Chapter 2 Linear Equations and Functions

Ex 2.8

Answer 1e.

We know that the graph of a linear inequality in two variables is the set all points in a coordinate plane that represents the solutions of the inequality. The boundary line divides the planes into two half-planes.

Thus, the graph of a linear inequality in two variables is a **half-plane**.

We know that an ordered pair (x, y) is a solution of a linear inequality in two variables if the inequality is true when the values of x and y are substituted into it.

In order determine whether $(0, -4)$ is a solution of the inequality, substitute 0 for x and -4 for y.

$$5(0) - 2(-4) \overset{?}{\leq} 6$$
$$8 \overset{?}{\leq} 6$$

The statement is false and thus $(0, -4)$ is not a solution.

Answer 1gp.

a. Let x be the total number of first type of flower and y be the total number of second type of flower bought.

We can spend a total of \$30. Cost of the first flower is \$2 each, and that of second is \$3 each. Thus, the total cost of x number of first flower is $2x$, and that of the second flower is $3y$.

The above data can be written as follows.

Cost of one flower of first type (in dollars)	·	Total number	+	Cost of one flower of second type (in dollars)	·	Total number	≤	Total amount of money you can spend (in dollars)
⇓		⇓		⇓		⇓		
2	·	x	+	3	·	y	≤	30

Thus, the inequality is $2x + 3y \leq 30$.

b. In order to graph the inequality, first graph the boundary line $2x + 3y = 30$.

Substitute 0 for y in the above equation and solve for x.

$$2x + 3(0) = 30$$
$$2x = 30$$
$$x = 15$$

The x-intercept is 15. Point to be plotted on the graph is (15, 0).

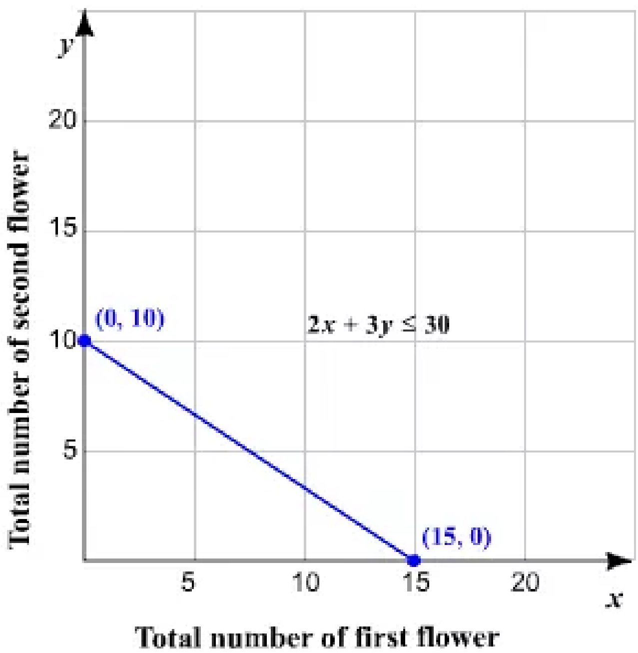
>

Now, replace x with 0 and solve for y.

$$2(0) + 3y = 30$$
$$3y = 30$$
$$x = 10$$

Since the y-intercept is 10, point to be plotted on the graph is (0, 10).

Plot the points (15, 0) and (0, 10) on the graph and draw a line passing through them. Since ≤ is the inequality sign used, draw a solid line.

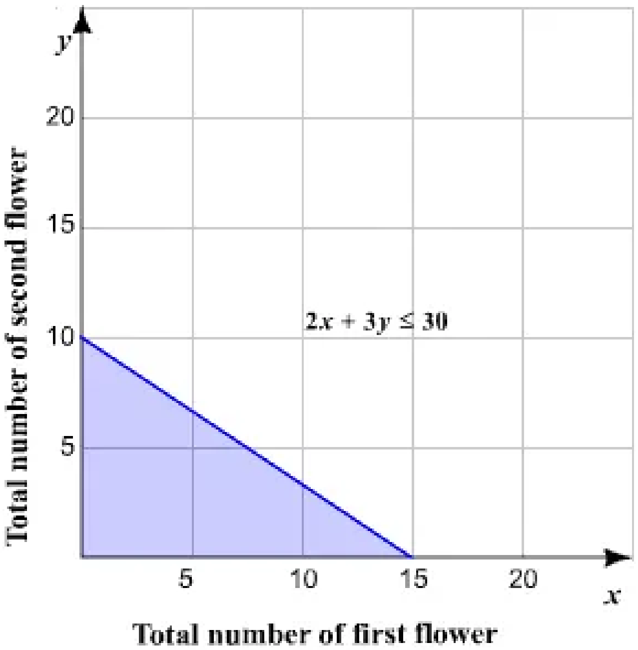


Let us take a test point (0, 0) which does not lie on the boundary line. Substitute 0 for y, and 0 for x. Check if the test point satisfies the given inequality.

$$2(0) + 3(0) \overset{?}{\leq} 30$$

$$0 \leq 30 \qquad \text{TRUE}$$

The inequality is true and thus the test point is a solution. Shade the half-plane that contains (0, 0).



c. Replace y with 5 in $2x + 3y \leq 30$.

$$2x + 3(5) \leq 30$$

Simplify.

$$2x + 15 \leq 30$$
$$2x \leq 15$$
$$2x \leq 15$$

Divide both the sides by 2.

$$\frac{2x}{2} \leq \frac{15}{2}$$
$$x \leq 7.5$$

Therefore, we can buy a maximum of 7 flowers of first type if we buy 5 flowers of second type.

Answer 1q.

We need to graph $y=|x+7|+4$.

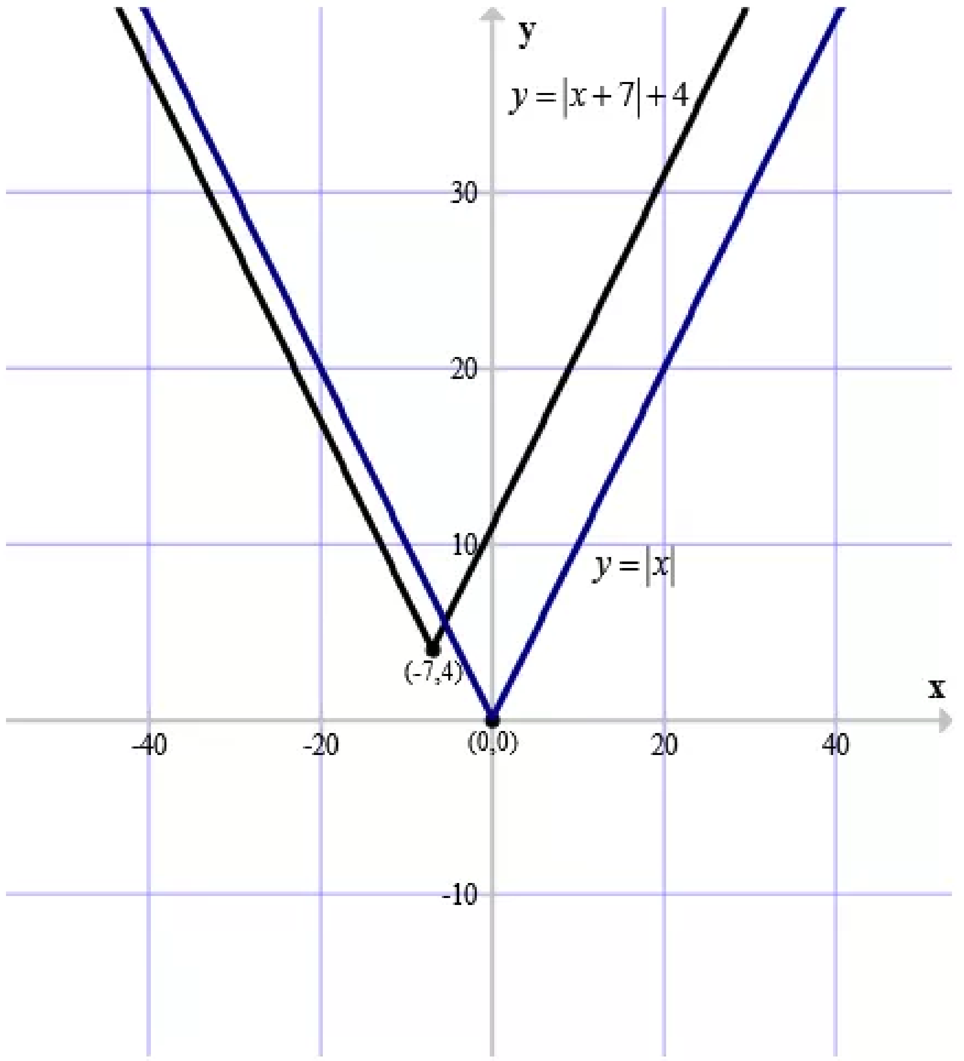
We have,

$$y=|x+7|+4$$

$$y=\begin{cases}(x+7)+4; x+7\geq 0\\ -(x+7)+4; x+7\leq 0\end{cases}$$

$$y=\begin{cases}x+11; x\geq -7\\ -x-3; x\leq -7\end{cases}$$

The graphs of $y=|x+7|+4$ and $y=|x|$ are as shown below.

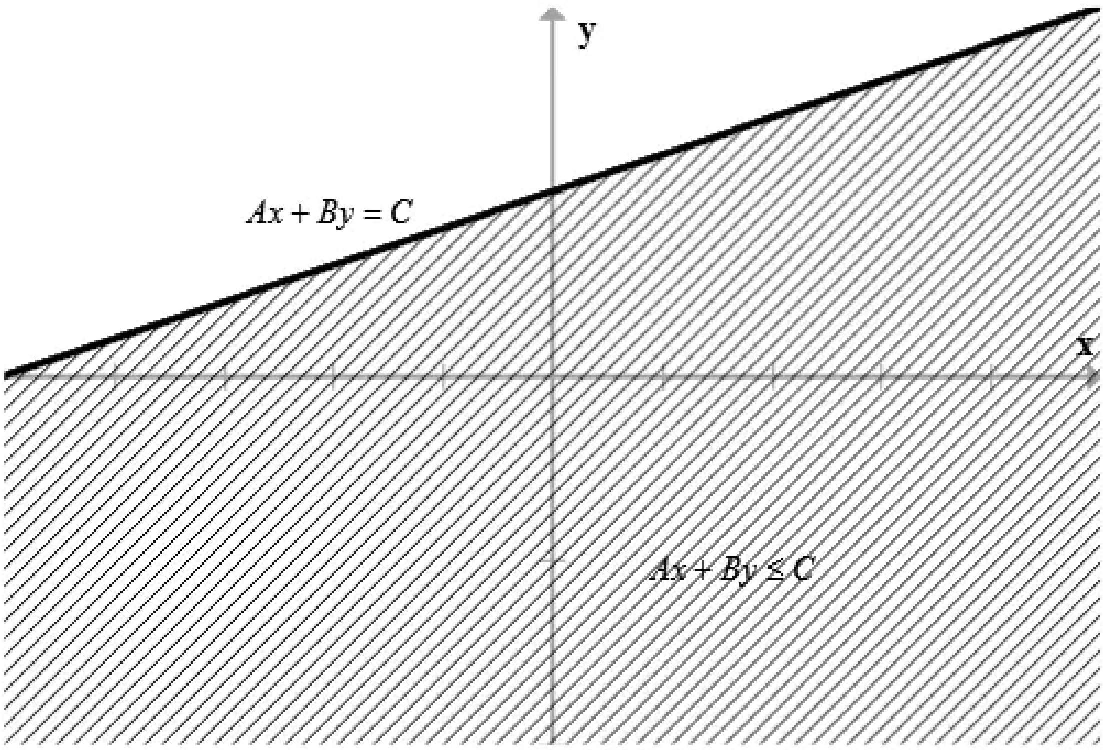


The graph of $y=|x+7|+4$ is the graph of $y=|x|$ translated up 4 units and left 7 units.

Answer 2e.

The graph of a linear inequality in two variables is the set of all points in a coordinate plane that represent solutions of the inequality. Therefore, the graph of a linear inequality in two variables is the half-plane whereas the graph of a linear equation in two variables is a straight line.

The graph of a linear equation $Ax+By=C$ and the graph of a liner inequality $Ax+By\le C$ are shown below.



Answer 2gp.

We need to check whether the ordered pair $(2,2)$ is a solution of $5x-2y\le 6$.

Substituting $x=2, y=2$ in the left hand side of the inequality $5x-2y\le 6$, we get

$$\begin{aligned}5(2)-2(2)&=10-4\\&=6\end{aligned}$$

Therefore, the ordered pair $(2,2)$ is a solution of $5x-2y\le 6$.

>

Answer 2mr.

(a)

Let the function be $y=a|x-h|+k$ where (h,k) is the vertex.

Here, the vertex is $(12.6, 24)$.

Substituting $h=12.6$ and $k=24$, we get

$$y=a|x-12.6|+(24)$$
$$y=a|x-12.6|+24$$

Again, the function passes through $(0,0)$. So, we can write

$$y = a|x - 12.6| + 24$$
$$0 = a|0 - 12.6| + 24$$
$$0 = a|-12.6| + 24$$
$$-24 = a(12.6)$$
$$a = -\frac{24}{12.6}$$

Hence, the function is

$$y = a|x - h| + k$$
$$y = \left(-\frac{24}{12.6}\right)|x - 12.6| + (24)$$
$$\boxed{y = \left(-\frac{24}{12.6}\right)|x - 12.6| + 24}$$

(b)
If the origin is shifted to the midpoint of the base, i.e., $(12.6, 0)$, then the vertex becomes $(0, 6)$.
Substituting $h = 0$ and $k = 6$, we get

$$y = a|x - 0| + (6)$$
$$y = a|x| + 6$$

Again, the function will pass through $(-12.6, 0)$. So, we can write

$$y = a|x| + 6$$
$$0 = a|-12.6| + 6$$
$$-6 = 12.6a$$
$$a = -\frac{6}{12.6}$$

Hence, the function is

$$y = a|x - h| + k$$
$$y = \left(-\frac{6}{12.6}\right)|x - 0| + (6)$$
$$\boxed{y = \left(-\frac{6}{12.6}\right)|x| + 6}$$

Answer 2q.

We need to graph $y=-2|x+10|-1$.

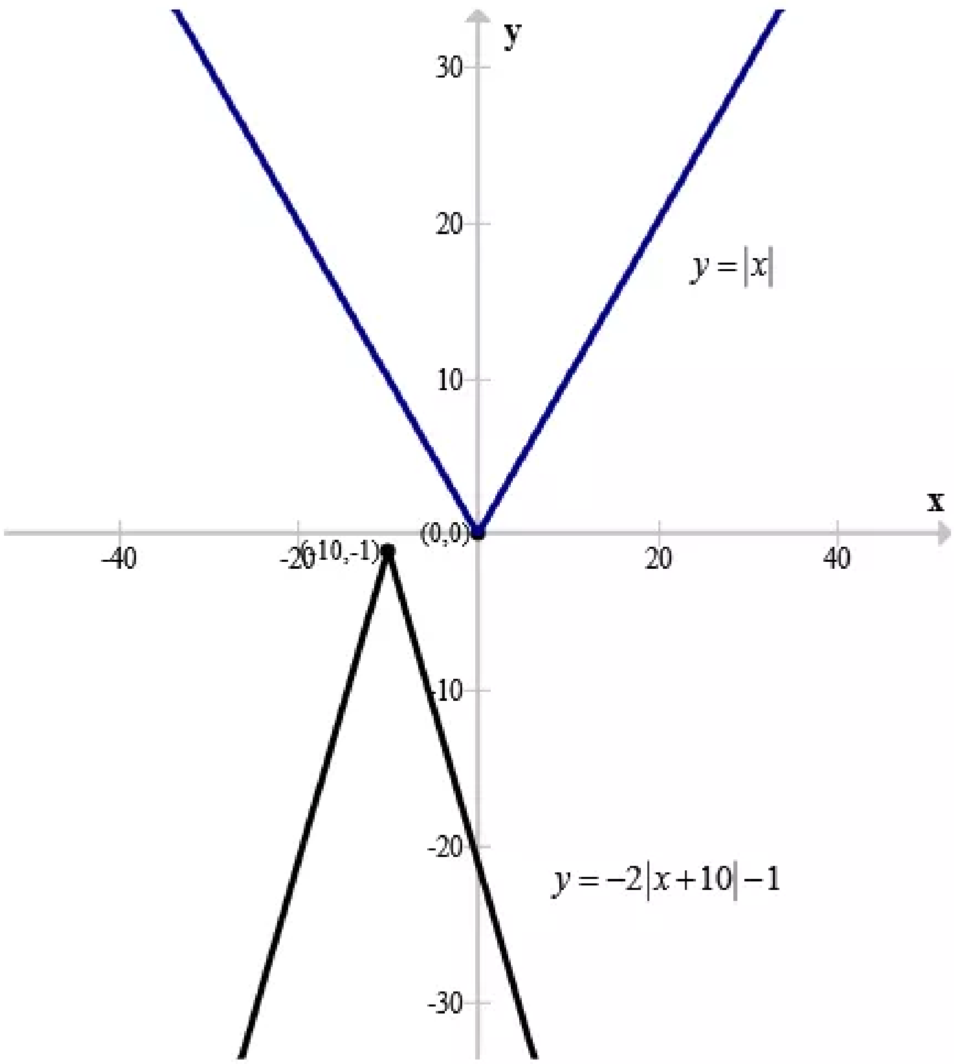
We have,

$$y=-2|x+10|-1$$

$$y=\begin{cases}-2(x+10)-1; x+10\geq 0\\ -2\{-(x+10)\}-1; x+10\leq 0\end{cases}$$

$$y=\begin{cases}-2x-21; x\geq -10\\ 2x+19; x\leq -10\end{cases}$$

The graphs of $y=-2|x+10|-1$ and $y=|x|$ are as shown below.



The graph of $y=-2|x+10|-1$ is the graph of $y=|x|$ translated down by 1 units and left by 10 units and the graph is vertically stretched by a factor of 2.

Answer 3e.

We know that an ordered pair (x, y) is a solution of a linear inequality in two variables if the inequality is true when the values of x and y are substituted into it.

In order determine whether (0, 10) is a solution of the inequality, substitute 0 for x.
$0 > -7$

The statement is true and thus (0, 10) is a solution.

Now, substitute −8 for x in the given inequality to check whether (−8, −5) is a solution.
$-8 > -7$

The statement is not true.
Therefore, (−8, −5) is not a solution of the given inequality.

Answer 3gp.

We know that an ordered pair (x, y) is a solution of a linear inequality if it is true for those values of x and y.

In order determine whether (−3, 8) is a solution of the inequality, substitute −3 for x and 8 for y.

$$\begin{aligned} 5x - 2y &\le 6 \\ 5(-3) - 2(8) &\overset{?}{\le} 6 \\ -15 - 16 &\overset{?}{\le} 6 \\ -31 &\le 6 \end{aligned}$$

The statement is true and thus (−3, 8) is a solution.

Answer 3mr.

We know that in a scatter plot, if y tends to increase as x increases, then the data will have a positive correlation. If y decreases with increase in x, then the data will have a negative correlation. If the points show no obvious pattern, then the data will have approximately no correlation.

In the given data, we can see that there is no specific pattern.

Thus, the data have approximately no correlation.

Answer 3q.

We need to graph $f(x) = \frac{1}{2}|x-1| - 5$.

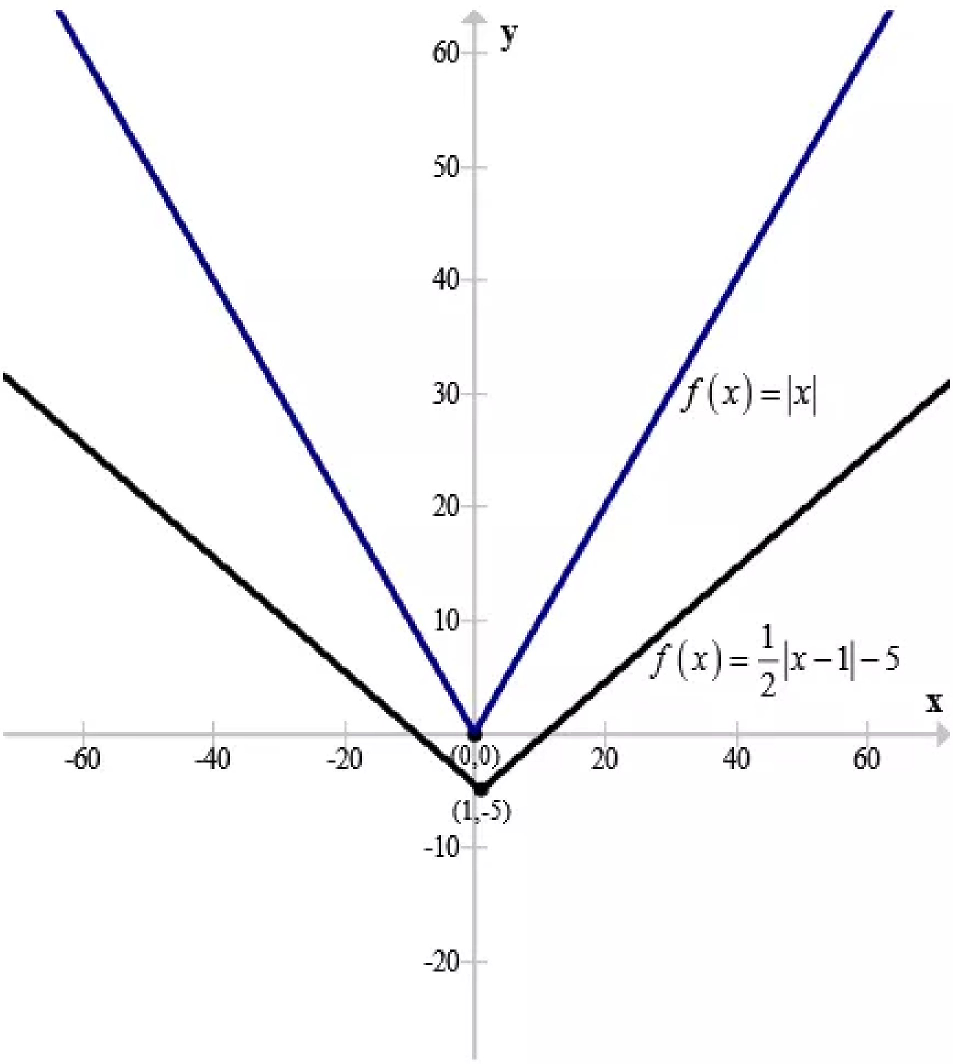
We have,

$$f(x)=\frac{1}{2}|x-1|-5$$

$$f(x)=\begin{cases}\frac{1}{2}(x-1)-5; x-1\geq 0\\ \frac{1}{2}\{-(x-1)\}-5; x-1\leq 0\end{cases}$$

$$f(x)=\begin{cases}\frac{1}{2}x-\frac{11}{2}; x\geq 1\\ -\frac{1}{2}x-\frac{9}{2}; x\leq 1\end{cases}$$

The graphs of $f(x)=\frac{1}{2}|x-1|-5$ and $f(x)=|x|$ are as shown below.



The graph of $f(x)=\frac{1}{2}|x-1|-5$ is the graph of $f(x)=|x|$ translated down by 5 units and right by 5 units and the graph is vertically shrunk by a factor of $\frac{1}{2}$.

Answer 4e.

We need to check whether the ordered pair $(3,2)$ is a solution of $y \le -5x$.

Substituting $x=3, y=2$ in the inequality $y \le -5x$, we get

$$2 \le -5(3)$$
$$2 \le -15$$

Thus, the result is not true. Therefore, the ordered pair $(3,2)$ is not a solution of $y \le -5x$.

We need to check whether the ordered pair $(-2,1)$ is a solution of $y \le -5x$.

Substituting $x=-2, y=1$ in the inequality $y \le -5x$, we get

$$1 \le -5(-2)$$
$$1 \le 10$$

Thus, the result is true. Therefore, the ordered pair $(-2,1)$ is a solution of $y \le -5x$.

Answer 4gp.

We need to check whether the ordered pair $(-1,-7)$ is a solution of $5x-2y \le 6$.

Substituting $x=-1, y=-7$ in the left hand side of the inequality $5x-2y \le 6$, we get

$$\begin{aligned} 5(-1)-2(-7) &= -5+14 \\ &= 9 \\ &> 6 \end{aligned}$$

Therefore, the ordered pair $(-1,-7)$ is not a solution of $5x-2y \le 6$.

Answer 4mr.

Let the linear inequality be $Ax+By<C$ whose solutions are $(1,-5)$ and $(7,-8)$.

Therefore, substituting $x=1, y=-5$ and $x=7, y=-8$ in the inequality $Ax+By<C$, we get

$$A-5B<C$$
$$7A-8B<C$$

Let us assume that $A=1, B=1$, then

$$-4<C$$
$$-1<C$$

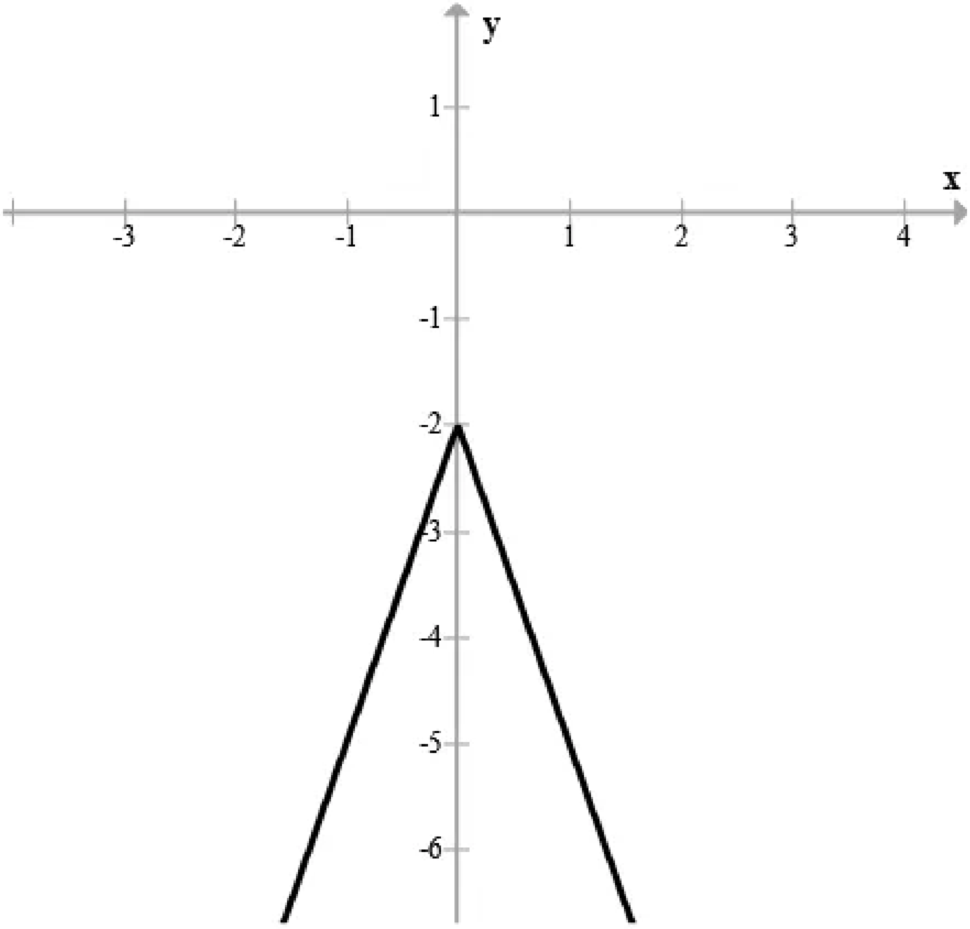
Let $C=1$.

Therefore, the inequality is

$$Ax+By<C$$
$$(1)x+(1)y<(1)$$
$$\boxed{x+y<1}$$

Answer 4q.

The given graph is shown below.



Since the graph is V-shaped, let the equation of the graph be $y = a|x-h|+k$ where (h,k) is the vertex of the graph.

The vertex of the given graph is $(0,-2)$.

Substituting $h=0$ and $k=-2$, we get

$$y = a|x-0|+(-1)$$
$$y = a|x|-1$$

Again, the graph passes through $(-1,-4)$. So, we can write

$$y = a|x|-1$$
$$-4 = a|-1|-1$$
$$-4 = a(1)-1$$
$$-4+1 = a$$
$$a = -3$$

Hence, the equation of the graph is

$$y = a|x-h|+k$$

$$y = (-3)|x-0|+(-1)$$

$$\boxed{y = -3|x|-1}$$

Answer 5e.

We know that an ordered pair (x, y) is a solution of a linear inequality in two variables if the inequality is true when the values of x and y are substituted into it.

In order determine whether (0, 4) is a solution of the inequality, substitute 0 for x, and 4 for y.

$$4 \overset{?}{\geq} -2(0)+4$$

$$4 \overset{?}{\geq} 4$$

The inequality is true and thus (0, 4) is a solution of the given inequality.

Now, substitute -1 for x, and 8 for y in the given inequality to check whether $(-1, 8)$ is a solution.

$$8 \overset{?}{\geq} -2(-1)+4$$

$$8 \overset{?}{\geq} 2+4$$

$$8 \overset{?}{\geq} 6$$

Since the inequality statement is not true, $(-1, 8)$ is not a solution of the given inequality.

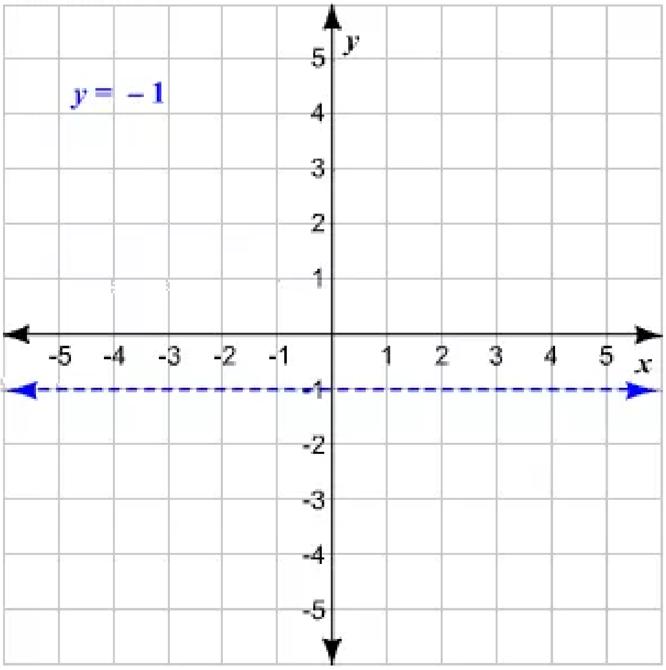
Answer 5gp.

STEP 1 **Graph the boundary line of the inequality.**

In order to obtain the boundary line, replace the inequality sign with = sign. Then, we get an equation of the form $y = c$ which is the equation of a horizontal line passing through $(0, c)$.

In this case, the value of c is -1. This means that $y = -1$ passes through $(0, -1)$.

Graph the boundary line $y = -1$. Since > is the inequality sign used, draw a dashed line.

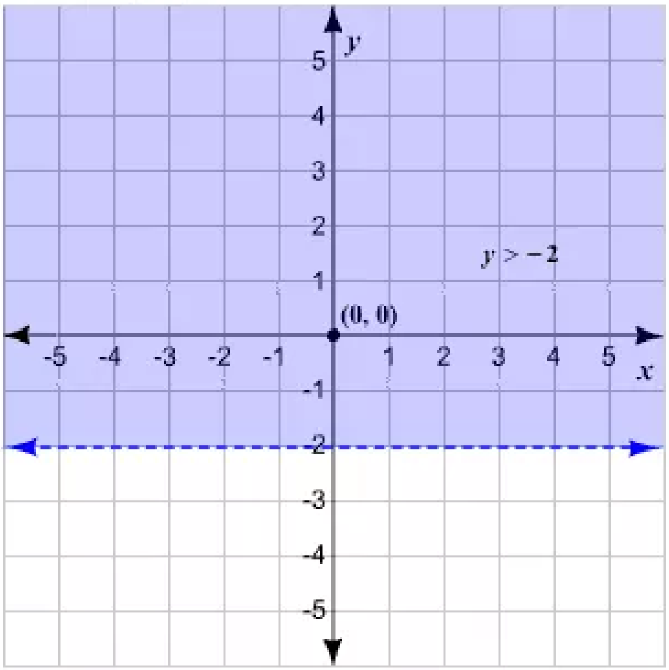


STEP 2 **Test a point.**

Let us take a test point (0, 0), which does not lie on the boundary line. Substitute 0 for y and check if the test point satisfies the given inequality.

$0 > -1$ TRUE

The test point is a solution of the inequality. Shade the half-plane that contains (0, 0).



Answer 5mr.

If the ratios of y to x are equal, then the data show direct variation.

Check whether the ratios of y to x are equal.

$$\frac{10.95}{1} = 10.95$$

$$\frac{21.90}{2} = 10.95$$

$$\frac{32.85}{3} = 10.95$$

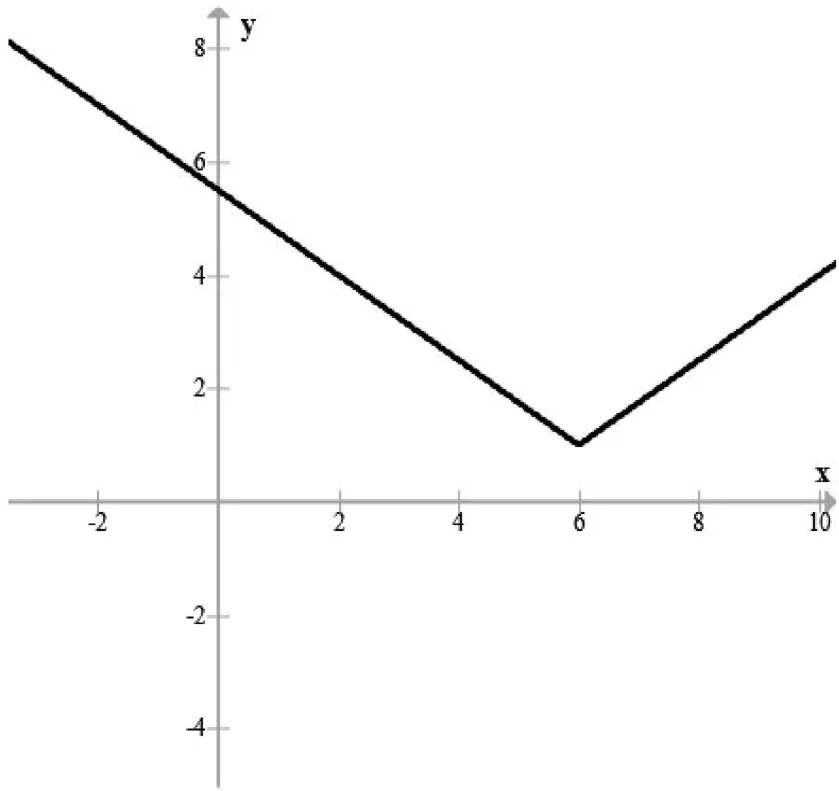
$$\frac{43.80}{4} = 10.95$$

$$\frac{54.75}{5} = 10.95$$

We get the same ratio for all values of x and y. The data shows direct variation.

Answer 5q.

The given graph is shown below.



Since the graph is V-shaped, let the equation of the graph be $y = a|x-h|+k$ where (h,k) is the vertex of the graph.

The vertex of the given graph is $(6,1)$.

Substituting $h=6$ and $k=1$, we get

$$y = a|x-6|+(1)$$

$$y = a|x-6|+1$$

Hence, the equation of the graph is

$$y = a|x-h|+k$$

$$y = \left(\frac{3}{4}\right)|x-6|+(1)$$

$$\boxed{y = \frac{3}{4}|x-6|+1}$$

Answer 6e.

We need to check whether the ordered pair $(0,0)$ is a solution of $2x-y<3$.

Substituting $x=0, y=0$ in the inequality $2x-y<3$, we get

$$2(0)-(0)<3$$
$$0-0<3$$
$$0<3$$

Thus, the result is true. Therefore, the ordered pair $(0,0)$ is a solution of $2x-y<3$.

We need to check whether the ordered pair $(2,-2)$ is a solution of $2x-y<3$.

Substituting $x=2, y=-2$ in the inequality $2x-y<3$, we get

$$2(2)-(-2)<3$$
$$4+2<3$$
$$6<3$$

Thus, the result is not true. Therefore, the ordered pair $(2,-2)$ is not a solution of $2x-y<3$.

Answer 6gp.

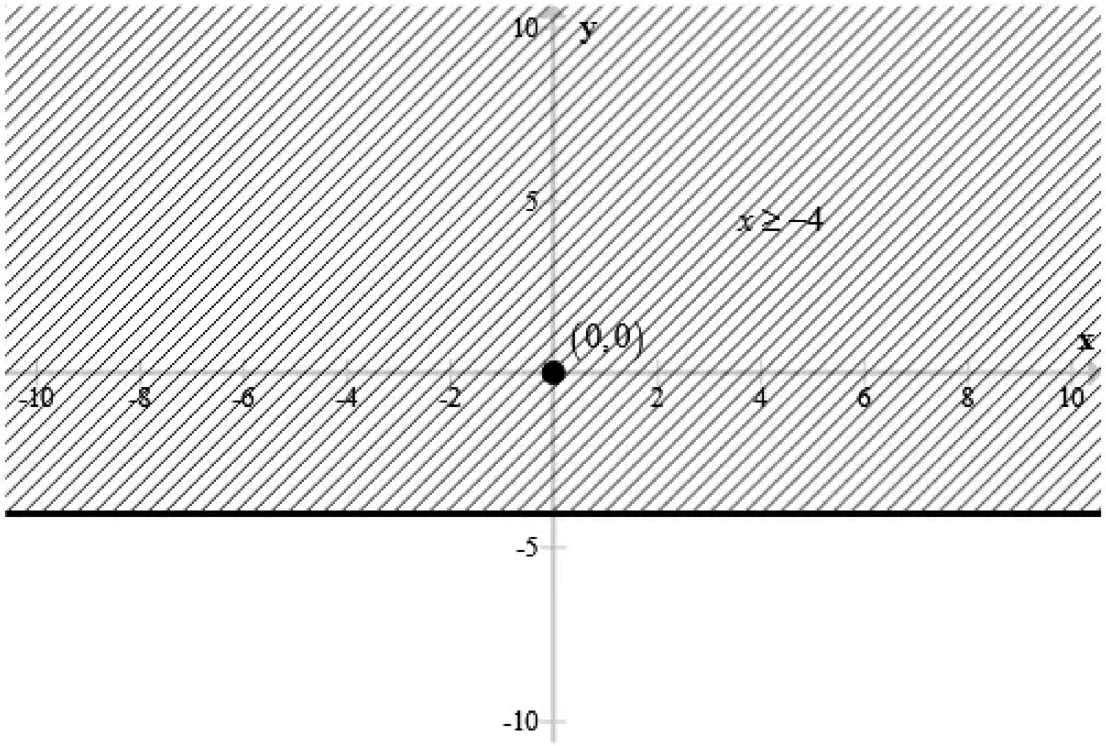
We need to graph the inequality $x \geq -4$.

We first graph the boundary line $x=-4$ using a solid line as the inequality symbol is $\geq$.

Let the test point be $(0,0)$. Substituting $x=0$ in the inequality $x \geq -4$,

$$0 \geq -4$$

Thus, the result is true. Therefore, $(0,0)$ is a solution of the inequality $x \geq -4$. Therefore, we shade the half-plane that contains $(0,0)$.



Answer 6mr.

Below is the table showing the number of daily newspaper and its circulation:

year	newspaper	Circulation(millions)
1900	2226	15.1
1920	2042	27.8
1940	1878	41.1
1960	1763	58.9
1980	1745	62.2
2000	1480	55.8

(a)

The scatter plot of the data since 1990, newspaper has been shown below in figure (1) .

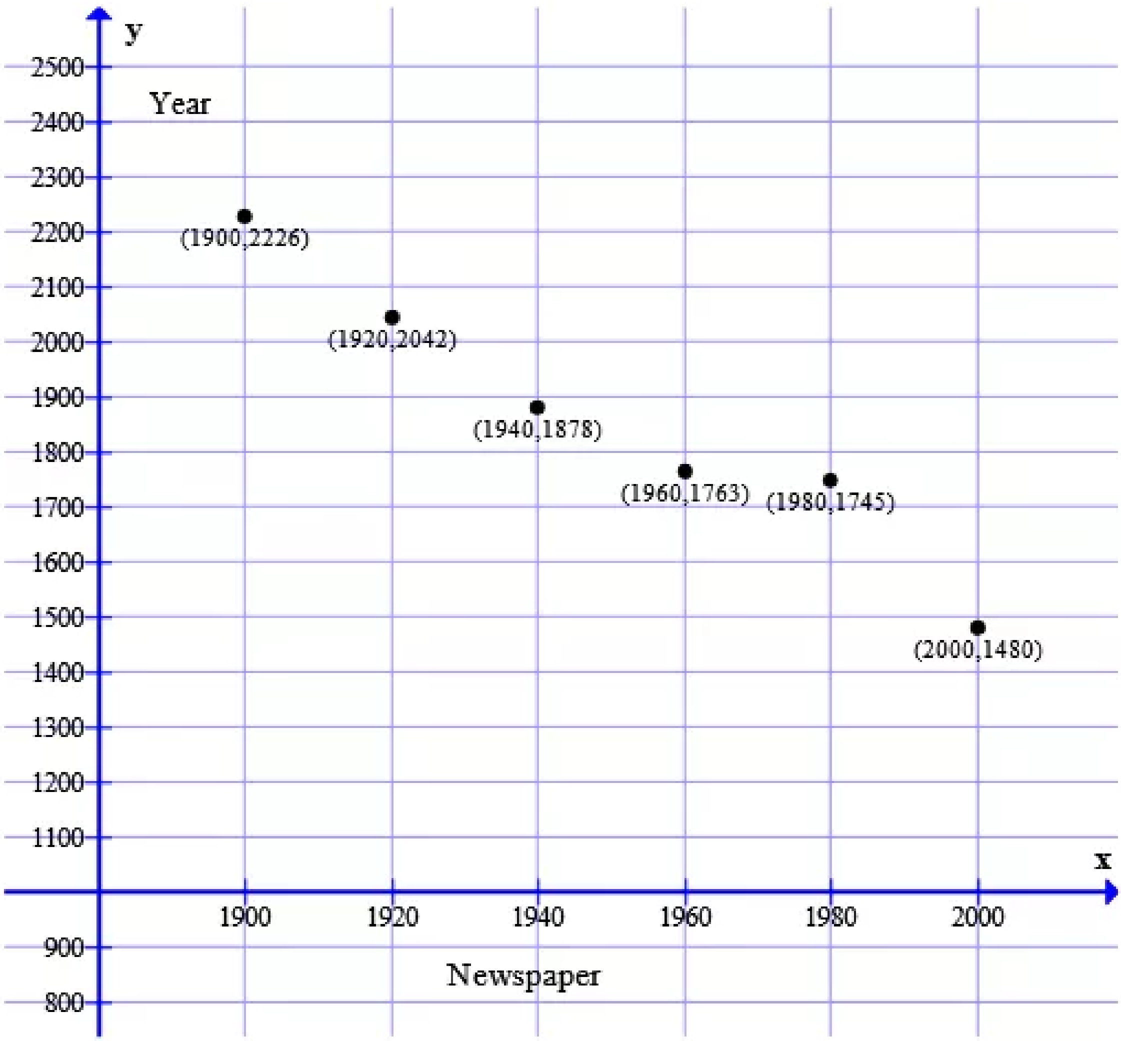


Figure (1)

(b)

The best fitting line for the scatter plot of the data since 1990, newspaper is shown below:

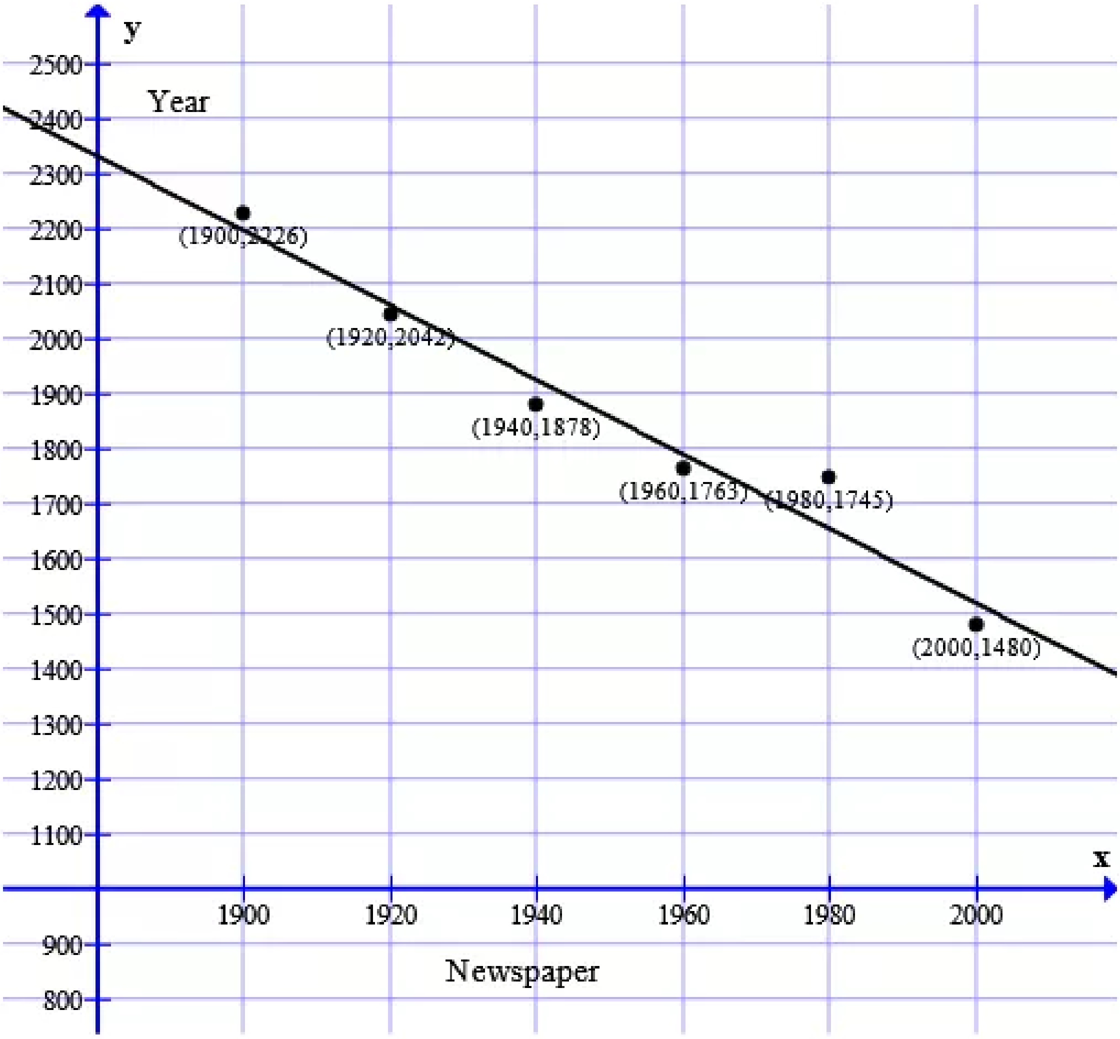


Figure (1)

(c)

The daily newspaper in 2020 can be evaluated as follows:

The equation of the line from the figure (1) is

$$L(x) = -6.76x + 15048.81$$

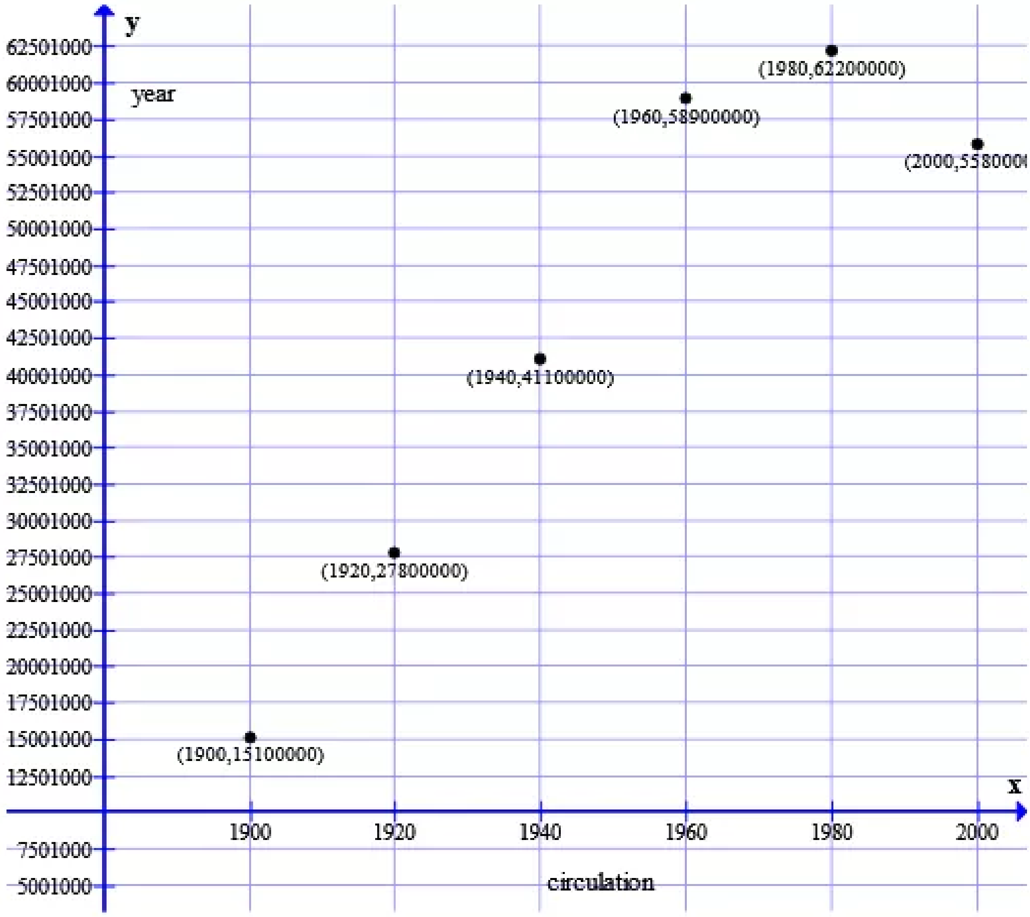
Putting, $x = 30$ we have

$$L(x) = -6.76(30) + 15048.81$$
$$= 14846$$

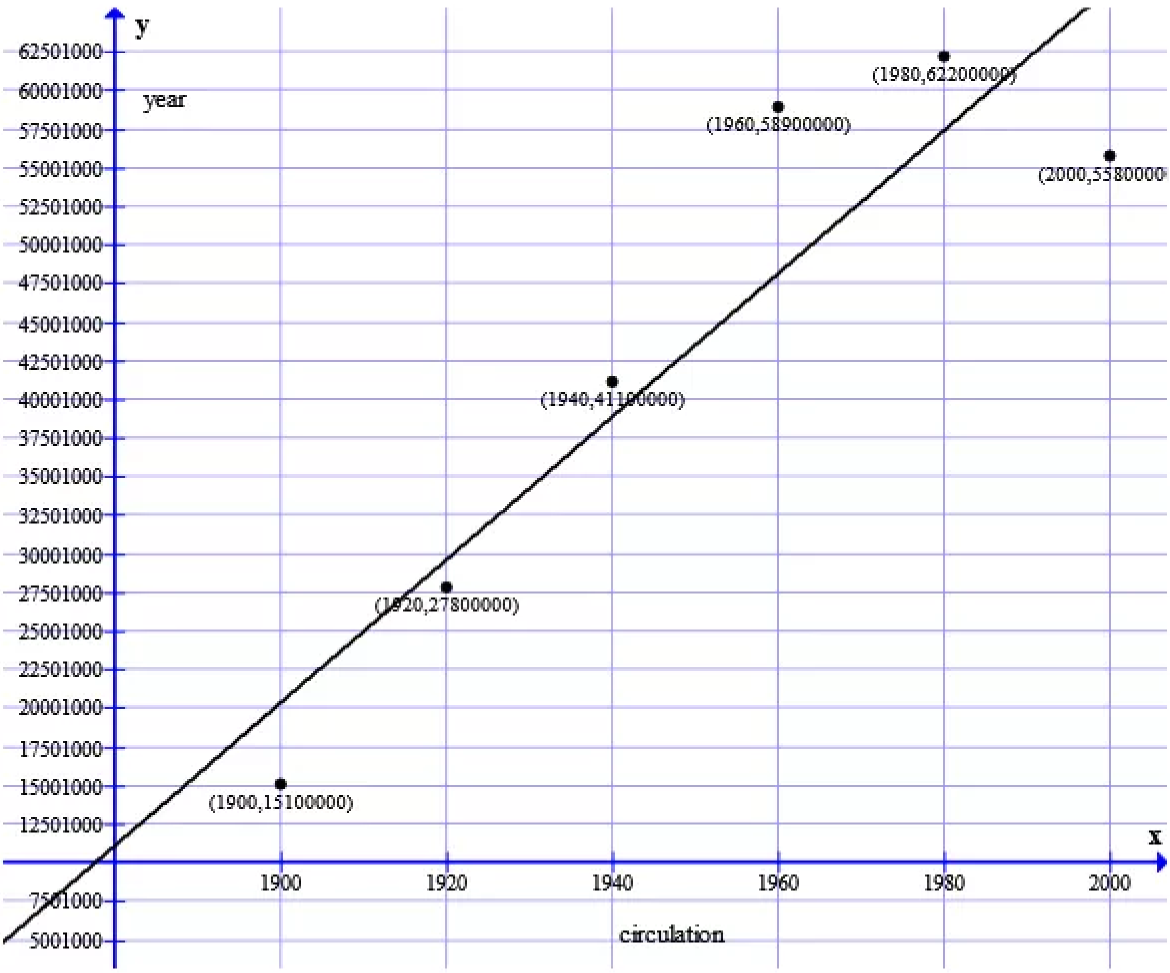
Therefore, The daily newspaper in 2020 will be $\boxed{14846}$.

(d)

The scatter plot of the data since 1990, circulation has been shown below in figure (2).



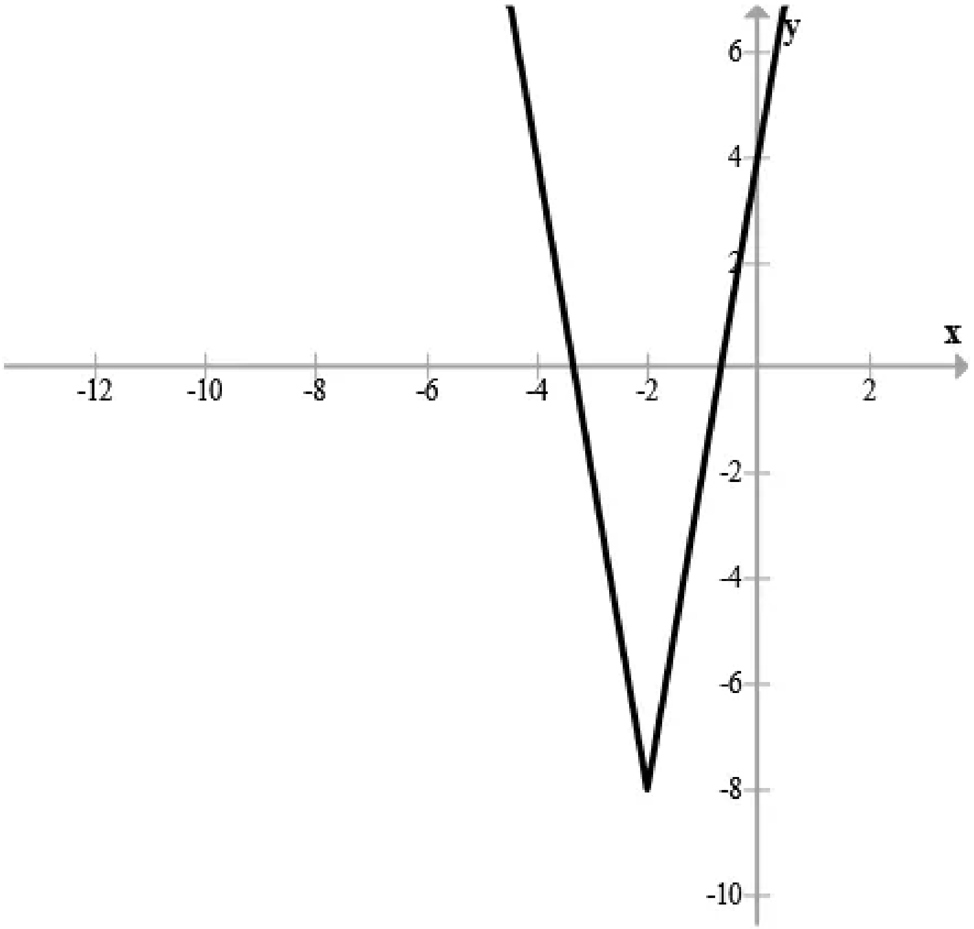
The linear model of the data for circulation is not reasonable since the line does meet most of the data given in the table as shown in the graph below:



Hence it is not reasonable to predict the circulation in 2020 by a linear model.

Answer 6q.

The given graph is shown below.



Since the graph is V-shaped, let the equation of the graph be $y = a|x - h| + k$ where (h, k) is the vertex of the graph.

The vertex of the given graph is $(-2, -8)$.

Substituting $h = -2$ and $k = -8$, we get

$$y = a|x - (-2)| + (-8)$$

$$y = a|x + 2| - 8$$

Again, the graph passes through $(-1, -2)$. So, we can write

$$y = a|x + 2| - 8$$

$$-2 = a|(-1) + 2| - 8$$

$$-2 = a|-1 + 2| - 8$$

$$-2 + 8 = a|1|$$

$$a = 6$$

Hence, the equation of the graph is

$$y = a|x-h|+k$$

$$y = (6)|x-(-2)|+(-8)$$

$$\boxed{y = 6|x+2|-8}$$

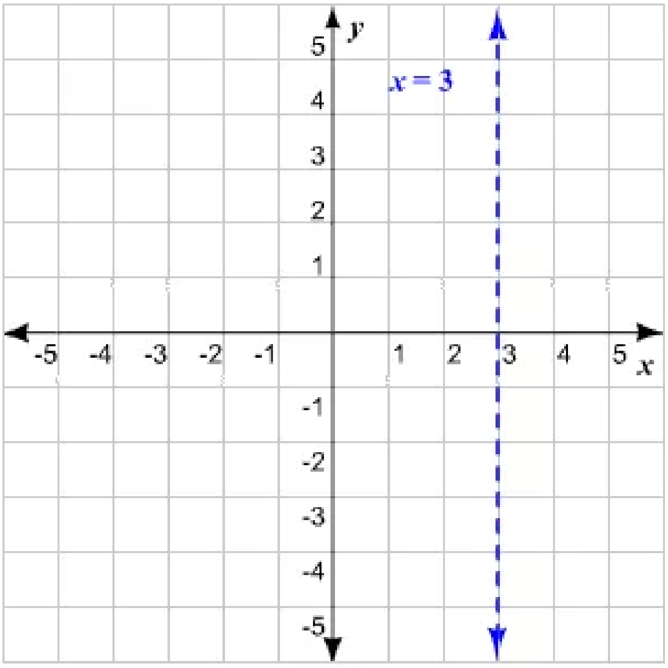
Answer 7e.

STEP 1 **Graph the boundary line of the inequality.**

In order to obtain the boundary line, replace the inequality sign with = sign. Then, we get an equation of the form $x = c$ which is the equation of a vertical line passing through $(c, 0)$.

In this case, the value of c is 3. This means that $x = 3$ passes through $(3, 0)$.

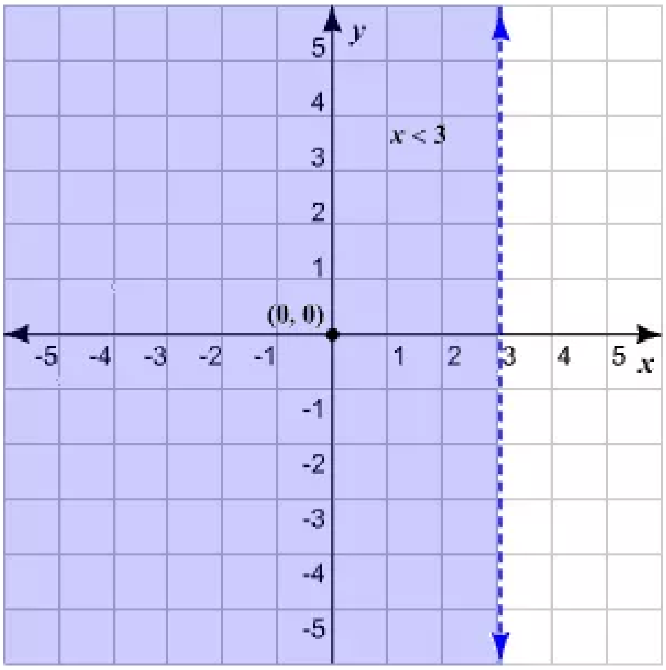
Graph the boundary line $x = 3$. Since $<$ is the inequality sign used, draw a dashed line.



STEP 2 **Test a point.**

Let us take a test point (0, 0) which does not lie on the boundary line.
Substitute 0 for x and check if the test point satisfies the given inequality.
$0 < 3$ TRUE

The test point is a solution of the inequality. Shade the half-plane that contains (0, 0).



Answer 7gp.

STEP 1 **Graph the boundary line of the inequality.**

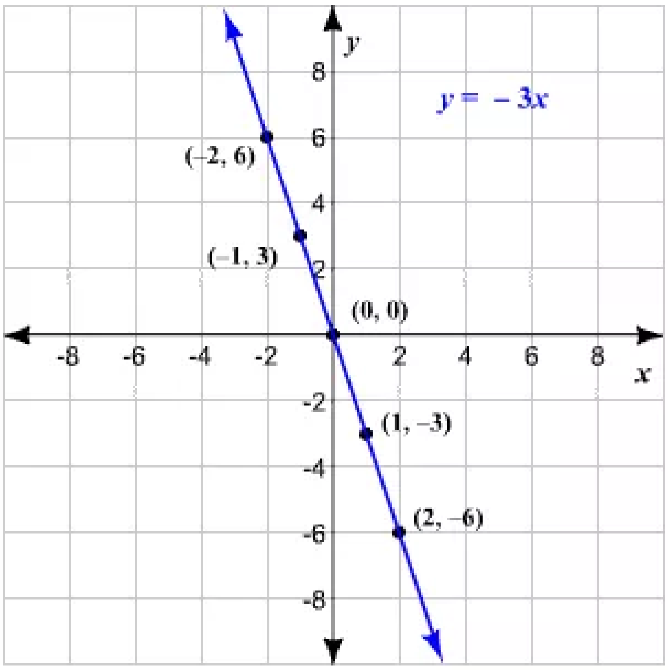
In order to obtain the boundary line, replace the inequality sign with "=" sign. Then, we get an equation of the form $y = -3x$.

We have to find some points that satisfy the equation. For this, choose some values for x and evaluate the corresponding values of y.

x	-2	-1	0	1	2
$y = -3x$	6	3	0	-3	-6

The points are (–2, 6), (–1, 3), (0, 0), (1, –3), and (2, –6).

Plot the points on the graph and draw a line passing through them. Since $\geq$ is the inequality sign used, draw a solid line.



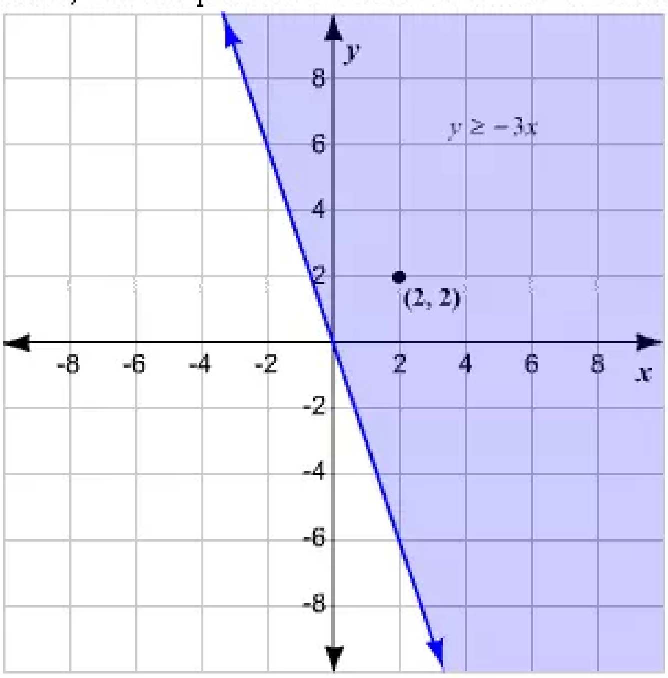
STEP 2 **Test a point.**

Let us take a test point (2, 2), which does not lie on the boundary line. Substitute 2 for y, and 2 for x. Check if the test point satisfies the given inequality.

$$2 \overset{?}{\geq} -3(2)$$

$$2 \geq -6 \qquad \text{TRUE}$$

Thus, the test point is a solution. Shade the half-plane that contains (2, 2).

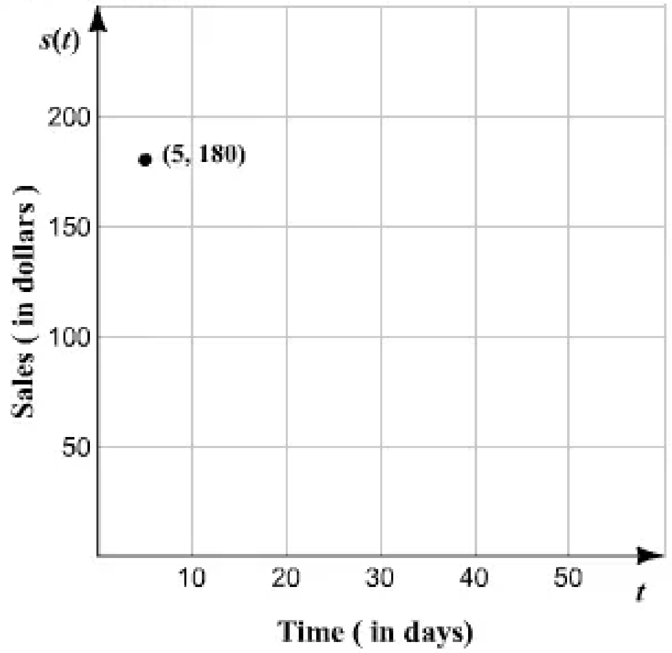


Answer 7mr.

Step 1 The given function is of the form $y = a|x - h| + k$, where (h, k) is the vertex of the function.

We get the value of h as 5 and of k as 180. Thus, the vertex of the given function is (5, 180).

Plot the vertex.



Step 2 Use symmetry to find two more points.
Substitute any value, say, 105 for $s(t)$ in the given function.
$105 = -15|t - 5| + 180$

Subtract 180 from both the sides of the equation.

$$105 - 180 = -15|t - 5| + 180 - 180$$
$$-75 = -15|t - 5|$$

Divide both the sides by -15.

$$\frac{-75}{-15} = \frac{-15|t - 5|}{-15}$$
$$5 = |t - 5|$$

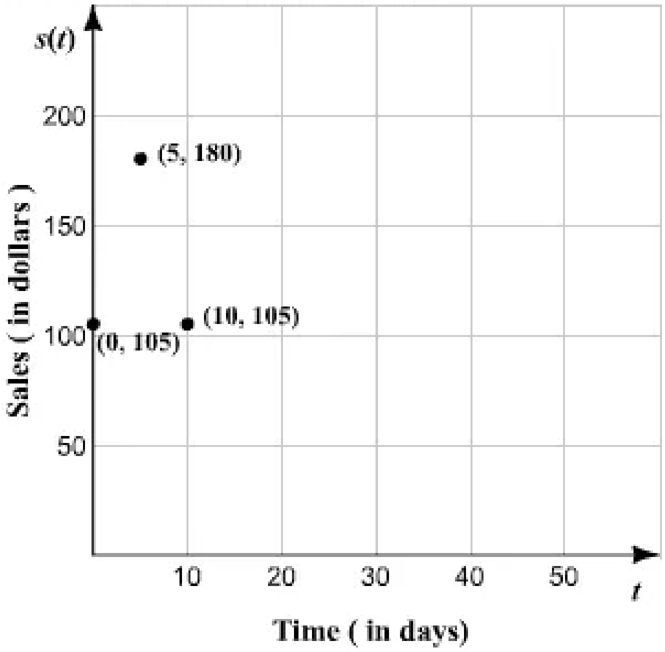
We get $t - 5 = 5$ and $t - 5 = -5$.

Add 5 to both the sides of the two equations.

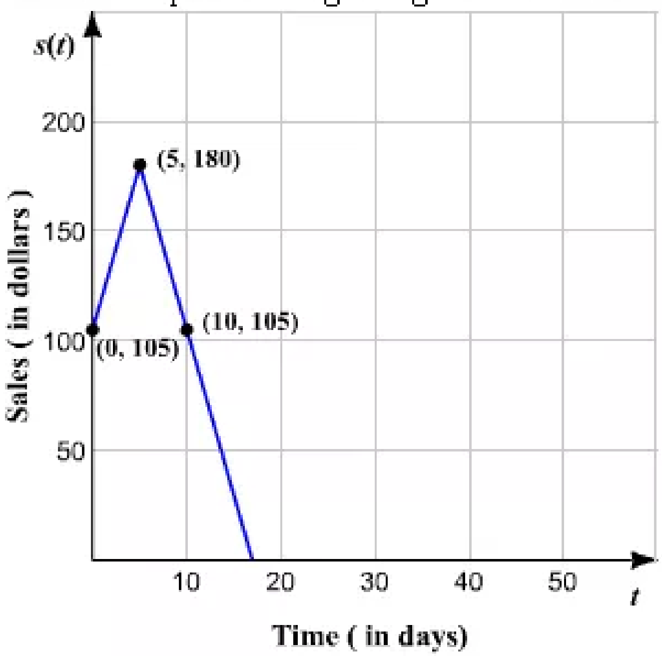
$$t - 5 + 5 = 5 + 5 \quad \text{and} \quad t - 5 + 5 = -5 + 5$$
$$t = 10 \quad \text{and} \quad t = 0$$

The two points are (10, 105) and (0, 105).

Plot these points on the graph.



Step 3 Connect the points using straight lines to obtain a V-shaped graph.



From the graph, we note that the highest value for s, which is the weekly sales in dollars, is 180.

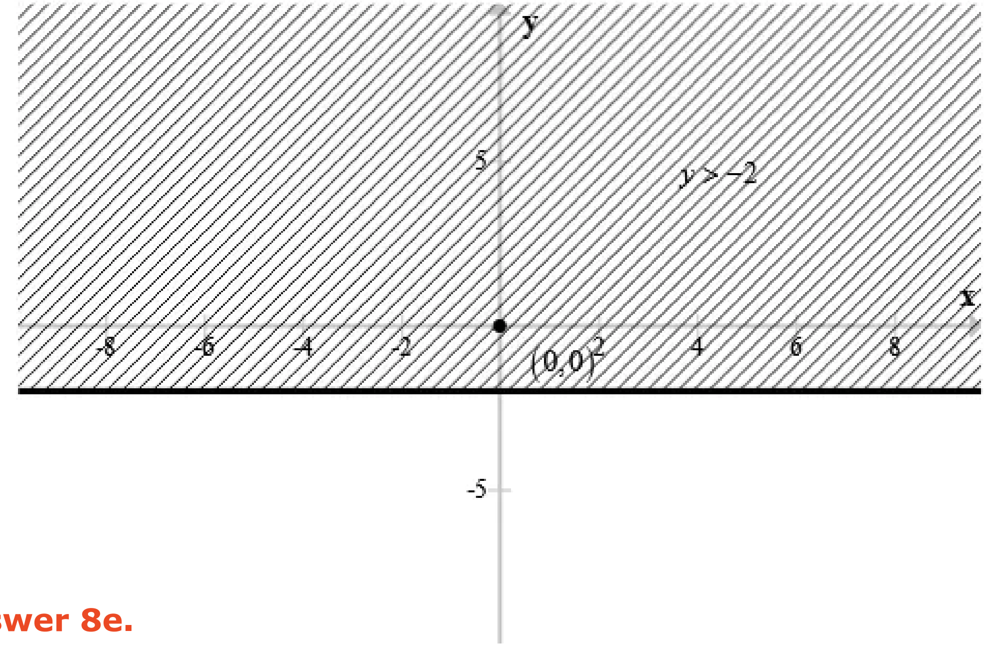
Therefore, the maximum amount of money raised in a day is \$180.

Answer 7q.

We need to graph the inequality $y > -2$.
The boundary of the inequality is $y = -2$.
We first graph the boundary $y = -2$ using a dashed line as the inequality symbol is $>$.
Let the test point be $(0,0)$. Substituting $y = 0$ in the inequality $y > -2$,

$$0 > -2$$

Thus, the result is true. Therefore, $(0,0)$ is a solution of the inequality $y > -2$. Therefore, we shade the half-plane that contains $(0,0)$.

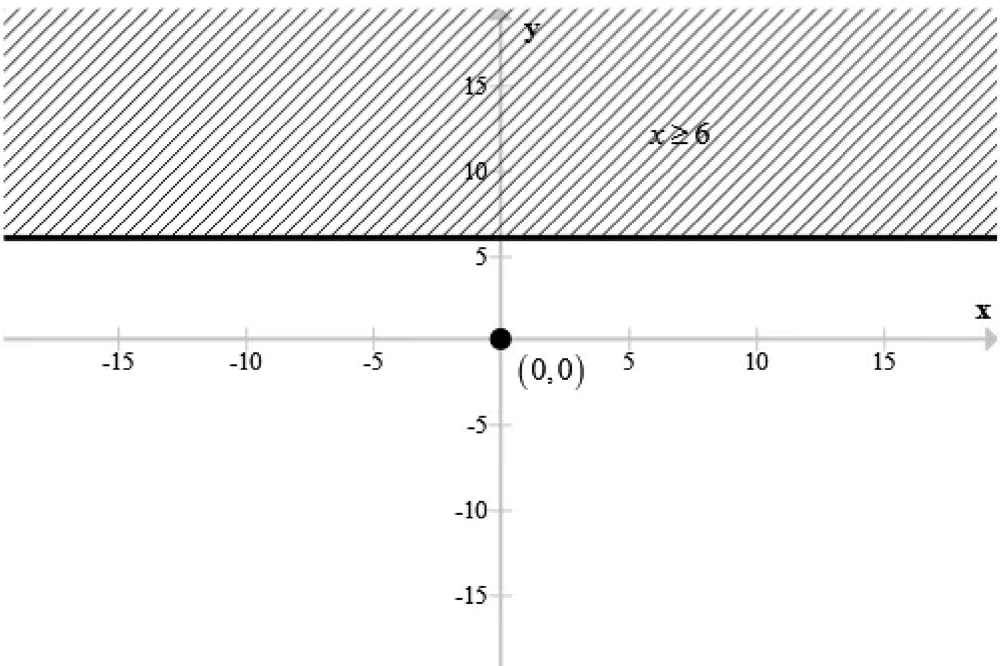


Answer 8e.

We need to graph the inequality $x \geq 6$.
The boundary of the inequality is $x = 6$.
We first graph the boundary $x = 6$ using a solid line as the inequality symbol is $\leq$.
Let the test point be $(0,0)$. Substituting $x = 0$ in the inequality $x \geq 6$,

$$0 \geq 6$$

Thus, the result is not true. Therefore, $(0,0)$ is not a solution of the inequality $x \geq 6$. Therefore, we shade the half-plane that does not contain $(0,0)$ and the shaded region is the solution of the inequality $x \geq 6$.



Answer 8gp.

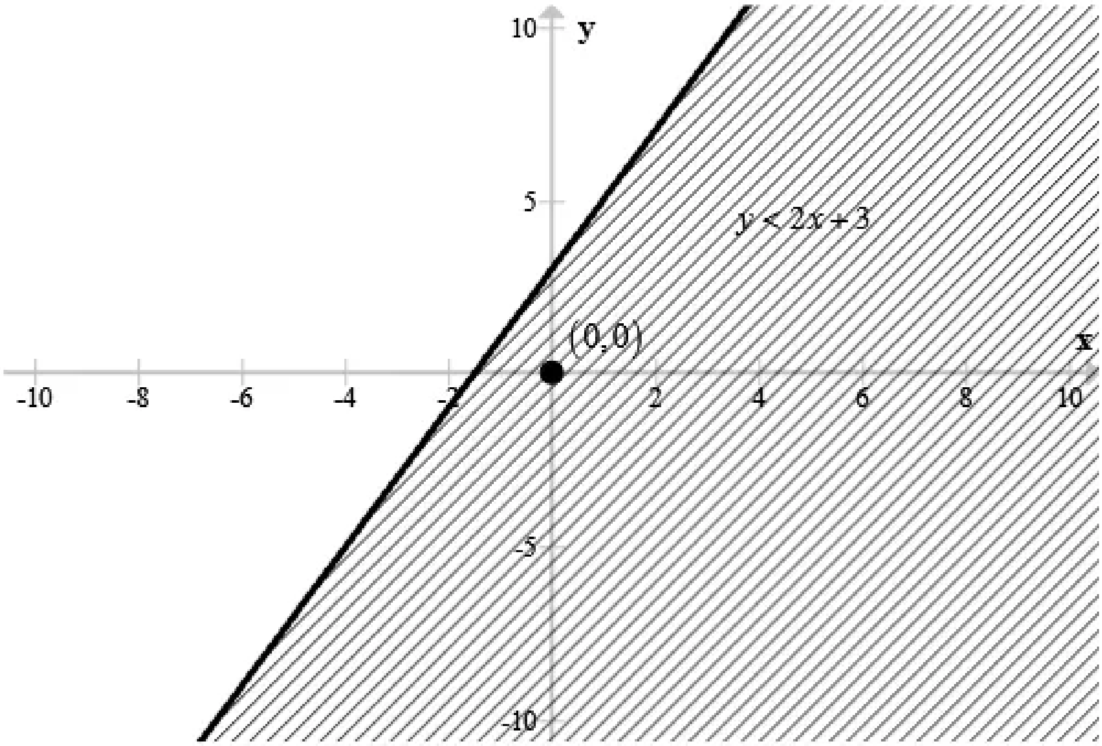
We need to graph the inequality $y < 2x + 3$.

We first graph the boundary line $y = 2x + 3$ using a dashed line as the inequality symbol is $<$.

Let the test point be $(0,0)$. Substituting $x = 0, y = 0$ in the inequality $y < 2x + 3$, we get

$$(0) < 2(0) + 3$$
$$0 < 0 + 3$$
$$0 < 3$$

Therefore, $(0,0)$ is a solution of the inequality $y < 2x + 3$. Therefore, we shade the half-plane that contains $(0,0)$.



Answer 8q.

We need to graph the inequality $y \le 3x+1$.

The boundary of the inequality is $y = 3x+1$.

We first graph the boundary $y = 3x+1$ using a solid line as the inequality symbol is $\le$.

Let the test point be $(0,0)$. Substituting $x = 0, y = 0$ in the inequality $y \le 3x+1$,

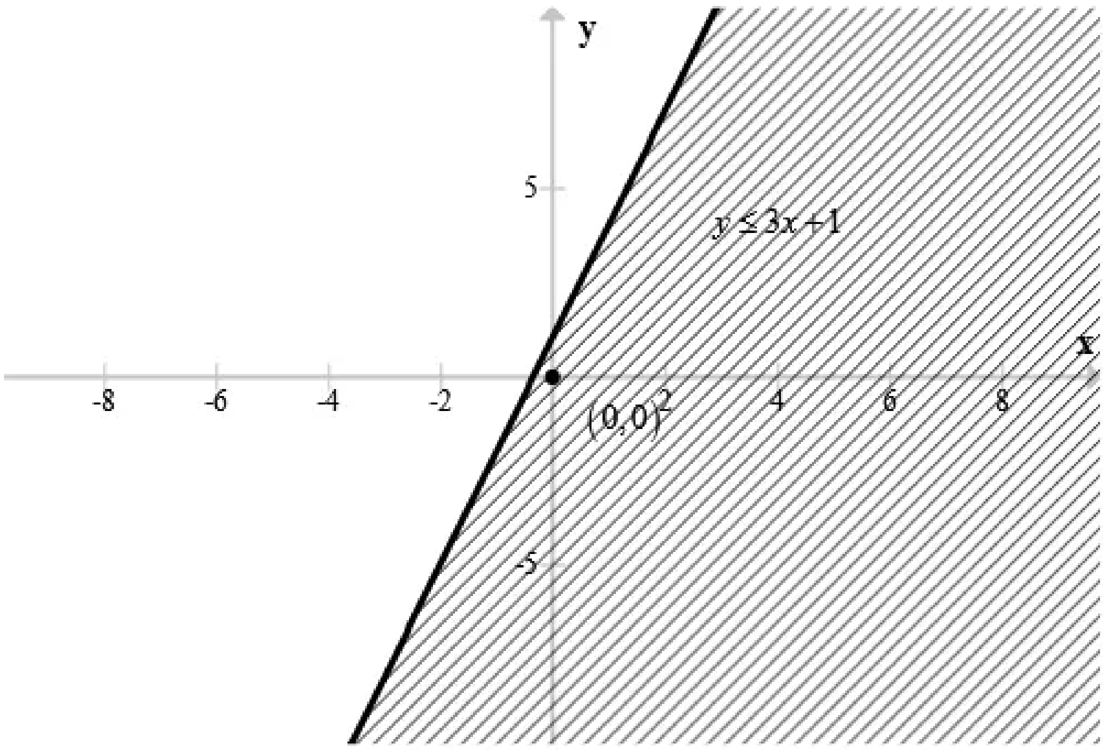
$$0 \le 3(0)+1$$

$$0 \le 0+1$$

$$0 \le 1$$

Thus, the result is true. Therefore, $(0,0)$ is a solution of the inequality $y \le 3x+1$.

Therefore, we shade the half-plane that contains $(0,0)$.



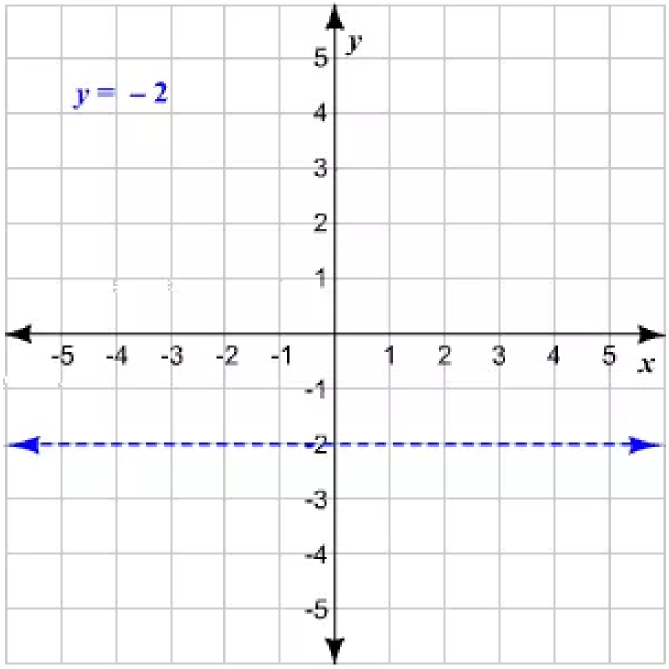
Answer 9e.

STEP 1 **Graph the boundary line of the inequality.**

In order to obtain the boundary line, replace the inequality sign with = sign. Then, we get an equation of the form $y = c$ which is the equation of a horizontal line passing through $(0, c)$.

In this case, the value of c is -2. This means that $y = -2$ passes through $(0, -2)$.

Graph the boundary line $y = -2$. Since > is the inequality sign used, draw a dashed line.

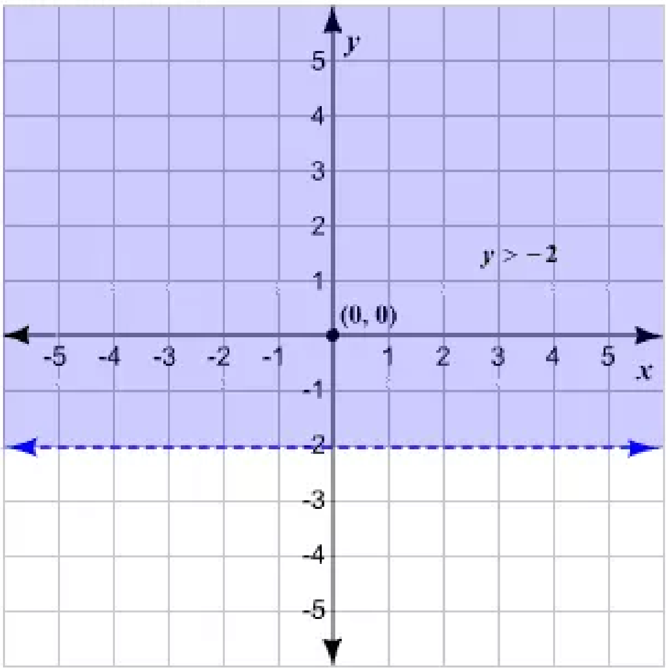


STEP 2 **Test a point.**

Let us take a test point (0, 0) which does not lie on the boundary line. Substitute 0 for y and check if the test point satisfies the given inequality.

$0 > -2$ TRUE

The test point is a solution of the inequality. Shade the half-plane that contains (0, 0).



Answer 9gp.

STEP 1 **Graph the boundary line of the inequality.**

In order to obtain the boundary line, replace the inequality sign with "=". Then, we get an equation of the form $x + 3y = 9$.

Substitute 0 for y in above equation and solve for x to obtain the x-intercept.

$$x + 3(0) = 9$$
$$x = 9$$

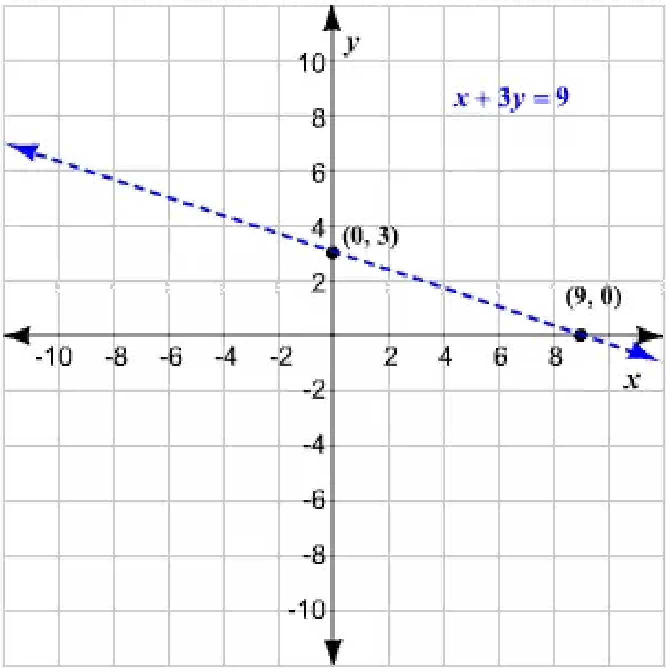
The x-intercept is 9. A point that can be plotted on the graph is (9, 0).

Next, replace x with 0 and solve for y to find the y-intercept.

$$0 + 3y = 9$$
$$3y = 9$$
$$y = 3$$

Since the y-intercept is 3, another point on the graph is (0, 3).

Plot (9, 0) and (0, 3) on the graph and draw a line passing through them. Since < is the inequality sign used, draw a dashed line.



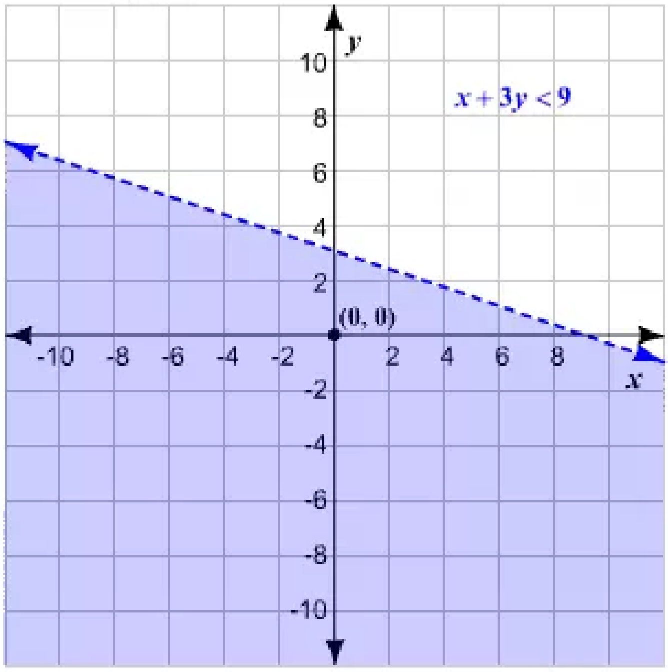
STEP 2 **Test a point.**

Let us take a test point, which does not lie on the boundary line, say, (0, 0). Substitute 0 for y, and 0 for x. Check if the test point satisfies the given inequality.

$$0 + 3(0) \overset{?}{<} 9$$

$$0 < 9 \qquad \text{TRUE}$$

The test point is a solution to the inequality. Shade the half-plane that contains (0, 0).



Answer 9q.

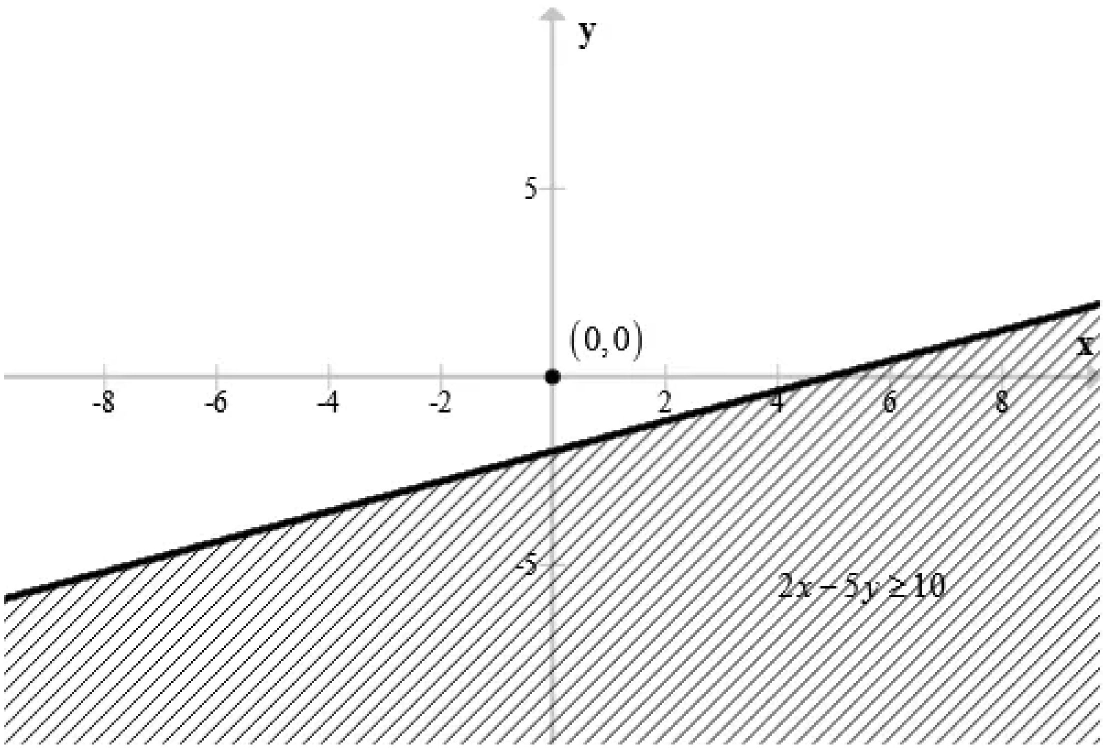
We need to graph the inequality $2x-5y \geq 10$.
The boundary of the inequality is $2x-5y=10$.
We first graph the boundary $2x-5y=10$ using a solid line as the inequality symbol is $\geq$.
Then,

$$\begin{aligned} 2x-5y&=10 \\ -5y&=-2x+10 \\ \left(\frac{-5}{-5}\right)y&=\left(\frac{-2}{-5}\right)x+\left(\frac{10}{-5}\right) \\ y&=\frac{2}{5}x-2 \end{aligned}$$

Let the test point be $(0,0)$. Substituting $x=0, y=0$ in the inequality $2x-5y \geq 10$,

$$\begin{aligned} 2(0)-5(0)&\geq 10 \\ 0-0&\geq 10 \\ 0&\geq 10 \end{aligned}$$

Thus, the result is not true. Therefore, $(0,0)$ is not a solution of the inequality $2x-5y \geq 10$. Therefore, we shade the half-plane that does not contain $(0,0)$.



Answer 10e.

We need to graph the inequality $-2y \le 8$.

The boundary of the inequality is $-2y = 8$.

We first graph the boundary $-2y = 8$ using a solid line as the inequality symbol is $\le$.

Then,

$$-2y = 8$$

$$\frac{-2}{-2}y = \frac{8}{-2}$$

$$y = -4$$

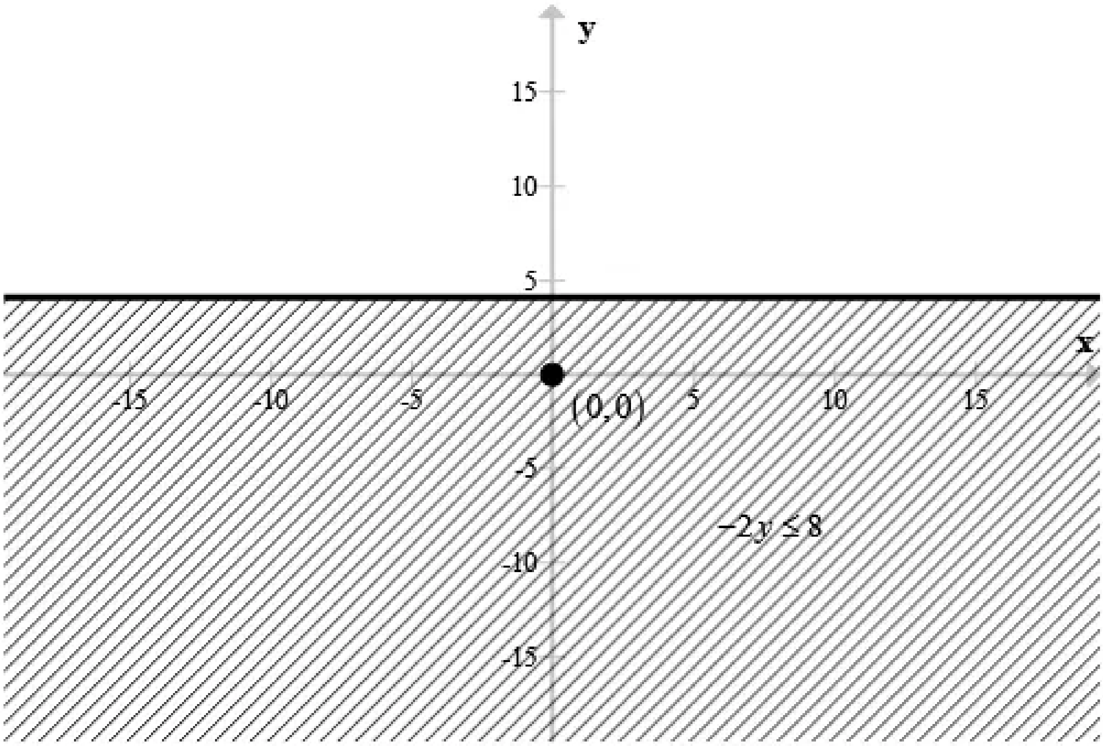
Let the test point be $(0,0)$. Substituting $y = 0$ in the inequality $-2y \le 8$,

$$-2(0) \le 8$$

$$0 \le 8$$

Thus, the result is true. Therefore, $(0,0)$ is a solution of the inequality $-2y \le 8$.

Therefore, we shade the half-plane that contains $(0,0)$ and the shaded region is the solution of the inequality $-2y \le 8$.

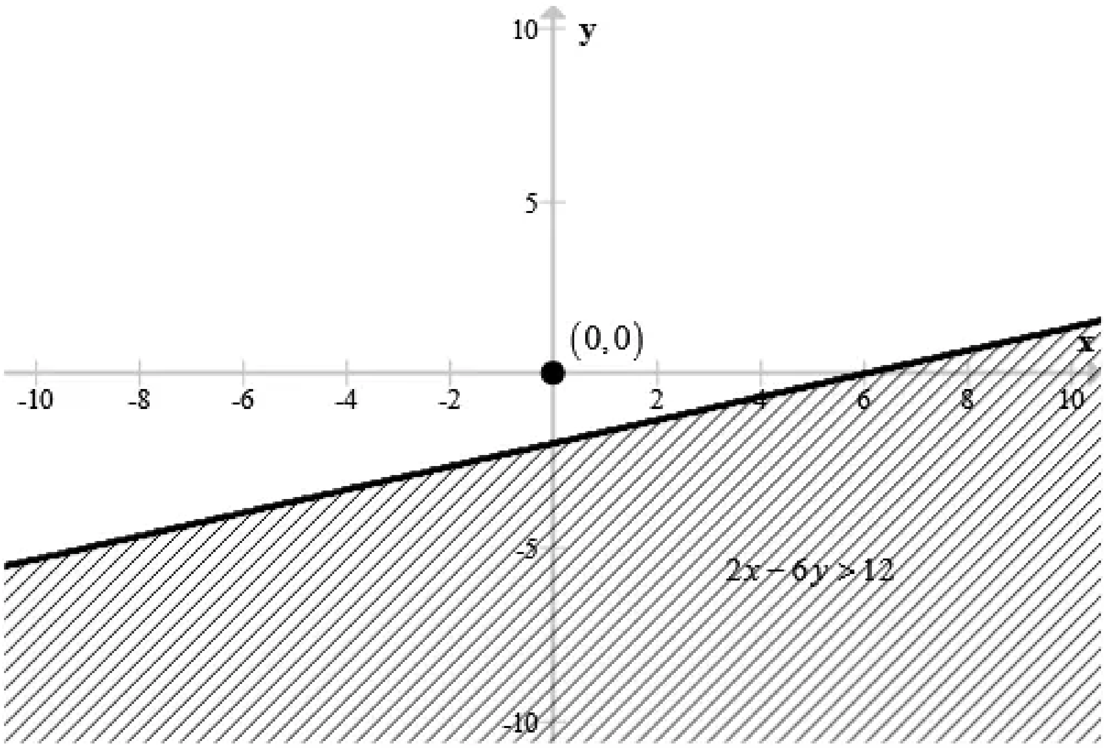


Answer 10gp.

We need to graph the inequality $2x-6y>12$.
We first graph the boundary line $2x-6y=12$ using a dashed line as the inequality symbol is $<$.
Let the test point be $(0,0)$. Substituting $x=0, y=0$ in the inequality $2x-6y>12$, we get

$$2(0)-6(0)>12$$
$$0-0>12$$
$$0>12$$

Thus, the result is not true. Therefore, $(0,0)$ is not a solution of the inequality $2x-6y>12$. Therefore, we shade the half-plane that does not contain $(0,0)$.



Answer 10q.

Let x be the number of times car can be raced on the Rally track and y be the number of times car can be raced on the Grand Prix track.
Therefore, total credits required to drive the cars on the Rally track is $2x$ and the total credits required to drive the cars on the Grand Prix track is $3y$.
Hence, the inequality is

$$2x+3y\le 20$$

We need to graph the inequality $2x+3y \le 20$.

We first graph the boundary line $2x+3y=20$ using a solid line as the inequality symbol is $\le$.

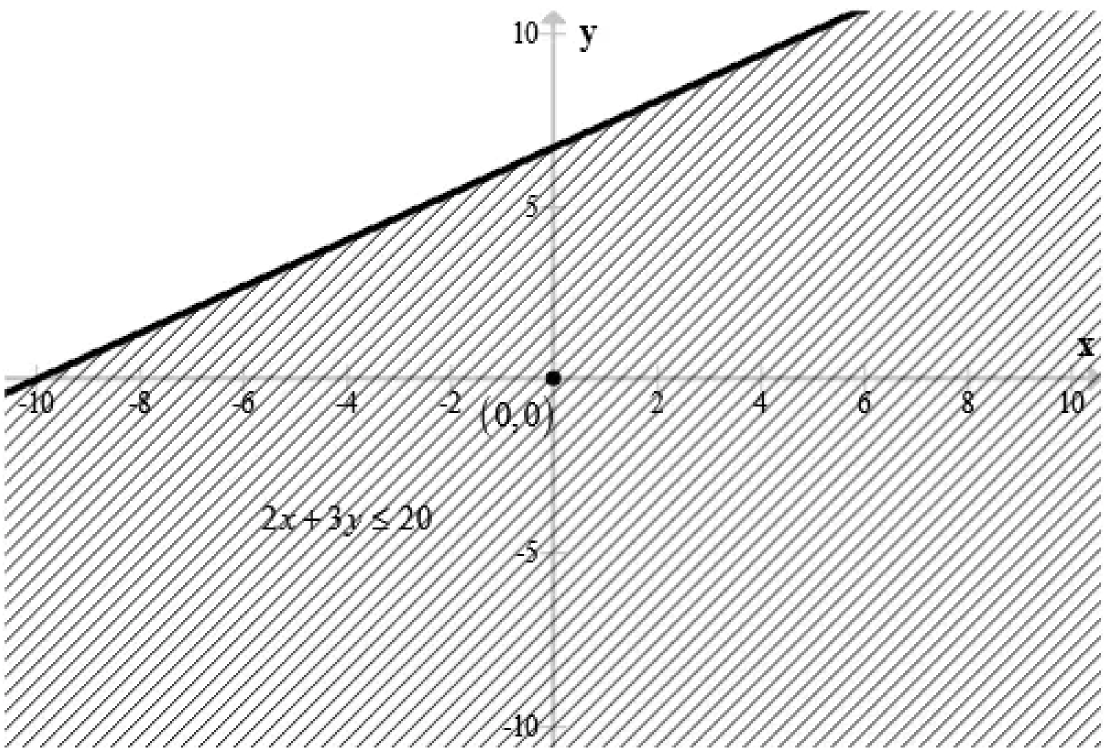
Then,

$$\begin{aligned} 2x+3y &= 20 \\ 3y &= 2x+20 \\ \frac{3}{3}y &= \frac{2}{3}x+\frac{20}{3} \\ y &= \frac{2}{3}x+\frac{20}{3} \end{aligned}$$

Let the test point be $(0,0)$. Substituting $x=0, y=0$ in the inequality $2x+3y \le 20$, we get

$$\begin{aligned} 2(0)+3(0) &\le 20 \\ 0+0 &\le 20 \\ 0 &\le 20 \end{aligned}$$

Thus, the result is true. Therefore, $(0,0)$ is a solution of the inequality $2x+3y \le 20$. Therefore, we shade the half-plane that contains $(0,0)$ and the shaded region is the solution of the inequality $2x+3y \le 20$.



We can choose any arbitrary three points from the shaded portion of the graph. The three possible solution as obtained from the graph are $(1,1), (2,2)$ and $(1,2)$.

Answer 11e.

STEP 1 **Graph the boundary line of the inequality.**

In order to obtain the boundary line, replace the inequality sign with = sign. Then, we get an equation of the form $y = -2x - 1$.

Substitute 0 for y in the above equation and solve for x.

$$\begin{aligned} 0 &= -2x - 1 \\ 2x &= -1 \\ x &= -\frac{1}{2} \end{aligned}$$

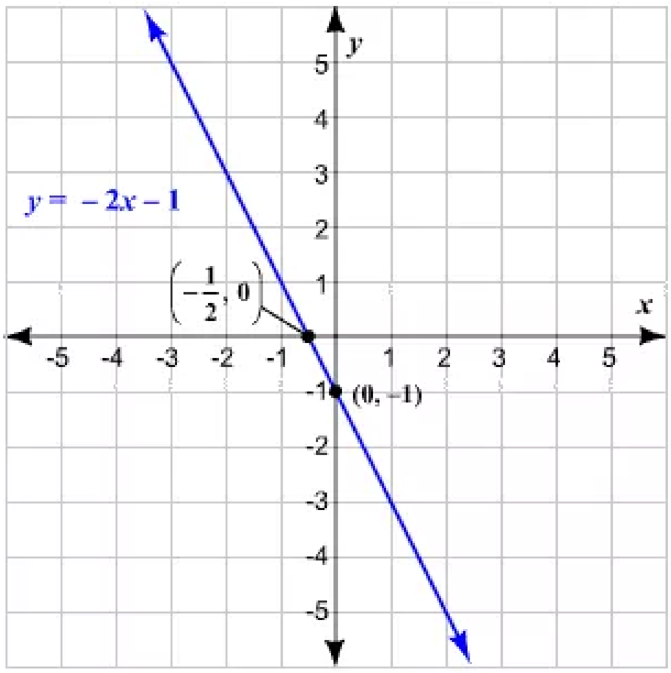
The x-intercept is $-\frac{1}{2}$. Point to be plotted on the graph is $\left(-\frac{1}{2}, 0\right)$.

Now, replace x with 0 and solve for y.

$$\begin{aligned} y &= 2(0) - 1 \\ y &= -1 \end{aligned}$$

Since the y-intercept is -1, point to be plotted on the graph is $(0, -1)$.

Plot the points $\left(-\frac{1}{2}, 0\right)$ and $(0, -1)$ on the graph and draw a line passing through them. Since $\leq$ is the inequality sign used, draw a solid line.



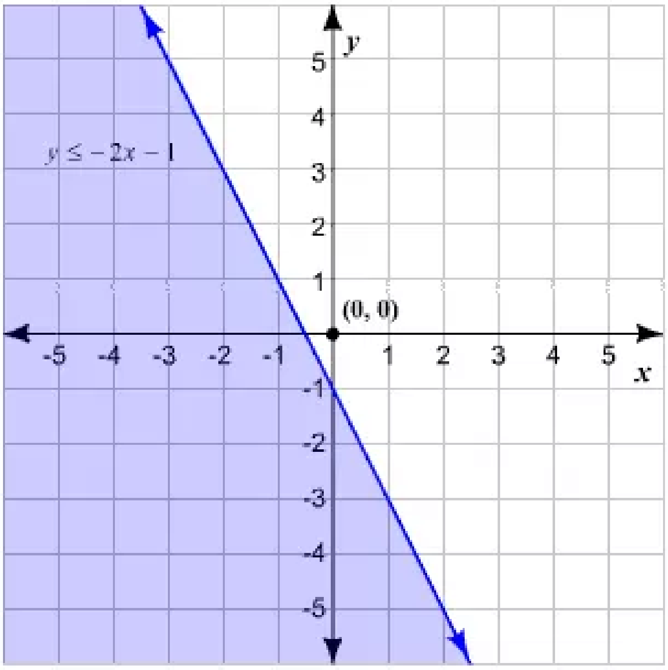
STEP 2 **Test a point.**

Let us take a test point (0, 0) which does not lie on the boundary line. Substitute 0 for y, and 0 for x. Check if the test point satisfies the given inequality.

$$0 \overset{?}{\leq} -2(0) - 1$$

$$0 \leq -1 \qquad \text{FALSE}$$

The test point is not a solution. Shade the half-plane that does not contain (0, 0).



Answer 11gp.

STEP 1 **Write an inequality.**

Let x be the total time available for standard scene, and y be the total time available for high quality scene.

We know that the standard rate of normal scene is 0.4MB per second, and that of complex scene is 1.2MB per second. Thus, the total time taken for standard scene is $0.4x$ and the total time for high quality scene is $1.2y$.

The above data can be written as follows.

Standard rate (MB/sec)	·	Standard time (sec)	+	High quality rate (MB/sec)	·	High quality time (sec)	≤	Total space (MB)
⇓		⇓		⇓		⇓		
0.4	·	x	+	1.2	·	y	≤	420

Thus, the inequality is $0.4x + 1.2y \leq 420$.

STEP 2 **Graph the inequality**.

In order to graph the inequality, first graph the boundary line $0.4x + 1.2y = 420$.

Substitute 0 for y in the above equation and solve for x.

$$\begin{aligned} 0.4x + 1.2(0) &= 420 \\ 0.4x &= 420 \\ x &= 1050 \end{aligned}$$

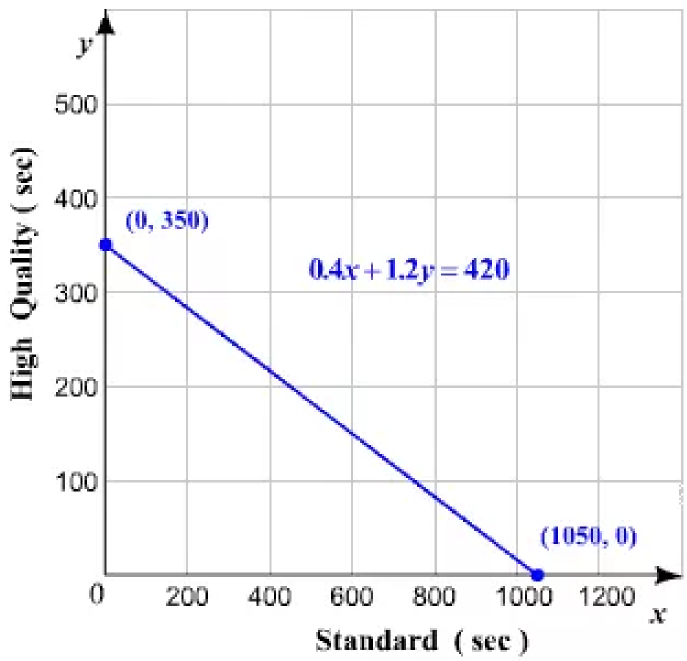
The x-intercept is 1050. Point to be plotted on the graph is (1050, 0).

Now, replace x with 0 and solve for y.

$$\begin{aligned} 0.4(0) + 1.2y &= 420 \\ 1.2y &= 420 \\ y &= 350 \end{aligned}$$

Since the y-intercept is 350, point to be plotted on the graph is (0, 350).

Plot the points (1050, 0) and (0, 350) on the graph and draw a line passing through them. Since ≤ is the inequality sign used, draw a solid line.

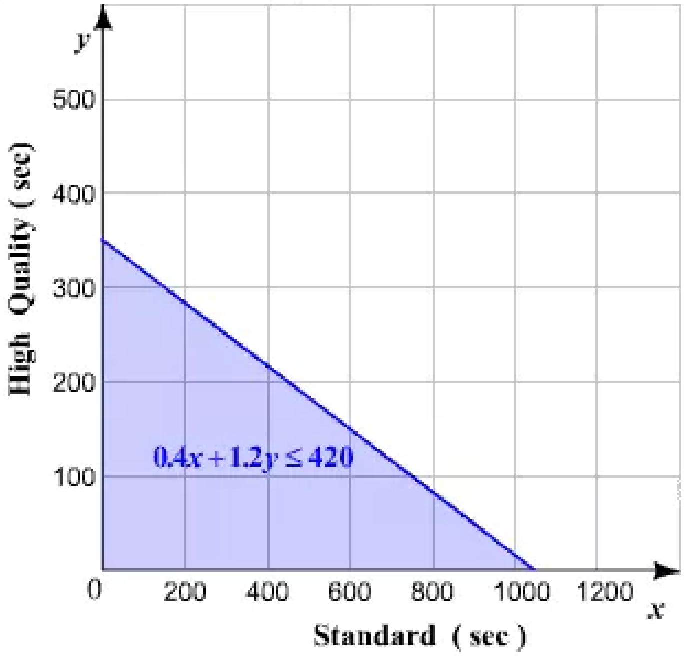


Let us take a test point (0, 0), which does not lie on the boundary line. Substitute 0 for y, and 0 for x. Check if the test point satisfies the given inequality.

$$0.4(0) + 1.2(0) \overset{?}{\leq} 420$$

$$0 \leq 420 \qquad \text{TRUE}$$

The inequality is true and thus the test point is a solution. Shade the half-plane that contains (0, 0).

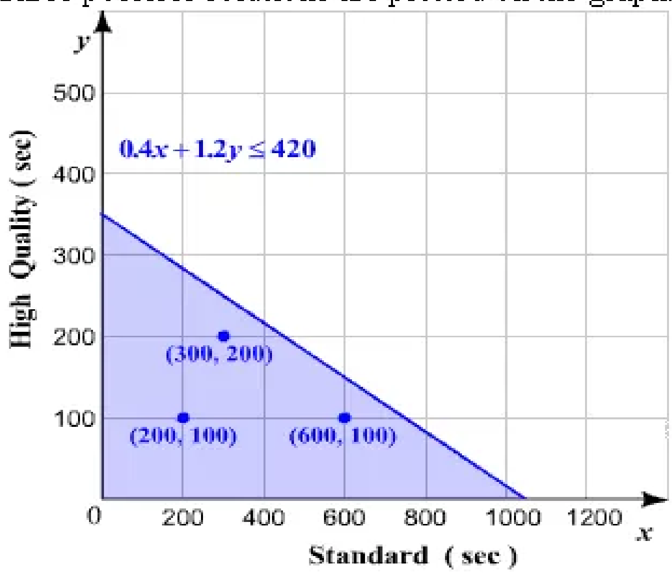


STEP 3 **Identify solutions.**

In order to find the possible solutions, substitute several values for x and y and check the inequality.

(x, y)	$0.4x + 1.2y \leq 420$
(200, 100)	$200 \leq 420$
(300, 200)	$360 \leq 420$
(600, 100)	$360 \leq 420$

Three possible solutions are plotted on the graph.



Thus, we can say, 200 seconds of standard and 100 seconds of high-quality, 300 seconds of standard and 200 seconds of high-quality, 600 seconds of standard and 100 seconds of high-quality.

Answer 12e.

We need to graph the inequality $y < 3x + 3$.

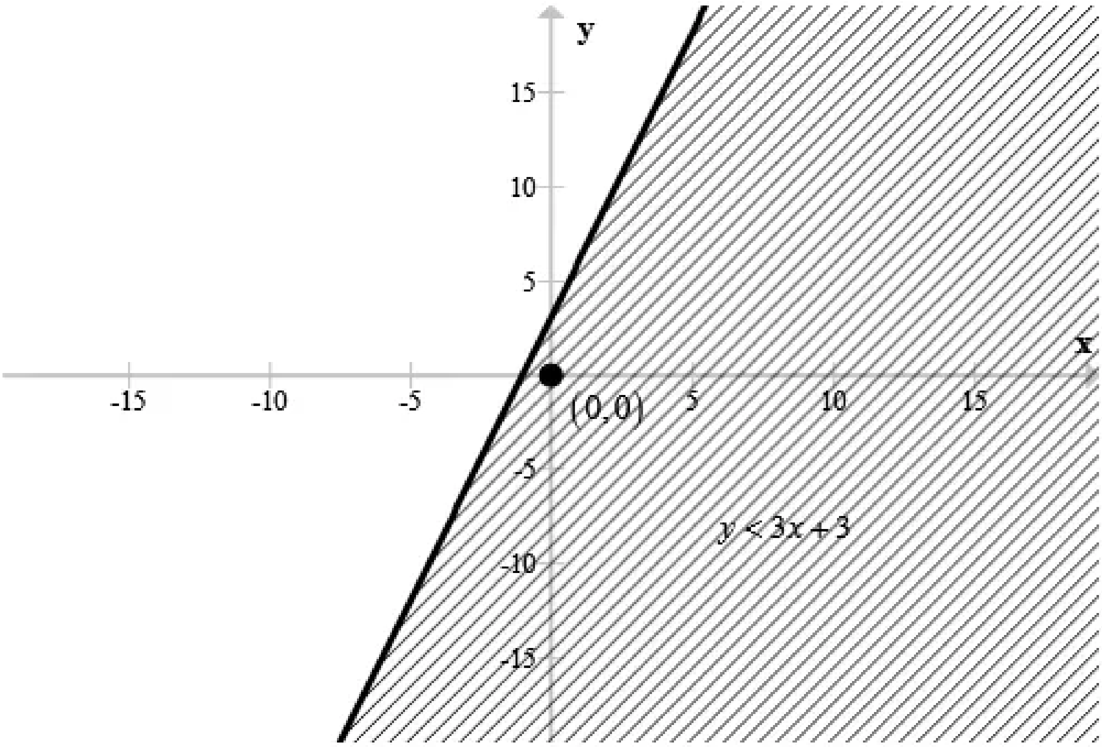
The boundary of the inequality is $y = 3x + 3$.

We first graph the boundary $y = 3x + 3$ using a solid line as the inequality symbol is $\leq$.

Let the test point be $(0,0)$. Substituting $x = 0, y = 0$ in the inequality $y < 3x + 3$,

$$0 < 3(0) + 3$$
$$0 < 0 + 3$$
$$0 < 3$$

Thus, the result is true. Therefore, $(0,0)$ is a solution of the inequality $y < 3x + 3$. Therefore, we shade the half-plane that contains $(0,0)$ and the shaded region is the solution of the inequality $y < 3x + 3$.



We need to graph the inequality $y \le |x-2|+1$.

The boundary of the inequality is $y = |x-2|+1$.

We first graph the boundary $y = |x-2|+1$ using a solid line as the inequality symbol is $\le$.

Then,

$$y = |x-2|+1$$

$$y = \begin{cases} (x-2)+1; x-2 \ge 0 \\ -(x-2)+1; x-2 \le 0 \end{cases}$$

$$y = \begin{cases} x-1; x \ge 2 \\ -x+3; x \le 2 \end{cases}$$

Let the test point be $(0,0)$. Substituting $x=0, y=0$ in the inequality $y \le |x-2|+1$, we get

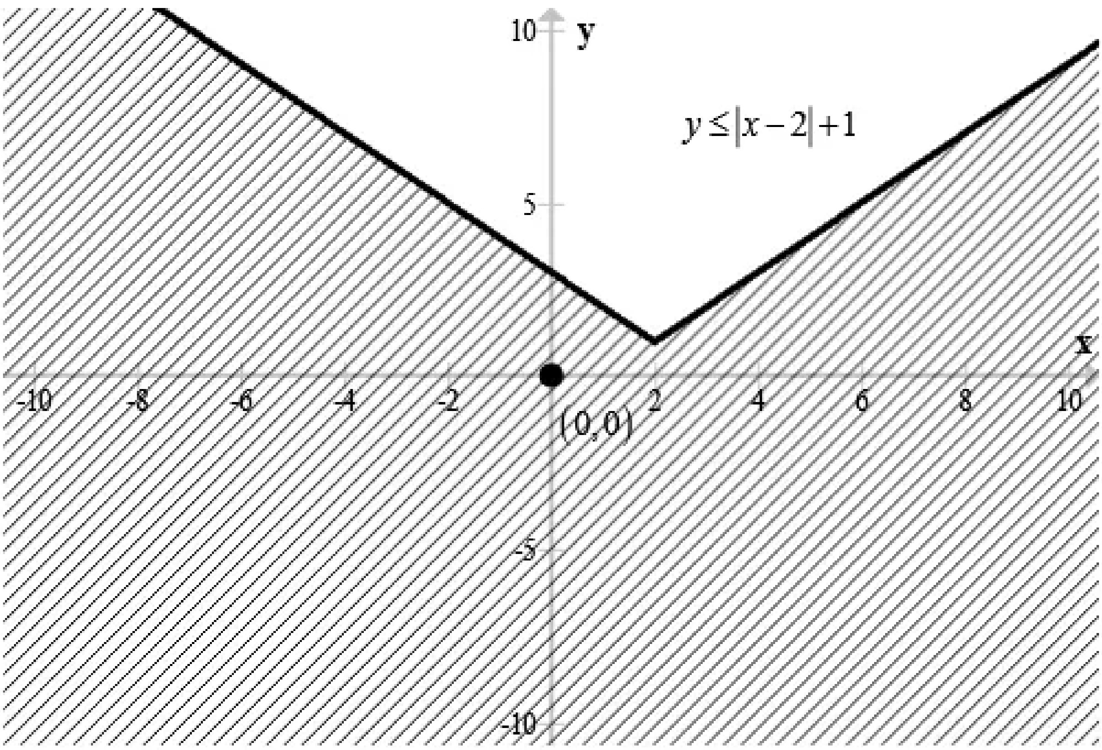
$$0 \le |0-2|+1$$

$$0 \le |-2|+1$$

$$0 \le 2+1$$

$$0 \le 3$$

Thus, the result is true. Therefore, $(0,0)$ is a solution of the inequality $y \le |x-2|+1$. Therefore, we shade the half-plane that contains $(0,0)$ and the shaded region is the solution of the inequality $y \le |x-2|+1$.



Answer 13e.

STEP 1 **Graph the boundary line of the inequality.**

In order to obtain the boundary line, replace the inequality sign with "=".

Then, we get an equation of the form $y = \frac{3}{4}x + 1$.

Substitute 0 for y in the above equation and solve for x.

$$0 = \frac{3}{4}x + 1$$

$$-\frac{4}{3} = x$$

The x-intercept is $-\frac{4}{3}$. A point that can be plotted on the graph is

$\left(-\frac{4}{3}, 0\right)$.

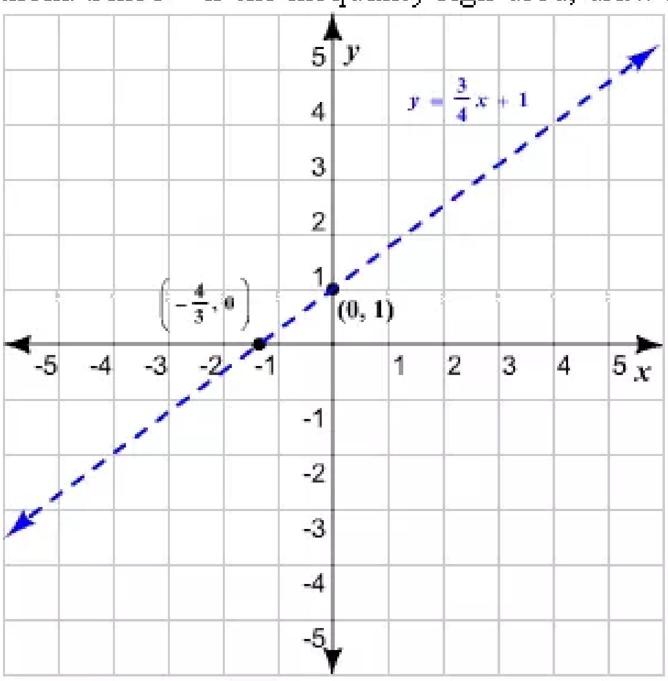
Next, replace x with 0 and solve for y.

$$y = \frac{3}{4}(0) + 1$$

$$y = 1$$

Since the y-intercept is 1, another point that can be plotted on the graph is (0, 1).

Plot $\left(-\frac{4}{3}, 0\right)$ and (0, 1) on the graph and draw a line passing through them. Since > is the inequality sign used, draw a dashed line.



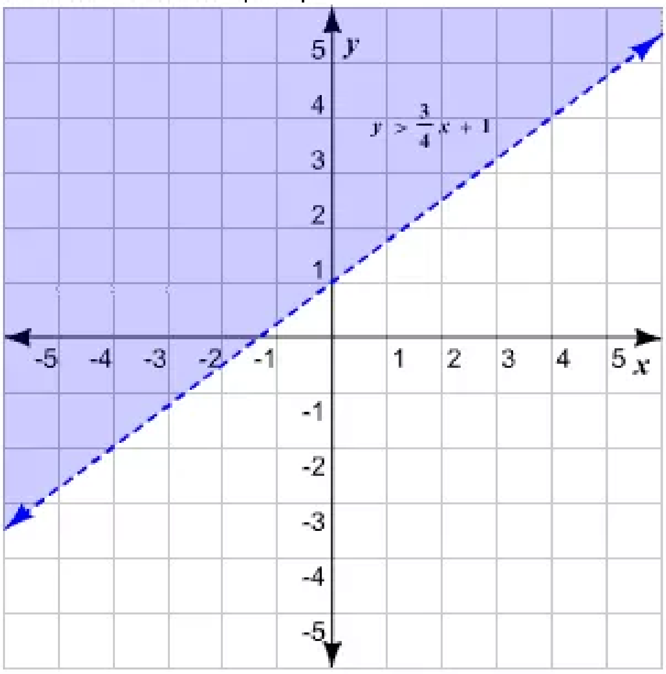
STEP 2 **Test a point.**

Let us take a test point that does not lie on the boundary line, say, (0, 0). Substitute 0 for y, and 0 for x. Check if the test point satisfies the given inequality.

$$0 \overset{?}{>} \frac{3}{4}(0) + 1$$

$$0 > 1 \qquad \text{FALSE}$$

The test point is not a solution to the inequality. Shade the half-plane that does not contain (0, 0).



Answer 13gp.

STEP 1 **Graph the boundary line of the inequality.**

In order to obtain the boundary line, replace the inequality sign with "=". Then, we get a function of the form $y = |x - h| + k$, where (h, k) is the vertex of the function.

In this case, we get the value of h as -3 and of k as -2. Thus, the vertex is $(-3, -2)$.

Let us use symmetry to find two more points.
Rewrite the function to isolate $|x + 3|$ to one side of the equation. For this, first add 2 to both the sides.

$$y + 2 = -|x + 3| - 2 + 2$$

$$y + 2 = -|x + 3|$$

Now, multiply both the sides by −1.

$$(-1)(y+2) = -|x+3|(-1)$$
$$-y-2 = |x+3|$$

We know that | x −3 | is always positive. Thus, substitute a value less than or equal to−2, say, −5 for y.

$$|x+3| = -(-5)-2$$
$$|x+3| = 5-2$$
$$|x+3| = 3$$

We get, $x+3 = 3$ and $x+3 = -3$

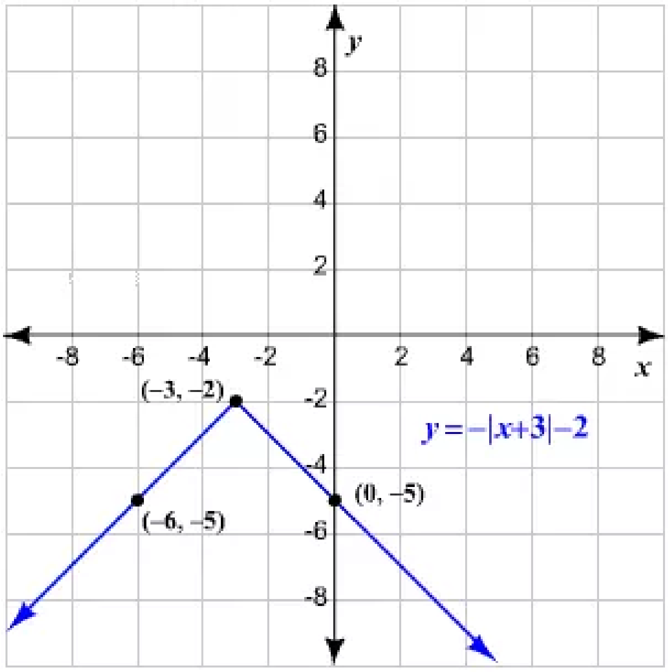
Subtract 3 from both sides of the two equations.

$x+3-3 = 3-3$ and $x+3-3 = -3-3$

$x = 0$ and $x = -6$

The two points are (0, −5) and (−6, −5).

Plot (−3, −2), (0, −5) and (−6, −5) on the graph. Connect these points using straight lines to obtain a V-shaped graph. Since ≥ is the inequality sign used, draw a solid line.



STEP 2 **Test a point.**

Let us take a test point, which does not lie on the boundary line, say, (0, 0). Substitute 0 for y, and 0 for x in the function. Check if the test point satisfies the given inequality.

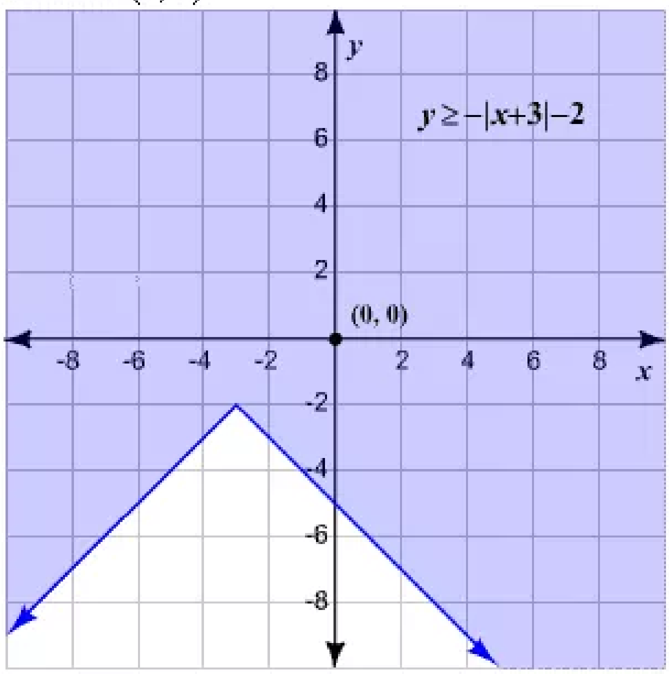
$0 \overset{?}{\geq} -|0+3|-2$

$0 \overset{?}{\geq} -|3|-2$

$0 \overset{?}{\geq} -3-2$

$0 \geq -5$ TRUE

The test point is a solution of the inequality. Shade the half-plane that contains (0, 0).



Answer 14e.

We need to graph the inequality $y \geq -\frac{2}{3}x - 2$.

The boundary of the inequality is $y = -\frac{2}{3}x - 2$.

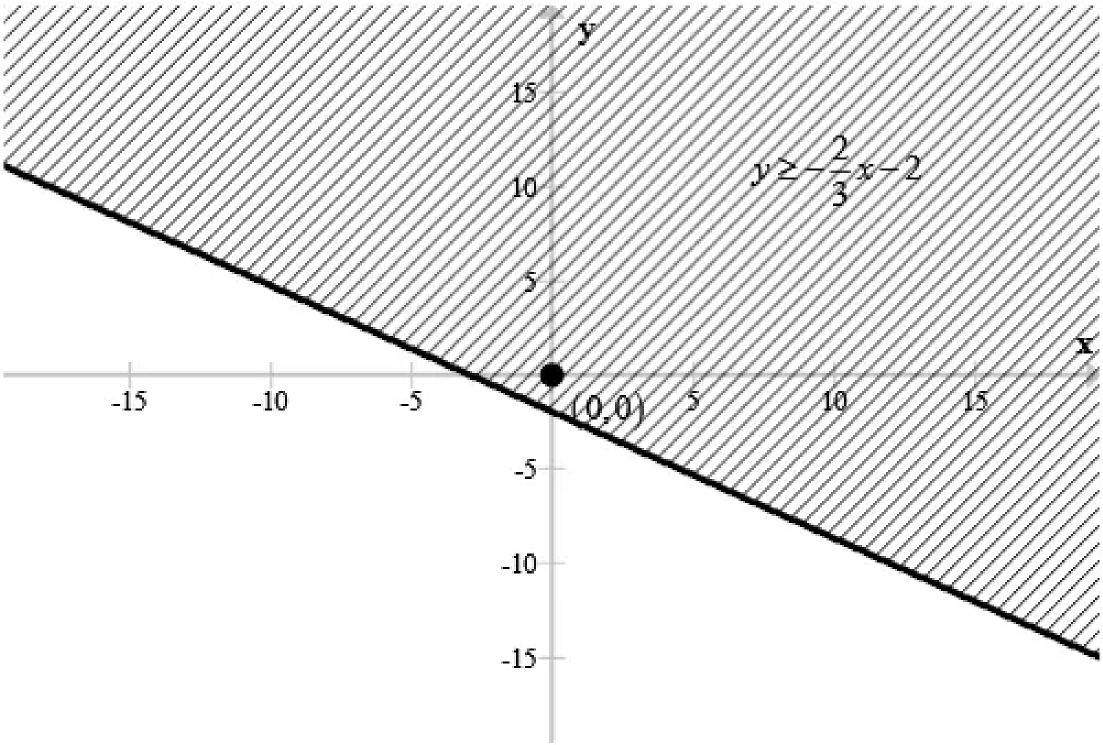
We first graph the boundary $y = -\frac{2}{3}x - 2$ using a solid line as the inequality symbol is $\leq$.

Let the test point be $(0,0)$. Substituting $x = 0, y = 0$ in the inequality $y \geq -\frac{2}{3}x - 2$,

$$0 \geq -\frac{2}{3}(0) - 2$$
$$0 \geq 0 - 2$$
$$0 \geq -2$$

Thus, the result is true. Therefore, $(0,0)$ is a solution of the inequality $y \geq -\frac{2}{3}x - 2$.

Therefore, we shade the half-plane that contains $(0,0)$ and the shaded region is the solution of the inequality $y \geq -\frac{2}{3}x - 2$.



Answer 14gp.

We need to graph the inequality $y \leq 3|x-1| - 3$.

The boundary of the inequality is $y = 3|x-1| - 3$.

We first graph the boundary $y = 3|x-1|-3$ using a solid line as the inequality symbol is $\leq$.

Then,

$$y = 3|x-1|-3$$

$$y = \begin{cases} 3(x-1)-3; x-1 \geq 0 \\ -3(x-1)-3; x-1 \leq 0 \end{cases}$$

$$y = \begin{cases} 3x-6; x \geq 1 \\ -3x; x \leq 1 \end{cases}$$

Let the test point be $(1,1)$. Substituting $x=1, y=1$ in the inequality $y \leq 3|x-1|-3$, we get

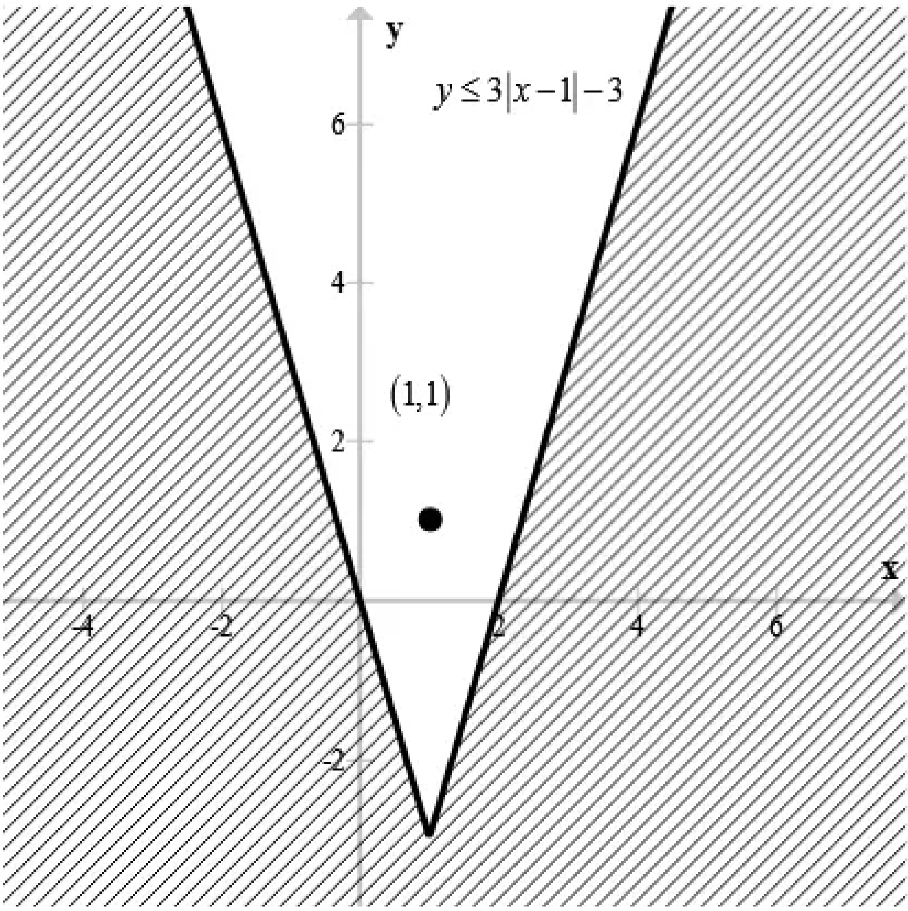
$$1 \leq 3|1-1|-3$$

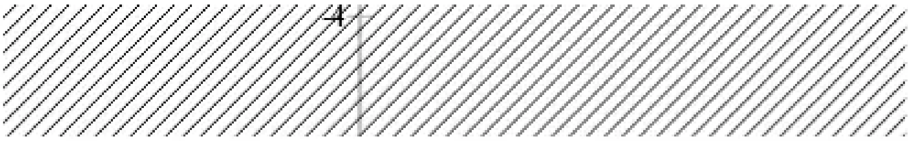
$$1 \leq 3|0|-3$$

$$1 \leq 0-3$$

$$1 \leq -3$$

Thus, the result is not true. Therefore, $(1,1)$ is a solution of the inequality $y \leq 3|x-1|-3$. Therefore, we shade the coordinate plane that does not contain $(1,1)$ and the shaded region is the solution of the inequality $y \leq 3|x-1|-3$.





Answer 15e.

STEP 1 **Graph the boundary line of the inequality.**

In order to obtain the boundary line, replace the inequality sign with “=”. Then, we get an equation of the form $2x + y = 6$.

Substitute 0 for y in above equation and solve for x.

$$\begin{aligned} 2x + 0 &= 6 \\ 2x &= 6 \\ x &= 3 \end{aligned}$$

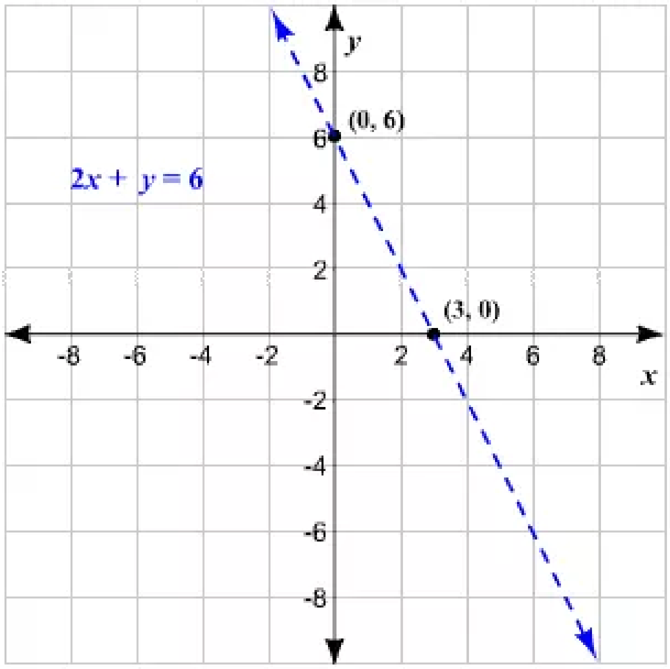
The x-intercept is 3. A point that can be plotted on the graph is (3, 0).

Next, replace x with 0 and solve for y.

$$\begin{aligned} 2(0) + y &= 6 \\ y &= 6 \end{aligned}$$

Since the y-intercept is 6, another point that can be plotted on the graph is (0, 6).

Plot (3, 0) and (0, 6) on the graph and draw a line passing through them. Since $<$ is the inequality sign used, draw a dashed line.



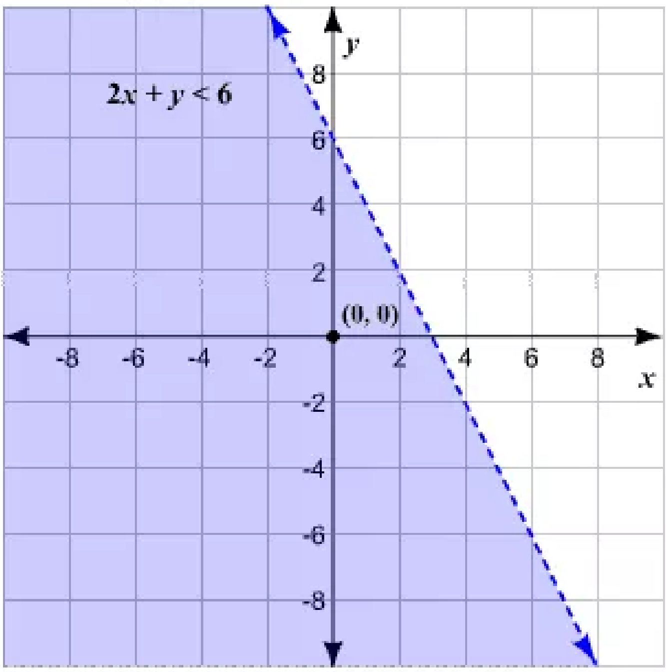
STEP 2 **Test a point.**

Let us take a test point which does not lie on the boundary line, say, (0, 0). Substitute 0 for *y*, and 0 for *x*. Check if the test point satisfies the given inequality.

$$2(0) + 0 \overset{?}{<} 6$$

$$0 < 6 \qquad \text{TRUE}$$

The test point is a solution to the inequality. Shade the half-plane that contains (0, 0).



Answer 16e.

We need to graph the inequality $x+4y>-12$.

The boundary of the inequality is $x+4y>-12$.

We first graph the boundary $x+4y=-12$ using a solid line as the inequality symbol is $\leq$.

Then,

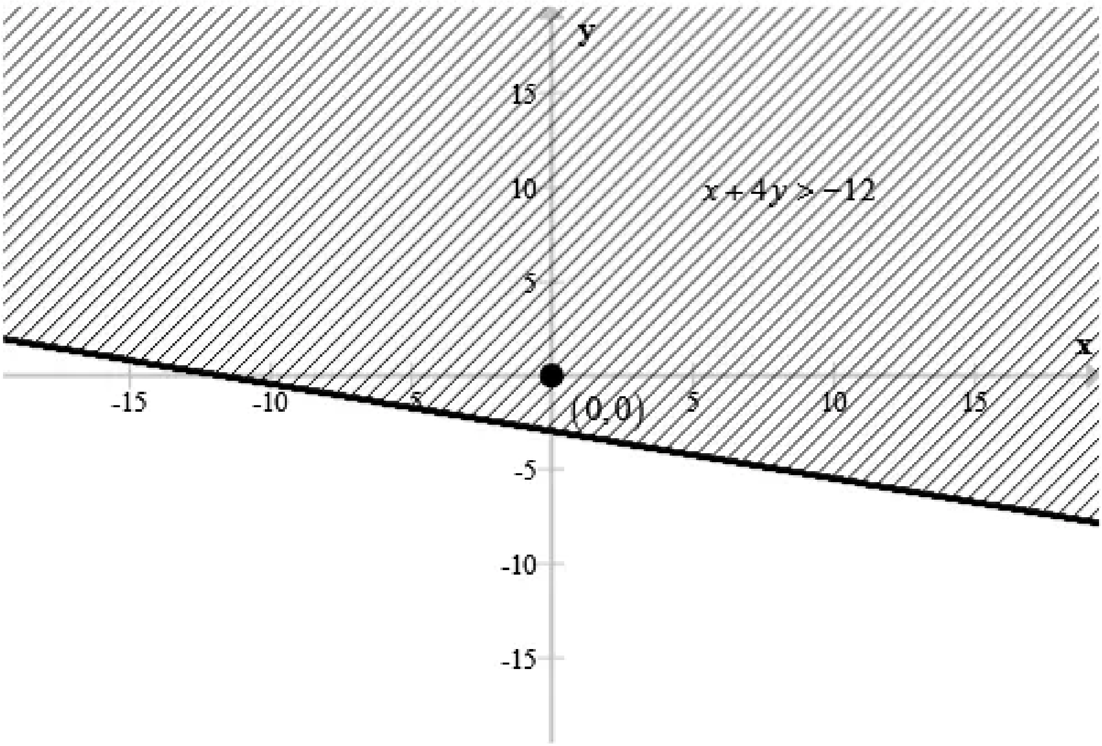
$$x+4y=-12$$
$$4y=-x-12$$
$$\frac{4}{4}y=-\frac{x}{4}-\frac{12}{4}$$
$$y=-\frac{1}{4}x-3$$

Let the test point be $(0,0)$. Substituting $x=0, y=0$ in the inequality $x+4y>-12$,

$$0+4(0)>-12$$
$$0+0>-12$$
$$0>-12$$

Thus, the result is true. Therefore, $(0,0)$ is a solution of the inequality $x+4y>-12$.

Therefore, we shade the half-plane that contains $(0,0)$ and the shaded region is the solution of the inequality $x+4y>-12$.



Answer 17e.

STEP 1 **Graph the boundary line of the inequality.**

In order to obtain the boundary line, replace the inequality sign with "=". Then, we get an equation of the form $3x - y = 1$.

Substitute 0 for y in above equation and solve for x.

$$3x - 0 = 1$$
$$3x = 1$$
$$x = \frac{1}{3}$$

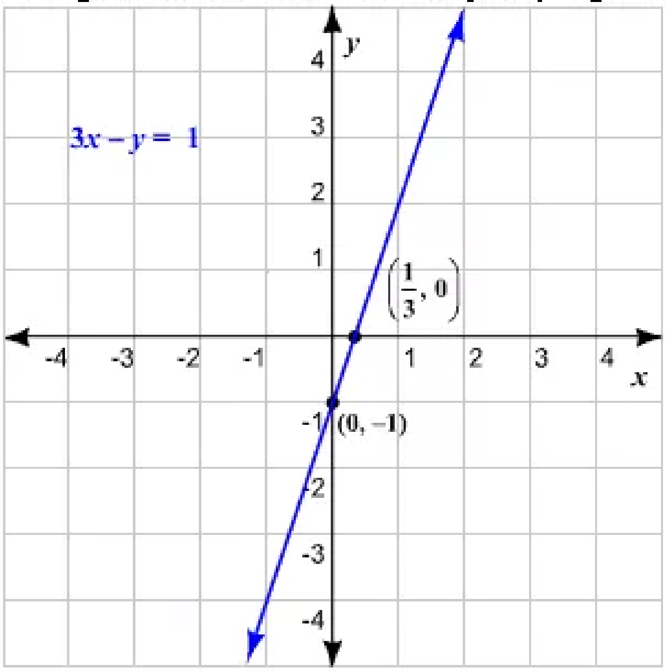
The x-intercept is $\frac{1}{3}$. A point that can be plotted on the graph is $\left(\frac{1}{3}, 0\right)$.

Next, replace x with 0 and solve for y.

$$3(0) - y = 1$$
$$-y = 1$$
$$y = -1$$

Since the y-intercept is -1, another point that can be plotted on the graph is $(0, -1)$.

Plot the points $\left(\frac{1}{3}, 0\right)$, and $(0, -1)$ on the graph and draw a line passing through them. Since $\geq$ is the inequality sign used, draw a solid line.



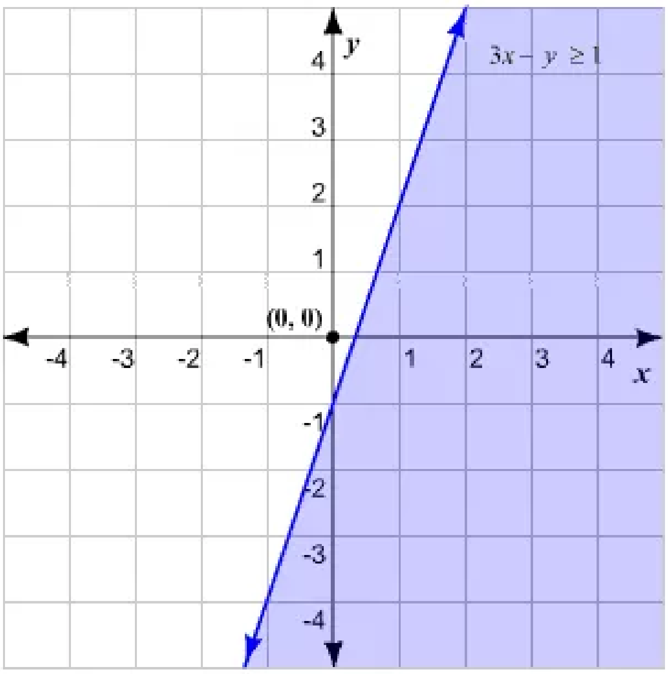
STEP 2 **Test a point.**

Let us take a test point (0, 0) which does not lie on the boundary line. Substitute 0 for y, and 0 for x. Check if the test point satisfies the given inequality.

$$3(0) - 0 \overset{?}{\geq} 1$$

$$0 \geq 1 \qquad \text{FALSE}$$

The test point is not a solution to the inequality. Shade the half-plane that does not contain (0, 0).



Answer 18e.

We need to graph the inequality $2x+5y\le -10$.

The boundary of the inequality is $2x+5y=-10$.

We first graph the boundary $2x+5y=-10$ using a solid line as the inequality symbol is $\le$.

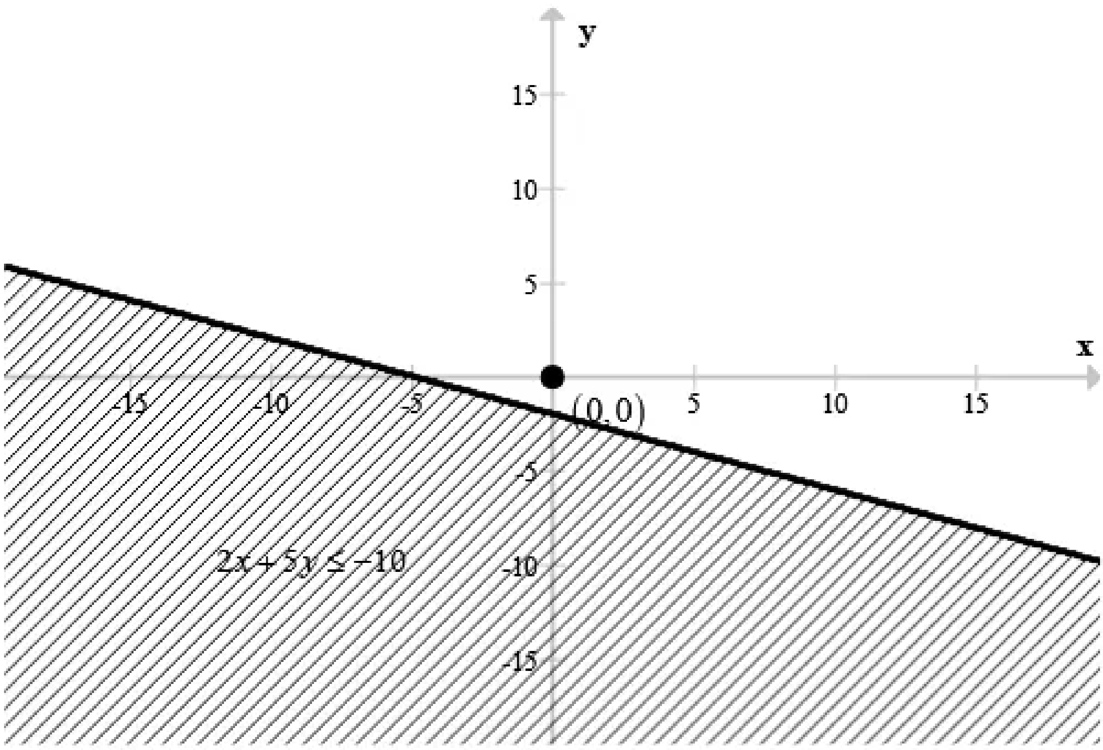
Then,

$$2x+5y=-10$$
$$5y=-2x-10$$
$$\frac{5}{5}y=-\frac{2}{5}x-\frac{10}{5}$$
$$y=-\frac{2}{5}x-2$$

Let the test point be $(0,0)$. Substituting $x=0, y=0$ in the inequality $2x+5y\le -10$,

$$2(0)+5(0)\le -10$$
$$0+0\le -10$$
$$0\le -10$$

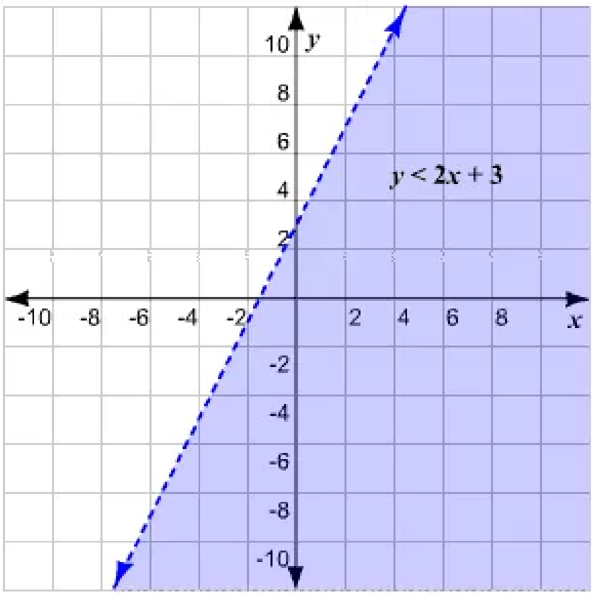
Thus, the result is not true. Therefore, $(0,0)$ is not a solution of the inequality $2x+5y\le -10$. Therefore, we shade the half-plane that does not contain $(0,0)$ and the shaded region is the solution of the inequality $2x+5y\le -10$.



Answer 19e.

In the given inequality, the symbol < is used. The boundary line should have been dashed.

Let us correct this error and graph the inequality with dashed boundary line.



Answer 20e.

We need to graph the inequality $y \geq -3x-2$.

The boundary of the inequality is $y = -3x-2$.

We first graph the boundary $y = -3x-2$ using a solid line as the inequality symbol is $\leq$.

Let the test point be $(0,0)$. Substituting $x = 0, y = 0$ in the inequality $y \geq -3x-2$,

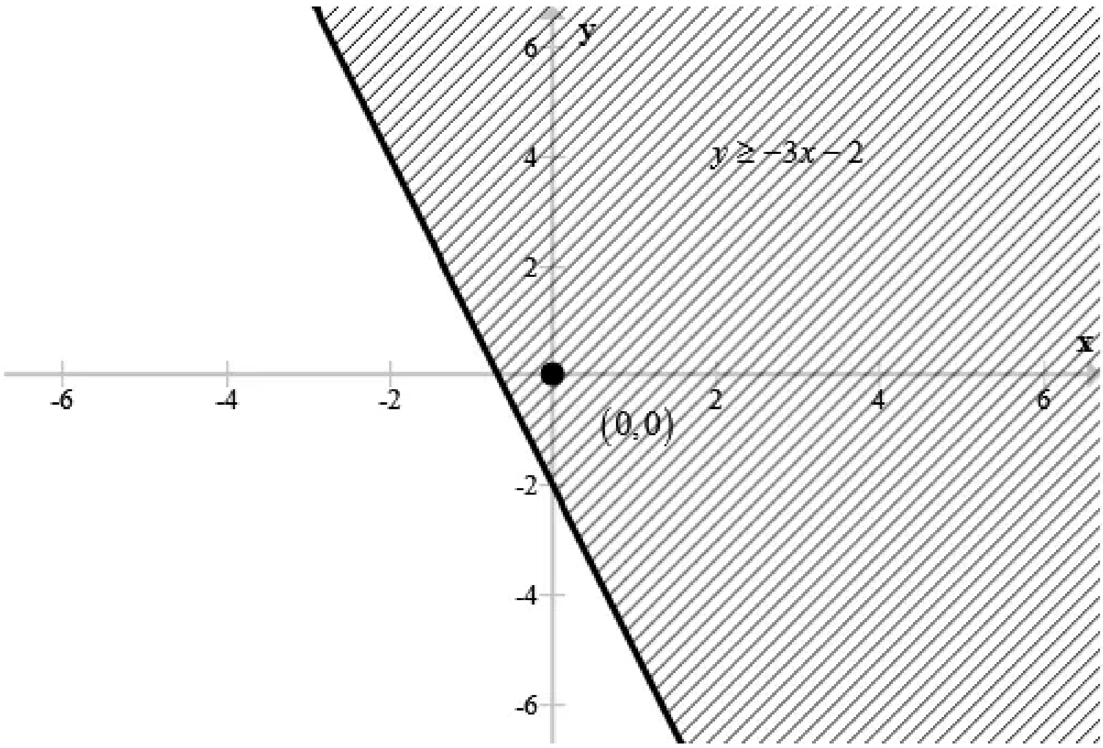
$$0 \geq -3(0)-2$$

$$0 \geq 0-2$$

$$0 \geq -2$$

Thus, the result is true. Therefore, $(0,0)$ is a solution of the inequality $y \geq -3x-2$.

Therefore, we shade the half-plane that contains $(0,0)$ and the shaded region is the solution of the inequality $y \geq -3x-2$.



Answer 21e.

An ordered pair (x, y) is a solution of a linear inequality if it is true for those values of x and y.

In order to determine whether (0, 0) is a solution of the inequality, substitute 0 for x, and 0 for y.

$$3(0) - 5(0) \stackrel{?}{<} 30$$
$$0 < 30 \qquad \text{TRUE}$$

Thus, (0, 0) is a solution to the inequality.

Now substitute -1 for x, and 7 for y in the given inequality to check whether $(-1, 7)$ is a solution.

$$3(-1) - 5(7) \stackrel{?}{<} 30$$
$$-3 - 35 \stackrel{?}{<} 30$$
$$-38 < 30 \qquad \text{TRUE}$$

Therefore, $(-1, 7)$ is a solution of the given inequality.

Next, let us replace x with 1 and y with -7 in the given inequality.

$$3(1) - 5(-7) \stackrel{?}{<} 30$$
$$3 + 35 \stackrel{?}{<} 30$$
$$38 < 30 \qquad \text{FALSE}$$

Thus, $(1, -7)$ is not a solution of the given inequality.

We have to check if $(-5, -5)$ is a solution of the given inequality. Substitute -5 for x and -5 for y in the given inequality.

$$3(-5) - 5(-5) \stackrel{?}{<} 30$$
$$-15 + 25 \stackrel{?}{<} 30$$
$$10 < 30 \qquad \text{TRUE}$$

It is clear that $(-5, -5)$ is a solution of the given inequality.

Therefore, the ordered pair $(1, -7)$ is not a solution to the inequality.

Answer 22e.

We need to graph the inequality $y > |x-1|$.

The boundary of the inequality is $y = |x-1|$.

We first graph the boundary $y = |x-1|$ using a solid line as the inequality symbol is $\leq$.

Then,

$$y = |x-1|$$

$$y = \begin{cases} (x-1); x-1 \geq 0 \\ -(x-1); x-1 \leq 0 \end{cases}$$

$$y = \begin{cases} x-1; x \geq 1 \\ -x+1; x \leq 1 \end{cases}$$

Let the test point be $(0,0)$. Substituting $x=0, y=0$ in the inequality $y > |x-1|$, we get

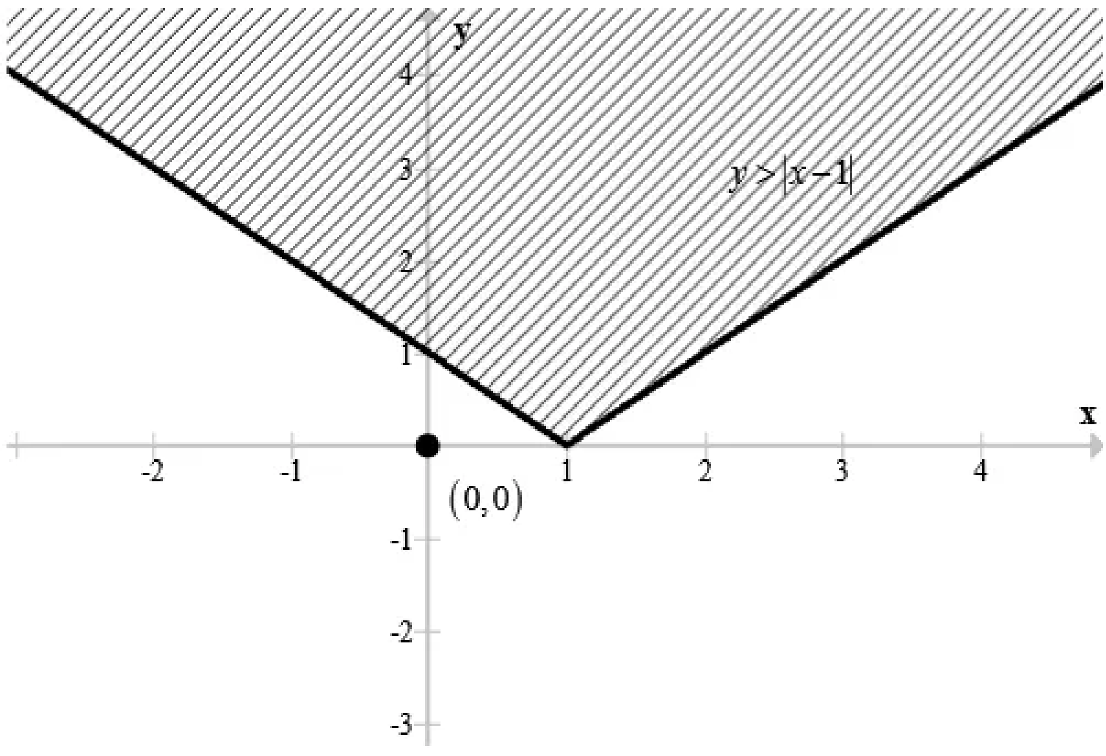
$$0 > |0-1|$$

$$0 > |-1|$$

$$0 > 1$$

Thus, the result is not true. Therefore, $(0,0)$ is not a solution of the inequality $y > |x-1|$.

Therefore, we shade the half-plane that does not contain $(0,0)$.



Answer 23e.

STEP 1 **Graph the boundary line of the inequality.**

In order to obtain the boundary line, replace the inequality sign with "=". Then, we get a function of the form $y = |x - h| + k$, where (h, k) is the vertex of the function.

In this case, we get the value of h as 0 and that of k as 5. Thus, the vertex is (0, 5).

Let us use symmetry to find two more points.
Rewrite the function.

$$y - 5 = |x| + 5 - 5$$

$$y - 5 = |x|$$

Swap the sides.

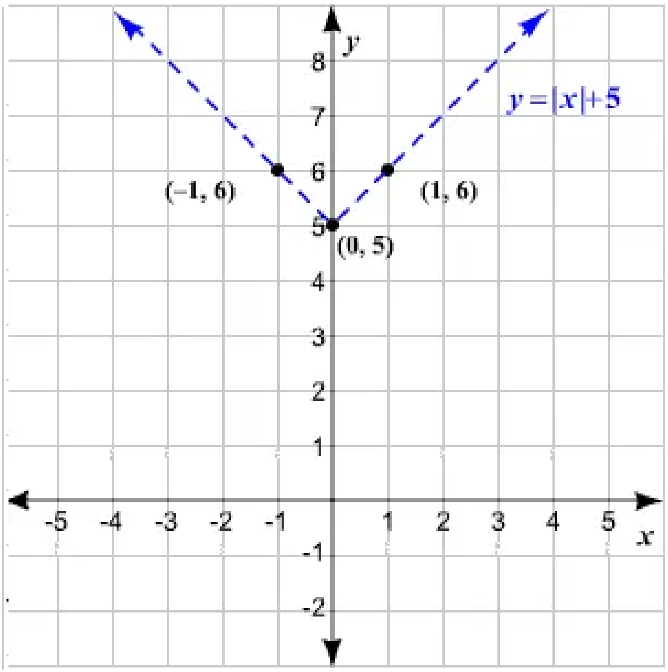
$$|x| = y - 5$$

We know that $|x|$ is always positive. This means that y will be greater than or equal to 5. Substitute a value, say, 6 for y.

$$|x| = 6 - 5$$
$$= 1$$

We get two values for x: 1 and −1. The two points are (1, 6) and (−1, 6).

Plot (0, 5), (1, 0) and (−1, 0) on the graph. Connect these points using straight lines to obtain a V-shaped graph. Since < is the inequality sign used, draw a dashed line.



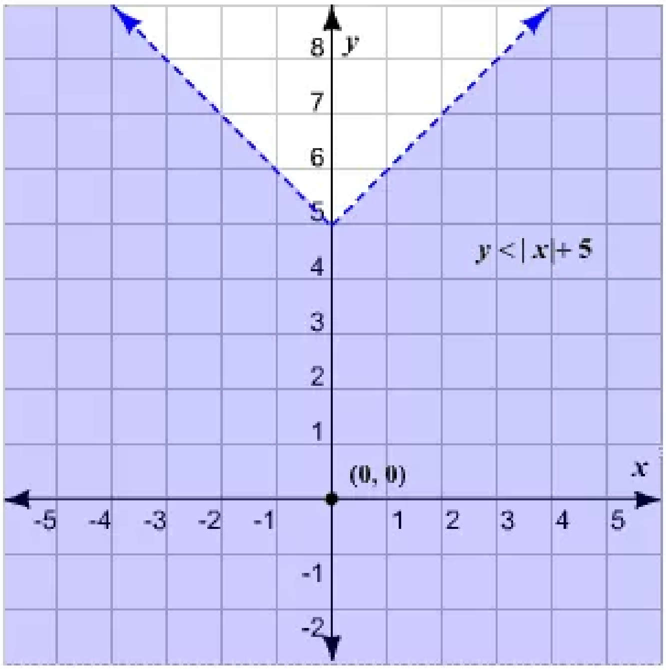
STEP 2 **Test a point.**

Let us take a test point that does not lie on the boundary line, say, (0, 0). Substitute 0 for *y*, and 0 for *x* in the function. Check if the test point satisfies the given inequality.

$$0 \overset{?}{<} |0| + 5$$

$$0 < 5 \qquad \text{TRUE}$$

The test point is a solution to the inequality. Shade the half-plane that contains (0, 0).



Answer 24e.

We need to graph the inequality $y > |x+4| - 3$.

The boundary of the inequality is $y = |x+4| - 3$.

We first graph the boundary $y = |x+4| - 3$ using a solid line as the inequality symbol is $\leq$.

Then,

$$y = |x+4| - 3$$

$$y = \begin{cases} (x+4) - 3; x+4 \geq 0 \\ -(x+4) - 3; x+4 \leq 0 \end{cases}$$

$$y = \begin{cases} x+1; x \geq -4 \\ -x-7; x \leq -4 \end{cases}$$

Let the test point be $(0,0)$. Substituting $x = 0, y = 0$ in the inequality $y > |x+4| - 3$, we get

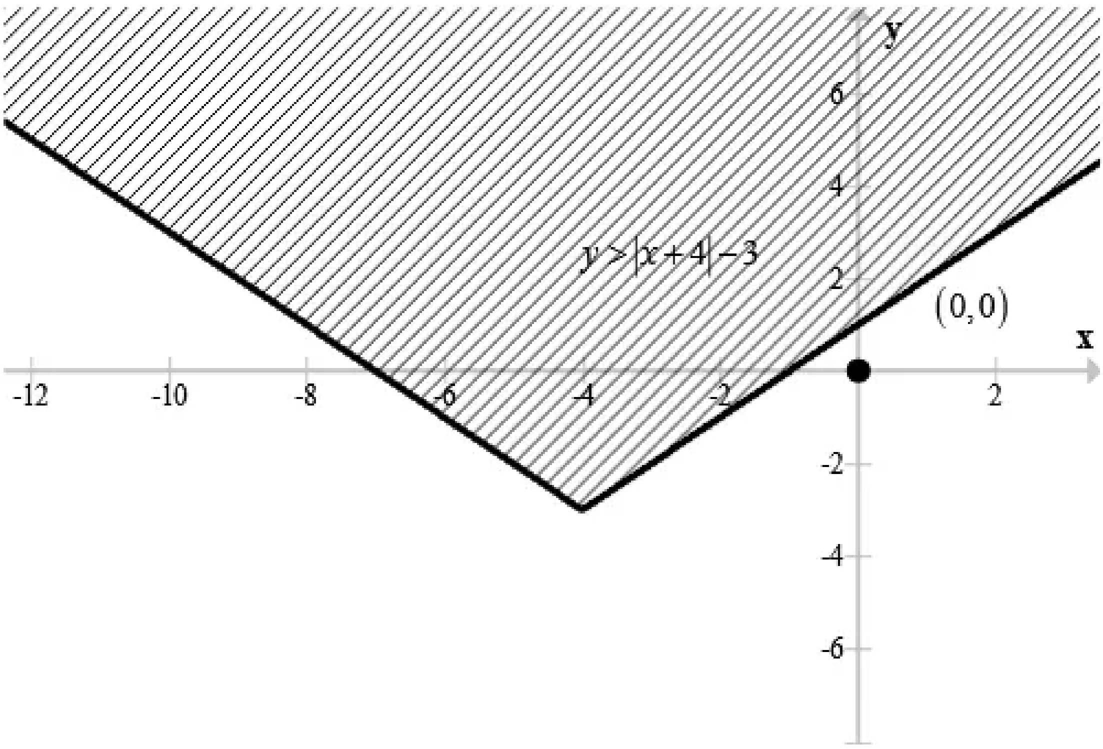
$$0 > |0+4| - 3$$

$$0 > |4| - 3$$

$$0 > 4 - 3$$

$$0 > 1$$

Thus, the result is not true. Therefore, $(0,0)$ is not a solution of the inequality $y > |x+4| - 3$. Therefore, we shade the half-plane that does not contain $(0,0)$.



Answer 25e.

STEP 1 **Graph the boundary line of the inequality.**

In order to obtain the boundary line, replace the inequality sign with "=". Then, we get a function of the form $y = |x - h| + k$, where (h, k) is the vertex of the function's graph.

In this case, we get the value of h as 2 and that of k as 1. Thus, the vertex is (2, 1).

Let us use symmetry to find two more points.
Substitute any value, say, 0 for y in the given function.

$$0 = -\frac{1}{2}|x - 2| + 1$$

Subtract 1 from both sides of the equation.

$$0 - 1 = -\frac{1}{2}|x - 2| + 1 - 1$$

$$-1 = -\frac{1}{2}|x - 2|$$

Multiply both the sides by −2.

$$(-2)(-1) = (-2)\left(-\frac{1}{2}\right)|x - 2|$$

$$2 = |x - 2|$$

We get $x - 2 = 2$ and $x - 2 = -2$.

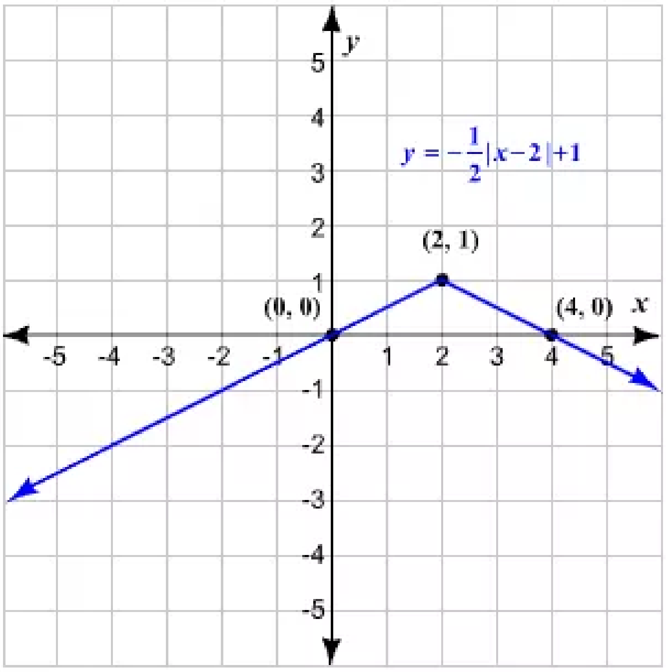
Add 2 to both sides of the two equations.

$$x - 2 + 2 = 2 + 2 \quad \text{and} \quad x - 2 + 2 = -2 + 2$$

$$x = 4 \quad \text{and} \quad x = 0$$

The two points are (4, 0) and (0, 0).

Plot (2, 1), (4, 0) and (0, 0) on the graph. Connect these points using straight lines to obtain a V-shaped graph. Since ≤ is the inequality sign used, draw a solid line.



STEP 2 **Test a point.**

Let us take a test point, which does not lie on the boundary line, say, (2, 2). Substitute 2 for y, and 2 for x in the function. Check if the test point satisfies the given inequality.

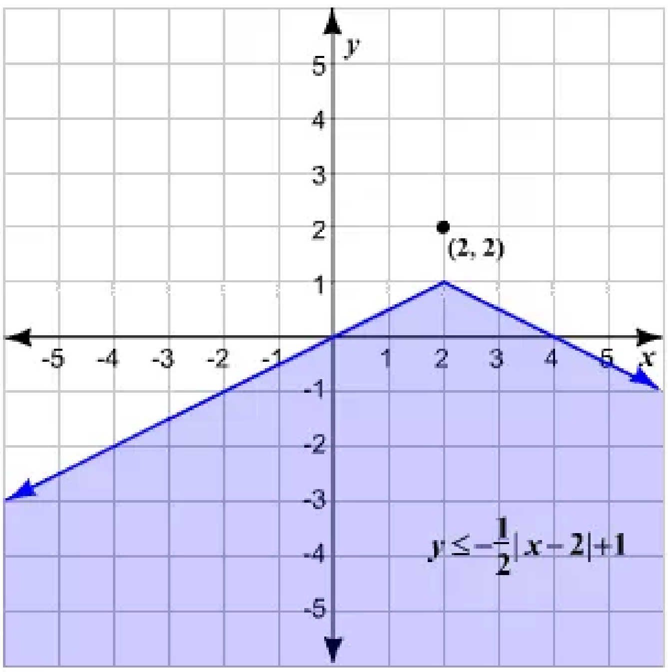
$$2 \overset{?}{\leq} -\frac{1}{2}|2-2|+1$$

$$2 \overset{?}{\leq} -\frac{1}{2}|0|+1$$

$$2 \overset{?}{\leq} 0+1$$

$2 \leq 1$ FALSE

The test point is not a solution to the inequality. Shade the half-plane that does not contain (2, 2).



Answer 26e.

We need to graph the inequality $y < 3|x| + 2$.

The boundary of the inequality is $y = 3|x| + 2$.

We first graph the boundary $y = 3|x| + 2$ using a solid line as the inequality symbol is $\leq$.

Then,

$$y = 3|x| + 2$$

$$y = \begin{cases} 3(x) + 2; x \geq 0 \\ 3(-x) + 2; x \leq 0 \end{cases}$$

$$y = \begin{cases} 3x + 2; x \geq 0 \\ -3x + 2; x \leq 0 \end{cases}$$

Let the test point be $(0,0)$. Substituting $x = 0, y = 0$ in the inequality $y < 3|x| + 2$, we get

$$0 < 3|0| + 2$$

$$0 < 3|0| + 2$$

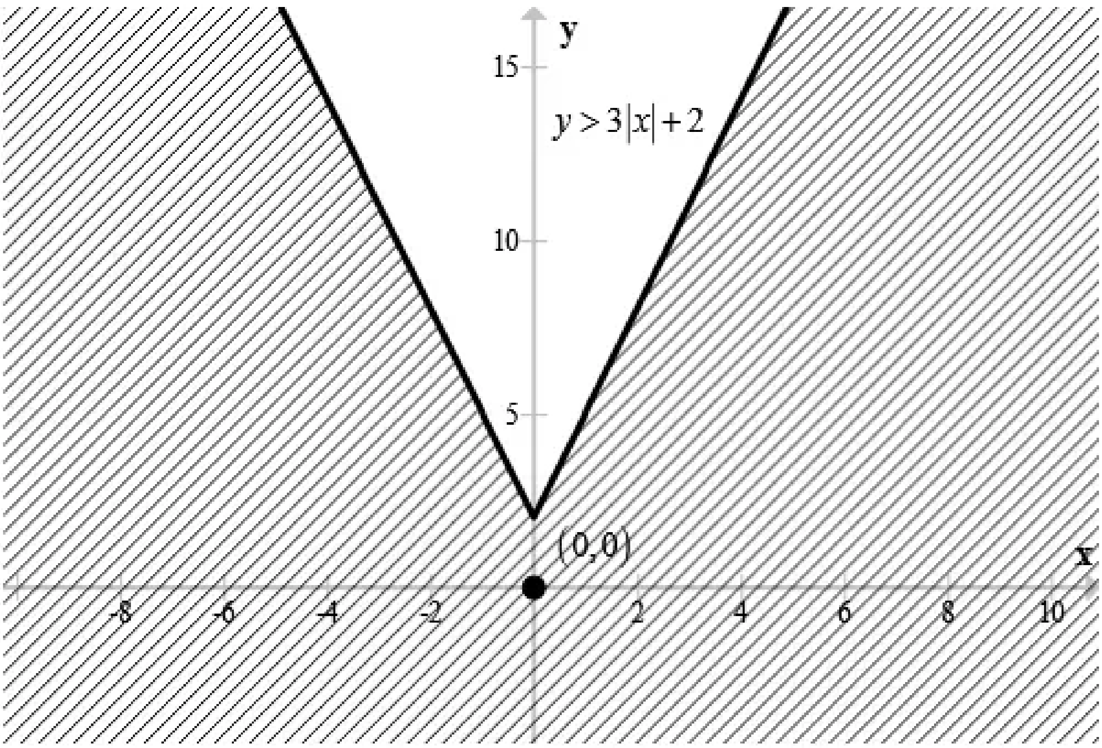
$$0 < 3(0) + 2$$

$$0 < 0 + 2$$

$$0 < 2$$

Thus, the result is true. Therefore, $(0,0)$ is a solution of the inequality $y < 3|x| + 2$.

Therefore, we shade the half-plane that contains $(0,0)$.



Answer 27e.

STEP 1 **Graph the boundary line of the inequality.**

In order to obtain the boundary line, replace the inequality sign with "=". Then, we get a function of the form $y = |x - h| + k$, where (h, k) is the vertex of the function's graph.

In this case, we get the value of h as 1 and that of k as –4. Thus, the vertex is (1, –4).

Let us use symmetry to find two more points.
Substitute any value, say, 0 for y in the given function.
$0 = 2|x - 1| - 4$

Add 4 to both the sides of the equation.

$$0 + 4 = 2|x - 1| - 4 + 4$$
$$4 = 2|x - 1|$$

Divide both the sides by 2.

$$\frac{4}{2} = \frac{2|x - 1|}{2}$$
$$2 = |x - 1|$$

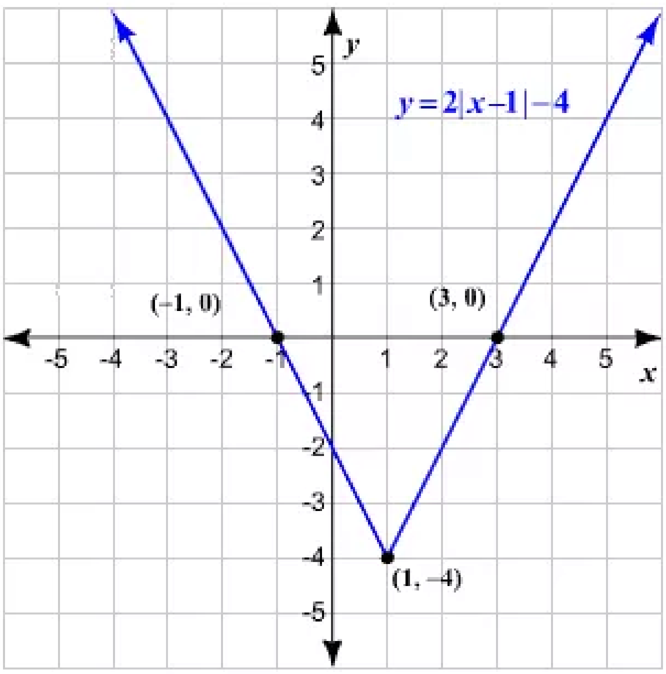
We get $x - 1 = 2$ and $x - 1 = -2$.

Add 1 to both sides of the two equations.

$$x - 1 + 1 = 2 + 1 \quad \text{and} \quad x - 1 + 1 = -2 + 1$$
$$x = 3 \quad \text{and} \quad x = -1$$

The two points are (3, 0) and (–1, 0).

Plot (1, –4), (3, 0) and (–1, 0) on the graph. Connect these points using straight lines to obtain a V-shaped graph. Since ≥ is the inequality sign used, draw a solid line.



STEP 2 **Test a point.**

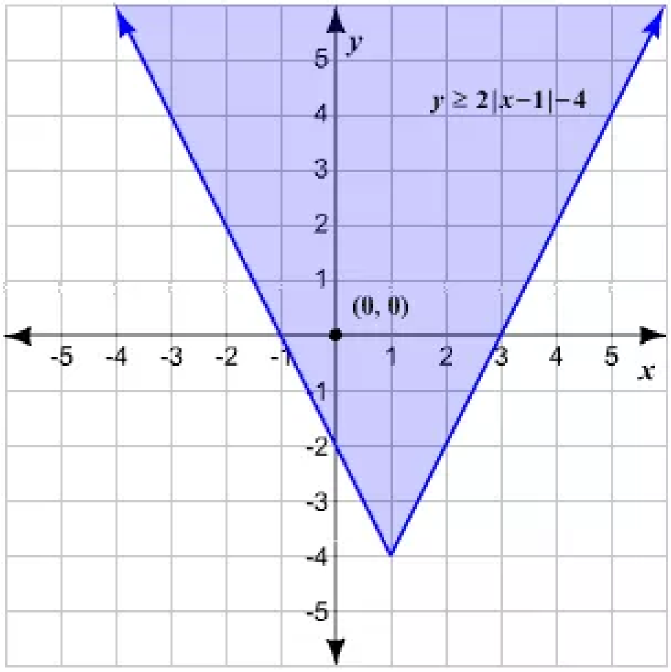
Let us take a test point, which does not lie on the boundary line, say, (0, 0). Substitute 0 for *y*, and 0 for *x* in the function. Check if the test point satisfies the given inequality.

$0 \overset{?}{\geq} 2|0-1|+5$

$0 \overset{?}{\geq} 2|-1|+5$

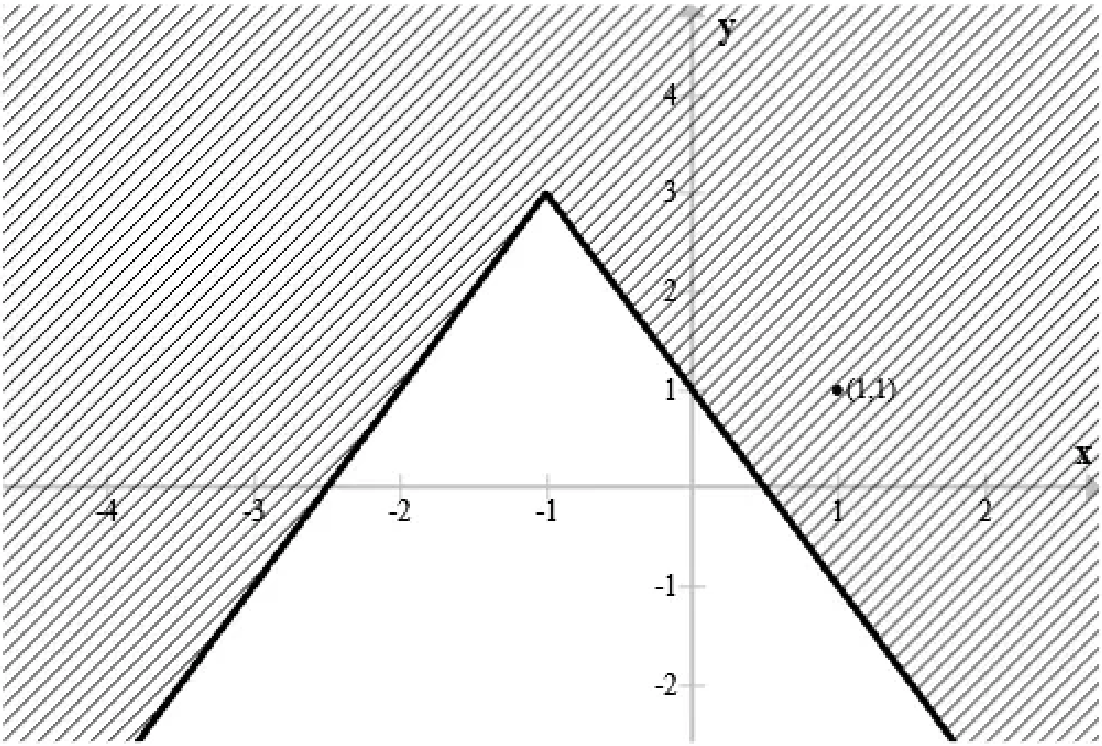
$0 \geq 7$ FALSE

The test point is not a solution to the inequality. Shade the half-plane that does not contain (0, 0).



Answer 28e.

The given graph is shown below.



Let the test point be $(1,1)$ which is a solution obtained from the graph.

Substituting $x=1, y=1$ in the inequality $y \le -2|x+1|+3$, we get

$$1 \le -2|1+1|+3$$
$$1 \le -2|2|+3$$
$$1 \le -4+3$$
$$1 \le -1$$

Thus, the result is not true. Therefore, $(1,1)$ is not a solution of the inequality $y \le -2|x+1|+3$. Therefore, the given graph is not the graph of $y \le -2|x+1|+3$.

Substituting $x=1, y=1$ in the inequality $y \le -2|x-1|+3$, we get

$$1 \le -2|1-1|+3$$
$$1 \le -2|0|+3$$
$$1 \le 0+3$$
$$1 \le 3$$

Thus, the result is true. Therefore, $(1,1)$ is a solution of the inequality $y \le -2|x-1|+3$. Therefore, the given graph is the graph of $y \le -2|x-1|+3$.

Since the boundary of the graph is a solid line, therefore, the given graph is not the graph of $y > -2|x+1|+3$.

Substituting $x=1, y=1$ in the inequality $y \geq -2|x+1|+3$, we get

$$1 \geq -2|1+1|+3$$
$$1 \geq -2|2|+3$$
$$1 \geq -4+3$$
$$1 \geq -1$$

Thus, the result is true. Therefore, $(1,1)$ is a solution of the inequality $y \geq -2|x+1|+3$.

Therefore, the given graph is the graph of $y \geq -2|x+1|+3$.

Hence, the given graph is the graph of $y \leq -2|x-1|+3$ and $y \geq -2|x+1|+3$.

Answer 29e.

An ordered pair (x, y) is a solution of a linear inequality if it is true for those values of x and y.

In order to determine whether (−6, 8) is a solution of the inequality, substitute −6 for x, and 8 for y.

$$8 \overset{?}{\geq} -\frac{2}{3}(-6) + \frac{1}{2}$$
$$8 \overset{?}{\geq} -2(-2) + \frac{1}{2}$$
$$8 \geq \frac{9}{2} \qquad \text{TRUE}$$

Thus, (−6, 8) is a solution to the inequality.

Substitute −3 for x, and −3 for y in the given inequality to check whether (−3, −3) is a solution.

$$-3 \overset{?}{\geq} -\frac{2}{3}(-3) + \frac{1}{2}$$
$$-3 \overset{?}{\geq} 2 + \frac{1}{2}$$
$$-3 \geq \frac{5}{2} \qquad \text{FALSE}$$

Therefore, (−3, −3) is not a solution to the given inequality.

Answer 30e.

We need to check whether the ordered pair $(0.5, 1)$ is a solution of $4.5 + y < 1.6x$.

Substituting $x = 0.5, y = 1$ in the inequality $4.5 + y < 1.6x$, we get

$$4.5 + 1 < 1.6(0.5)$$
$$5.5 < 0.8$$

Thus, the result is not true. Therefore, the ordered pair $(0.5, 1)$ is not a solution of $4.5 + y < 1.6x$.

We need to check whether the ordered pair $(3.8, 0)$ is a solution of $4.5 + y < 1.6x$.

Substituting $x = 3.8, y = 0$ in the inequality $4.5 + y < 1.6x$, we get

$$4.5 + 0 < 1.6(3.8)$$
$$4.5 < 6.08$$

Thus, the result is true. Therefore, the ordered pair $(3.8, 0)$ is a solution of $4.5 + y < 1.6x$.

Answer 31e.

An ordered pair (x, y) is a solution of a linear inequality if it is true for those values of x and y.

In order to determine whether $(0.5, -1)$ is a solution of the inequality, substitute 0.5 for x, and -1 for y.

$$0.2(0.5) + 0.7(-1) \overset{?}{>} -1$$
$$0.1 - 0.7 \overset{?}{>} -1$$
$$-0.6 > -1 \qquad \text{TRUE}$$

Thus, $(0.5, -1)$ is a solution.

Substitute -3 for x, and -1.5 for y in the given inequality to check whether $(-3, -1.5)$ is a solution.

$$0.2(-3) + 0.7(-1.5) \overset{?}{>} -1$$
$$-0.6 - 1.05 \overset{?}{>} -1$$
$$-1.65 > -1 \qquad \text{FALSE}$$

Therefore, $(-3, -1.5)$ is not a solution of the given inequality.

Answer 32e.

We need to check whether the ordered pair $\left(\frac{4}{3}, 0\right)$ is a solution of $\frac{1}{4}x - y > 1$.

Substituting $x = \frac{4}{3}, y = 0$ in the inequality $\frac{1}{4}x - y > 1$, we get

$$\frac{1}{4}\left(\frac{4}{3}\right) - (0) > 1$$
$$\frac{1}{3} - 0 > 1$$
$$\frac{1}{3} > 1$$

Thus, the result is not true. Therefore, the ordered pair $\left(\frac{4}{3}, 0\right)$ is not a solution of $\frac{1}{4}x - y > 1$.

We need to check whether the ordered pair $\left(\frac{2}{3}, -4\right)$ is a solution of $\frac{1}{4}x - y > 1$.

Substituting $x = \frac{2}{3}, y = -4$ in the inequality $\frac{1}{4}x - y > 1$, we get

$$\frac{1}{4}\left(\frac{2}{3}\right) - (-4) > 1$$
$$\frac{1}{6} + 4 > 1$$
$$\frac{25}{6} > 1$$

Thus, the result is true. Therefore, the ordered pair $\left(\frac{2}{3}, -4\right)$ is a solution of $\frac{1}{4}x - y > 1$.

Answer 33e.

STEP 1 **Graph the boundary line of the inequality.**

In order to obtain the boundary line, replace the inequality sign with "=" sign. Then, we get an equation of the form $3y = 4.5x + 15$.

Substitute 0 for y in above equation.

$$3(0) = 4.5x + 15$$
$$0 = 4.5x + 15$$

In order to solve for x, subtract $4.5x$ from both sides of the equation.

$$0 - 4.5x = 4.5x - 4.5x + 15$$
$$-4.5x = 15$$

Divide both the sides by −4.5.

$$\frac{-4.5x}{-4.5} = \frac{15}{-4.5}$$

$$x = -\frac{10}{3}$$

The x-intercept is $-\frac{10}{3}$. A point that can be plotted on the graph is $\left(-\frac{10}{3}, 0\right)$.

Next, replace x with 0 and simplify.

$$3y = 4.5(0) + 15$$

$$3y = 15$$

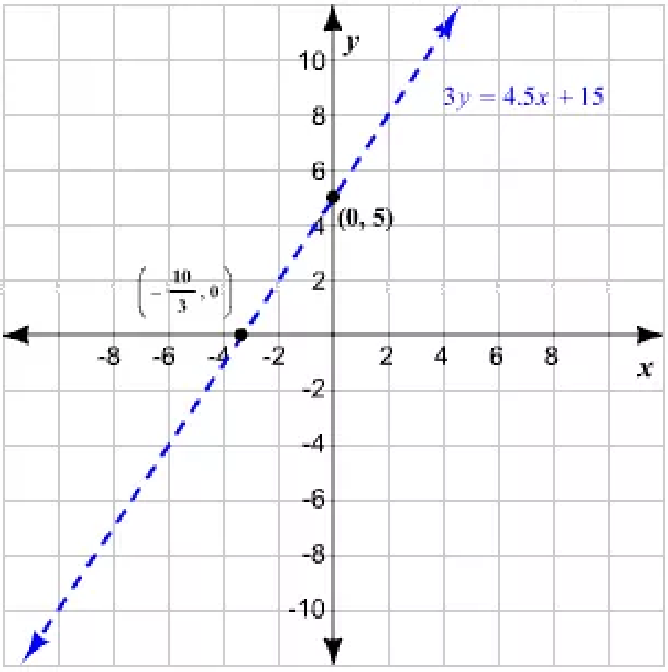
Solve for y. Divide both the sides by 3.

$$\frac{3y}{3} = \frac{15}{3}$$

$$y = 5$$

Since the y-intercept is 5, another point that can be plotted on the graph is (0, 5).

Plot $\left(-\frac{10}{3}, 0\right)$, and (0, 5) on the graph and draw a line passing through them. Since < is the inequality sign used, draw a dashed line.

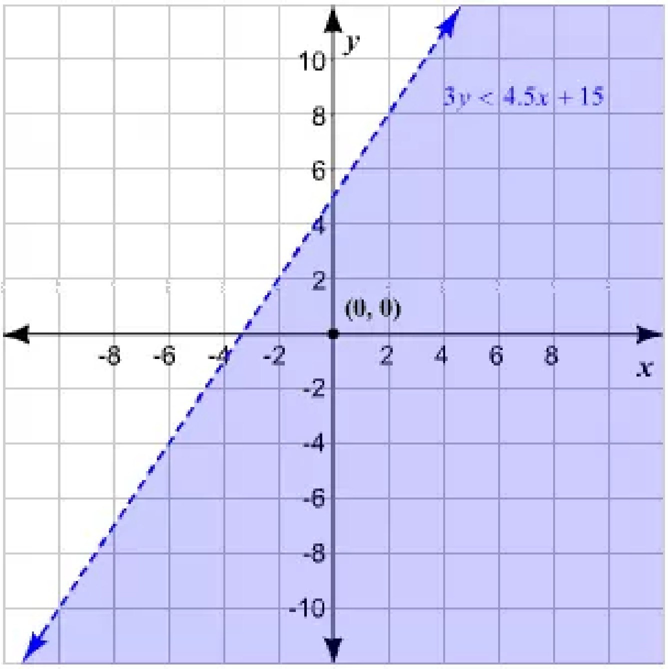


STEP 2 **Test a point.**

Let us take a test point that does not lie on the boundary line, say, (0, 0). Substitute 0 for y, and 0 for x. Check if the test point satisfies the given inequality.

$$3y < 4.5x + 15$$
$$3(0) \overset{?}{<} 4.5(0) + 15$$
$$0 < 15 \qquad \text{TRUE}$$

Thus, the test point is a solution. Shade the half-plane that contains (0, 0).



Answer 34e.

We need to graph the inequality $-1.5y-2x>3$.

The boundary of the inequality is $-1.5y-2x=3$.

We first graph the boundary $-1.5y-2x=3$ using a solid line as the inequality symbol is $\leq$.

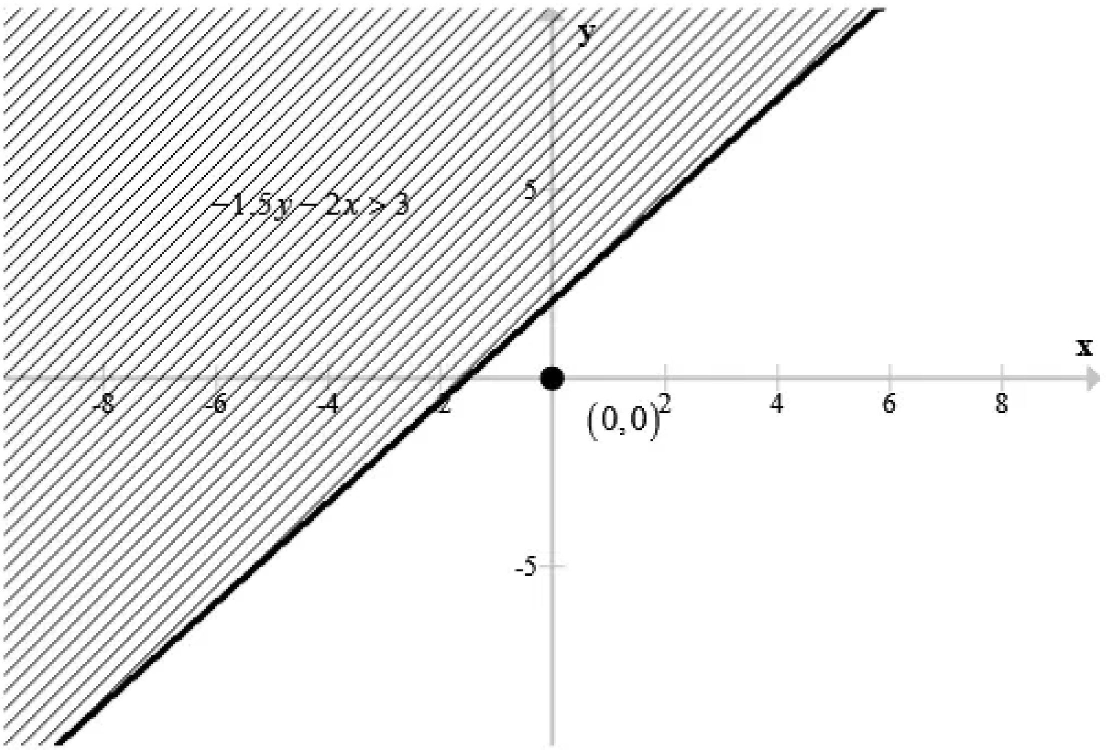
Then,

$$-1.5y-2x=3$$
$$-1.5y=2x+3$$
$$\left(\frac{-1.5}{-1.5}\right)y=\left(\frac{2}{-1.5}\right)x+\left(\frac{3}{-1.5}\right)$$
$$y=-\frac{2}{1.5}x+2$$

Let the test point be $(0,0)$. Substituting $x=0, y=0$ in the inequality $-1.5y-2x>3$,

$$-1.5(0)-2(0)>3$$
$$0-0>3$$
$$0>3$$

Thus, the result is not true. Therefore, $(0,0)$ is not a solution of the inequality $-1.5y-2x>3$. Therefore, we shade the half-plane that does not contain $(0,0)$.



Answer 35e.

STEP 1 **Graph the boundary line of the inequality.**

In order to obtain the boundary line, replace the inequality sign with "=". Then, we get an equation of the form $-y - 0.2 = -0.6x$.

Substitute 0 for y in above equation.

$$-0 - 0.2 = -0.6x$$
$$-0.2 = -0.6x$$

In order to solve for x, divide both the sides by -0.6.

$$\frac{-0.2}{-0.6} = \frac{-0.6x}{-0.6}$$
$$\frac{1}{3} = x$$

The x-intercept is $\frac{1}{3}$. A point that can be plotted on the graph is $\left(\frac{1}{3}, 0\right)$.

Next, replace x with 0 and simplify.

$$-y - 0.2 = -0.6(0)$$
$$-y - 0.2 = 0$$

Add 0.2 to both the sides.

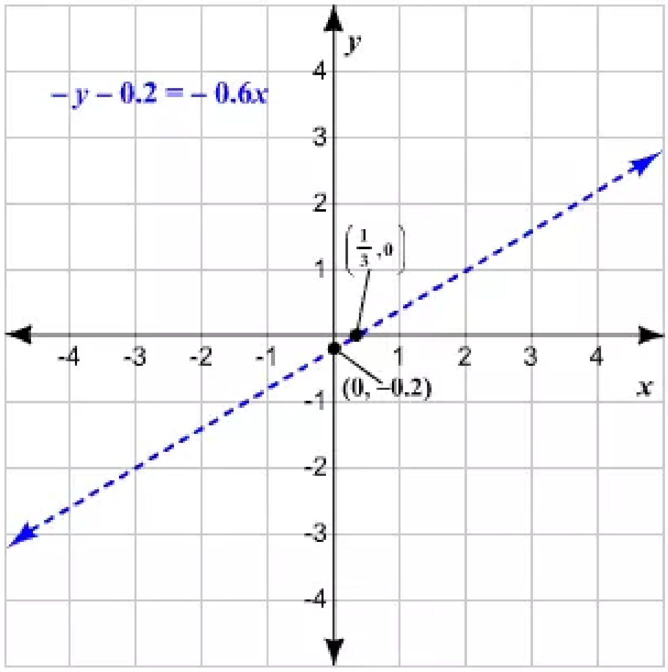
$$-y - 0.2 + 0.2 = 0 + 0.2$$
$$-y = 0.2$$

Divide both the sides by -1 and solve for y.

$$\frac{-y}{-1} = \frac{0.2}{-1}$$
$$y = -0.2$$

Since the y-intercept is -0.2, another point that can be plotted on the graph is $(0, -0.2)$.

Plot $\left(\frac{1}{3}, 0\right)$, and $(0, -0.2)$ on the graph and draw a line passing through them. Since > is the inequality sign used, draw a dashed line.



STEP 2 **Test a point.**

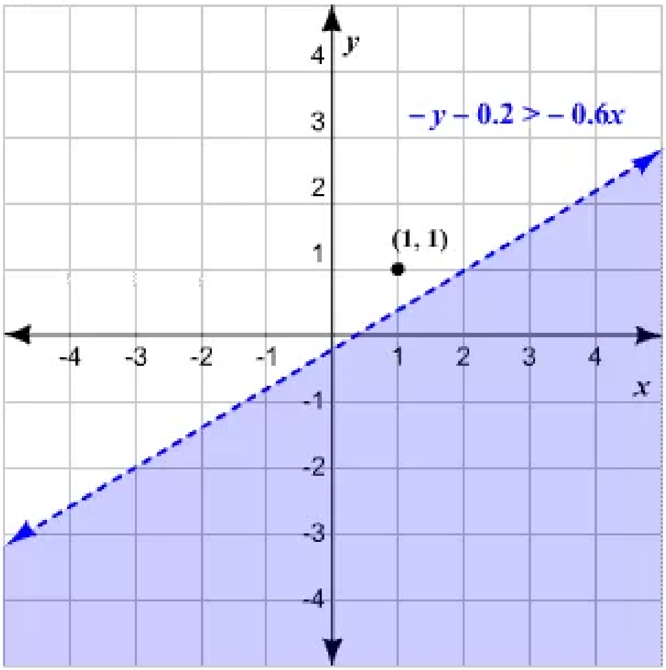
Let us take a test point that does not lie on the boundary line, say, (1, 1). Substitute 1 for y, and 1 for x. Check if the test point satisfies the given inequality.

$$-y-0.2 > -0.6x$$

$$-1-0.2 \overset{?}{>} -0.6(1)$$

$$-1.2 > -0.6 \qquad \text{FALSE}$$

The test point is not a solution. Shade the half-plane that does not contain (1, 1).



Answer 36e.

We need to graph the inequality $\frac{2}{3}x+\frac{1}{2}y>2$.

The boundary of the inequality is $\frac{2}{3}x+\frac{1}{2}y=2$.

We first graph the boundary $\frac{2}{3}x+\frac{1}{2}y=2$ using a solid line as the inequality symbol is $\le$.

Then,

$$\frac{2}{3}x+\frac{1}{2}y=2$$

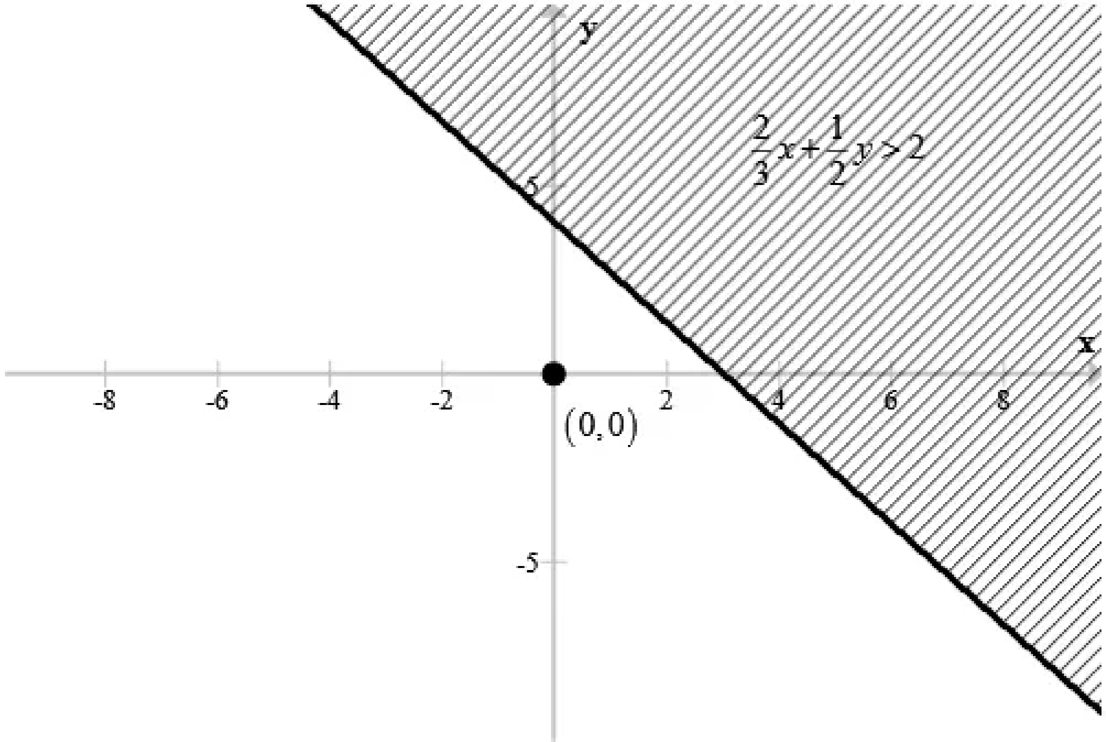
$$\frac{1}{2}y=-\frac{2}{3}x+2$$

$$y=-\frac{4}{3}x+4$$

Let the test point be $(0,0)$. Substituting $x=0, y=0$ in the inequality $\frac{2}{3}x+\frac{1}{2}y>2$,

$$\frac{2}{3}(0)+\frac{1}{2}(0)>2$$
$$0+0>2$$
$$0>2$$

Thus, the result is not true. Therefore, $(0,0)$ is not a solution of the inequality $\frac{2}{3}x+\frac{1}{2}y>2$. Therefore, we shade the half-plane that does not contain $(0,0)$.



Answer 37e.

STEP 1 **Graph the boundary line of the inequality.**

In order to obtain the boundary line, replace the inequality sign with "=". Then, we get a function of the form $y=|x-h|+k$, where (h, k) is the vertex of the function's graph.

In this case, we get the value of h as 3 and that of k as $-\frac{3}{2}$. Thus, the vertex is $\left(3, -\frac{3}{2}\right)$.

Let us use symmetry to find two more points.
Rewrite the function to isolate $| x - 3 |$ to one side of the equation. For this, first add $\frac{3}{2}$ to both the sides.

$$y + \frac{3}{2} = -\frac{5}{2}|x - 3| - \frac{3}{2} + \frac{3}{2}$$

$$y + \frac{3}{2} = -\frac{5}{2}|x - 3|$$

Now, multiply both the sides by $-\frac{2}{5}$.

$$-\frac{2}{5}\left(y + \frac{3}{2}\right) = -\frac{2}{5}\left(-\frac{5}{2}|x - 3|\right)$$

$$-\frac{2}{5}\left(y + \frac{3}{2}\right) = |x - 3|$$

We know that $| x -3 |$ is always positive. Substitute a value less than or equal to $-\frac{3}{2}$, say, $-\frac{5}{2}$ for y.

$$|x - 3| = -\frac{2}{5}\left(-\frac{5}{2} + \frac{3}{2}\right)$$

$$|x - 3| = -\frac{2}{5}\left(-\frac{2}{2}\right)$$

$$|x - 3| = \frac{2}{5}$$

We get $x - 3 = \frac{2}{5}$ and $x - 3 = -\frac{2}{5}$

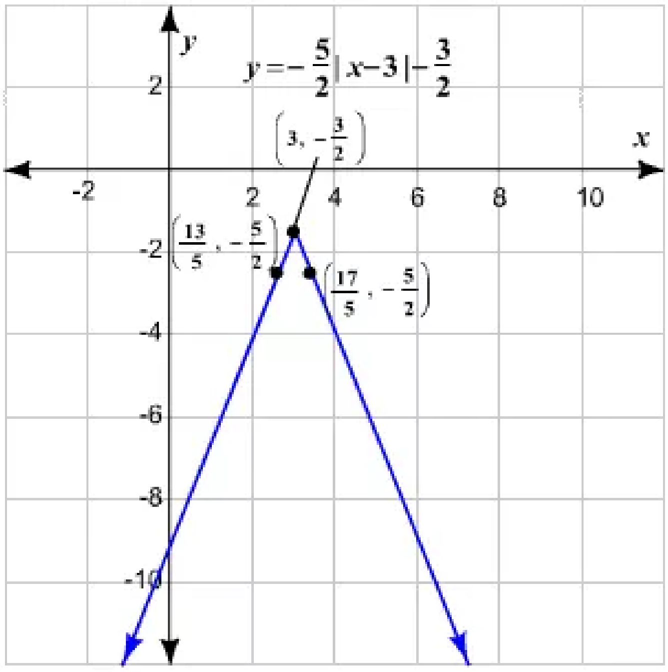
Add 3 to both sides of the two equations.

$$x - 3 + 3 = \frac{2}{5} + 3 \quad \text{and} \quad x - 3 + 3 = -\frac{2}{5} + 3$$

$$x = \frac{17}{5} \quad \text{and} \quad x = \frac{13}{5}$$

The two points are $\left(\frac{17}{5}, -\frac{5}{2}\right)$ and $\left(\frac{13}{5}, -\frac{5}{2}\right)$.

Plot $\left(3, -\frac{3}{2}\right)$, $\left(\frac{17}{5}, -\frac{5}{2}\right)$ and $\left(\frac{13}{5}, -\frac{5}{2}\right)$ on the graph. Connect these points using straight lines to obtain a V-shaped graph. Since $\geq$ is the inequality sign used, draw a solid line.



STEP 2 **Test a point.**

Let us take a test point that does not lie on the boundary line, say, (0, 0). Substitute 0 for y, and 0 for x in the function. Check if the test point satisfies the given inequality.

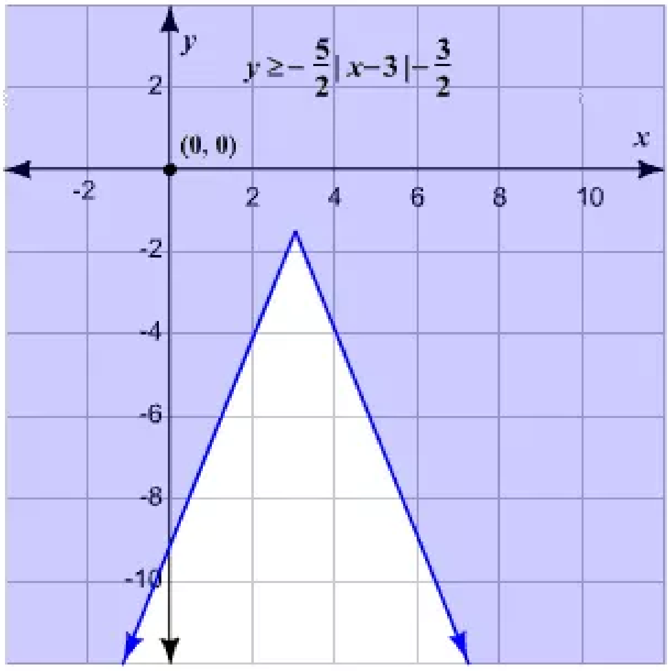
$$0 \overset{?}{\geq} -\frac{5}{2}|0-3| - \frac{3}{2}$$

$$0 \overset{?}{\geq} -\frac{5}{2}|-3| - \frac{3}{2}$$

$$0 \overset{?}{\geq} -\frac{15}{2} - \frac{3}{2}$$

$$0 \geq -9 \qquad \text{TRUE}$$

The test point is a solution of the inequality. Shade the half-plane that contains (0, 0).



Answer 38e.

We need to graph the inequality $2y-4\le -3|x+2|$.

The boundary of the inequality is $2y-4=-3|x+2|$.

We first graph the boundary $2y-4=-3|x+2|$ using a solid line as the inequality symbol is $\le$.

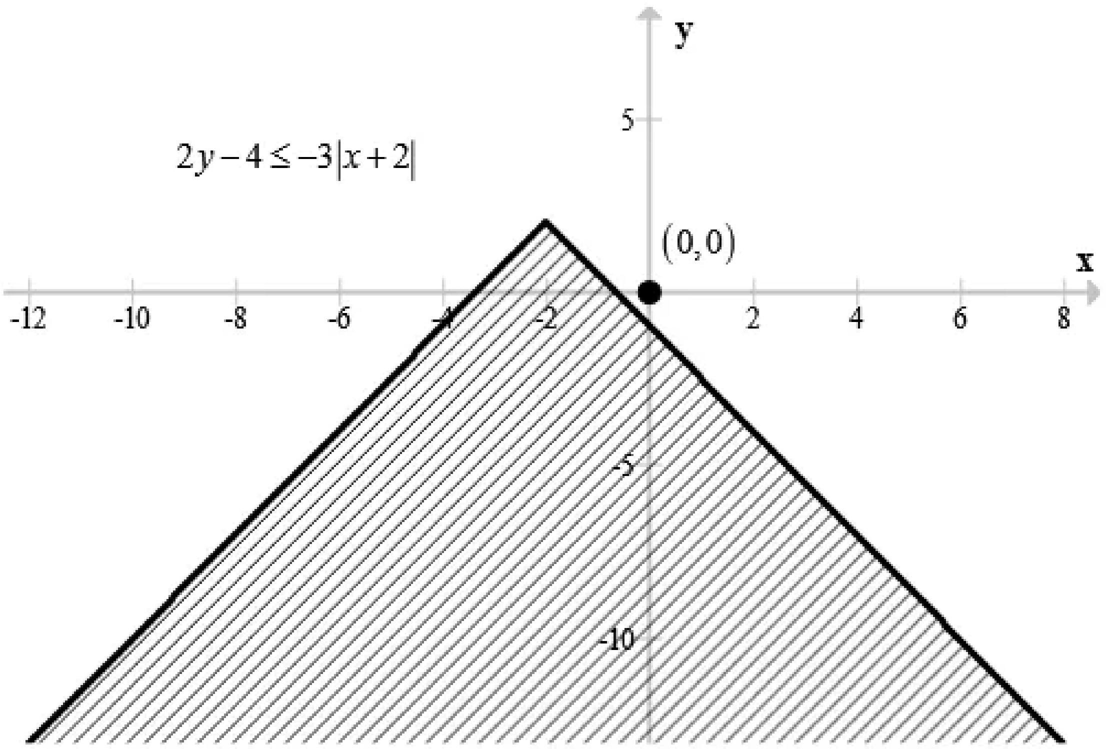
Then,

$$2y-4=-3|x+2|$$
$$2y=-3|x+2|+4$$
$$\frac{2}{2}y=-\frac{3}{2}|x+2|+\frac{4}{2}$$
$$y=-\frac{3}{2}|x+2|+2$$
$$y=\begin{cases}-\frac{3}{2}(x+2)+2; x+2\ge 0\\ -\frac{3}{2}\{-(x+2)\}+2; x+2\le 0\end{cases}$$
$$y=\begin{cases}-\frac{3}{2}x-1; x\ge -2\\ \frac{3}{2}x+5; x\le -2\end{cases}$$

Let the test point be $(0,0)$. Substituting $x=0, y=0$ in the inequality $2y-4\le -3|x+2|$, we get

$$2(0)-4\le -3|0+2|$$
$$0-4\le -3|2|$$
$$-4\le -3(2)$$
$$-4\le -6$$

Thus, the result is not true. Therefore, $(0,0)$ is not a solution of the inequality $2y-4\le -3|x+2|$. Therefore, we shade the half-plane that does not contain $(0,0)$.



Answer 39e.

First, find the slope of the line passing through the points $(-1, 3)$ and $(1, 6)$.
Ratio of vertical change to horizontal change will give us the slope.

$$m = \frac{y_2 - y_1}{x_2 - x_1}$$

Substitute $(-1, 3)$ for (x_1, y_1), and $(1, 6)$ for (x_2, y_2) and evaluate.

$$\begin{aligned} m &= \frac{6-3}{1-(-1)} \\ &= \frac{3}{2} \end{aligned}$$

The slope of the line that passes through $(-1, 3)$ and $(1, 6)$ is $\frac{3}{2}$.

An equation of a line in the point-slope form with slope m and passing through the point (x_1, y_1) is $y - y_1 = m(x - x_1)$.

Substitute -1 for x_1, 3 for y_1, and $\frac{3}{2}$ for m in the point-slope form.

$$\begin{aligned} y-(3) &= \frac{3}{2}\left[x-(-1)\right] \\ y-3 &= \frac{3}{2}(x+1) \\ y-3 &= \frac{3}{2}x+\frac{3}{2} \end{aligned}$$

Add 3 to both sides of the equation.

$$y - 3 + 3 = \frac{3}{2}x + \frac{3}{2} + 3$$
$$y = \frac{3}{2}x + \frac{9}{2}$$

Multiply both the sides by 2.

$$2y = 2\left(\frac{3}{2}x + \frac{9}{2}\right)$$
$$2y = 3x + 9$$

Rewrite the equation.
$-3x + 2y = 9$

Thus, the equation of the line that passes through $(-1, 3)$ and $(1, 6)$ is $-3x + 2y = 9$.

In order to determine the inequality symbol, substitute 4 for x and 0 for y in $-3x + 2y = 9$.
Solve left hand side of the equation.
$-3(4) + 2(0) = -12$
We can see that -12 is less than 9. Since (4,0) is not a solution the inequality symbol $\geq$ is to be used.

Therefore, the linear inequality is $-3x + 2y \geq 9$.

Answer 40e.

The graph of a linear inequality in two variables is the set of all points in a coordinate plane that represent solutions of the inequality. Therefore, the graph of a linear inequality in two variables is the half-plane.
If a point is chosen on the boundary line, it would give the information about the boundary line whether it is included in the solution half-plane or not. But we do not get any information about which half-plane belongs to the solution of the inequality.
Therefore, it is not helpful to choose a test point that lies on the boundary line.

Answer 41e.

From the graph given, let us take the points (0,3) and (5, 0) which lie on the boundary line.
First, find the slope of the line passing through the points (0,3) and (5, 0).
Ratio of vertical change to horizontal change will give us the slope.

$$m = \frac{y_2 - y_1}{x_2 - x_1}$$

Substitute (0, 3) for (x_1, y_1), and (5, 0) for (x_2, y_2) and evaluate.

$$m = \frac{0 - 3}{5 - 0}$$
$$= \frac{-3}{5}$$

The slope of the line that passes through (0,3) and (5, 0) is $-\frac{3}{5}$.

Next, find the equation of a line.
An equation of a line in the point-slope form with slope m and passing through the point (x_1, y_1) is $y - y_1 = m(x - x_1)$.

Substitute 0 for x_1, 3 for y_1, and $-\frac{3}{5}$ for m in the point-slope form.

$$y - (3) = -\frac{3}{5}(x - 0)$$

$$y - 3 = -\frac{3}{5}x$$

In order to clear the fraction, multiply both the sides by 5.

$$5(y - 3) = 5\left(-\frac{3}{5}x\right)$$

$$5y - 15 = -3x$$

Rewrite the equation.
$3x + 5y = 15$

Thus, the equation of the line that passes through (0, 3) and (5, 0) is $3x + 5y = 15$

In order to determine the inequality symbol, substitute 1 for x and 1 for y in $3x + 5y = 15$.
Solve left hand side of the equation.
$3(1) + 5(1) = 8$

We can see that 8 is less than 15. Since (1, 1) is not a solution and a dashed boundary line is drawn, the symbol > is to be used.
Therefore, the linear inequality is $3x + 5y > 15$.

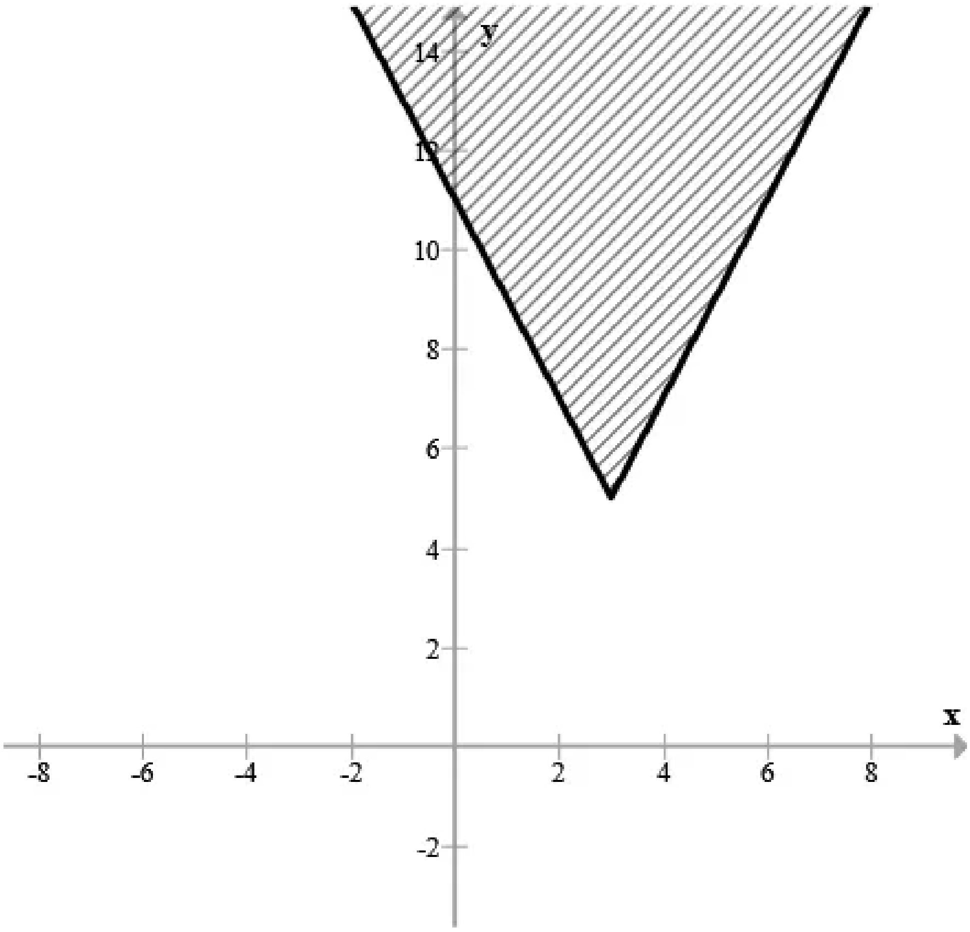
The cost of one game cd is \$5 and that of movie cd is \$3. We have \$ 15 with us to buy cds of both type. This situation can represent such an inequality.

Answer 42e.

The given inequality is $y \geq 2|x-3|+5$ with vertex $(3,5)$ and symmetry about $x=3$.

The equation of the boundary is $y=2|x-3|+5$.

The graph is as shown below.



Let the vertex of the new inequality be $(0,11)$ and symmetry about $y=0$.

Then the equation is of the form $x=a|y-h|+k$.

Substituting $h=0$ and $k=11$, we get

$$x=a|y-0|+11$$

$$x=a|y|+11$$

We choose another point $(-4,12)$ outside the inequality $y \geq 2|x-3|+5$ and above the vertex $(0,11)$.

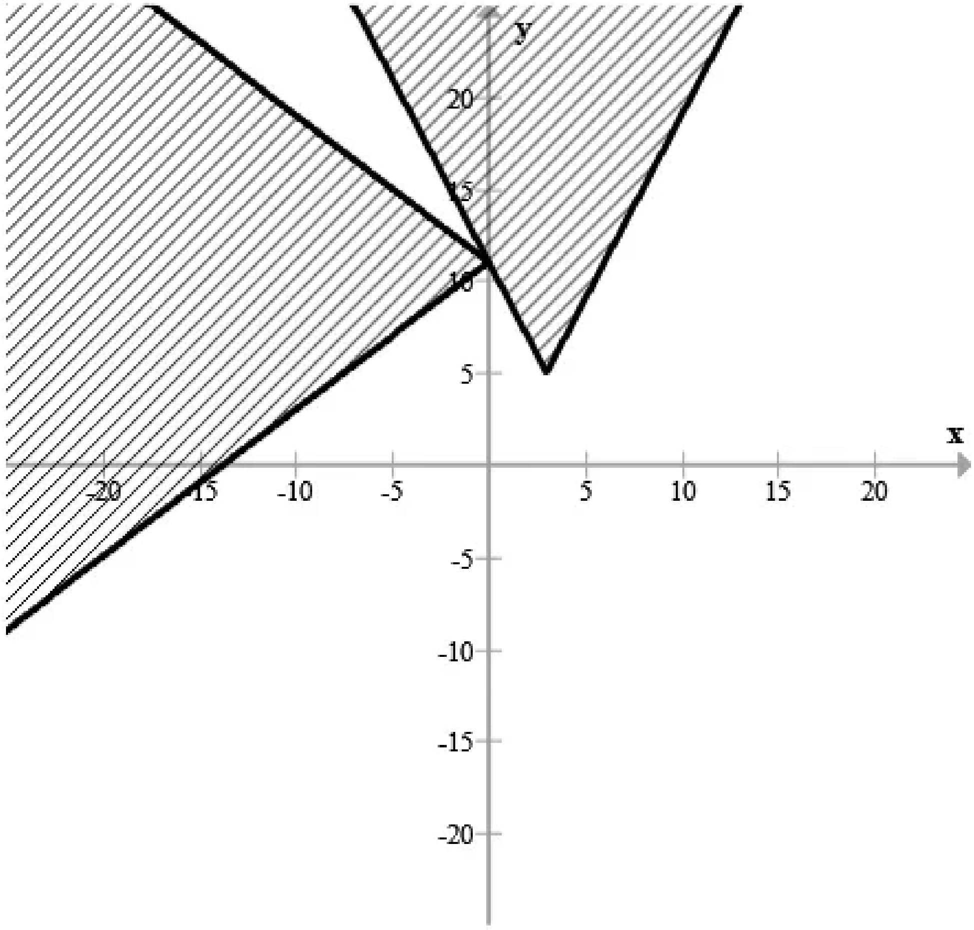
Substituting $x=-4, y=12$ in the inequality $x=a|y|+11$, we get

$$x=a|y|+11$$
$$-4=a|12|+11$$
$$-4-11=a(12)$$
$$-15=12a$$
$$a=-\frac{15}{12}$$

Hence, the boundary of the new inequality is

$$x=a|y|+11$$
$$x=\left(-\frac{15}{12}\right)|y|+11$$

Consider the half plane left of the boundary $x=\left(-\frac{15}{12}\right)|y|+11$ as shown below.



Since $(-20,0)$ is a solution, therefore the inequality is $x\le\left(-\frac{15}{12}\right)|y|+11$.

Therefore, the absolute value inequality is $\boxed{x\le\left(-\frac{15}{12}\right)|y|+11}$.

Answer 43e.

Let x be the total time taken for the calls made within the first country and y be the total time taken for the calls made within the second country.

We know that the card cost for the calls made in the first country is \$.03 per minute and that in the second country is \$.06 per minute. Thus, the total card cost for the calls made within the first country for x minutes is $0.03x$ and the total card cost for the calls made within the second country for y minutes is $0.06y$.

The above data can be written as follows.

The card cost within the first country (in dollars)	·	Total time taken (in minutes)	+	The card cost within the second country (in dollars)	·	Total time taken (in minutes)	≤	Phone card amount (in dollars)
⇓		⇓		⇓		⇓		
0.03	·	x	+	0.06	·	y	≤	20

Therefore, the inequality is $0.03x + 0.06y \le 20$.

Answer 44e.

Let the number of small pizzas be x and the number of large pizzas be y.

Since a small pizza uses 12 ounces of dough, so total amount of dough used by small pizzas is $12x$. Again, a large pizza uses 18 ounces of dough, so total amount of dough used by large pizzas is $18y$. Therefore, an inequality is

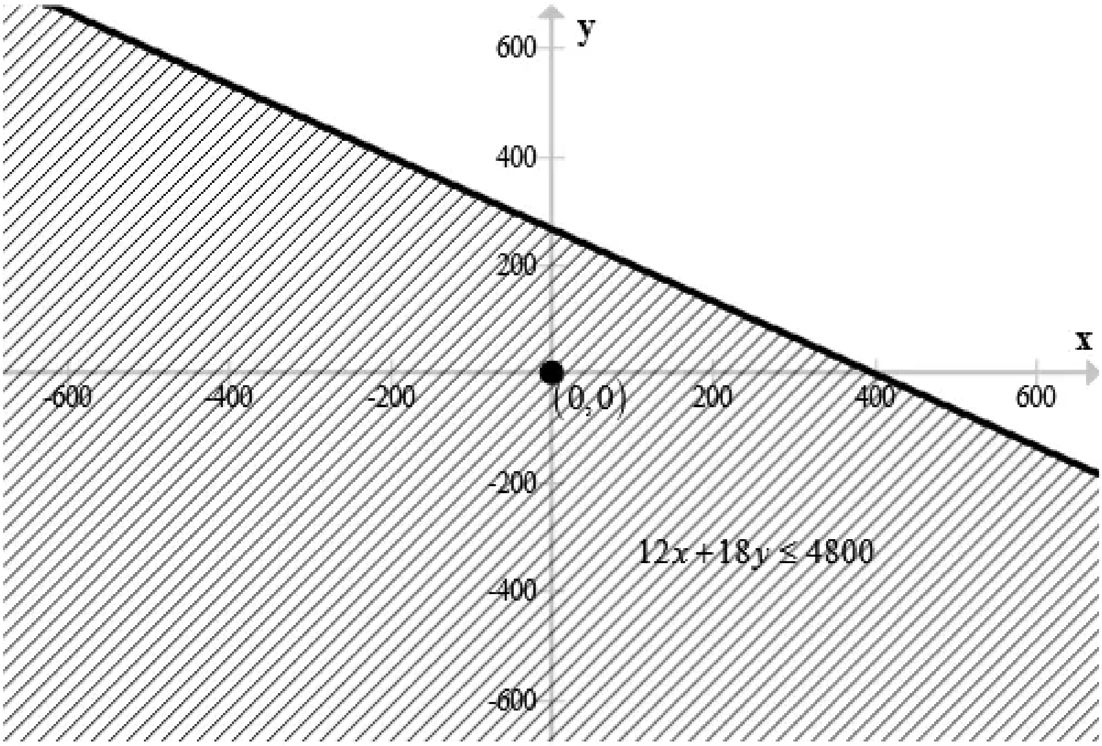
$$12x + 18y \le 4800$$

We need to graph the inequality $12x+18y \le 4800$.
We first graph the boundary line $12x+18y=4800$ using a solid line as the inequality symbol is $\le$.
Let the test point be $(0,0)$. Substituting $x=0, y=0$ in the inequality $12x+18y \le 4800$, we get

$$12(0)+18(0) \le 4800$$
$$0+0 \le 4800$$
$$0 \le 4800$$

Thus, the result is true. Therefore, $(0,0)$ is a solution of the inequality $12x+18y \le 4800$.

Therefore, we shade the half-plane that contains $(0,0)$ and the shaded region is the solution of the inequality $12x+18y \le 4800$.



We can choose any arbitrary three points from the shaded portion of the graph. The three possible solutions can be obtained from the shaded portion of the graph. The solutions are $(10,10)$, $(50,50)$ and $(100,100)$.

Answer 45e.

STEP 1 **Write an inequality.**
Let x be the total yards of cotton lace and y be the total yards of linen lace.

We know that the cost of cotton lace is \$1.50 per yard and that of linen lace is \$2.50 per yard. Thus, the total cost of x yards of cotton lace is $1.50x$ and the total cost of y yards of cotton lace is $2.50y$.

The above data can be written as follows.

The cost of cotton lace per yard (in dollars)	·	Total yards	+	The cost of linen lace per yard (in dollars)	·	Total yards	≤	Total amount of lace for crafts (in dollars)
⇓		⇓		⇓		⇓		
1.50	·	x		2.50	·	y	≤	75

Thus, the inequality is $1.50x + 2.50y \le 75$.

STEP 2 **Graph the inequality.**

In order to graph the inequality, first graph the boundary line $1.50x + 2.50y = 75$.

Substitute 0 for y in the above equation and solve for x.

$$1.50x + 2.50(0) = 75$$
$$1.50x = 75$$
$$x = 50$$

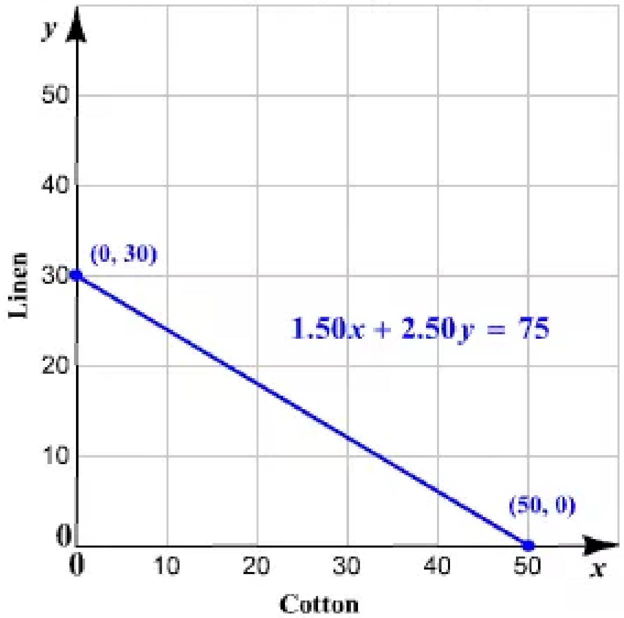
The x-intercept is 50. A point on the graph is (50, 0).

Now, replace x with 0 and solve for y.

$$1.50(0) + 2.50y = 75$$
$$2.50y = 75$$
$$y = 30$$

Since the y-intercept is 30, another point on the graph is (0, 30).

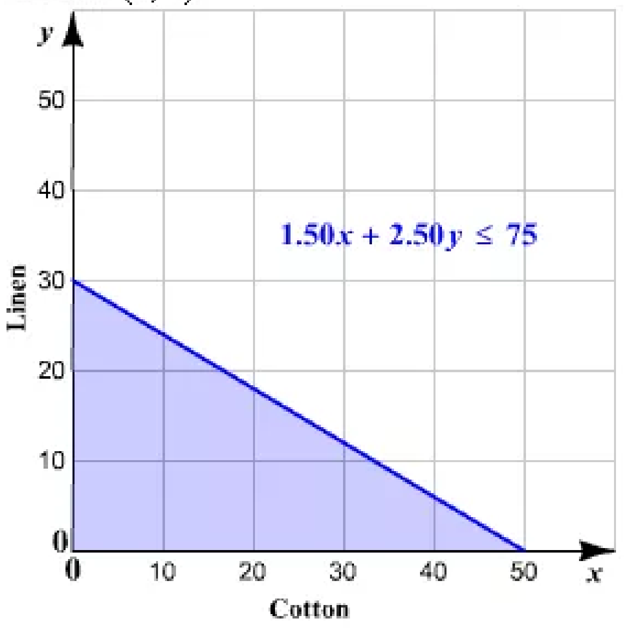
Plot (50, 0) and (0, 30) on the graph and draw a line segment to join them. Since ≤ is the inequality sign used, draw a solid line.



Let us take a test point which does not lie on the boundary line, say, (0, 0). Substitute 0 for y, and 0 for x to check if the test point satisfies the given inequality.

$$1.50(0)+2.50(0) \overset{?}{\leq} 75$$
$$0 \leq 75 \quad \text{TRUE}$$

The test point is a solution to the inequality. Shade the half-plane that contains (0, 0).



STEP 3 Replace x with 24 in $1.50x+2.50y \leq 75$ and simplify.

$$1.50(24)+2.50y \leq 75$$
$$36+2.50y \leq 75$$

Subtract 36 from both the sides.

$$36+2.50y-36 \leq 75-36$$
$$2.50y \leq 39$$

Divide both the sides by 2.50.

$$\frac{2.50y}{2.50} \leq \frac{39}{2.50}$$
$$y \leq 15.6$$

Therefore, the amount of linen lace you can buy is 15.6 yards or less.

Answer 46e.

Let the number of T-shirts and caps be x and y respectively.

Therefore, total sales obtained by selling T-shirts is $15x$ and total sales obtained by selling caps is $10y$. Since the total sales must exceeds \$1800, therefore the inequality is

$$15x+10y \geq 1800$$

To make 40% profit on shirts, the profit on shirts is $0.4(15x)$.

To make 30% profit on shirts, the profit on caps is $0.3(10y)$.

For profit to exceeds $600, the above equation can be modified as follows.

$$0.4(15x)+0.3(10y)\geq 600$$

Answer 47e.

(a) Let the two people canoe together for x days and bicycle together for y days. We know that the rent of a canoe is $11 per day and that of two bikes is $\$13(2)$ or $26 per day. Thus, the total rent of canoe is $\$11x$ and the total rent of mountain bikes is $\$26y$.

The above data can be written as follows.

The total rent of canoe (in dollars)	·	Total days	+	The total rent of bike (in dollars)	·	Total days	≤	Total amount to spend (in dollars)
⇓		⇓		⇓		⇓		
11	·	x	+	26	·	y	≤	120

Thus, the inequality is $11x + 26y \leq 120$.

In order to graph the inequality, first graph the boundary line $11x + 26y = 120$.

Substitute 0 for y in the above equation and solve for x.

$$\begin{aligned} 11x + 26(0) &= 120 \\ 11x &= 120 \\ x &= 10.9 \end{aligned}$$

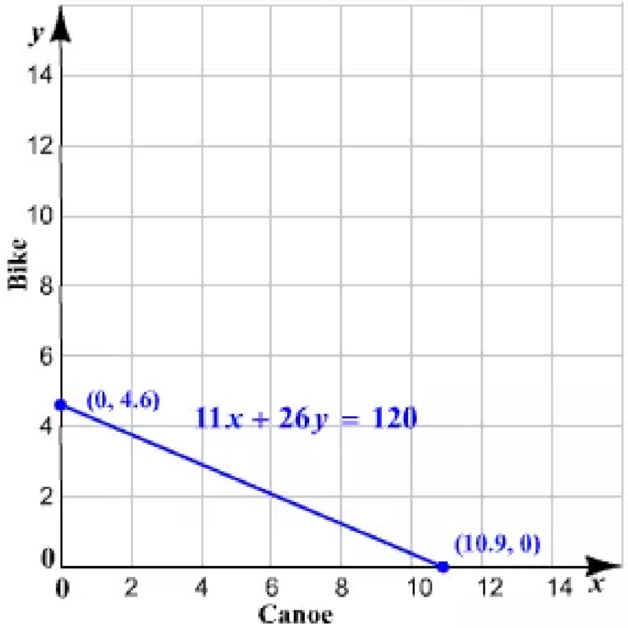
The x-intercept is 10.9. A point on the graph is (10.9, 0).

Now, replace x with 0 and solve for y.

$$\begin{aligned} 11(0) + 26y &= 120 \\ 26y &= 120 \\ y &= 4.6 \end{aligned}$$

Since the y-intercept is 4.6, another point on the graph is (0, 4.6).

Plot (10.9, 0) and (0, 4.6) on the graph and draw a line segment to join them. Since ≤ is the inequality sign used, draw a solid line.

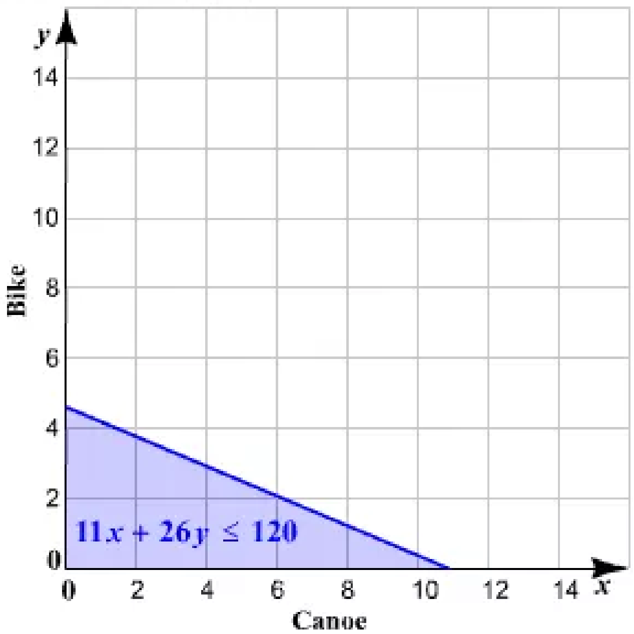


Let us take a test point which does not lie on the boundary line, say, (0, 0). Substitute 0 for y, and 0 for x to check if the test point satisfies the given inequality.

$$11(0) + 26(0) \overset{?}{\leq} 120$$

$$0 \leq 120 \qquad \text{TRUE}$$

The inequality is true and thus the test point is a solution. Shade the half-plane that contains (0, 0).



(b) In order to find the possible solutions, substitute several values for x and y and check the inequality.

(x, y)	$11x + 26y \le 120$
$(2, 3)$	$100 \le 120$
$(3, 2)$	$85 \le 120$
$(2, 2)$	$74 \le 120$

Thus, we can say that 2 days canoeing and 3 days biking, 3 days canoeing and 2 days biking, and 2 days canoeing and 2 days biking are the possible solutions.

(c) We know that the rent of a canoe is \$11 per day and that of a bike is \$13 per day. The total amount spent each day is \$11 + \$24 or \$36.

It is given that on a particular day, the first person will canoe alone and the second person will bicycle alone. The amount spent on this day will be \$11 + \$13 or \$24. Thus, the total amount spent for the two weeks is \$120 – \$24 or \$96.

The above data can be written as follows.

The total rent of canoe (in dollars)	·	Total days	+	The total rent of bike (in dollars)	·	Total days	≤	Total amount to spend (in dollars)
⇓		⇓		⇓		⇓		
11	·	x	+	26	·	y	≤	96

The inequality is $11x + 26y \le 96$.

In order to graph the inequality, first graph the boundary line $11x + 26y = 96$.

Substitute 0 for y in the above equation and solve for x.

$$11x + 26(0) = 96$$
$$11x = 96$$
$$x = 8.7$$

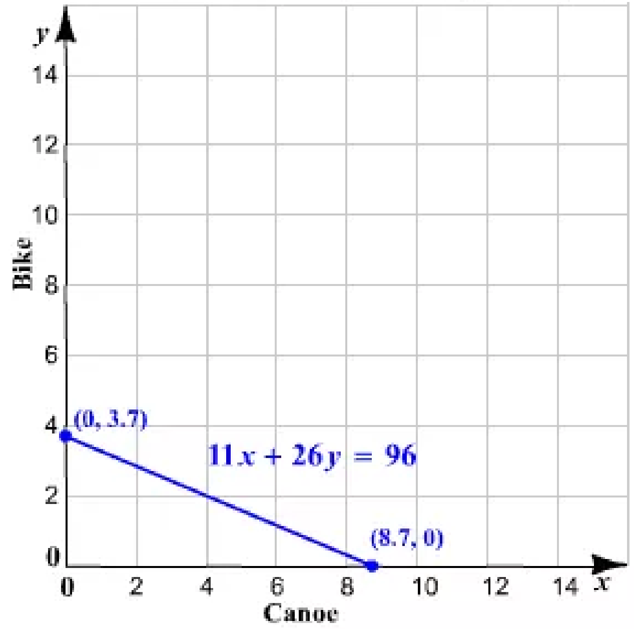
The x-intercept is 8.7. Point to be plotted on the graph is (8.7, 0).

Now, replace x with 0 and solve for y.

$$11(0) + 26y = 96$$
$$26y = 96$$
$$y = 3.7$$

Since the y-intercept is 3.7, point to be plotted on the graph is (0, 3.7).

Plot the points (8.7, 0) and (0, 3.7) on the graph and draw a line passing through them. Since ≤ is the inequality sign used, draw a solid line.

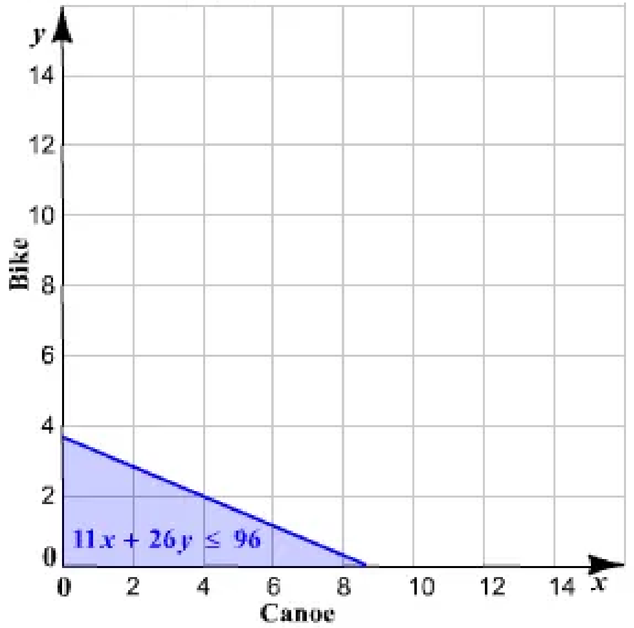


Let us take a test point (0, 0) which does not lie on the boundary line. Substitute 0 for y, and 0 for x. Check if the test point satisfies the given inequality.

$$11(0) + 26(0) \overset{?}{\leq} 96$$

$$0 \leq 96 \qquad \text{TRUE}$$

The inequality is true and thus the test point is a solution. Shade the half-plane that contains (0, 0).



In order to find the possible solutions, substitute several values for x and y and check the inequality.

(x, y)	$11x + 26y \leq 96$
$(2, 1)$	$48 \leq 96$
$(3, 2)$	$85 \leq 96$
$(2, 2)$	$74 \leq 96$

Thus, we can say that 2 days canoeing and 1 day biking, 3 days canoeing and 2 days biking, and 2 days canoeing and 2 days biking are the possible solutions.

Answer 48e.

(d)

The graph of the inequality $0.20884x + 0.27192y \leq 407.886$ is as shown below.

$$V_2 = \pi(2)^2(5)$$

$$V_2 = 62.80 \text{ in}^3$$

The volume of the cooler is

$$V_c = \pi(5)^2(12)$$

$$V_c = 94200 \text{ in}^3$$

(b)

Let the number of times container 1 can be filled and emptied into the cooler be x and the number of times container 2 can be filled and emptied into the cooler be y. Therefore, the inequality is

$$V_1x + V_2y \leq V_c$$

$$48.23x + 62.80y \leq 94200$$

(c)

The volume of the container 1in gallons is

$$V_1 = 48.23(0.00433) \text{ gal}$$

$$V_1 = 0.20884 \text{ gal}$$

The volume of the container 2 in gallons is

$$V_2 = 62.80(0.00433) \text{ gal}$$

$$V_2 = 0.27192 \text{ gal}$$

The volume of the cooler in gallons is

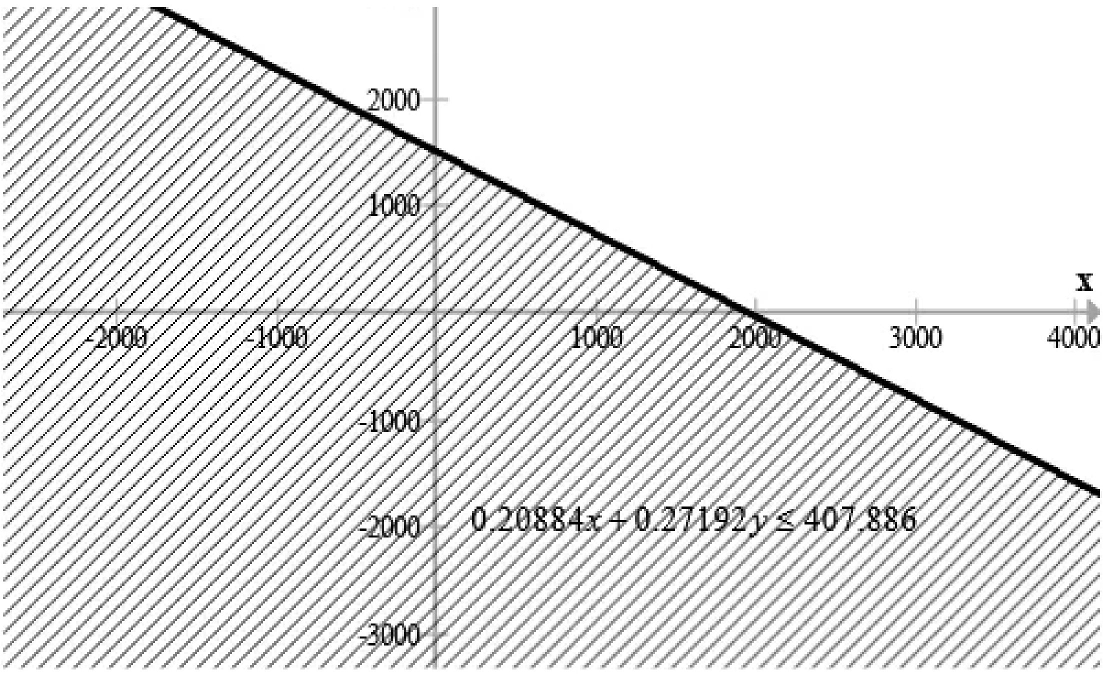
$$V_c = 94200(0.00433) \text{ gal}$$

$$V_c = 407.886 \text{ gal}$$

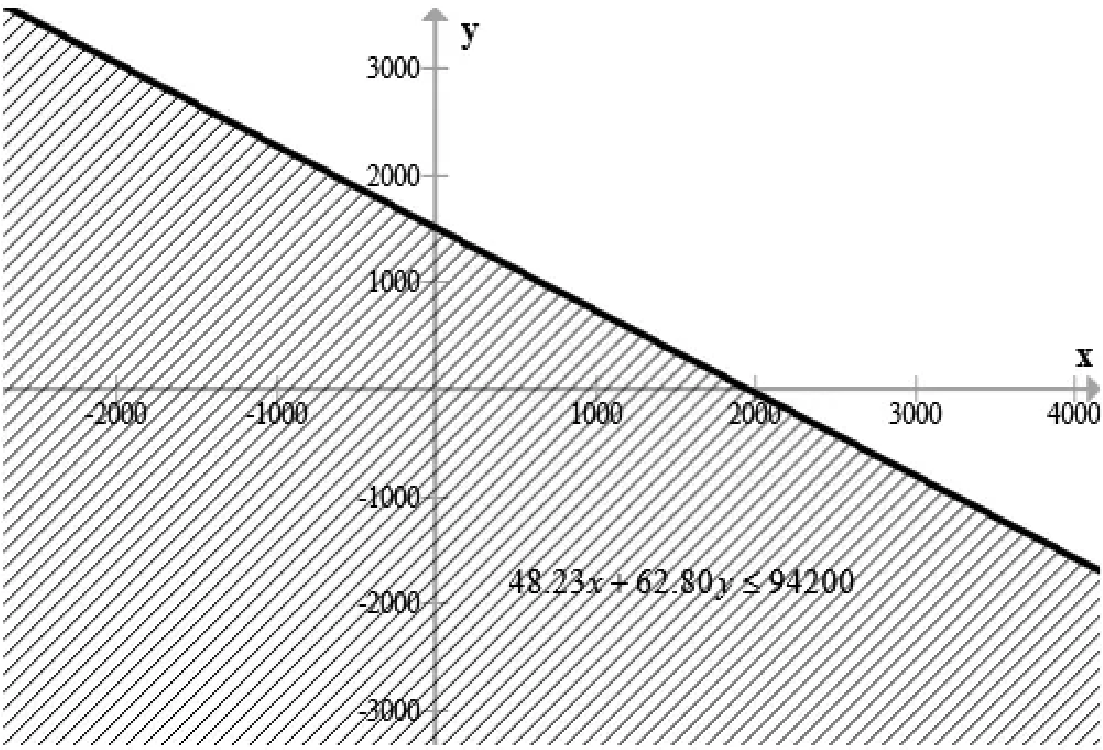
Therefore, the inequality is

$$V_1x + V_2y \leq V_c$$

$$0.20884x + 0.27192y \leq 407.886$$



The graph of the inequality $48.23x + 62.80y \le 94200$ is as shown below.



Both the graphs are identical.
Since the conversion of units does not affect the solution set, therefore, the graphs of the inequalities are identical.

Answer 49e.

(a) The height h of the given television screen is 16.5 in. The width w is 27.4 in. We know that the wide screen television image satisfies the inequality $\frac{w}{h} > \frac{4}{3}$.

The ratio of the width to the height of the given screen is $\frac{27.4}{16.5}$ or 1.66 which is greater than $\frac{4}{3}$ or 1.33 in.

Thus, we can say the given television screen satisfies the requirements of the wide screen image

(b) According to the Pythagorean Theorem

$$\begin{array}{ccccc} \text{Diagonal}^2 & = & \text{Height}^2 & + & \text{Width}^2 \\ \downarrow & & \downarrow & & \downarrow \\ d^2 & = & h^2 & + & w^2 \end{array}$$

Divide each term of the above equation by h^2.

$$\left(\frac{d}{h}\right)^2 = \left(\frac{h}{h}\right)^2 + \left(\frac{w}{h}\right)^2$$

$$\left(\frac{d}{h}\right)^2 = 1 + \left(\frac{w}{h}\right)^2$$

Replace w with 4 and h with 3 in the above equation.

$$\left(\frac{d}{h}\right)^2 = 1 + \left(\frac{4}{3}\right)^2$$

Take square root on both the sides and simplify.

$$\sqrt{\left(\frac{d}{h}\right)^2} = \sqrt{1 + \left(\frac{4}{3}\right)^2}$$

$$\frac{d}{h} = \sqrt{\frac{25}{9}}$$

$$= \frac{5}{3}$$

When the ratio of the width to the height of the widescreen television image is $\frac{4}{3}$,

the value of $\frac{d}{h}$ is $\frac{5}{3}$.

We know that the widescreen television image satisfies the inequality $\frac{w}{h} > \frac{4}{3}$.

Thus, the value of $\frac{d}{h}$ will be greater than $\frac{5}{3}$.

Therefore, the inequality describing the possible values of d and h for a widescreen image $\frac{d}{h} > \frac{5}{3}$.

Answer 50e.

The given table is

x	0	1	2	3
y	11	15	19	23

From the table it is observed that the value of y changes by 4 units when x changes by 1 unit. Therefore, the table represented by a linear equation of the form:

$$y = mx + c$$

Substituting $x = 0$ and $y = 11$ in the equation $y = mx + c$, we get

$$11 = m(0) + c$$

$$11 = 0 + c$$

$$c = 11$$

Substituting $x = 1$ and $y = 15$ in the equation $y = mx + c$, we get

$$15 = m(1) + (11) \qquad [\text{Since } c = 11]$$

$$15 = m + 11$$

$$m = 15 - 11$$

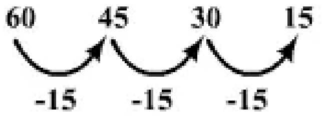
$$m = 4$$

Hence, the relation between x and y is

$$\boxed{y = 4x + 11}$$

Answer 51e.

We can see that each y-value decreases by 15 units per x-value.



We know that the initial value of y is 60.

Now, we can use the pattern to write a verbal model for the table.

y-value = Initial y-value − Rate of change · x-value

⇓ ⇓ ⇓ ⇓

$y = 60 - 15 \cdot x$

Therefore an equation for the given table is $y = 60 - 15x$.

Answer 52e.

The equation is $x+3y=-6$.

The equation can be written in intercept form as

$$x+3y=-6$$

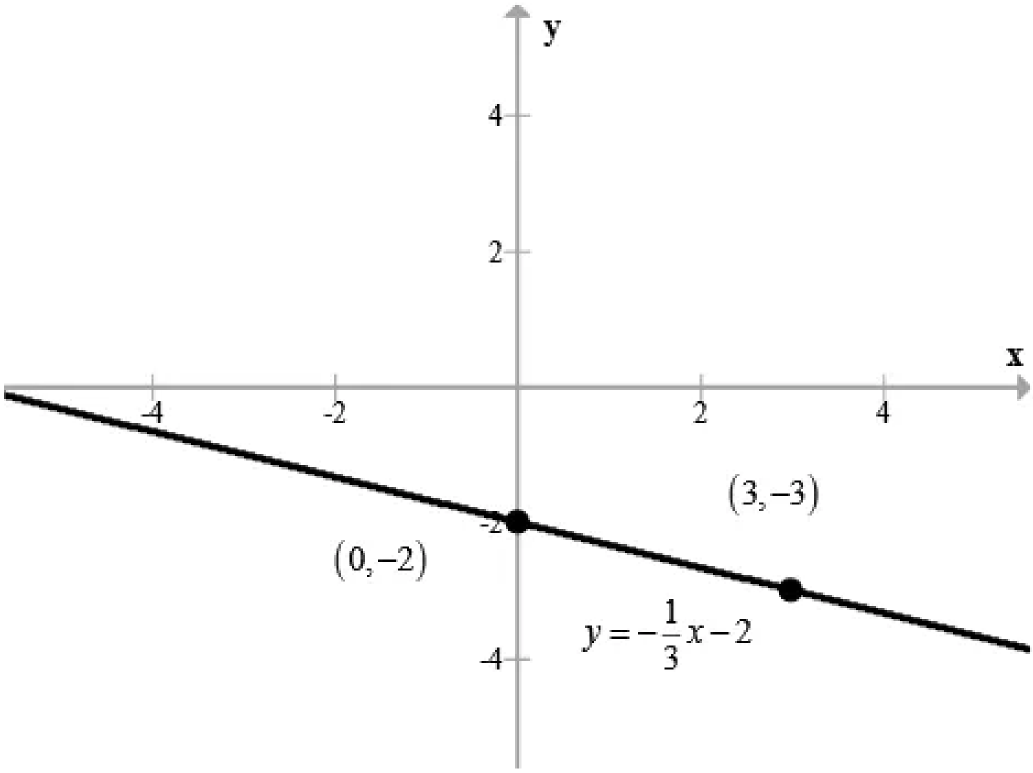
$$3y=-x-6$$

$$\frac{3}{3}y=-\frac{1}{3}x-\frac{6}{3}$$

$$y=-\frac{1}{3}x-2$$

Here, the y-intercept is -2. So, we plot the point $(0,-2)$ where the line crosses y-axis.

The slope of the line is $-\frac{1}{3}$ or $\frac{-1}{3}$. So, we plot a second point on the line by starting at $(0,-2)$ and then moving down 1 unit and right 3 units. The second point is $(3,-3)$. We then draw a line through these two points.



Answer 53e.

The x-coordinate of a point where a graph intersects the x-axis is the x-intercept.

For finding the x-intercept, first substitute 0 for y in the equation.

$4x-3(0)=15$

Now, solve for x.

$$4x = 15$$

$$\frac{4x}{4} = \frac{15}{4}$$

$$x = \frac{15}{4}$$

Thus, the x-intercept of the line is $\frac{15}{4}$. The point to be plotted on the graph is $\left(\frac{15}{4}, 0\right)$.

The y-coordinate of a point where a graph intersects the y-axis is the y-intercept.

Substitute 0 for x in the equation to find the y-intercept.

$4(0) - 3y = 15$

Solve for y.

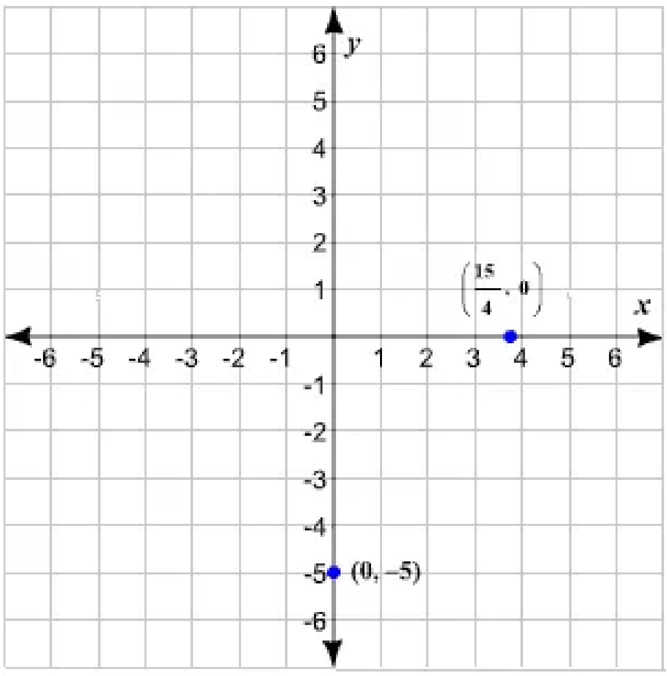
$$-3y = 15$$

$$\frac{-3y}{-3} = \frac{15}{-3}$$

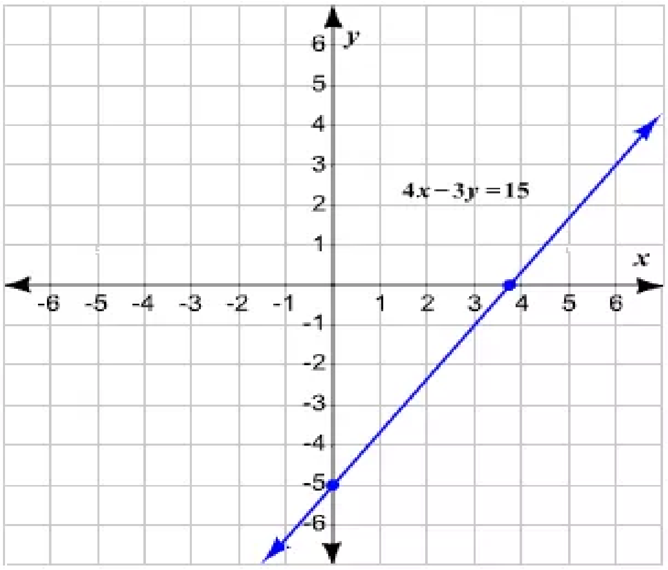
$$y = -5$$

The y-intercept of the line is -5. Another point on the graph is $(0, -5)$.

For graphing the given equation, first plot the points on a coordinate plane.



Draw a line through the two points.



Answer 54e.

The equation is $8x-6y=18$.

The equation can be written in intercept form as

$$8x-6y=18$$

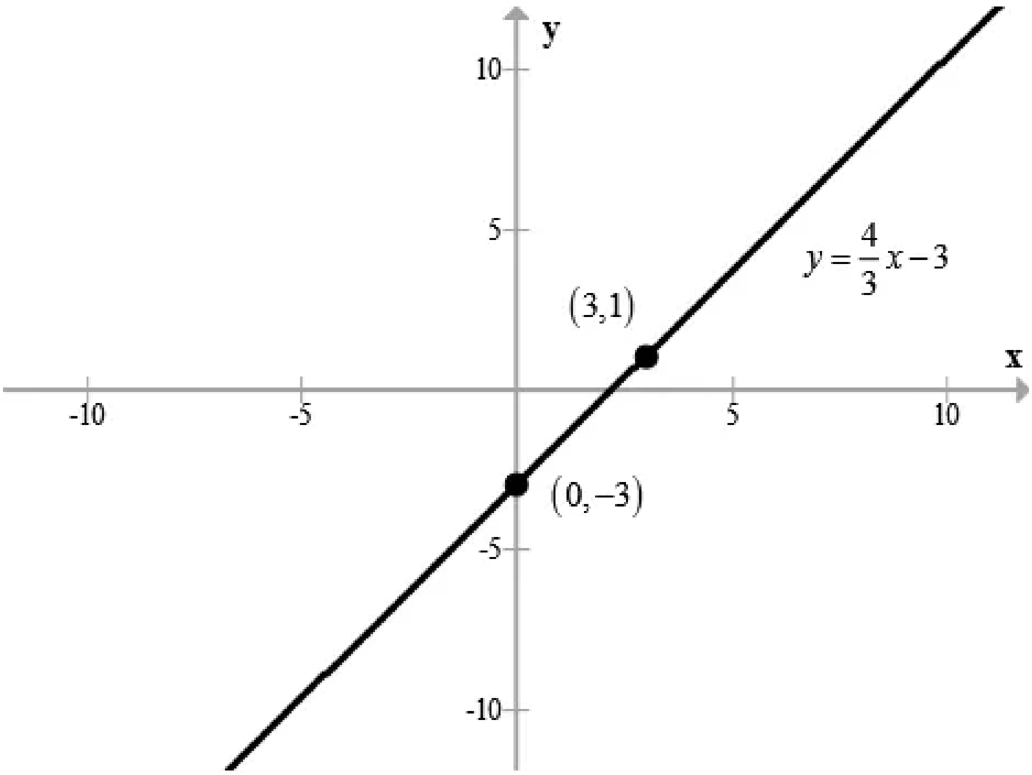
$$-6y=-8x+18$$

$$\left(\frac{-6}{-6}\right)y=-\left(\frac{8}{-6}\right)x+\left(\frac{18}{-6}\right)$$

$$y=\frac{4}{3}x-3$$

Here, the y-intercept is -3. So, we plot the point $(0,-3)$ where the line crosses y-axis.

The slope of the line is $\frac{4}{3}$. So, we plot a second point on the line by starting at $(0,-3)$ and then moving up 4 units and right 3 units. The second point is $(3,1)$. We then draw a line through these two points.



Answer 55e.

The x-coordinate of a point where a graph intersects the x-axis is the x-intercept.

For finding the x-intercept, first substitute 0 for y in the equation.
$6x + 9(0) = 18$

Now, solve for x.

$$6x = 18$$

$$\frac{6x}{6} = \frac{18}{6}$$

$$x = 3$$

Thus, the x-intercept of the line with the given equation is 3. The point to be plotted on the graph is (3, 0).

The y-coordinate of a point where a graph intersects the y-axis is the y-intercept.

Substitute 0 for x in the equation to find the y-intercept.
$6(0) + 9y = 18$

Solve for y.

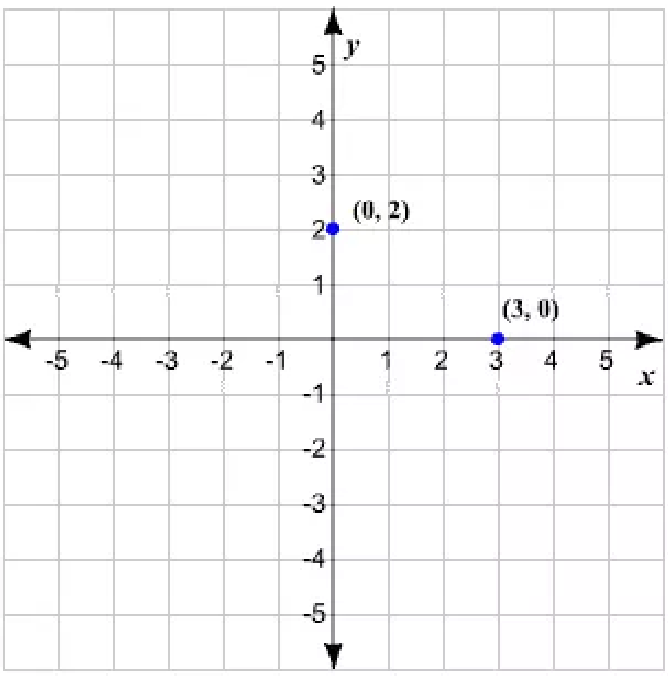
$$9y = 18$$

$$\frac{9y}{9} = \frac{18}{9}$$

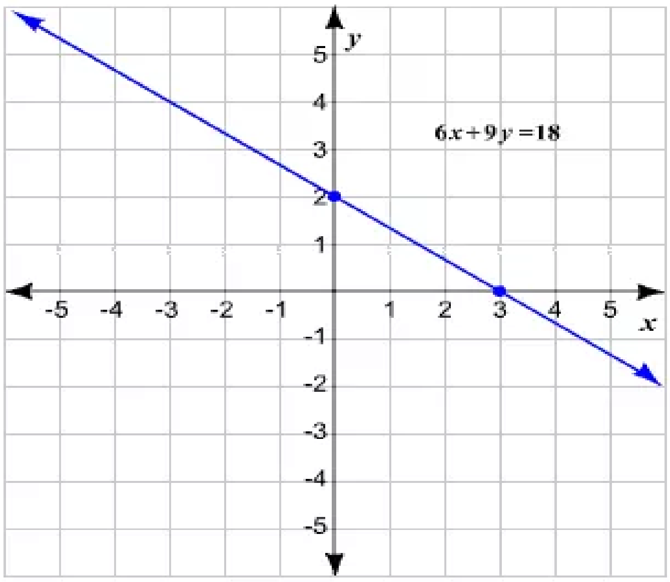
$$y = 2$$

The y-intercept of the line with the given equation is 2. Another point on the graph is (0, 2).

For graphing the given equation, first plot the points on a coordinate plane.



Draw a line through the two points.



Answer 56e.

The equation is $-2x-5y=20$.

The equation can be written in intercept form as

$$-2x-5y=20$$

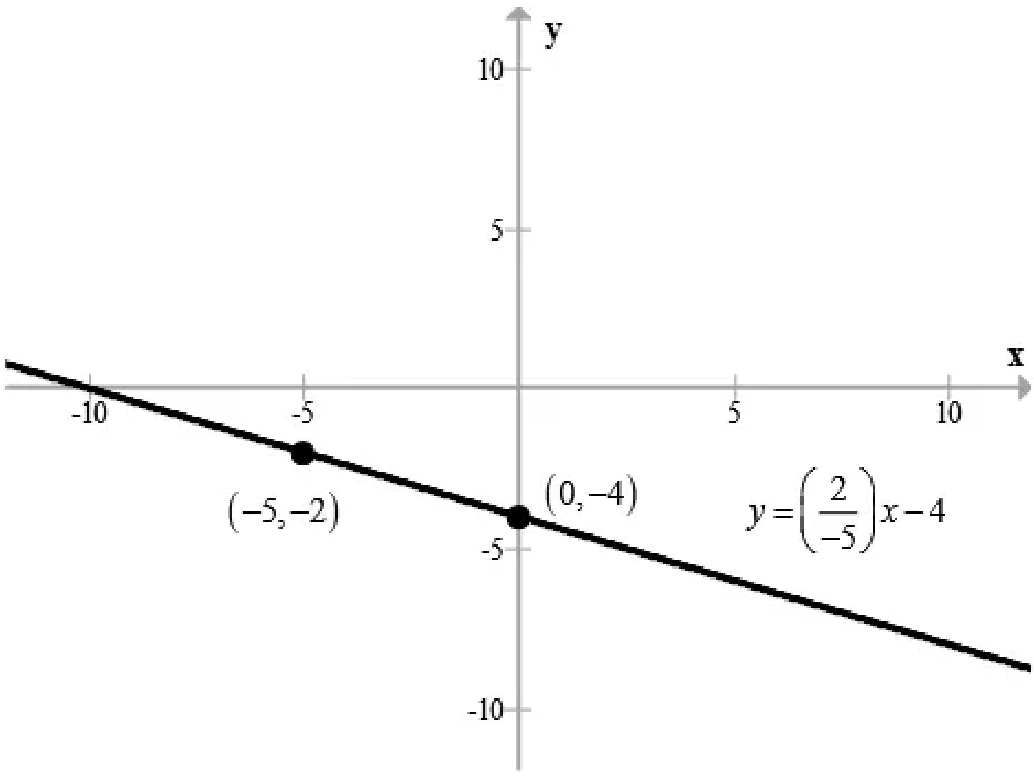
$$-5y=2x+20$$

$$\left(\frac{-5}{-5}\right)y=\left(\frac{2}{-5}\right)x+\left(\frac{20}{-5}\right)$$

$$y=\left(\frac{2}{-5}\right)x-4$$

Here, the y-intercept is -4. So, we plot the point $(0,-4)$ where the line crosses y-axis.

The slope of the line is $\frac{2}{-5}$. So, we plot a second point on the line by starting at $(0,-4)$ and then moving up 2 units and left 5 units. The second point is $(-5,-2)$. We then draw a line through these two points.



Answer 57e.

The x-coordinate of a point where a graph intersects the x-axis is the x-intercept.

For finding the x-intercept, first substitute 0 for y in the equation.
$-10x + 4(0) = 20$

Now, solve for x.

$$-10x = 20$$
$$\frac{-10x}{-10} = \frac{20}{-10}$$
$$x = -2$$

Thus, the x-intercept of the line with the given equation is -2. The point that can be plotted on the graph is $(-2, 0)$.

The y-coordinate of a point where a graph intersects the y-axis is the y-intercept.

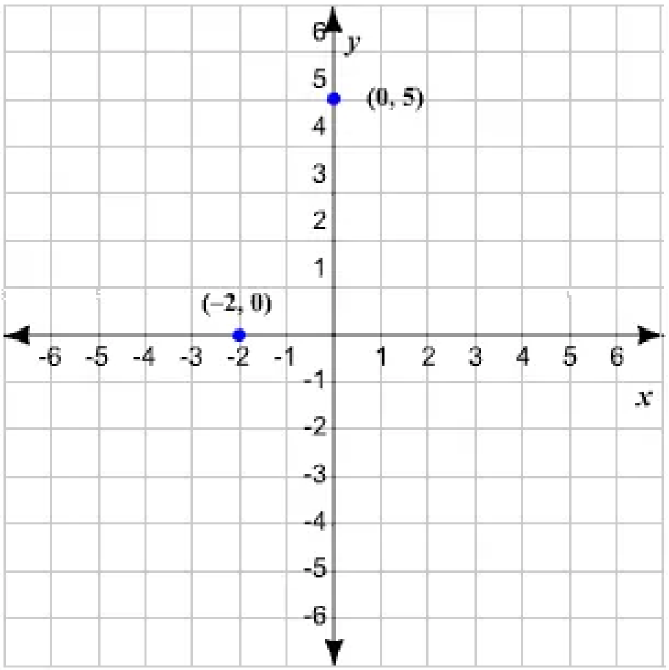
Substitute 0 for x in the equation to find the y-intercept.
$-10(0) + 4y = 20$

Solve for y.

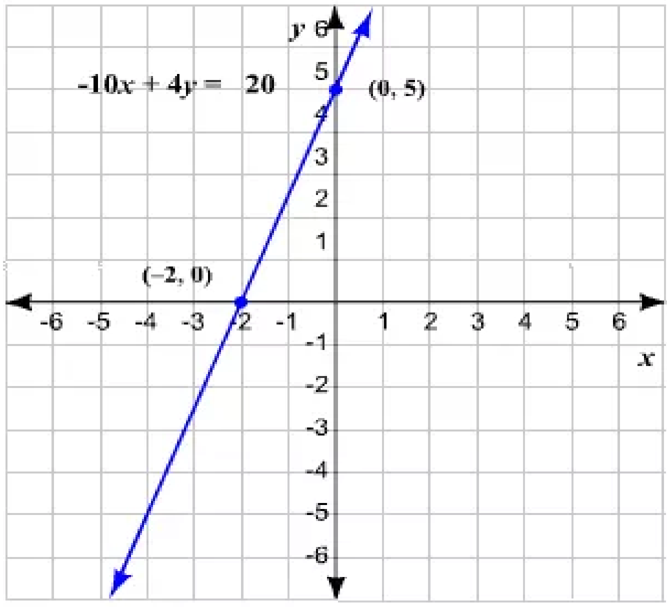
$$4y = 20$$
$$\frac{4y}{4} = \frac{20}{4}$$
$$y = 5$$

The y-intercept of the line with the given equation is 5. Another point is $(0, 5)$.

For graphing the given equation, first plot the points on a coordinate plane.



Draw a line through the two points.



Answer 58e.

Given that the slope of the line is $m = \frac{4}{5}$ and the line passes through the point $(10, -2)$.

The equation of the line having slope m and passing through (x_1, y_1) in point-slope form is

$$y - y_1 = m(x - x_1)$$

Hence, the equation of the line is

$$y - (-2) = \frac{4}{5}(x - 10)$$

$$y + 2 = \frac{4}{5}x - 8$$

$$y = \frac{4}{5}x - 8 - 2$$

$$y = \frac{4}{5}x - 10$$

$$5y = 4x - 50$$

$$\boxed{4x - 5y = 50}$$

Answer 59e.

An equation of a line in point-slope form with slope m and passing through (x_1, y_1) is $y - y_1 = m(x - x_1)$.

Substitute 3 for x_1, 7 for y_1, and -3 for m in the point-slope form.

$y - 7 = -3(x - 3)$

Remove the parentheses using the distributive property.

$y - 7 = -3x + 9$

Add 7 to both the sides.

$$y - 7 + 7 = -3x + 9 + 7$$

$$y = -3x + 16$$

The equation of the line is $y = -3x + 16$.

Answer 60e.

Given that the line passes through the points $(0,2)$ and $(5,8)$.

The equation of the line passing through the points (x_1, y_1) and (x_2, y_2) is

$$y - y_1 = \left(\frac{y_2 - y_1}{x_2 - x_1}\right)(x - x_1)$$

Hence, the equation of the line is

$$y - 8 = \left(\frac{8-2}{5-0}\right)(x - 0)$$

$$y - 8 = \left(\frac{6}{5}\right)x$$

$$5y - 40 = 6x$$

$$\boxed{6x - 5y = 40}$$

Answer 61e.

We need to find the slope of the line passing through the given points to get the equation of that line. The slope m of a line is the ratio of vertical change to horizontal change.

$$m = \frac{y_2 - y_1}{x_2 - x_1}$$

Substitute -6 for y_2, -1 for y_1, 7 for x_2, and 4 for x_1.

$$m = \frac{-6 - (-1)}{7 - 4}$$

Evaluate.

$$m = \frac{-6 + 1}{7 - 4}$$

$$= -\frac{5}{3}$$

The slope of the line is $-\frac{5}{3}$.

Use the point-slope form to determine the equation of the line. The equation $y - y_1 = m(x - x_1)$ is the point-slope form of a line with slope m and passing through the point (x_1, y_1).

Substitute $-\frac{5}{3}$ for m, 4 for x_1, and -1 for y_1.

$$y - (-1) = -\frac{5}{3}(x - 4)$$

$$y + 1 = -\frac{5}{3}(x - 4)$$

Use the distributive property to open the parentheses.

$$y + 1 = -\frac{5}{3}x + \frac{20}{3}$$

Subtract 1 from both the sides.

$$y + 1 - 1 = -\frac{5}{3}x + \frac{20}{3} - 1$$

$$y = -\frac{5}{3}x + \frac{17}{3}$$

The equation of the line is $y = -\frac{5}{3}x + \frac{17}{3}$.