Graph the inequality.

1. $x - y < 5$

$-y < -x + 5$

$y > x - 5$

2. $2x + y > 10$

$y > -2x + 10$

3. $y \geq -3$

4. $6x - 3y < 5$

$-3y < -6x + 5$

$y > 2x + (-\frac{5}{3})$

$y > 2x - \frac{5}{3}$

Warm Up

* solve and graph
* use coordinate grid and graph like a linear equation.
* Remember:
  - Type of line
  - Shading

Solve the system of linear equations using the substitution method.

1. $-x - 3y + 8z = 43$
   $8x - 5y - 2z = 57$
   $7x - 2y - 3z = 40$

2. $-3x - 3y + 7z = 67$
   $3z = 21$
   $-3x + 2y - 2z = -16$

Cumulative Warm Up

* Use either substitution or elimination to solve.

Essential Question

How can you solve a quadratic inequality?

quadratic Inequalities in two variables: can be written:

$y < ax^2 + bx + c$

$y > ax^2 + bx + c$

$y \leq ax^2 + bx + c$

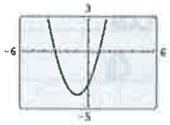
$y \geq ax^2 + bx + c$

Essential Question

What you will learn:

- Graph quadratic inequalities in two variables
- Solve quadratic inequalities in one variable.

Work with a partner. The graphing calculator screen shows the graph of $f(x) = x^2 + 2x - 3$. Explain how you can use the graph to solve the inequality $x^2 + 2x - 3 \le 0$. Then solve the inequality.



- The x-values for which the graph touches or is below the x-axis are solutions $-3 \le x \le 1$

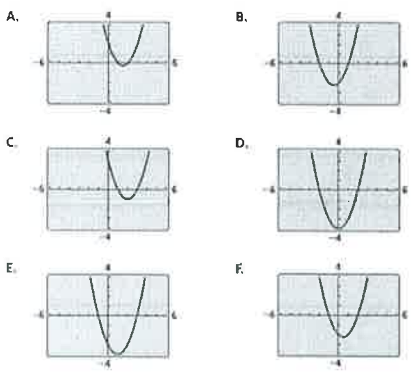
Exploration 1

* work with a partner discuss how you would solve the inequality
* where would you shade?
* what would shaded region mean?

Work with a partner. Match each inequality with the graph of its related quadratic function. Then use the graph to solve the inequality.

a. $x^2 - 3x + 2 > 0$ **b.** $x^2 - 4x + 3 \le 0$ **c.** $x^2 - 2x - 3 < 0$

d. $x^2 + x - 2 \ge 0$ **e.** $x^2 - x - 2 < 0$ **f.** $x^2 - 4 > 0$



Exploration 2

a. A; $x < 1$ or $x > 2$

b. C; $1 \le x \le 3$

c. E; $-1 < x < 3$

d. B; $x \le -2$ or $x \ge 1$

e. F; $-1 < x < 2$

f. D; $x < -2$ or $x > 2$

Core Concept

Graphing a Quadratic Inequality in Two Variables

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

Step 1 Graph the parabola with the equation $y = ax^2 + bx + c$. Make the parabola *dashed* for inequalities with $<$ or $>$ and *solid* for inequalities with $\le$ or $\ge$.

Step 2 Test a point (x, y) inside the parabola to determine whether the point is a solution of the inequality.

Step 3 Shade the region inside the parabola if the point from Step 2 is a solution. Shade the region outside the parabola if it is not a solution.

Core Concept

- use dash or solid parabola
- find test point inside the parabola to determine if true or not
- Shade side of parabola that makes the situation true

Graph $y < -x^2 - 2x - 1$.

axis of symmetry

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

$y < -(-1)^2 - 2(-1) - 1$

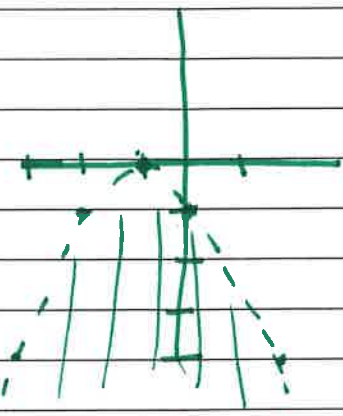
$y < -1 + 2 - 1$

$y < 0$ vertex $(-1, 0)$

Example 1

table

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



test point test $(0, -2)$

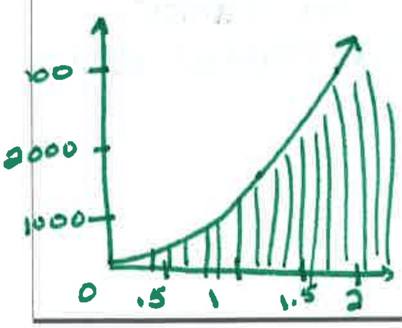
$-2 < -(0)^2 - 2(0) - 1$

$-2 < -1$ ← true statement

A manila rope used for rappelling down a cliff can safely support a weight W (in pounds) provided

$W \le 1480d^2$

where d is the diameter (in inches) of the rope. Graph the inequality and interpret the solution.



Example 2

pick test point $(1, 3000)$

$W \le 1480d^2$

$3000 \le 1480(1)^2$

$3000 \not\le 1480$

Not a solution - shade outside parabola

* Use technology to solve.

Graph the system of quadratic inequalities.

$y < -x^2 + 3$ Inequality 1

$y \ge x^2 + 2x - 3$ Inequality 2

↓

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

Example 3

- Graph both Inequalities individually
- Pick test point
- Shade
- find overlapping area

Graph the inequality.

1. $y \geq x^2 + 2x - 8$
2. $y \leq 2x^2 - x - 1$
3. $y > -x^2 + 2x + 4$

4. Graph the system of inequalities consisting of $y \leq -x^2$ and $y > x^2 - 3$.

Monitoring Progress 1-4

* Student practice

Solving w/ one variable

Solve $x^2 - 3x - 4 < 0$ algebraically.

$(x-4)(x+1) < 0$

$x = 4 \quad x = -1$

$-1 < x < 4$

Example 4

· Can use multiple methods:

· Factoring

· test points on either side to determine where to shade

Solve $3x^2 - x - 5 \geq 0$ by graphing.

$a = 3 \quad b = -1 \quad c = -5$

$$x = \frac{-(-1) \pm \sqrt{(-1)^2 - 4(3)(-5)}}{2(3)}$$

$$x = \frac{1 \pm \sqrt{61}}{6}$$

Example 5

· use Quadratic Formula

· Simplify the quad. answer

$x \approx -1.14$ and $x \approx 1.47$

$x \leq -1.14$ or $x \geq 1.47$

would be graphed on either side of parabola on x-axis.

A rectangular parking lot must have a perimeter of 440 feet and an area of at least 8000 square feet. Describe the possible lengths of the parking lot.

Perimeter = 440 Area ≥ 8000

Solve for w → $2L + 2w = 440$ $lw \geq 8000$

$\frac{2w}{2} = \frac{440 - 2L}{2}$

$l(220 - l) \geq 8000$

$220l - l^2 \geq 8000$

$-l^2 + 220l - 8000 \geq 0$

Example 6

· Can choose a test point $l = 100$ to test solution

* use graphing Calculator to graph.

Intercepts: $l \approx 45.97$

$l \approx 174.03$

$45.97 \leq l \leq 174.03$

approx. length atleast 46 feet and at most 174 feet.

Solve the inequality.

5. $2x^2 + 3x \leq 2$

6. $-3x^2 - 4x + 1 < 0$

7. $2x^2 + 2 > -5x$

8. WHAT IF? In Example 6, the area must be at least 8500 square feet. Describe the possible lengths of the parking lot.

Monitoring Progress 5-8

* Student practice

Exit Ticket: Solve algebraically and graphically: $x^2 + 10x + 9 \geq 0$.

Closure

What method would you use to solve?