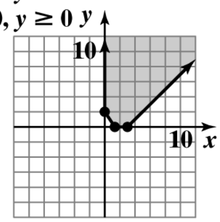
Now consider the inequalities $x \geq 0$ and $y \geq 0$. The inequalities mean that both x and y will be positive. This means that we only need to consider quadrant I.

Next, graph each of the inequalities. The solution to the system is the intersection of the shaded half-planes.

$3x + 2y \geq 4$
$x - y \leq 3$
$x \geq 0, y \geq 0$



53. $2x - y > 2$
$2x - y < -2$

First consider $2x - y > 2$. Replace the inequality symbol with an equal sign and we have $2x - y = 2$. Solve for y to obtain slope-intercept form.

$$2x - y = 2$$
$$-y = -2x + 2$$
$$y = 2x - 2$$

y–intercept = –2 slope = 2

Now, use the origin as a test point.

$$2x - y > 2$$
$$2(0) - 0 > 2$$
$$0 > 2$$

This is a false statement. This means that the point $(0,0)$ will not fall in the shaded half-plane.

Now consider $2x - y < -2$. Replace the inequality symbol with an equal sign and we have $2x - y = -2$. Solve for y to obtain slope-intercept form.

$$2x - y = -2$$
$$-y = -2x - 2$$
$$y = 2x + 2$$

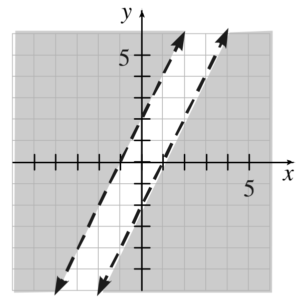
y–intercept = 2 slope = 2

Now, use the origin as a test point.

$$2x - y < -2$$
$$2(0) - 0 < -2$$
$$0 < -2$$

This is a false statement. This means that the point $(0,0)$ will not fall in the shaded half-plane.

Next, graph each of the inequalities. The solution to the system is the intersection of the shaded half-planes.

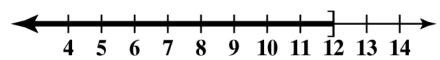


The graphs of the inequalities do not intersect, so there is no solution. The solution set is $\varnothing$ or $\{\ \}$.

Chapter 9 Test

1. $3(x+4) \geq 5x - 12$

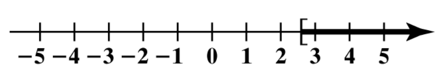
$$3x + 12 \geq 5x - 12$$
$$-2x + 12 \geq -12$$
$$-2x \geq -24$$
$$\frac{-2x}{-2} \leq \frac{-24}{-2}$$
$$x \leq 12$$



The solution set is $(-\infty, 12]$.

2. $\frac{x}{6} + \frac{1}{8} \leq \frac{x}{2} - \frac{3}{4}$

$$24\left(\frac{x}{6}\right) + 24\left(\frac{1}{8}\right) \leq 24\left(\frac{x}{2}\right) - 24\left(\frac{3}{4}\right)$$
$$4x + 3 \leq 12x - 6(3)$$
$$4x + 3 \leq 12x - 18$$
$$-8x + 3 \leq -18$$
$$-8x \leq -21$$
$$\frac{-8x}{-8} \geq \frac{-21}{-8}$$
$$x \geq \frac{21}{8}$$



The solution set is $\left[\frac{21}{8}, \infty\right)$.

3. a. cost = fixed costs + variable cost

$C(x) = 60,000 + 200x$

b. revenue = price · quantity

$R(x) = 450x$

c. profit = revenue − cost

$$P(x) = R(x) - C(x)$$
$$= 450x - (60,000 + 200x)$$
$$= 450x - 60,000 - 200x$$
$$= 250x - 60,000$$

d.
$$P(x) > 0$$
$$250x - 60,000 > 0$$
$$250x > 60,000$$
$$x > 240$$

More than 240 computer desks need to be produced and sold to make a profit.

4. $\{2,4,6,8,10\} \cap \{4,6,12,14\} = \{4,6\}$

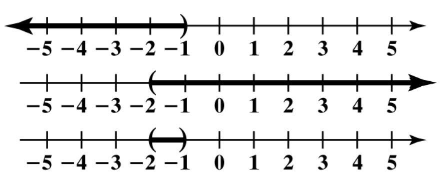
5. $\{2,4,6,8,10\} \cup \{4,6,12,14\}$

$= \{2,4,6,8,10,12,14\}$

6. $2x + 4 < 2$ and $x - 3 > -5$

$2x < -2$ $\quad$ $x > -2$

$x < -1$

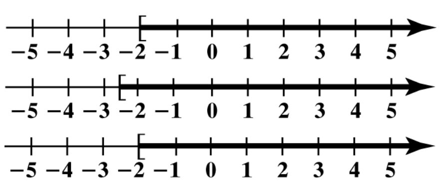


The solution set is $(-2,-1)$.

7. $x + 6 \geq 4$ and $2x + 3 \geq -2$

$x \geq -2$ $\quad$ $2x \geq -5$

$x \geq -\frac{5}{2}$

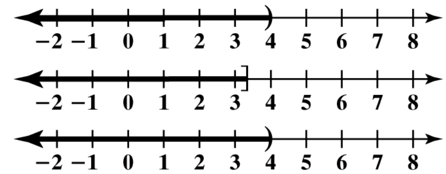


The solution set is $[-2,\infty)$.

8. $2x - 3 < 5$ or $3x - 6 \leq 4$

$2x < 8$ $\quad$ $3x \leq 10$

$x < 4$ $\quad$ $x \leq \frac{10}{3}$

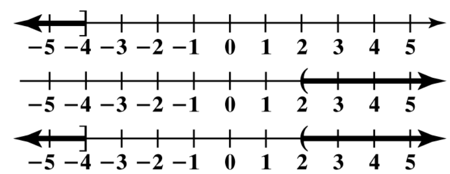


The solution set is $(-\infty,4)$.

9. $x + 3 \leq -1$ or $-4x + 3 < -5$

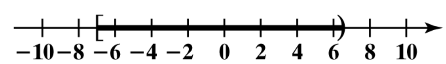
$x \leq -4$ $\quad$ $-4x < -8$

$x > 2$



The solution set is $(-\infty,-4] \cup (2,\infty)$.

10.
$$-3 \leq \frac{2x+5}{3} < 6$$
$$3(-3) \leq 3\left(\frac{2x+5}{3}\right) < 3(6)$$
$$-9 \leq 2x + 5 < 18$$
$$-9 - 5 \leq 2x + 5 - 5 < 18 - 5$$
$$-14 \leq 2x < 13$$
$$-7 \leq x < \frac{13}{2}$$



The solution set is $\left[-7,\frac{13}{2}\right)$.

11. $|5x + 3| = 7$

$5x + 3 = 7$ or $5x + 3 = -7$

$5x = 4$ $\quad$ $5x = -10$

$x = \frac{4}{5}$ $\quad$ $x = -2$

The solutions are -2 and $\frac{4}{5}$ and the solution set is $\left\{-2,\frac{4}{5}\right\}$.

12. $|6x+1| = |4x+15|$

$$6x+1 = 4x+15$$
$$2x+1 = 15$$
$$2x = 14$$
$$x = 7$$

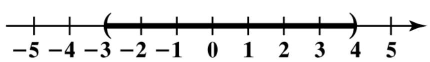
or

$$6x+1 = -(4x+15)$$
$$6x+1 = -4x-15$$
$$10x+1 = -15$$
$$10x = -16$$
$$x = -\frac{16}{10} = -\frac{8}{5}$$

The solutions are $-\frac{8}{5}$ and 7 and the solution set is $\left\{-\frac{8}{5}, 7\right\}$.

13. $|2x-1| < 7$

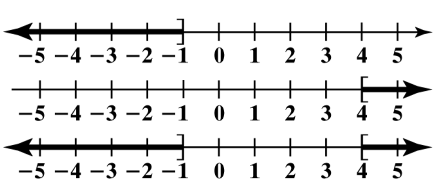
$$-7 < 2x-1 < 7$$
$$-7+1 < 2x-1+1 < 7+1$$
$$-6 < 2x < 8$$
$$-3 < x < 4$$



The solution set is $(-3, 4)$.

14. $|2x-3| \geq 5$

$$2x-3 \leq -5 \quad \text{or} \quad 2x-3 \geq 5$$
$$2x \leq -2 \qquad\qquad 2x \geq 8$$
$$x \leq -1 \qquad\qquad x \geq 4$$



The solution set is $(-\infty, -1] \cup [4, \infty)$.

15. $|b-98.6| > 8$

$$b-98.6 > -8 \quad \text{or} \quad b-98.6 > 8$$
$$b > 90.6 \qquad\qquad b > 106.6$$

Interval notation: $(-\infty, 90.6) \cup (106.6, \infty)$

Hypothermia occurs when the body temperature is below $90.6°F$ and hyperthermia occurs when the body temperature is over $106.6°F$.

16. $3x - 2y < 6$

First, find the intercepts to the equation $3x - 2y = 6$.

Find the x–intercept by setting $y = 0$.

$$3x - 2y = 6$$
$$3x - 2(0) = 6$$
$$3x = 6$$
$$x = 2$$

Find the y–intercept by setting $x = 0$.

$$3x - 2y = 6$$
$$3(0) - 2y = 6$$
$$-2y = 6$$
$$y = -3$$

Next, use the origin as a test point.

$$3x - 2y < 6$$
$$3(0) - 2(0) < 6$$
$$0 < 6$$

This is a true statement. This means that the point will fall in the shaded half-plane.