Adv. Alg. With Trig. Glawe
Graphing Quadratic Inequalities

Name: Key Date: ________ Pd: ______

A quadratic inequality in two variables can be written in one of the following forms:

$y < ax^2 + bx + c$ $\quad$ $y \leq ax^2 + bx + c$ $\quad$ $y > ax^2 + bx + c$ $\quad$ $y \geq ax^2 + bx + c$

To graph a quadratic inequality in one of the forms above, follow these steps:

Step 1: **Graph** the parabola $y = ax^2 + bx + c$. Make the parabola *dashed* for inequalities with < or > (not equal to) and *solid* for inequalities with ≤ or ≥.

Step 2: **Test** a point (x, y) to determine whether the point is a solution of the inequality. Remember the point you test cannot be on the parabola itself.

Step 3: **Shade** the region using the point you tested in Step 2. If the point produces a true statement, then you shade where the point is. If the point produces a false statement, then you shade where the point is not.

Example: Graph $y > x^2 + 3x - 4$.

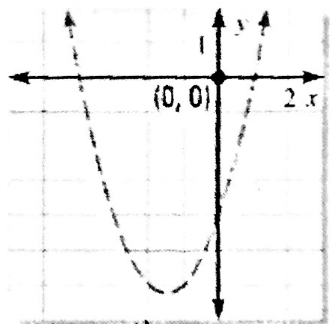
Step 1: **Graph** $y = x^2 + 3x - 4$. Since the inequality symbol is >, make the parabola dashed.

Step 2: **Test** a point, such as (0, 0).

$y > x^2 + 3x - 4$ $\quad$ $0 > (0)^2 + 3(0) - 4$ $\quad$ $0 > -4$ ✓

So, (0,0) is a solution of the inequality.

Step 3: **Shade** the region of the parabola where (0, 0) is (inside the parabola).



Graph the following quadratic inequalities on a coordinate plane.

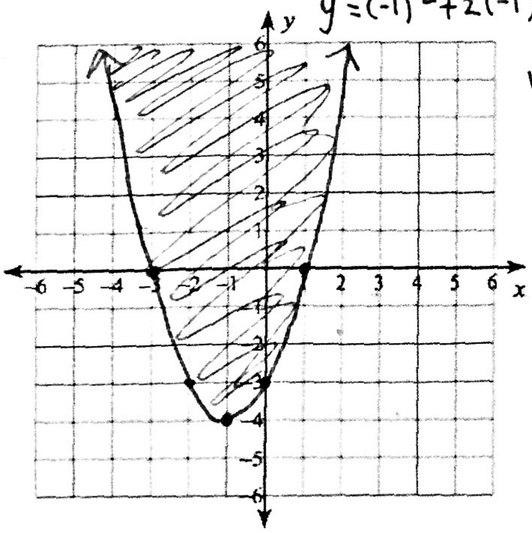
1) $y \geq x^2 + 2x - 3$

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

$y = (-1)^2 + 2(-1) - 3 =$
$1 - 2 - 3 = -4$

vertex:
$(-1, -4)$

x	y
-3	0
-2	-3
-1	-4
0	-3
1	0



Test: (0,0)
$0 \geq 0^2 + 2(0) - 3$ $\quad$ $0 \geq -3$ ✓

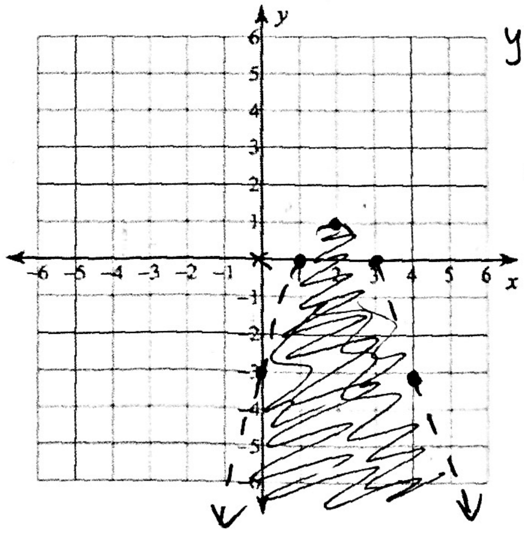
2) $y < -x^2 + 4x - 3$

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

$y = -(2)^2 + 4(2) - 3$
$= -4 + 8 - 3$
$= 1$

vertex:
$(2, 1)$

x	y
0	-3
1	0
2	1
3	0
4	-3



Test: (0,0):
$0 < -0^2 + 4(0) - 3$ $\quad$ $0 < -3$ X

Graph the following system of quadratic inequalities on a coordinate plane. Remember, it is helpful just to use arrows at first and then shade your final solution. You may need to change the units of your axes.

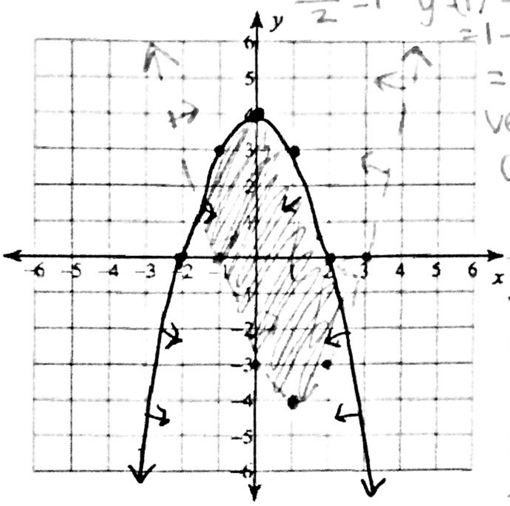
$x = \frac{-b}{2a} = \frac{-0}{2(-1)} = 0 \quad y = -0^2 + 4$
$y = 4$
vertex: $(0, 4)$

3) • $y \le -x^2 + 4$
• $y > x^2 - 2x - 3$

$x = \frac{-b}{2a} = \frac{-(-2)}{2(1)} = \frac{2}{2} = 1 \quad y = (1)^2 - 2(1) - 3 = 1 - 2 - 3 = -4$
vertex: $(1, -4)$

x	y
-2	0
-1	3
0	4
1	3
2	0

x	y
-1	0
0	-3
1	-4
2	-3
3	0



Test: $(0,0)$:
$0 \le -0^2 + 4 \quad 0 \le 4$ ✓

Test $(0,0)$:
$0 > 0^2 - 2(0) - 3 \quad 0 > -3$ ✓

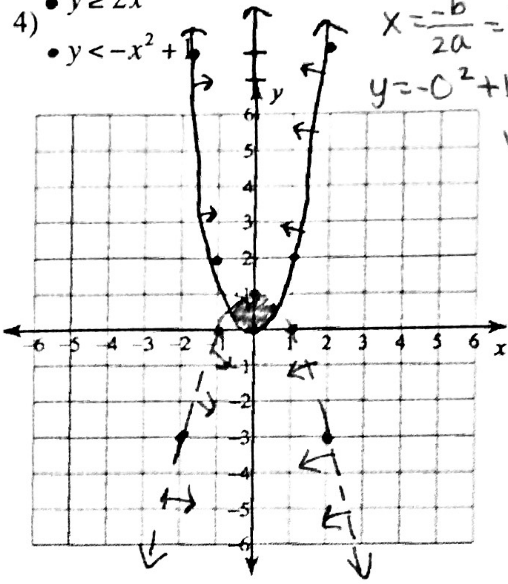
$x = \frac{-b}{2a} = \frac{-0}{2(2)} = 0 \quad y = 2(0)^2 = 0$
vertex: $(0,0)$

4) • $y \ge 2x^2$
• $y < -x^2 + 1$

$x = \frac{-b}{2a} = \frac{-0}{2(-1)} = 0$
$y = -0^2 + 1 \quad y = 1$
vertex: $(0, 1)$

x	y
-2	8
-1	2
0	0
1	2
2	8

x	y
-2	-3
-1	0
0	1
1	0
2	-3



Test: $(0,2)$
$2 \ge 2(0)^2 \quad 2 \ge 0$ ✓

Test: $(0,0)$
$0 < -0^2 + 1 \quad 0 < 1$ ✓

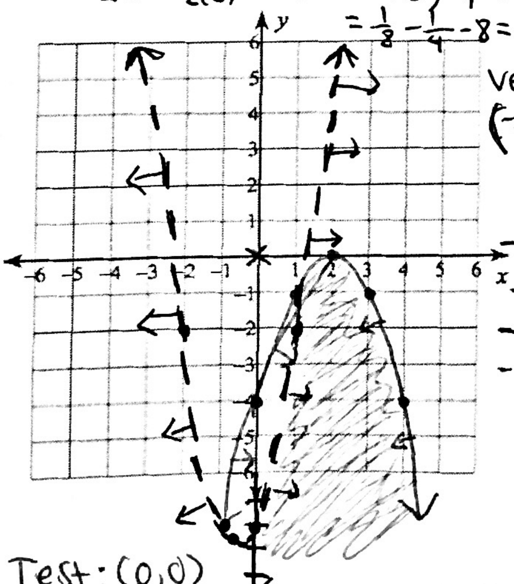
5) • $y \le -x^2 + 4x - 4$
• $y < 2x^2 + x - 8$

$x = \frac{-b}{2a} = \frac{-4}{2(-1)} = \frac{-4}{-2} = 2$
$y = -(2)^2 + 4(2) - 4 = -4 + 8 - 4 = 0$
Vertex: $(2, 0)$

$x = \frac{-b}{2a} = \frac{-1}{2(2)} = -\frac{1}{4}$
$y = 2(\frac{-1}{4})^2 + (\frac{-1}{4}) - 8 = 2(\frac{1}{16}) - \frac{1}{4} - 8 = \frac{1}{8} - \frac{1}{4} - 8 = \frac{-65}{8}$
Vertex: $(\frac{-1}{4}, \frac{-65}{8})$

x	y
0	-4
1	-1
2	0
3	-1
4	-4

x	y
-2	-2
-1	-8
-1/4	-65/8
0	-8
1	-2



Test: $(0,0)$
$0 \le -0^2 + 4(0) - 4 \quad 0 \le -4$ X

Test: $(0,0)$
$0 \le 2(0)^2 + 0 - 8 \quad 0 \le -8$ X

• $y \ge x^2 - x - 6$

$x = \frac{-b}{2a} = \frac{-(-1)}{2(1)} = \frac{1}{2}$
$y = (\frac{1}{2})^2 - (\frac{1}{2}) - 6 = \frac{1}{4} - \frac{1}{2} - 6 = \frac{-25}{4}$
vertex: $(\frac{1}{2}, \frac{-25}{4})$

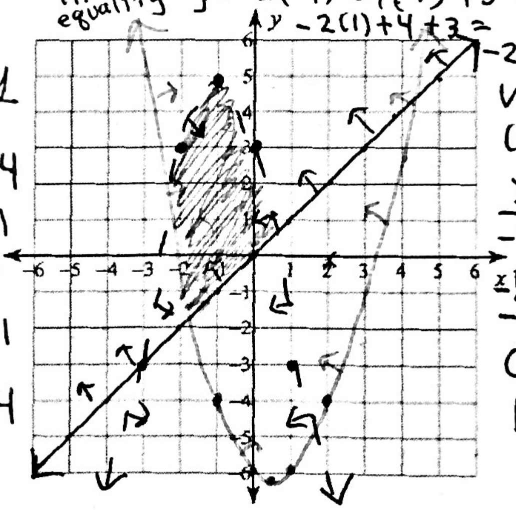
6) • $y < -2x^2 - 4x + 3$
• $y \ge x$

linear equality

$x = \frac{-b}{2a} = \frac{-(-4)}{2(-2)} = \frac{4}{-4} = -1$
$y = -2(-1)^2 - 4(-1) + 3 = -2(1) + 4 + 3 = -2 + 7 = 5$
Vertex: $(-1, 5)$

x	y
-3	-3
-2	3
-1	5
0	3
1	-3

x	y
-1	-4
0	-6
1/2	-25/4
1	-6
2	-4



Test: $(0,0)$
$0 \ge 0^2 - 0 - 6 \quad 0 \ge -6$ ✓

Test: $(0,0)$
$0 < -2(0)^2 - 4(0) + 3 \quad 0 < 3$ ✓

Test: $(2,0)$:
$0 \ge 2$ X