5.7 Graph Linear Inequalities in Two Variables

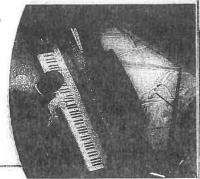**Before** You graphed linear equations in two variables.

Now You will graph linear inequalities in two variables.

Why? So you can analyze a music competition, as in Ex. 56.

A **linear inequality in two variables,** such as $x - 3y < 6$, is the result of replacing the = sign in a linear equation with <, ≤, >, or ≥. A **solution of an inequality in two variables** x and y is an ordered pair (x, y) that produces a true statement when the values of x and y are substituted into the inequality.

EXAMPLE 1 Standardized Test Practice

Which ordered pair is *not* a solution of $x - 3y \leq 6$?

Ⓐ (0, 0) Ⓑ (6, −1) Ⓒ (10, 3) Ⓓ (−1, 2)

Solution

Check whether each ordered pair is a solution of the inequality.

Test (0, 0): $x - 3y \leq 6$ Write inequality.

$0 - 3(0) \leq 6$ Substitute 0 for x and 0 for y.

$0 \leq 6$ ✓   Simplify.

Test (6, −1): $x - 3y \leq 6$ Write inequality.

$6 - 3(-1) \leq 6$ Substitute 6 for x and −1 for y.

$9 \leq 6$ ✗   Simplify.

So, (0, 0) is a solution of $x - 3y \leq 6$ but (6, −1) is *not* a solution.

▶ The correct answer is B. Ⓐ Ⓑ Ⓒ Ⓓ

✓ **GUIDED PRACTICE**   for Example 1

Tell whether the ordered pair is a solution of $-x + 2y < 8$.

1. (0, 0) **2.** (0, 4) **3.** (3, 5)

GRAPH OF AN INEQUALITY In a coordinate plane, the **graph of an inequality in two variables** is the set of points that represent all solutions of the inequality. The *boundary line* of a linear inequality divides the coordinate plane into two **half-planes.** Only one half-plane contains the points that represent the solutions of the inequality.

5.7 EXERCISES

SKILL PRACTICE

1. **VOCABULARY** Copy and complete: The ordered pair $(2, -4)$ is a(n) __?__ of $3x - y > 7$.

2. ★ **WRITING** *Describe* the difference between graphing a linear inequality in two variables and graphing a linear equation in two variables.

EXAMPLE 1
for Exs. 3–15

CHECKING SOLUTIONS Tell whether the ordered pair is a solution of the inequality.

3. $x + y < -4$; $(0, 0)$

4. $x - y \le 5$; $(8, 3)$

5. $y - x > -2$; $(-1, -4)$

6. $2x + 3y \ge 14$; $(5, 2)$

7. $4x - 7y > 28$; $(-2, 4)$

8. $-3y - 2x < 12$; $(5, -6)$

9. $2.8x + 4.1y \le 1$; $(0, 0)$

10. $0.5y - 0.5x > 3.5$; $(6, 2)$

11. $x \ge -3$; $(-4, 0)$

12. $y \le 8$; $(-9, -7)$

13. $\frac{3}{4}x - \frac{1}{3}y < 6$; $(-8, 12)$

14. $\frac{2}{5}x + y \ge 2$; $(1, 2)$

15. ★ **MULTIPLE CHOICE** Which ordered pair is *not* a solution of $x + 5y < 15$?

ⓐ $(-1, -3)$ ⓑ $(-1, 3)$ ⓒ $(1, 3)$ ⓓ $(3, 2)$

EXAMPLES 2, 3, 4, and 5
for Exs. 16–38

16. ★ **MULTIPLE CHOICE** The graph of which inequality is shown?

ⓐ $x + y \le -1$ ⓑ $x + y \ge -1$

ⓒ $x - y \le -1$ ⓓ $x - y \ge -1$

GRAPHING INEQUALITIES Graph the inequality.

17. $y > x + 3$

18. $y \le x - 2$

19. $y < 3x + 5$

20. $y \ge -2x + 8$

21. $x + y < -8$

22. $x - y \le -11$

23. $x + 8y > 16$

24. $5x - y \ge 1$

25. $2(x + 2) > 7y$

26. $y - 4 < x - 6$

27. $-4y \le 16x$

28. $6(2x) \ge -24y$

29. $y < -3$

30. $x \ge 5$

31. $x > -2$

32. $y \le 4$

33. $3(x - 2) > y + 8$

34. $x - 4 \le -2(y + 6)$

35. $\frac{1}{2}(x + 2) + 3y < 8$

36. $2(x + 1) \ge \frac{1}{4}y - 1$

ERROR ANALYSIS *Describe* and correct the error in graphing the inequality.

37. $2y - x \ge 2$

38. $x \le -3$