6-6 Systems of Inequalities

Solve each system of inequalities by graphing.

1. \( x \geq 4 \)
   \( y \leq x - 3 \)

SOLUTION:
Graph each inequality.
The graph of \( x \geq 4 \) is solid and is included in the graph of the solution.

The graph of \( y \leq x - 3 \) is also solid and is included in the graph of the solution.

The solution of the system is the set of ordered pairs in the intersection of the graphs of \( x \geq 4 \) and \( y \leq x - 3 \).

This region is shaded in the graph below.
2. $y > -2$
   $y \leq x + 9$

**SOLUTION:**
Graph each inequality.

The graph of $y > -2$ is dashed and is not included in the graph of the solution.

The graph of $y \leq x + 9$ is solid and is included in the graph of the solution.

The solution of the system is the set of ordered pairs in the intersection of the graphs of $y > -2$ and $y \leq x + 9$.

This region is shaded in the graph below.
6-6 Systems of Inequalities

3. \( y < 3x + 8 \)
   \( y \geq 4x \)

**SOLUTION:**
Graph each inequality.
The graph of \( y < 3x + 8 \) is dashed and is not included in the graph of the solution.

The graph of \( y \geq 4x \) is solid and is included in the graph of the solution.

The solution of the system is the set of ordered pairs in the intersection of the graphs of \( y < 3x + 8 \) and \( y \geq 4x \).
Overlay the graphs and locate the green region. This is the intersection.

The solution region is shaded in the graph below.
6-6 Systems of Inequalities

4. $3x - y \geq -1$
   $2x + y \geq 5$

   **SOLUTION:**
   Graph each inequality. The graph of $3x - y \geq -1$ is solid and is included in the graph of the solution. The graph of $2x + y \geq 5$ is also solid and is included in the graph of the solution. The solution of the system is the set of ordered pairs in the intersection of the graphs of $3x - y \geq -1$ and $2x + y \geq 5$. The solution region is the darkest shaded area in the graph below.

5. $y \leq 2x - 7$
   $y \geq 2x + 7$

   **SOLUTION:**
   Graph each inequality. The graph of $y \leq 2x - 7$ is solid. The graph of $y \geq 2x + 7$ is also solid. The solution of the system is the set of ordered pairs in the intersection of the graphs of $y \leq 2x - 7$ and $y \geq 2x + 7$. This region is shaded in the graph below. Because the graphs do not intersect, there is no solution.
6-6 Systems of Inequalities

6. \(y > -2x + 5\)  
\(y \geq -2x + 10\)

**SOLUTION:**
Graph each inequality.
The graph of \(y > -2x + 5\) is dashed and is not included in the graph of the solution.

The graph of \(y \geq -2x + 10\) is solid.

Because the lines are parallel and the solution of the system must satisfy \(y > -2x + 5\) and \(y \geq -2x + 10\), the line \(y \geq -2x + 10\) is included in the solution. Overlay the graphs and locate the green region. This is the intersection.

The solution of the system is the set of ordered pairs in the intersection of the graphs of \(y > -2x + 5\) and \(y \geq -2x + 10\). The solution region is shaded in the graph below.
6-6 Systems of Inequalities

7. \(2x + y \leq 5\)  
   \(2x + y \leq 7\)

**SOLUTION:**
Graph each inequality.
The graph of \(2x + y \leq 5\) is solid.

The graph of \(2x + y \leq 7\) is also solid.

The solution of the system is the set of ordered pairs in the intersection of the graphs of \(2x + y \leq 5\) and \(2x + y \leq 7\). This region is shaded in the graph below.

Because the lines are parallel and the solution of the system must satisfy \(2x + y \leq 5\) and \(2x + y \leq 7\), the line \(2x + y \leq 5\) is included in the solution but the line \(2x + y \leq 7\) is not.
8. \(5x - y < -2\)
\(5x - y > 6\)

**SOLUTION:**
Graph each inequality. The graph of \(5x - y < -2\) is dashed and is not included in the graph of the solution. The graph of \(5x - y > 6\) is also dashed and is not included in the graph of the solution. The solution of the system is the set of ordered pairs in the intersection of the graphs of \(5x - y < -2\) and \(5x - y > 6\). To find the solution, overlay the graphs and locate the green region. Because the graphs do not intersect, there is no solution.

![Graph of inequalities]

9. **AUTO RACING** At a race car driving school, there are safety requirements.

![Rules to Qualify]

a. Define the variables, and write a system of inequalities to represent the height and weight requirements in this situation. Then graph the system.

b. Name one possible solution.

c. Is \((50, 180)\) a solution? Explain.

**SOLUTION:**

a. Let \(h\) = the height of the driver in inches and \(w\) = the weight of the driver in pounds; \(h < 79\) and \(w < 295\).
6-6 Systems of Inequalities

b. Sample answer: 72 in. and 220 lb

c. Yes. (50, 180) is a solution because the point falls in the shaded region.
6-6 Systems of Inequalities

Solve each system of inequalities by graphing.

10. \( y < 6 \)
   \( y > x + 3 \)

**SOLUTION:**
Graph each inequality.
The graph of \( y < 6 \) is dashed and is not included in the graph of the solution.

The graph of \( y > x + 3 \) is also dashed and is not included in the graph of the solution.

The solution of the system is the set of ordered pairs in the intersection of the graphs of \( y < 6 \) and \( y > x + 3 \). Overlay the graphs and locate the green region. This is the intersection.

The solution region is shaded in the graph below.
11. \( y \geq 0 \)
    \( y \leq x - 5 \)

   **SOLUTION:**
   Graph each inequality. The graph of \( y \geq 0 \) is solid and is included in the graph of the solution. The graph of \( y \leq x - 5 \) is also solid and is included in the graph of the solution. The solution of the system is the set of ordered pairs in the intersection of the graphs of \( y \geq 0 \) and \( y \leq x - 5 \). The solution region is the darkest shaded area in the graph below.

   ![Graph of inequalities](image)

12. \( y \leq x + 10 \)
    \( y > 6x + 2 \)

   **SOLUTION:**
   Graph each inequality.
   The graph of \( y \leq x + 10 \) is solid and is included in the graph of the solution.

   ![Graph of inequalities](image)

   The graph of \( y > 6x + 2 \) is dashed and is not included in the graph of the solution.

   ![Graph of inequalities](image)

   The solution of the system is the set of ordered pairs in the intersection of the graphs of \( y \leq x + 10 \) and \( y > 6x + 2 \). Overlay the graphs and locate the green region. This is the intersection.
13. $y < 5x - 2$
   $y > -6x + 2$

**SOLUTION:**

Graph each inequality. The graph of $y < 5x - 2$ is dashed and is not included in the graph of the solution. The graph of $y > -6x + 2$ is also dashed and is included in the graph of the solution. The solution of the system is the set of ordered pairs in the intersection of the graphs of $y < 5x - 2$ and $y > -6x + 2$. The solution region is the darkest shaded area in the graph below.
14. \(2x - y \leq 6\)  
\(x - y \geq -1\)

**SOLUTION:**
Graph each inequality. The graph of \(2x - y \leq 6\) is solid and is included in the graph of the solution. The graph of \(x - y \geq -1\) is also solid and is included in the graph of the solution. The solution of the system is the set of ordered pairs in the intersection of the graphs of \(2x - y \leq 6\) and \(x - y \geq -1\). The solution region is the darkest shaded area in the graph below.

![Graph of 2x - y ≤ 6 and x - y ≥ -1](image)

15. \(3x - y > -5\)  
\(5x - y < 9\)

**SOLUTION:**
Graph each inequality. The graph of \(3x - y > -5\) is dashed and is not included in the graph of the solution. The graph of \(5x - y < 9\) is also dashed and is not included in the graph of the solution. The solution of the system is the set of ordered pairs in the intersection of the graphs of \(3x - y > -5\) and \(5x - y < 9\). The solution region is the darkest shaded area in the graph below.

![Graph of 3x - y > -5 and 5x - y < 9](image)
6-6 Systems of Inequalities

16. \( y \geq x + 10 \)
   \( y \leq x - 3 \)

**SOLUTION:**
Graph each inequality. The graph of \( y \geq x + 10 \) is solid. The graph of \( y \leq x - 3 \) is also solid. The solution of the system is the set of ordered pairs in the intersection of the graphs of \( y \geq x + 10 \) and \( y \leq x - 3 \). This region is shaded in the graph below. Notice that the graphs do not intersect, so there is no solution.

17. \( y < 5x - 5 \)
   \( y > 5x + 9 \)

**SOLUTION:**
Graph each inequality. The graph of \( y < 5x - 5 \) is dashed and is not included in the graph of the solution. The graph of \( y > 5x + 9 \) is also dashed and is not included in the graph of the solution. The solution of the system is the set of ordered pairs in the intersection of the graphs of \( y < 5x - 5 \) and \( y > 5x + 9 \). This region is shaded in the graph below. Notice that the graphs do not intersect, so there is no solution.
18. \( y \geq 3x - 5 \)
\( 3x - y \geq -4 \)

**SOLUTION:**
Graph each inequality.
The graph of \( y \geq 3x - 5 \) is solid and is included in the graph of the solution.

The graph of \( 3x - y \geq -4 \) is dashed and is not included in the graph of the solution.

The solution of the system is the set of ordered pairs in the intersection of the graphs of \( y \geq 3x - 5 \) and \( 3x - y \geq -4 \).
Overlay the graphs and locate the green region. This is the intersection.

The solution region is shaded in the graph below.
19. \(4x + y > -1\)
\(y < -4x + 1\)

**SOLUTION:**

Graph each inequality.

The graph of \(4x + y > -1\) is dashed and is not included in the graph of the solution.

The graph of \(y < -4x + 1\) is also dashed and is not included in the graph of the solution.

The solution of the system is the set of ordered pairs in the intersection of the graphs of \(4x + y > -1\) and \(y < -4x + 1\).

Overlay the graphs and locate the green region. This is the intersection.

The solution region is shaded in the graph below.

20. \(3x - y \geq -2\)
6-6 Systems of Inequalities

\[ y < 3x + 4 \]

**SOLUTION:**

Graph each inequality.

The graph of \(3x - y \geq -2\) is solid.

The graph of \(y < 3x + 4\) is dashed and is not included in the graph of the solution.

Because the lines are parallel and the solution of the system must satisfy \(3x - y \geq -2\) and \(y < 3x + 4\), the line \(3x - y \geq -2\) is included in the solution. The solution of the system is the set of ordered pairs in the intersection of the graphs of \(3x - y \geq -2\) and \(y < 3x + 4\).

Overlay the graphs and locate the green region. This is the intersection.

The solution region is shaded in the graph below.
21. \( y > 2x - 3 \)
\( 2x - y \geq 1 \)

**SOLUTION:**
Graph each inequality.
The graph of \( y > 2x - 3 \) is dashed and is not included in the graph of the solution.

The graph of \( 2x - y \geq 1 \) is solid and is included in the graph of the solution.

The solution of the system is the set of ordered pairs in the intersection of the graphs of \( y > 2x - 3 \) and \( 2x - y \geq 1 \). Overlay the graphs and locate the green region. This is the intersection.

The solution region is shaded in the graph below.
6-6 Systems of Inequalities

22. \(5x - y < -6\)
   \(3x - y \geq 4\)

**SOLUTION:**

Graph each inequality.

The graph of \(5x - y < -6\) is dashed and is not included in the graph of the solution.

The graph of \(3x - y \geq 4\) is solid and is included in the graph of the solution.

The solution of the system is the set of ordered pairs in the intersection of the graphs of \(5x - y < -6\) and \(3x - y \geq 4\).

This region is shaded in the graph below.
23. \( x - y \leq 8 \)
\( y < 3x \)

**SOLUTION:**
Graph each inequality.
The graph of \( x - y \leq 8 \) is solid and is included in the graph of the solution.

![Graph of x - y ≤ 8](image1)

The graph of \( y < 3x \) is dashed and is not included in the graph of the solution.

![Graph of y < 3x](image2)

The solution of the system is the set of ordered pairs in the intersection of the graphs of \( x - y \leq 8 \) and \( y < 3x \).

![Solution of the system](image3)

This region is shaded in the graph below.
6-6 Systems of Inequalities

24. \(4x + y < -2\)
   \(y > -4x\)

**SOLUTION:**
Graph each inequality. The graph of \(4x + y < -2\) is dashed and is not included in the graph of the solution. The graph of \(y > -4x\) is also dashed and is not included in the graph of the solution. The solution of the system is the set of ordered pairs in the intersection of the graphs of \(4x + y < -2\) and \(y > -4x\). This region is shaded in the graph below. Notice that the graphs do not intersect, so there is no solution.
25. **ICE RINKS** Ice resurfacers are used for rinks of at least 1000 square feet and up to 17,000 square feet. The price ranges from as little as $10,000 to as much as $150,000.

a. Define the variables, and write a system of inequalities to represent this situation. Then graph the system.

b. Name one possible solution.

c. Is (15,000, 30,000) a solution? Explain.

**SOLUTION:**

a. Let \( x \) represent square footage of the rink. Let \( y \) represent the price of the resurfacing. \( 10,000 \leq p \leq 150,000; \ 1000 \leq f \leq 17,000 \).

b. Sample answer: an ice resurfacer for a rink of 5000 ft\(^2\) and a price of $20,000

c. Yes. The point (15,000, 30,000) satisfies each inequality.
26. **CCSS MODELING** Josefina works between 10 and 30 hours per week at a pizzeria. She earns $6.50 an hour, but can earn tips when she delivers pizzas.

   a. Write a system of inequalities to represent the dollars \(d\) she could earn for working \(h\) hours in a week.

   \[
   \begin{align*}
   d &\geq 6.50h \\
   10 &\leq h \leq 30
   \end{align*}
   \]

   b. Graph this system.

   c. If Josefina received $17.50 in tips and earned a total of $180 for the week, how many hours did she work?

   **SOLUTION:**

   a. \(d \geq 6.50h\)
   
   b. 
   
   ![Graph of earnings versus hours]

   c. Because Josefina received $17.50 in tips, her hourly wages can be found by $180 – $17.50 = $162.50. Next, divide $162.50 by $6.50 per hour to determine how many hours she worked. $162.50 \div $6.50 = 25$, so Josefina worked for 25 hours.
6-6 Systems of Inequalities

Solve each system of inequalities by graphing.

27. \( x + y \geq 1 \)
   \( x + y \leq 2 \)

**SOLUTION:**

Graph each inequality.

The graph of \( x + y \geq 1 \) is solid and is included in the graph of the solution.

The graph of \( x + y \leq 2 \) is also solid and is included in the graph of the solution.

The solution of the system is the set of ordered pairs in the intersection of the graphs of \( x + y \geq 1 \) and \( x + y \leq 2 \).

This region is shaded in the graph below.
6-6 Systems of Inequalities

28. \(3x - y < -2\)
   \(3x - y < 1\)

**SOLUTION:**
Graph each inequality.
The graph of \(3x - y < -2\) is dashed and is not included in the graph of the solution.

The graph of \(3x - y < 1\) is also dashed and is not included in the graph of the solution.

The solution of the system is the set of ordered pairs in the intersection of the graphs of \(3x - y < -2\) and \(3x - y < 1\).

This region is shaded in the graph below.
29. $2x - y \leq -11$
   $3x - y \geq 12$

**SOLUTION:**
Graph each inequality.
The graph of $2x - y \leq -11$ is solid and is included in the graph of the solution.

The solution of the system is the set of ordered pairs in the intersection of the graphs of $2x - y \leq -11$ and $3x - y \geq 12$.

This region is shaded in the graph below.
30. \( y < 4x + 13 \)  
\( 4x - y \geq 1 \)  

**SOLUTION:**  
Graph each inequality.  
The graph of \( y < 4x + 13 \) is dashed and is not included in the graph of the solution.  

![Graph of \( y < 4x + 13 \)](image1)  
The graph of \( 4x - y \geq 1 \) is solid.  

![Graph of \( 4x - y \geq 1 \)](image2)  
Because the lines are parallel and the solution of the system must satisfy \( y < 4x + 13 \) and \( 4x - y \geq 1 \), the line \( 4x - y \geq 1 \) is included in the solution. Overlay the graphs and locate the green region. This is the intersection.  

![Graph of \( y < 4x + 13 \) and \( 4x - y \geq 1 \)](image3)  
The solution of the system is the set of ordered pairs in the intersection of the graphs of \( y < 4x + 13 \) and \( 4x - y \geq 1 \).  

The solution region is shaded in the graph below.  

![Shaded solution region](image4)
31. \(4x - y < -3\)
\(y \geq 4x - 6\)

**SOLUTION:**
Graph each inequality.
The graph of \(4x - y < -3\) is dashed and is not included in the graph of the solution.

The graph of \(y \geq 4x - 6\) is solid and is included in the graph of the solution.

The solution of the system is the set of ordered pairs in the intersection of the graphs of \(4x - y < -3\) and \(y \geq 4x - 6\). Overlay the graphs and locate the green region. This is the intersection.

The solution region is shaded in the graph below. Because the lines are parallel and the solution of the system must satisfy \(4x - y < -3\) and \(y \geq 4x - 6\), the line \(y \geq 4x - 6\) is not included in the solution.
6-6 Systems of Inequalities

32. \( y \leq 2x + 7 \)
\( y < 2x - 3 \)

**SOLUTION:**
Graph each inequality.
The graph of \( y \leq 2x + 7 \) is solid and is included in the graph of the solution.

The graph of \( y < 2x - 3 \) is dashed and is not included in the graph of the solution.

The solution of the system is the set of ordered pairs in the intersection of the graphs of \( y \leq 2x + 7 \) and \( y < 2x - 3 \). Overlay the graphs and locate the green region. This is the intersection.

The solution region is shaded in the graph below. Because the lines are parallel and the solution of the system must satisfy \( y \leq 2x + 7 \) and \( y < 2x - 3 \), the line \( y \leq 2x + 7 \) is not included in the solution.
33. \( y \geq -4x + 2 \)
\( y < 9x + 2 \)

**SOLUTION:**
Graph each inequality. The graph of \( y < 9x + 2 \) is dashed and is not included in the graph of the solution. The graph of \( y \geq -4x + 2 \) is solid and is included in the graph of the solution. The solution of the system is the set of ordered pairs in the intersection of the graphs of \( y \geq -4x + 2 \) and \( y \leq 9x + 2 \). The solution region is the darkest shaded area in the graph below.
34. \(2y \geq x\)
\(x - 3y > -6\)

**SOLUTION:**
Graph each inequality.
The graph of \(2y \geq x\) is solid and is included in the graph of the solution.

![Graph of 2y \geq x](image)

The graph of \(x - 3y > -6\) is dashed and is not included in the graph of the solution.

![Graph of x - 3y > -6](image)

The solution of the system is the set of ordered pairs in the intersection of the graphs of \(2y \geq x\) and \(x - 3y > -6\). Overlay the graphs and locate the green region. This is the intersection.

![Intersection of graphs](image)

The solution region is shaded in the graph below.

![Solution region shaded](image)
6-6 Systems of Inequalities

35. \( x - 5y > -15 \)
\[ 5y \geq x - 5 \]

**SOLUTION:**
Graph each inequality.
The graph of \( x - 5y > -15 \) is dashed and is not included in the graph of the solution.

![Graph of \( x - 5y > -15 \)](image)

The graph of \( 5y \geq x - 5 \) is solid and is included in the graph of the solution.

![Graph of \( 5y \geq x - 5 \)](image)

The solution of the system is the set of ordered pairs in the intersection of the graphs of \( x - 5y > -15 \) and \( 5y \geq x - 5 \). Overlay the graphs and locate the green region. This is the intersection.

![Solution region shaded graph](image)

The solution region is shaded in the graph below.

![Shaded solution region graph](image)

36. **CLASS PROJECT** An economics class formed a company to sell school supplies. They would like to sell at least
20 notebooks and 50 pens per week, with a goal of earning at least $60 per week.

**SOLUTION:**

a. Define the variables, and write a system of inequalities to represent this situation.

b. Graph the system.

c. Name one possible solution.

**SOLUTION:**

a. Let \( n \) = the number of notebooks and \( p \) = the number of pens; \( n \geq 20, p \geq 50, 2.50n + 1.25p \geq 60.\)

b. Sample answer: 25 notebooks and 100 pens
6-6 Systems of Inequalities
37. **FINANCIAL LITERACY** Opal makes $15 per hour working for a photographer. She also coaches a competitive soccer team for $10 per hour. Opal needs to earn at least $90 per week, but she does not want to work more than 20 hours per week.

   a. Define the variables, and write a system of inequalities to represent this situation.

   b. Graph this system.

   c. Give two possible solutions to describe how Opal can meet her goals.

   d. Is (2, 2) a solution? Explain.

**SOLUTION:**

   a. Let \( x \) = the hours worked for the photographer, let \( y \) = the hours coaching, \( x + y \leq 20, 15x + 10y \geq 90 \).

   b. 

   ![Graph of Earnings vs. Hours of Photography](image)

   c. Sample answer: 6 hours at the photographer’s, 10 hours of coaching; 8 hours at the photographer’s, 10 hours of coaching.

   d. No. The point (2, 2) does not fall in the shaded region. She would not earn enough money.
38. **CHALLENGE** Create a system of inequalities equivalent to $|x| \leq 4$.

**SOLUTION:**
You learned in Lesson 5-5 that the inequality $|x| \leq 4$ means that the distance between $x$ and 0 is less than or equal to 4. On a number line this would be the numbers between -4 and 4 inclusive, as shown below.

![Number Line](image)

Using a pair of linear equations, this would be shown as all the points between the lines $x = -4$ and $x = 4$. This could be expressed by the system of equations $x \leq 4$ and $x \geq -4$.

39. **REASONING** State whether the following statement is sometimes, always, or never true. Explain your answer with an example or counterexample.

*Systems of inequalities with parallel boundaries have no solutions.*

**SOLUTION:**
The following system of equations have parallel boundaries and have no solution since the shaded regions do not overlap.

$2x - y > 3$ and $2x - y < -1$

![Graph](image)

However, the system given by $y \leq 3$ and $y \leq -2$ also have parallel boundaries but the solution will contain an infinite number of points as one of the shaded regions completely overlaps the other.

![Graph](image)

The solution would be all the points such that $y \leq -2$.

Therefore, it is sometimes true that systems with parallel boundaries have no solution. It is also possible that the solution could be one of the regions determined by the parallel boundaries.
6-6 Systems of Inequalities

40. REASONING  Describe the graph of the solution of this system without graphing.

\[ \begin{align*}
6x - 3y &\leq -5 \\
6x - 3y &\geq -5
\end{align*} \]

**SOLUTION:**
Both inequalities have the same boundary line, which is included in the solution; however, they are shaded in different directions. So, the solution that satisfies both inequalities is only the line.

41. OPEN ENDED  One inequality in a system is \(3x - y > 4\). Write a second inequality so that the system will have no solution.

**SOLUTION:**
In order for the system to have no solution, the solution cannot overlap at all. Therefore, an inequality that would result in a system with no solution is \(3x - y < -4\).

42. CCSS PRECISION  Graph the system of inequalities. Estimate the area of the solution.

\[ \begin{align*}
y &\geq 1 \\
y &\leq x + 4 \\
y &\leq -x + 4
\end{align*} \]

**SOLUTION:**

To estimate the area, count up the total number of squares and half-squares. There are 6 whole squares and 6 half squares. \(6 + 6(0.5) = 9\). So, the area is \(9 \text{ units}^2\).
43. Jacui is beginning an exercise program that involves an intense cardiovascular workout. Her trainer recommends that for a person her age, her heart rate should stay within the following range as she exercises.

- It should be higher than 102 beats per minute.
- It should not exceed 174 beats per minute.

**WRITING IN MATH**  Explain what each colored region of the graph represents. Explain how shading in various colors can help to clearly show the solution set of a system of inequalities.

**SOLUTION:**
Sample answer: The yellow region represents the beats per minute below the target heart rate. The blue region represents the beats per minute above the target heart rate. The green region represents the beats per minute within the target heart rate. Shading in different colors clearly shows the overlapping solution set of the system of inequalities.
6-6 Systems of Inequalities

44. EXTENDED RESPONSE To apply for a scholarship, you must have a minimum of 20 hours of community service and a grade–point average of at least 3.75. Another scholarship requires at least 40 hours of community service and a minimum grade–point average of 3.0.

a. Write a system of inequalities to represent the credentials you must have to apply for both scholarships.

b. Graph the system of inequalities.

c. If you are eligible for both scholarships, give one possible solution.

\textbf{SOLUTION:}

\textbf{a.} \( c \geq 20 \) and \( g \geq 3.75 \)
\( c \geq 40 \) and \( g \geq 3.0 \)

\textbf{b.}

\begin{center}
\includegraphics[width=0.5\textwidth]{scholarship_graph.png}
\end{center}

c. Sample answer: 40 community service hours and a 3.75 grade points average
45. **GEOMETRY**  What is the measure of $\angle 1$?

![Diagram with angles 25°, 1, and 62°]

A  83°
B  87°
C  90°
D  93°

**SOLUTION:**

The three angles add up 180° because it is a straight line. Let $m$ = the measure of $\angle 1$.

\[
\begin{align*}
180 &= 25 + m + 62 \\
180 &= 87 + m \\
180 - 87 &= 87 + m - 87 \\
93 &= m
\end{align*}
\]

So, the correct choice is D.
6-6 Systems of Inequalities

46. **GEOMETRY**  What is the volume of the triangular prism?

![Triangular Prism Diagram]

- F 120 cm$^3$
- G 96 cm$^3$
- H 48 cm$^3$
- J 30 cm$^3$

**SOLUTION:**
To find the volume of the triangular prism use the formula:

\[
V = \frac{1}{2} bh\ell
\]

\[
= \frac{1}{2} (3)(4)(8)
\]

\[= 48\]

So, the correct choice is H.
47. Ten pounds of fresh tomatoes make about 15 cups of cooked tomatoes. How many cups of cooked tomatoes does one pound of fresh tomatoes make?

A 1 \frac{1}{2} cups

B 3 cups

C 4 cups

D 5 cups

**SOLUTION:**
Let \( x \) represent the number of cups of cooked tomatoes.

\[
\frac{10}{15} = \frac{1}{x}
\]
\[
10x = 1(15)
\]
\[
10x = 15
\]
\[
\frac{10x}{10} = \frac{15}{10}
\]
\[
x = \frac{3}{2}
\]

One pound of fresh tomatoes will make \( 1 \frac{1}{2} \) cups of cooked tomatoes.

So, the correct choice is A.
6-6 Systems of Inequalities

48. CHEMISTRY Orion Labs needs to make 500 gallons of 34% acid solution. The only solutions available are a 25% acid solution and a 50% acid solution. Write and solve a system of equations to find the number of gallons of each solution that should be mixed to make the 34% solution.

**SOLUTION:**
The total amount of acid is 34% of 500 = 170. The acid is 25% of one solution \(x\) and 50% of another \(y\). So, one equation is \(0.25x + 0.5y = 170\).

The total number of gallons is 500, which is the sum of the solutions. Therefore, the second equation is \(x + y = 500\).

\[
\begin{align*}
x + y &= 500 & \text{Equation 1} \\
x + y - y &= 500 - y \\
x &= 500 - y
\end{align*}
\]

Substitute into equation 2.

\[
\begin{align*}
0.25x + 0.5y &= 170 & \text{Equation 2} \\
0.25(500 - y) + 0.5y &= 170 & \text{Substitution} \\
125 - 0.25y + 0.5y &= 170 \\
125 + 0.25y &= 170 \\
125 - 125 + 0.25y &= 170 - 125 \\
0.25y &= 45 \\
\frac{0.25y}{0.25} &= \frac{45}{0.25} \\
y &= 180
\end{align*}
\]

Substitute 180 for \(y\) in either equation to find the value of \(x\).

\[
\begin{align*}
x + y &= 500 & \text{Equation 1} \\
x + 180 &= 500 \\
x + 180 - 180 &= 500 - 180 \\
x &= 320
\end{align*}
\]

320 gal of the 25% solution and 180 gal of the 50% solution should be mixed to make the 34% solution.
6-6 Systems of Inequalities

Use elimination to solve each system of equations.

49. \(x + y = 7\)
   \(2x + y = 11\)

**SOLUTION:**
Multiply equation 2 by \(-1\), then solve by elimination using addition.

\[
\begin{align*}
x + y &= 7 & \text{Equation 1} \\
(+) -2x - y &= -11 \\
- x &= -4 & \text{Add.} \\
-1(-x) &= -1(-4) & \text{Multiply.} \\
x &= 4 & \text{Simplify.}
\end{align*}
\]

Substitute in either equation and solve for \(y\).

\[
\begin{align*}
x + y &= 7 & \text{Equation 1} \\
4 + y &= 7 \\
4 - 4 + y &= 7 - 4 \\
y &= 3
\end{align*}
\]

The solution is (4, 3).

50. \(a - b = 9\)
   \(7a + b = 7\)

**SOLUTION:**

\[
\begin{align*}
a - b &= 9 & \text{Equation 1} \\
(+) 7a + b &= 7 & \text{Equation 2} \\
8a &= 16 & \text{Add.} \\
\frac{8a}{8} &= \frac{16}{8} & \text{Divide.} \\
a &= 2 & \text{Simplify.}
\end{align*}
\]

Substitute into either equation and solve for \(b\).

\[
\begin{align*}
a - b &= 9 & \text{Equation 1} \\
2 - b &= 9 \\
2 - 2 - b &= 9 - 2 \\
- b &= 7 \\
-1(-b) &= -1(7) \\
b &= -7
\end{align*}
\]

The solution is (2, -7).
51. \( q + 4r = -8 \)
\( 3q + 2r = 6 \)

**SOLUTION:**
First, multiply the second equation by \(-2\).
\[
\begin{align*}
q + 4r &= -8 & \text{Equation 1} \\
3q + 2r &= 6 & \text{Multiply by } -2 \\
\end{align*}
\]

\[
\begin{align*}
-5q &= -20 \\
q &= 4 \\
\end{align*}
\]

Substitute into either equation and solve for \( r \).
\[
\begin{align*}
q + 4r &= -8 & \text{Equation 1} \\
4 + 4r &= -8 \\
4 - 4 + 4r &= -8 - 4 \\
4r &= -12 \\
\frac{4r}{4} &= \frac{-12}{4} \\
r &= -3 \\
\end{align*}
\]

The solution is \((4, -3)\).
52. ENTERTAINMENT A group of 11 adults and children bought tickets for the baseball game. If the total cost was $156, how many of each type of ticket did they buy?

**SOLUTION:**
Let \( x \) represent the number of adult tickets and \( y \) represent the number of children’s tickets.

\[
\begin{align*}
x + y &= 11 \\
n15x + 12y &= 156
\end{align*}
\]

Notice that if you multiply the first equation by 12, the \( y \)-terms are the same, so subtract the equations.

\[
\begin{align*}
15x + 12y &= 156 \\
(-) 15x + 12y &= 156 \\
-3x &= -24 \\
x &= 8
\end{align*}
\]

Now, substitute 8 in for \( x \) into either equation and solve for \( y \).

\[
\begin{align*}
x + y &= 11 \\
8 + y &= 11 \\
y &= 3
\end{align*}
\]

So, 8 adult tickets and 3 children’s tickets were purchased.
6-6 Systems of Inequalities

Graph each inequality.
53. \(4x - 2 \geq 2y\)

**SOLUTION:**
Solve for \(y\) in terms of \(x\).

\[
\frac{4x - 2}{2} \geq \frac{2y}{2}
\]

\[2x - 1 \geq y\]

Because the inequality involves \(\geq\), graph the boundary using a solid line. Choose \((0, 0)\) as a test point.

\[2(0) - 1 \geq 0\]

\[-1 \not\geq 0\]
Since \(-1\) is not greater than or equal to 0, shade the half-plane that does not contain \((0, 0)\).
6-6 Systems of Inequalities

54. $9x - 3y < 0$

**SOLUTION:**
Solve for $y$ in terms of $x$.

$9x - 3y < 0$

$9x - 3y + 3y < 0 + 3y$

$9x < 3y$

$\frac{9x}{3} < \frac{3y}{3}$

$3x < y$

Because the inequality involves $<$, graph the boundary using a dashed line. Choose $(1, 1)$ as a test point.

$3(1) < 1$

$3 < 1$

Since 3 is not less than 01 shade the half-plane that does not contain $(1, 1)$. 

![Graph of the inequality $3x < y$ with the boundary graphed as a dashed line and the half-plane that does not contain $(1, 1)$ shaded.](image-url)
55. \(2y \leq -4x - 6\)

**SOLUTION:**
Solve for \(y\) in terms of \(x\).
\[
\frac{2y}{2} \leq \frac{-4x - 6}{2}
\]
\[
y \leq -2x - 3
\]
Because the inequality involves \(\leq\), graph the boundary using a solid line. Choose \((0, 0)\) as a test point.
\[
0 \leq -2(0) - 3
\]
\[
0 \leq -3
\]
Since 0 is not less than or equal to -3, shade the half-plane that does not contain \((0, 0)\).

![Graph of the inequality](image)

**Evaluate each expression.**

56. \(3^3\)

**SOLUTION:**
\[
3^3 = 3 \cdot 3 \cdot 3
\]
\[
= 27
\]

57. \(2^4\)

**SOLUTION:**
\[
2^4 = 2 \cdot 2 \cdot 2 \cdot 2
\]
\[
= 16
\]

58. \((-4)^3\)

**SOLUTION:**
\[
(-4)^3 = (-4) \cdot (-4) \cdot (-4)
\]
\[
= -64
\]