > -x^2 - 4x + 5$

try a value that works

(0,0)

$0 \stackrel{?}{<} -0^2 - 4(0) + 5$

$0 \stackrel{?}{<} 5$

$<$

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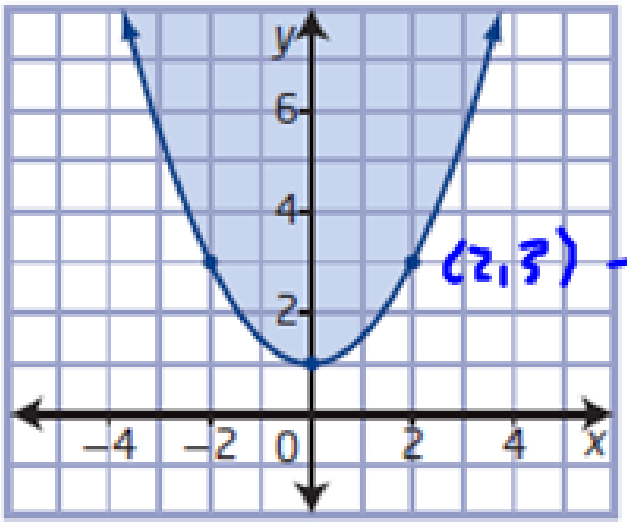
8. Write an inequality to describe each graph.

a)



boundary?

vertex (0,1)

(2,3)

$y = a(x-0)^2 + 1$

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

$3 = 4a + 1$

$2 = 4a$

$\frac{1}{2} = a$

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

pointcheck (0,3)

$y \overset{?}{<} \frac{1}{2}x^2 + 1$

$3 \overset{?}{<} 1$

$>$

above

$y \geq \frac{1}{2}x^2 + 1$

Homework:

1c,d, 2c,d, 3c,d, 8b (just like the last 4 examples)

4b,d, 5a,c, 6c,d, 7c,d

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*you can do more but these represent everything we can throw at you