Lesson 5 Non-Linear Inequalities in Two Variables

Steps:

1. Graph the quadratic equation
   - Determine whether the curve should be broken(dashed) or solid

   < > ≤ ≥

2. Determine where to shade
   - Choose a test point

Example 1: Sketch each of the following:

a.) $y < 3x^2 - 4$

broken

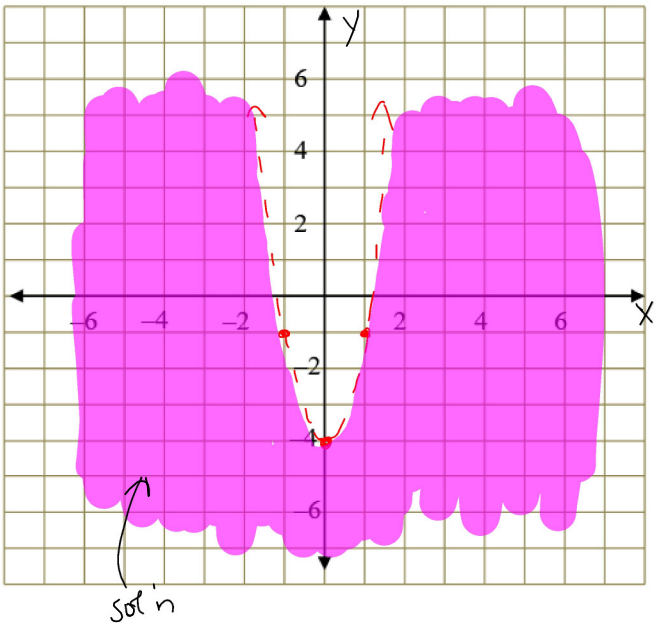
V (0, -4)

Test point (0, 0)

$0 \overset{?}{<} 3(0)^2 - 4$

$0 \overset{?}{<} -4$ False

∴ shade outside



b.) $y \geq x^2 - 2x - 5$

Solid

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

$y = x^2 - 2x + 1 - 5 - 1$

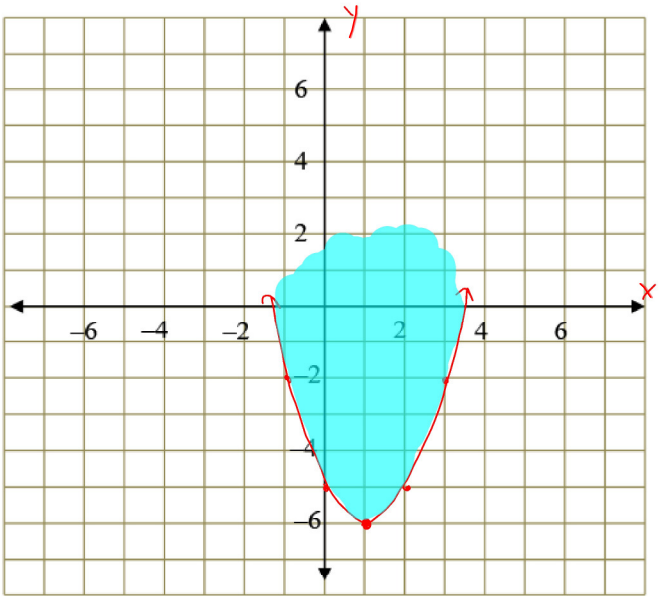
$y = (x-1)^2 - 6$

$V(1, -6)$

Test pt $(0, 0)$

$0 \geq 0^2 - 2(0) - 5$

$0 \geq -5$ True !!



c.) $y < 2x^2 - 8x + 1$

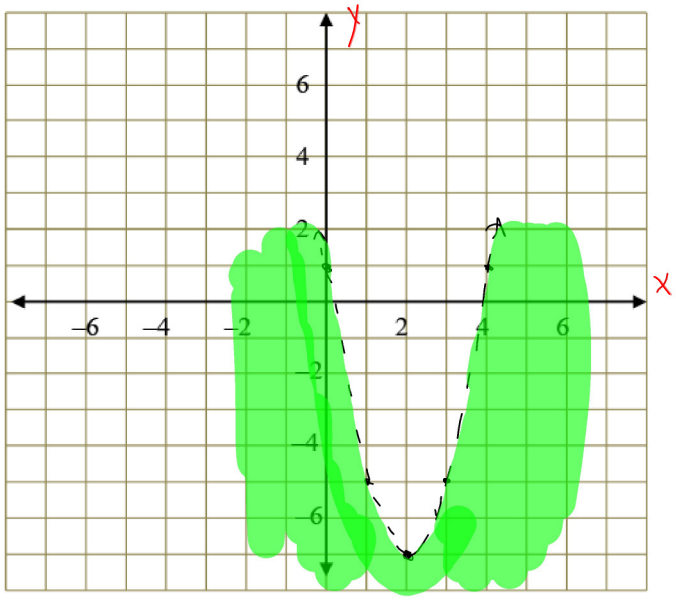
$y = 2(x^2 - 4x + 4) + 1 - 8$

$y = 2(x-2)^2 - 7$

Test pt $(1, 1)$

$1 \not< 2(1)^2 - 8(1) + 1$

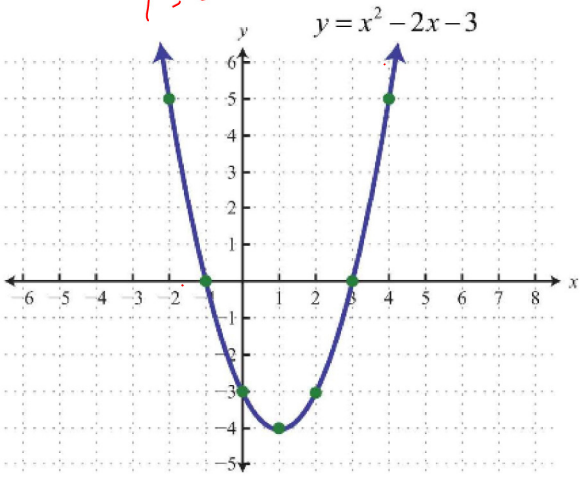
$1 \not< -5$ False



Example 2

Use the given graph to write the solution of the corresponding quadratic inequality $x^2 - 2x - 3 \geq 0$.

$y \geq 0$



sol'n

$(-\infty, -1] \cup [3, \infty)$

Example 3

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

$a > 0$ ∴ graph opens up

all values of x would make the inequality +ve

∴ no sol'n

$x^2 - x + 3 = 0$

$x = \dfrac{-(-1) \pm \sqrt{(-1)^2 - 4(1)(3)}}{2(1)}$

$= \dfrac{1 \pm \sqrt{-11}}{2}$ ← no real roots

graph never crosses the x-axis

Bulawka's Bullets

- Watch the difference between $y \leq ax^2 + bx + c$ (two variables so graph) and $ax^2 + bx + c \leq 0$ (one variable so chart) or cases
- Make sure you use a broken curve for $<$ or $>$

Review pg. 337 1a-c, 2, 3, 4a

↳ chart or cases (ignore # line)

$y = x^2 - x + 3$

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

$y = (x - \frac{1}{2})^2 + \frac{11}{4}$