Chapter 2 Linear Equations and Functions

Ex 2.7

Answer 1e.

The parent function of all absolute value functions is $f(x) = |x|$ and the vertex of the graph of this function is (0, 0). We know that the graph of form $y = |x - h| + k$ is the graph of $y = |x|$ translated h units horizontally and k units vertically. Here, after translation, (h, k) is the vertex for $y = |x - h| + k$.

The given statement can thus be completed as "The point (h, k) is the **vertex** of the graph of $y = |x - h| + k$."

We need to evaluate the function $f(x)$ for $x = -4$.

$$f(x) = \begin{cases} 9x - 4, & \text{if } x > 3 \\ \frac{1}{2}x + 1, & \text{if } x \le 3 \end{cases}$$

1

The given value of x is -4.
Since $-4 \le 3$, we need to evaluate the second function for $f(x)$.

$$f(x) = \frac{1}{2}x + 1$$

$$f(-4) = \frac{1}{2}(-4) + 1 \qquad \text{[By putting } -4 \text{ for } x]$$

$$= -2 + 1 \qquad \text{[Simplify]}$$

$$= -1$$

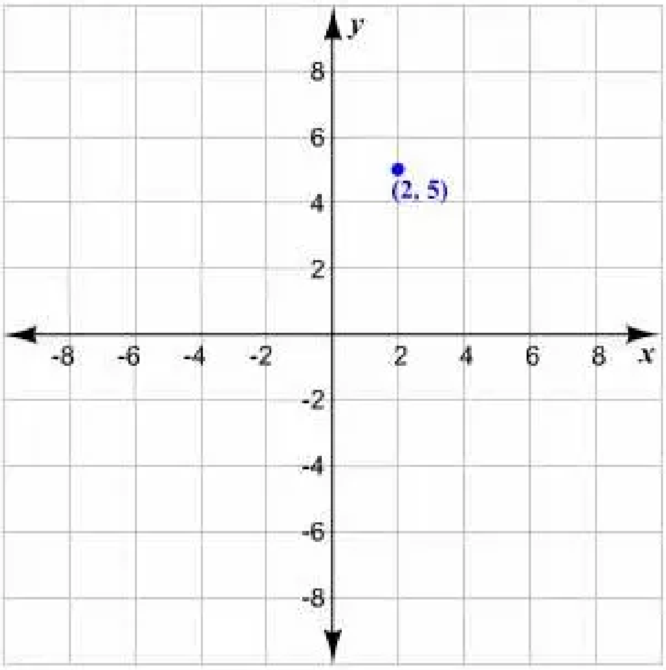
Therefore the function $\boxed{f(x) = -1}$.

Answer 1gp.

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

We get the value of h as 2 and of k as 5. Thus, the vertex is (2, 5).

Plot the vertex of the given function.



Step 2 Use symmetry to find two more points.

Rewrite the given equation to isolate the absolute value term.

$y - 5 = | x - 2 |$

We know that $| x - 2 |$ is always positive. Thus, we should substitute a value for y greater than 5 to get $| x - 2 |$ as a positive number.

Substitute any value, say, 6 for y in the given function.

$$6 - 5 = |x - 2|$$

$$1 = |x - 2|$$

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

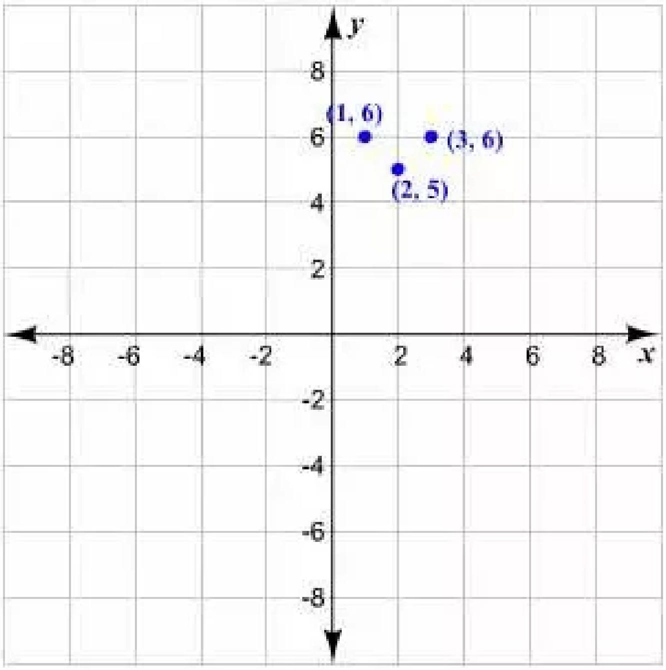
Add 2 to both the sides of the two equations.

$x - 2 + 2 = -1 + 2$ and $x - 2 + 2 = 1 + 2$

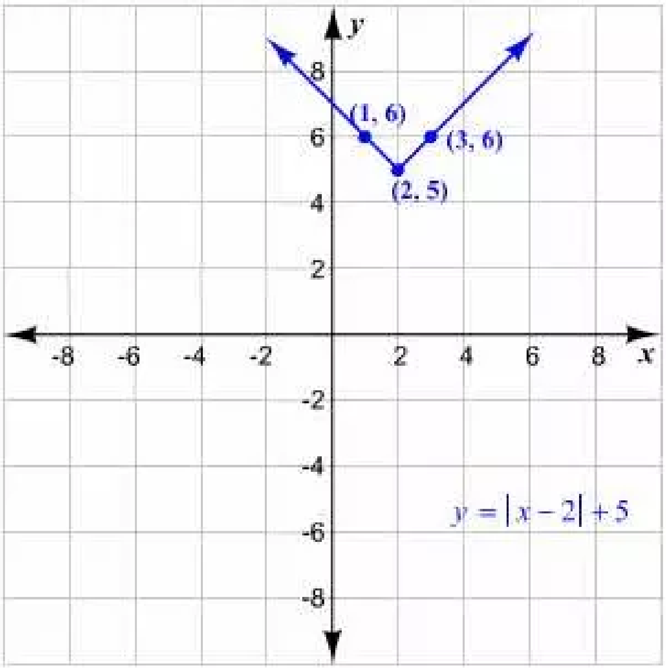
$x = 1$ and $x = 3$

The two points are (1, 6) and (3, 6).

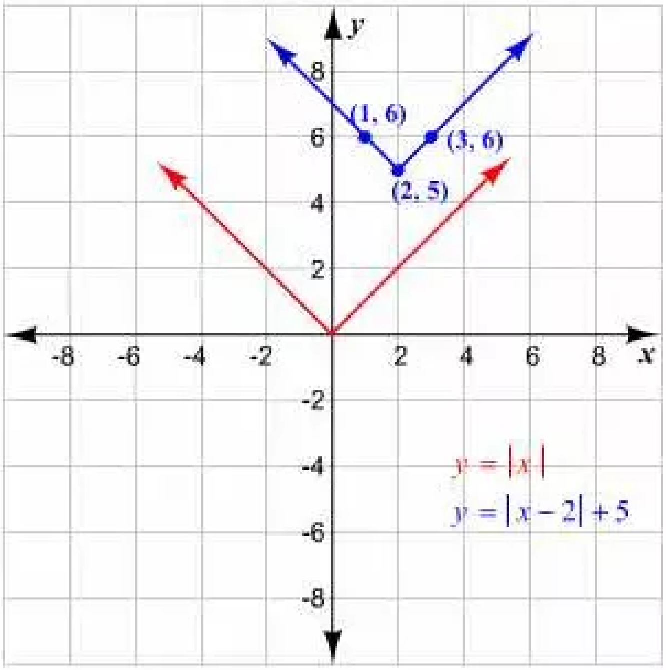
Plot these points on the graph.



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



Step 4 Similarly, graph $y = |x|$ on the same axis.



It is clear from the figure that the graph of $y = |x - 2| + 5$ is the graph of $y = |x|$ translated up 5 units and 2 units right.

Answer 2e.

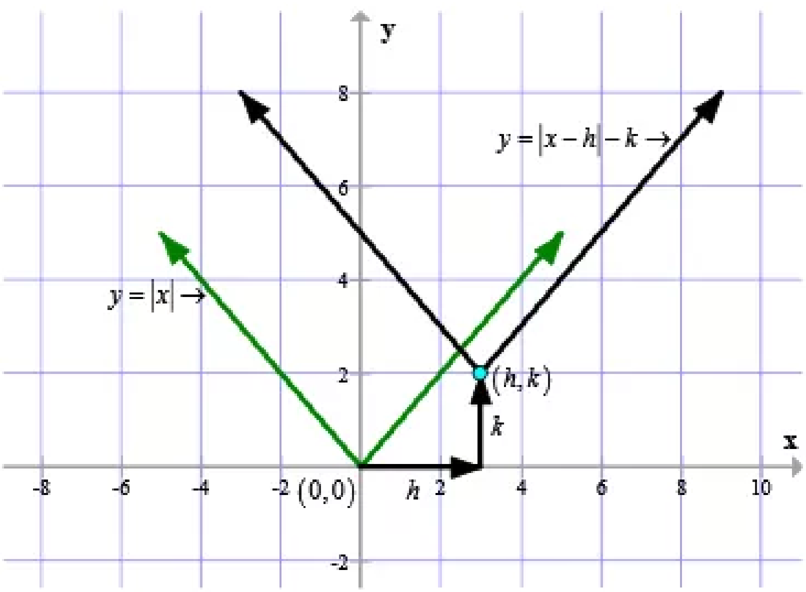
The three major types of transformation of graphs are:

(a)

Translation:

It a process to derive new absolute value functions from the parents function through the transformation of the parent graph by shifting the parent graph either horizontally or vertically or both without changing the size, shape or orientation.

Consider the graph of $y = |x - h| + k$. This graph can be draw with the help of the parent graph $y = |x|$ by translating h units horizontally and k units vertically but doesn't change the size, shape or orientation.



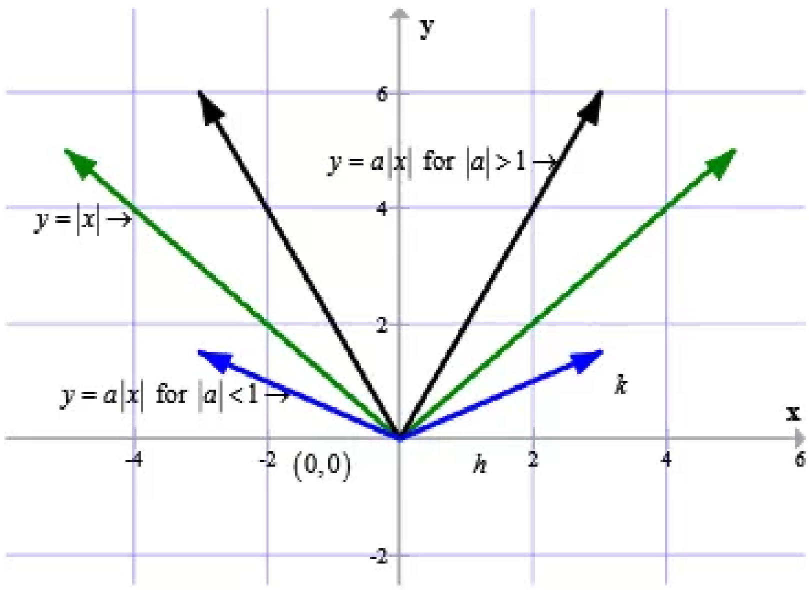
(b)

Stretches, shrinks and reflections:

When $|a| \neq 1$, the graph of $y = a|x|$ is the vertical stretch or a vertical shrink of the graph of $y = |x|$, depending on whether $|a|$ is less than or greater than 1.

For $|a| > 1$	For $|a| < 1$
• The graph is vertically stretched or elongated. • The graph of $y = a|x|$ is narrower than the graph of $y = |x|$.	• The graph is vertically shrunk, or compressed. • The graph of $y = a|x|$ is wider than the graph of $y = |x|$.

The graphical representation is shown below.

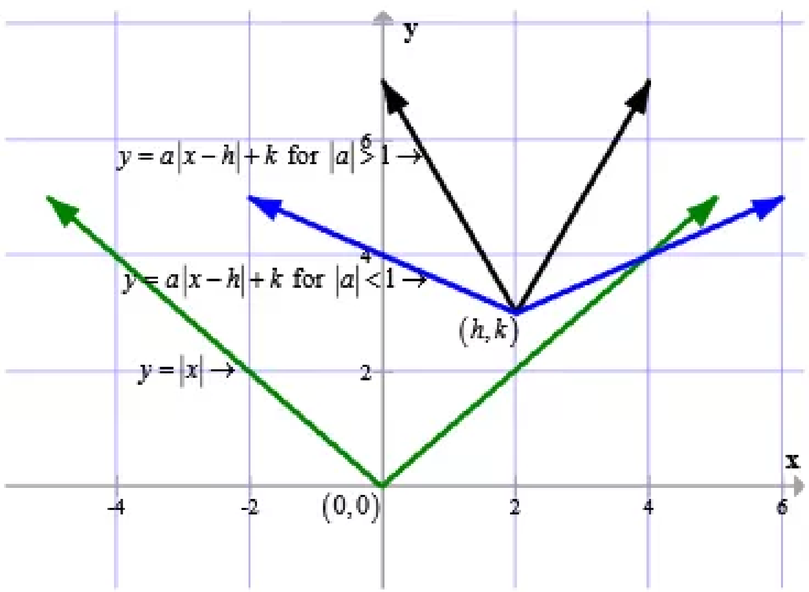


(c)

Multiple transformations:

This transformation involves (a) translation as well as the (b) stretching, shrinking and reflections. Consider the function $y = a|x-h| + k$

The graph of $y = a|x-h| + k$ with multiple transformations is shown below.



Answer 2ep.

We need to evaluate the function $f(x)$ for $x=2$.

$$f(x)=\begin{cases}9x-4, \text{ if } x>3\\ \frac{1}{2}x+1, \text{ if } x\leq 3\end{cases}$$

The given value of x is 2.
Since $2\leq 3$, we need to evaluate the second function for $f(x)$.

$$f(x)=\frac{1}{2}x+1$$

$$f(2)=\frac{1}{2}(2)+1 \qquad \text{[By putting 2 for } x\text{]}$$

$$=1+1 \qquad \text{[Simplify]}$$

$$=2$$

Therefore the function $\boxed{f(x)=2}$.

Answer 2gp.

The given function is,

$$y=\frac{1}{4}|x| \qquad \ldots\ldots (1)$$

We need to graph the function and compare with the graph $y=|x|$.

The standard function is of the form $y=a|x-h|+k$, where the vertex is (h,k) and the graph is symmetry about $x=h$.
Comparing the given function with the standard form, we have the vertex

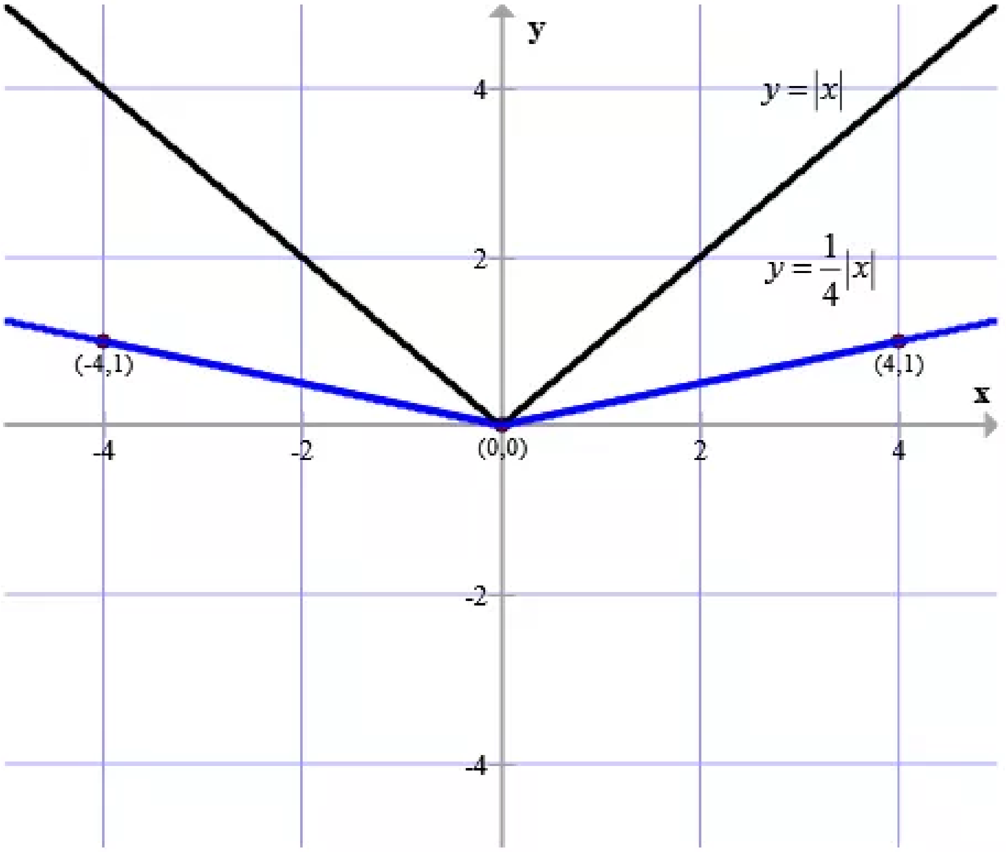
$$(h,k)=(0,0)$$

The graph of (1) is symmetric about $x=0$ and the graph is V-shaped.

By putting 4 for x in the equation $y=\frac{1}{4}|x|$ we get $y=1$.

Now we plot the point $(4,1)$ on the graph and by using symmetry we plot another point as $(-4,1)$. Then we connect the points with V-shaped graph.

The graph is as follows:



Now we compare this graph with the graph of the equation $y=|x|$.

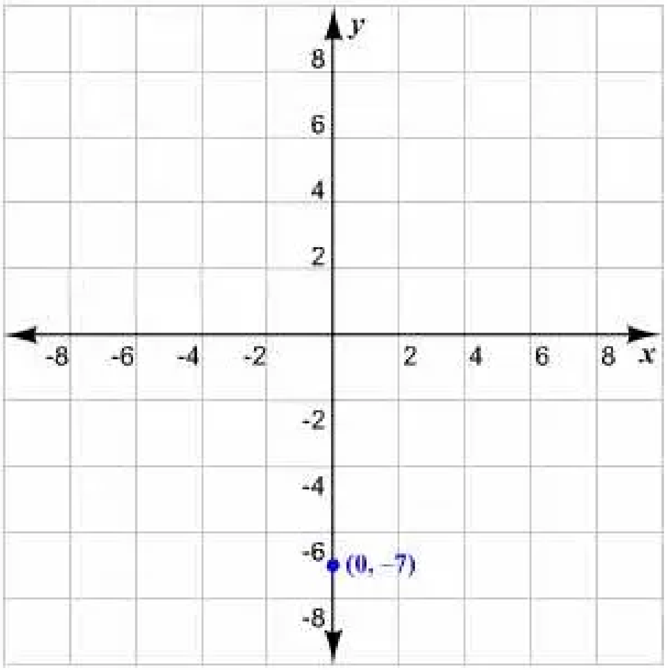
The graph of $y=\frac{1}{4}|x|$ is the graph of $y=|x|$ vertically shrunk by a factor $\frac{1}{4}$. The graph has vertex $(0,0)$ and passes through $(-4,1)$ and $(4,1)$.

Answer 3e.

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

We get the value of h as 0 and that of k as -7. Thus, the vertex is $(0, -7)$.

Plot (0, −7) as the vertex.



Step 2 Use symmetry to find two more points.

Substitute any value, say, 0 for y in the given function.

$0 = |x| - 7$

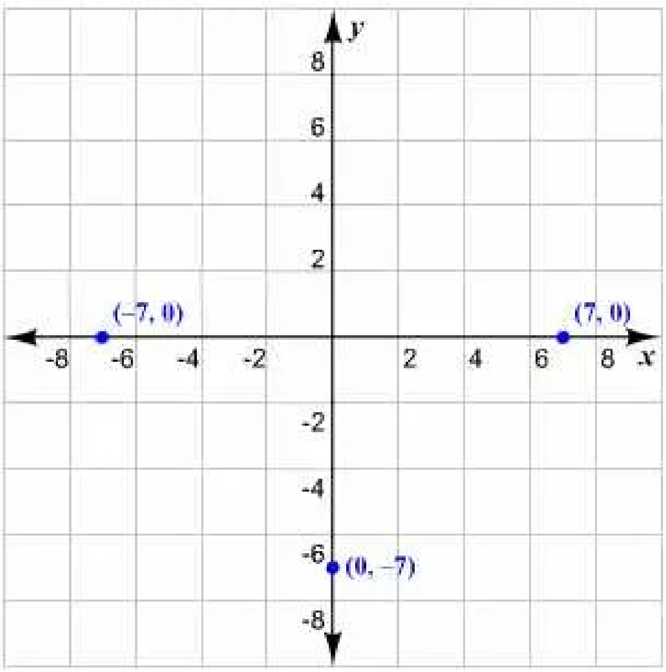
Add 7 to both the sides.

$$0 + 7 = |x| - 7 + 7$$

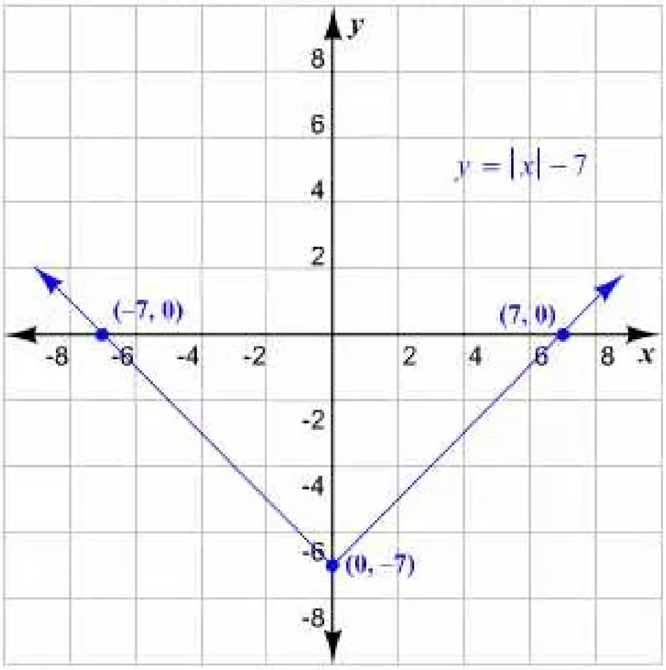
$$7 = |x|$$

We get two values for x: 7 and −7. The two points are (7, 0) and (−7, 0).

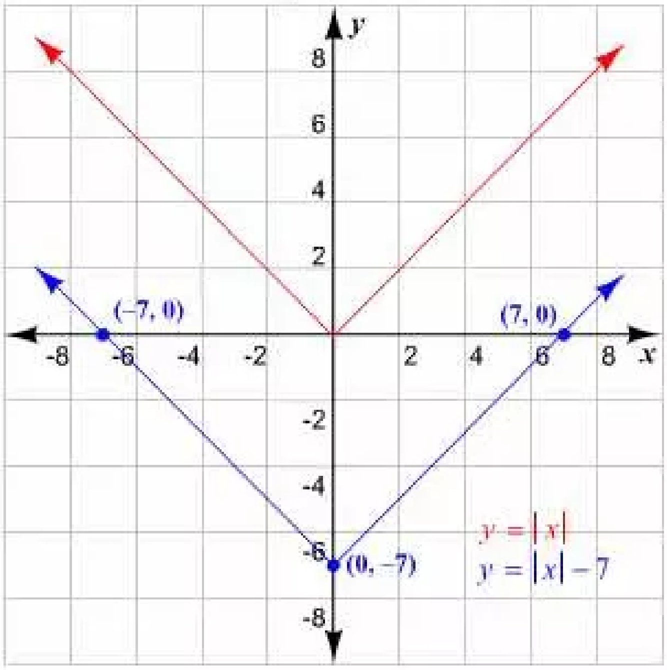
Plot these points on the graph.



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



Step 4 Similarly, graph $y = |x|$ on the same axis.



It is clear from the figure that the graph of $y = |x| - 7$ is the graph of $y = |x|$ translated down 7 units.

Answer 3ep.

We need to evaluate the function $f(x)$ for $x = 3$.

$$f(x) = \begin{cases} 9x - 4, & \text{if } x > 3 \\ \frac{1}{2}x + 1, & \text{if } x \le 3 \end{cases}$$

The given value of x is 3.

Since $3 \le 3$, we need to evaluate the second function for $f(x)$.

$$f(x) = \frac{1}{2}x + 1$$

$$f(3) = \frac{1}{2}(3) + 1 \qquad \text{[By putting 3 for } x\text{]}$$

$$= 1.5 + 1 \qquad \text{[Simplify]}$$

$$= 2.5$$

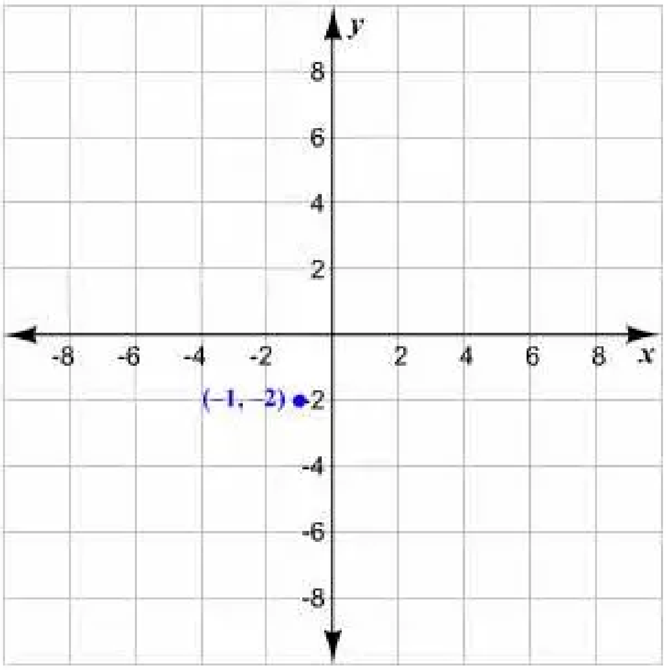
Therefore the function $\boxed{f(x) = 2.5}$.

Answer 3gp.

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 -1 and of k as -2. Thus, the vertex of the given function is $(-1, -2)$.

Plot the vertex.



Step 2 Use symmetry to find two more points.

Rewrite the equation $y = -3|x+1| - 2$.

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

We know that $|x+1|$ is always positive. Thus, we should a substitute a value for y greater than 5 to get $|x+1|$ as a positive number.

Substitute any value, say, -5 for y in the given function.

$$-\frac{-5+2}{3} = |x+1|$$

$$-\frac{-3}{3} = |x+1|$$

$$1 = |x+1|$$

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

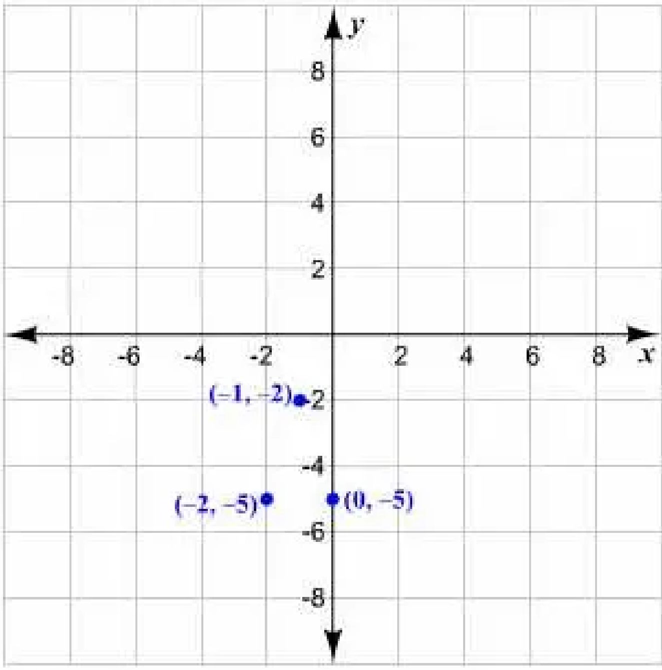
Subtract 1 from both the sides of the two equations.

$x+1-1 = 1-1$ and $x+1-1 = -1-1$

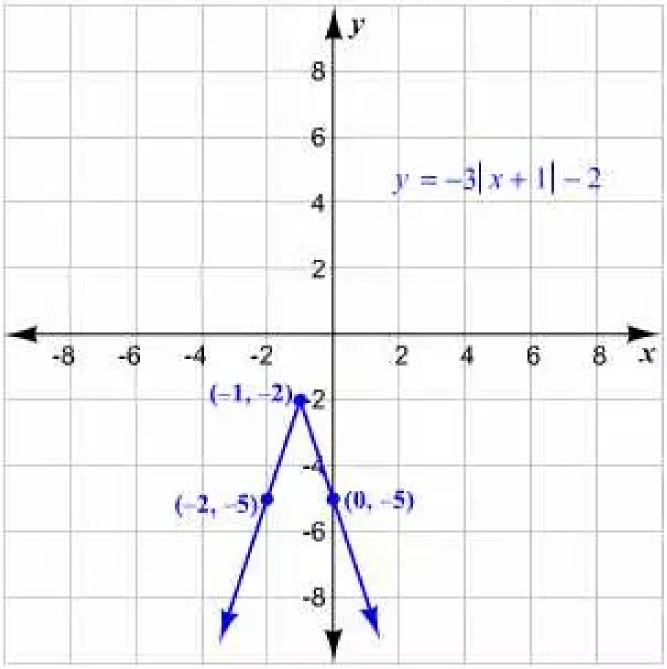
$x = 0$ and $x = -2$

The two points are $(0, -5)$ and $(-2, -5)$.

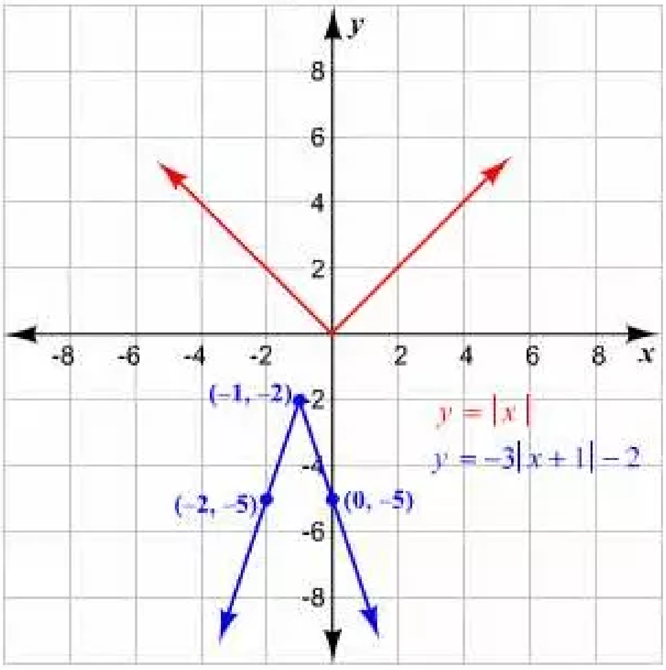
Plot these points on the graph.



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



Step 4 Similarly, graph $y = |x|$ on the same axis.



It is clear from the figure that the graph of $y = -3|x+1| - 2$ is the graph of $y = |x|$ vertically stretched by a factor of 3, translated 1 unit to the left and down 2 units, and finally reflected in the x-axis.

Answer 4e.

The given function is,

$$y = |x+2| \qquad \ldots\ldots (1)$$

We need to graph the function and compare with the graph $y = |x|$.

The standard function is of the form $y = |x-h|+k$, where the vertex is (h,k) and the graph is symmetry about $x = h$.

Comparing the given function with the standard form, we have the vertex as

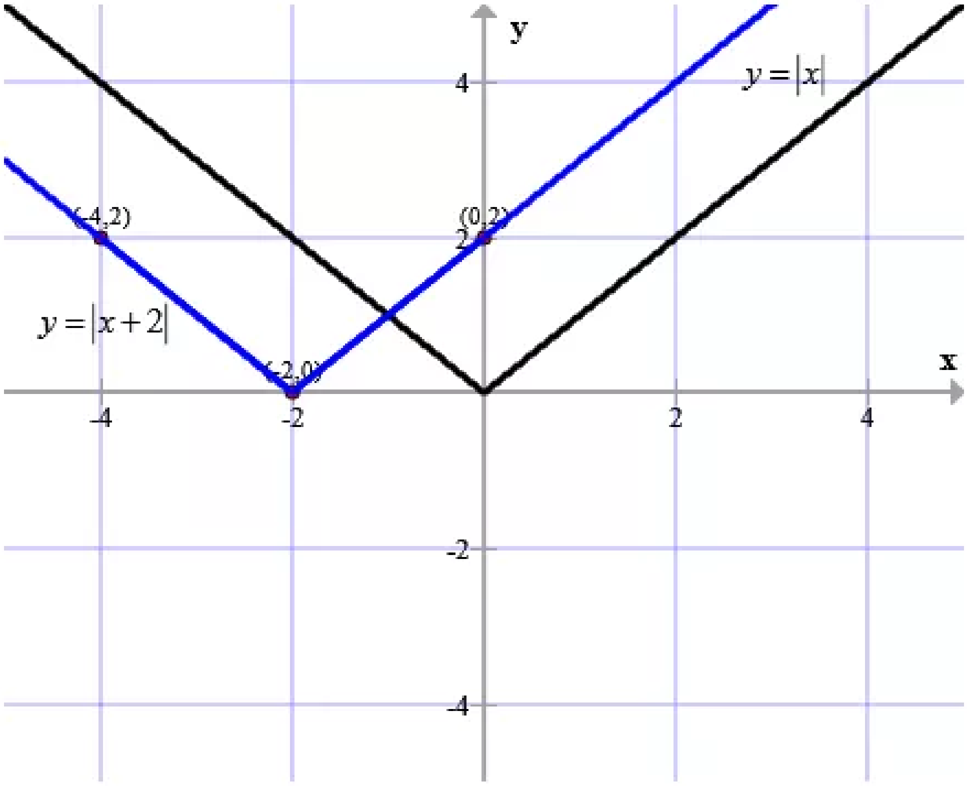
$$(h,k) = (-2,0)$$

The graph of (1) is symmetric about $x+2=0$.

If we put 0 for x in the equation $y = |x+2|$ then, $y = 2$.

Now we plot the point $(0,2)$ on the graph and by using symmetry we plot another point as $(-4,2)$. Then we connect the points with a V-shaped graph.

The graph is as follows:



Now we compare this graph with the graph of the equation $y = |x|$.

The graph of $y = |x+2|$ is the graph of $y = |x|$ shifted left 2 units.

Answer 4ep.

We need to evaluate the function $f(x)$ for $x=5$.

$$f(x)=\begin{cases}9x-4, \text{ if } x>3 \\ \frac{1}{2}x+1, \text{ if } x\le 3\end{cases}$$

The given value of x is 5.

Since $5>3$, we need to evaluate the first function for $f(x)$.

$$f(x)=9x-4$$

$$f(5)=9(5)-4 \qquad \text{[By putting 5 for } x\text{]}$$

$$=45-4 \qquad \text{[Simplify]}$$

$$=41$$

Therefore the function $\boxed{f(x)=41}$.

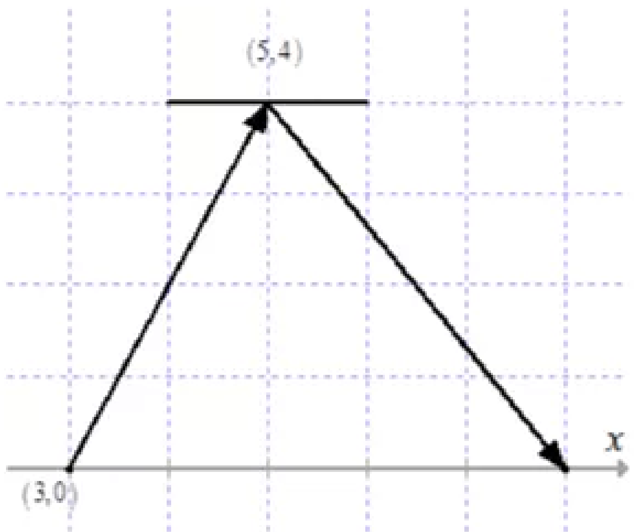
Answer 4gp.

To find an equation for the path of the beam.

The reference beam originates at $(3,0)$ and reflects off a mirror at $(5,4)$.

To find the equation of the path of the beam.

Considering the figure:



The vertex of the path of the reference beam is $(5,4)$.

The general equation of a line passing through vertex (h,k) is

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

Substituting the value $(h,k)=(5,4)$ in the equation $y=a|x-h|+k$, we get

$$y = a|x-5|+4$$

Now substituting the co-ordinates of the points $(3,0)$ in the equation and solving for a we get

$$0 = a|3-5|+4$$
$$0 = 2a+4$$
$$2a = -4$$
$$a = -\frac{4}{2} \qquad [2 \text{ is divided in both side}]$$
$$= -2$$

Substituting $a=-2$ we get the equation of the path of the beam as,

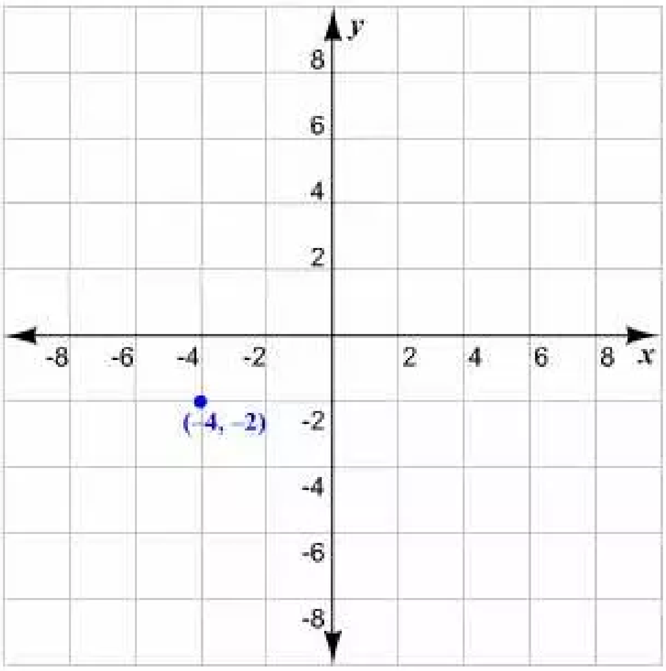
$$\boxed{y=-2|x-5|+4}$$

Answer 5e.

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

We get the value of h as -4 and that of k as -2. The vertex is $(-4, -2)$.

Plot the vertex.



Step 2 Use symmetry to find two more points.

Substitute any value, say, 0 for y in the given function.

$0 = |x + 4| - 2$

Add 2 to both the sides.

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

$$2 = |x + 4|$$

We get $x + 4 = 2$ and $x + 4 = -2$.

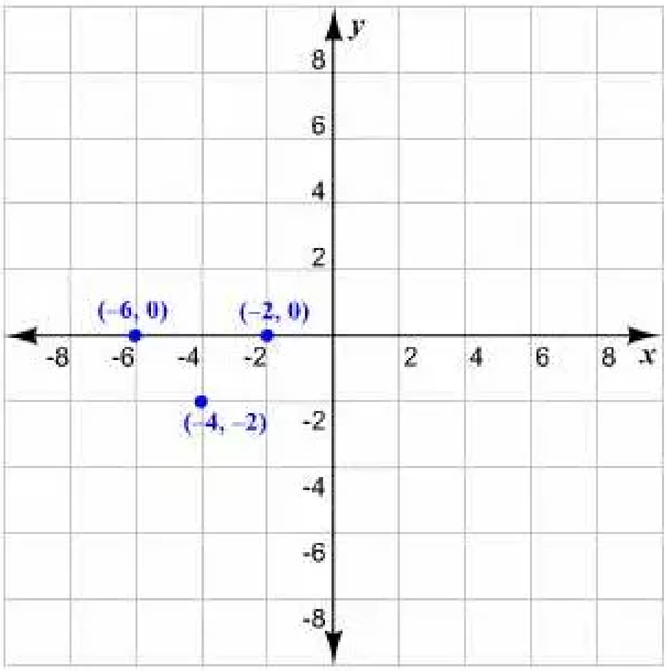
Subtract 4 from both the sides of the two equations.

$x + 4 - 4 = 2 - 4$ and $x + 4 - 4 = -2 - 4$

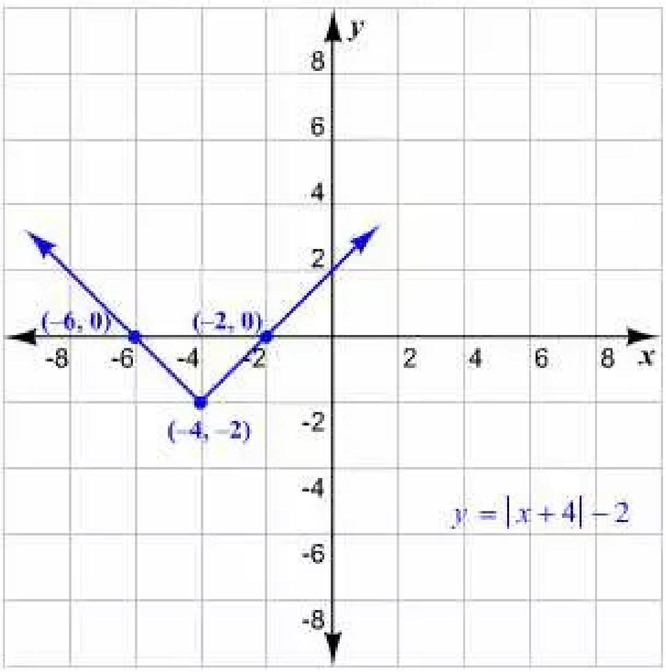
$x = -2$ and $x = -6$

The two points are $(-2, 0)$ and $(-6, 0)$.

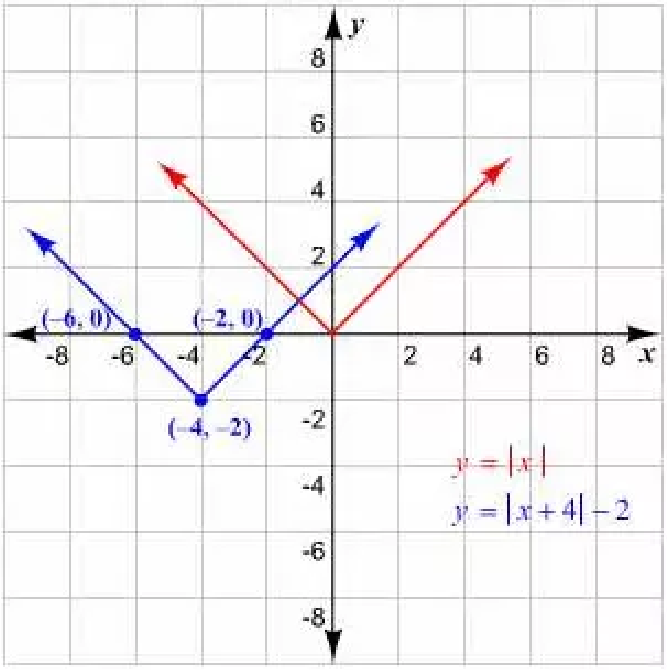
Plot these points on the graph.



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



Step 4 Similarly, graph $y = |x|$ on the same axis.



It is clear from the figure that the graph of $y = |x + 4| - 2$ is the graph of $y = |x|$ translated down 2 units and 4 units left.

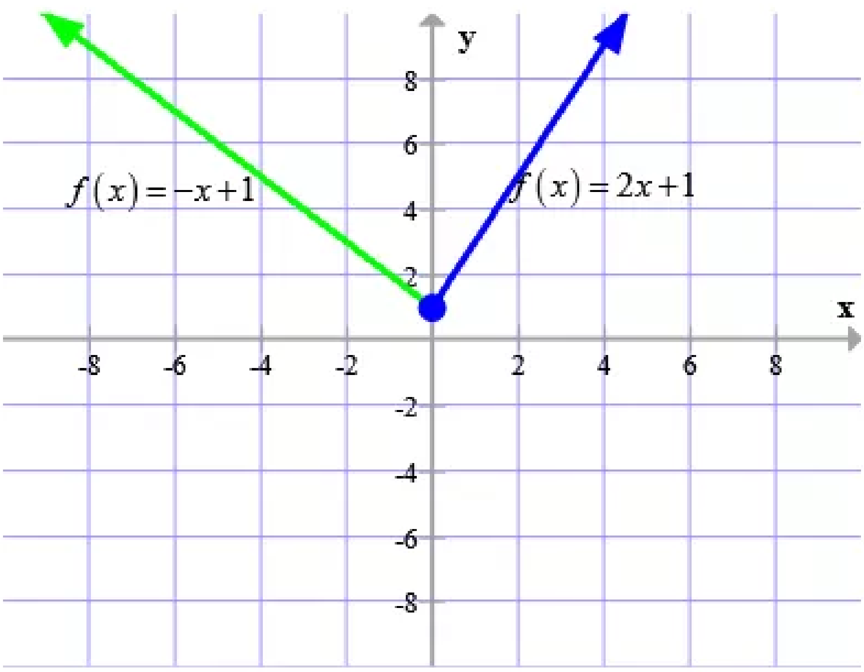
Answer 5ep.

We need to graph the function $f(x)$.

$$f(x) = \begin{cases} 2x+1, & \text{if } x \geq 0 \\ -x+1, & \text{if } x < 0 \end{cases}$$

For the condition $x \geq 0$, we draw the graph $f(x) = 2x + 1$ from $x = 0$ to the right of $x = 0$ and for the condition $x < 0$, we draw the graph $f(x) = -x + 1$ to the left of $x = 0$.

The graph for $f(x)$ is drawn below:



Answer 5gp.

The required graph of the function $y = 0.5 \cdot f(x)$ is the graph of $y = f(x)$ shrunk vertically by a factor of 0.5.

Graph $y = 0.5 \cdot f(x)$. Find the coordinates of the required graph by multiplying each y-coordinate by 0.5.

The resulting coordinates of the graph of the function $y = 0.5 \cdot f(x)$ are noted in a table.

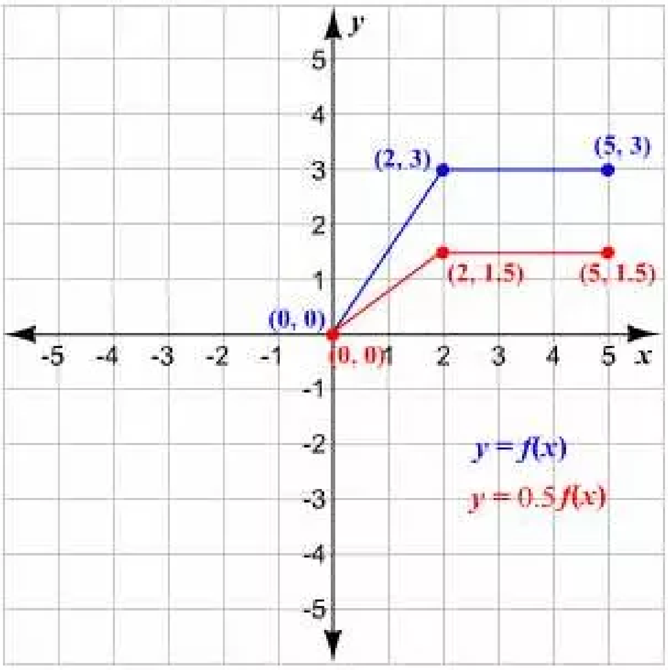
$y = f(x)$

x	y
2	3
0	0
5	3

$y = 0.5 \cdot f(x)$

x	y
2	1.5
0	0
5	1.5

Plot the points and connect them using straight line segments.



Answer 6e.

The given function is,

$$f(x) = |x-1| + 4 \qquad \text{...... (1)}$$

We need to graph the function and compare with the graph $y = |x|$.

The standard function is of the form $y=|x-h|+k$, where the vertex is (h,k) and the graph is symmetry about $x=h$.
Comparing the given function with the standard form, we have the vertex as

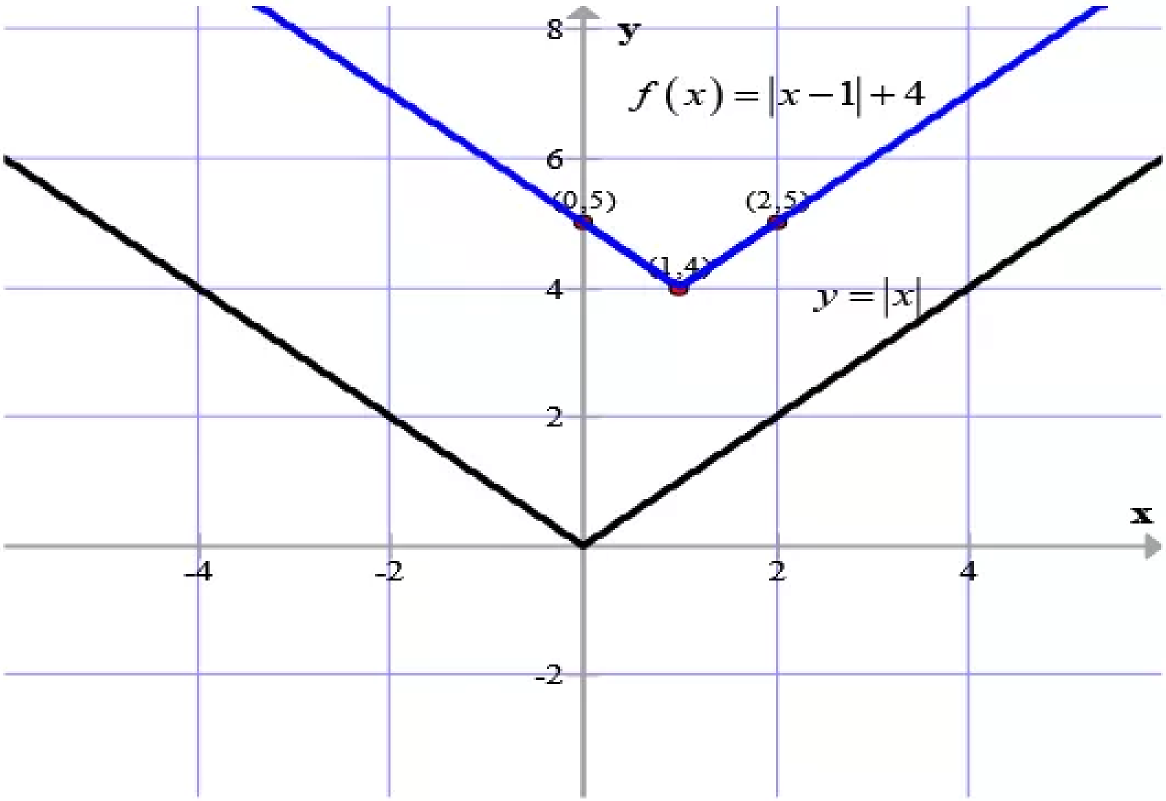
$$(h,k)=(1,4)$$

The graph of (1) is symmetric about $x=1$.
If we put 2 for x in the equation $f(x)=|x-1|+4$ then,

$$f(x)=y$$
$$=5$$

Now we plot the point $(2,5)$ on the graph and by using symmetry we plot another point as $(0,5)$. Then we connect the points with a V-shaped graph.

The graph is as follows:



Now we compare this graph with the graph of the equation $y=|x|$.

The graph of $f(x)=|x-1|+4$ is the graph of $y=|x|$ translated right 1 unit and up 4 units.

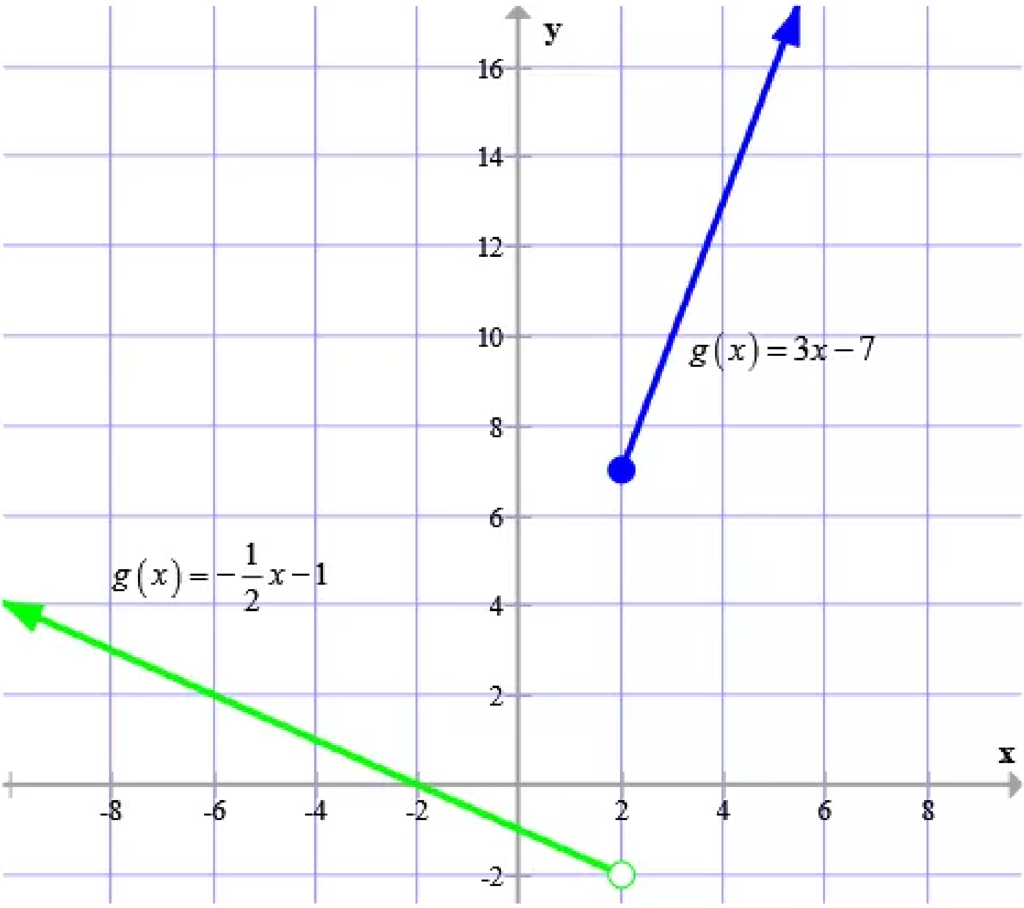
Answer 6ep.

We need to graph the function $g(x)$.

$$g(x)=\begin{cases}-\frac{1}{2}x-1, & \text{if } x<2 \\ 3x-7, & \text{if } x\geq 2\end{cases}$$

For the condition $x < 2$, we draw the graph $g(x) = -\frac{1}{2}x - 1$ to the left of $x = 2$ and for the condition $x \geq 2$, we draw the graph $g(x) = 3x - 7$ from $x = 2$ to the right of $x = 2$.

The graph for $g(x)$ is drawn below:

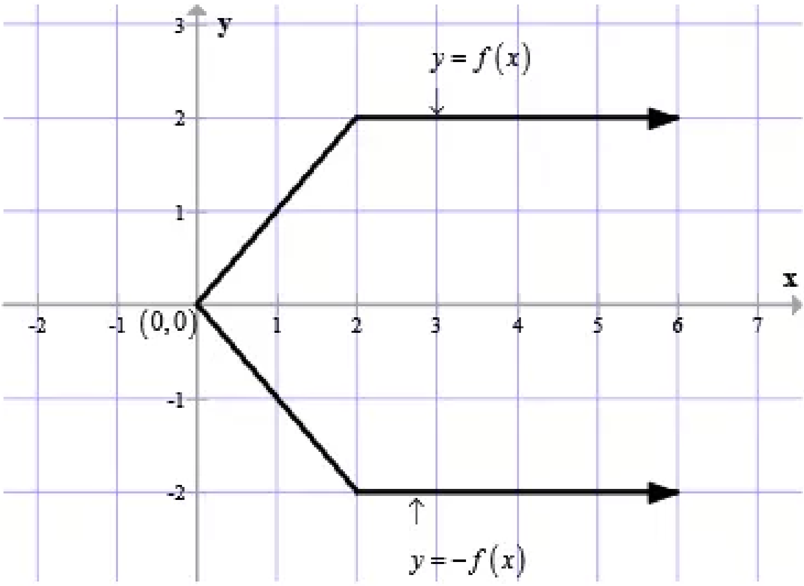


Answer 6gp.

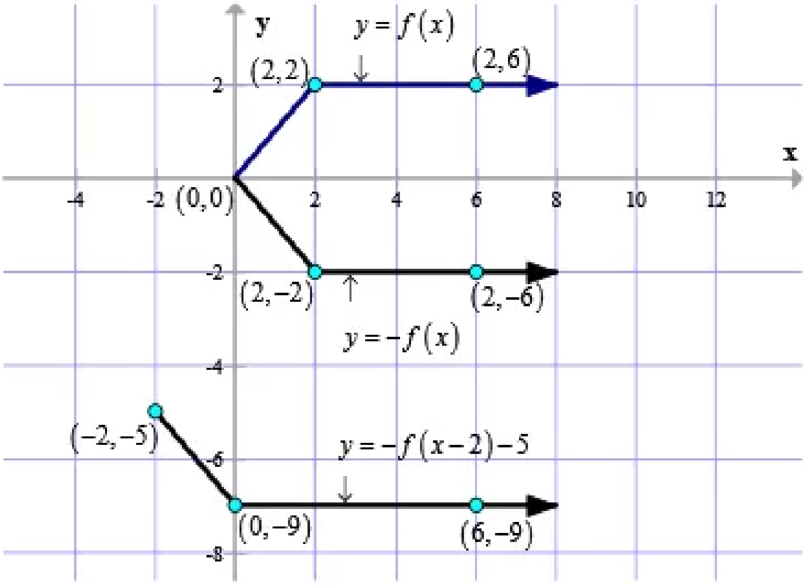
The given function is:

$$y=-f(x-2)-5$$

Here at first we will draw the graph of $y=f(x)$. The mirror image of $y=f(x)$ with respect to x - axis will give us the graph of $y=-f(x)$



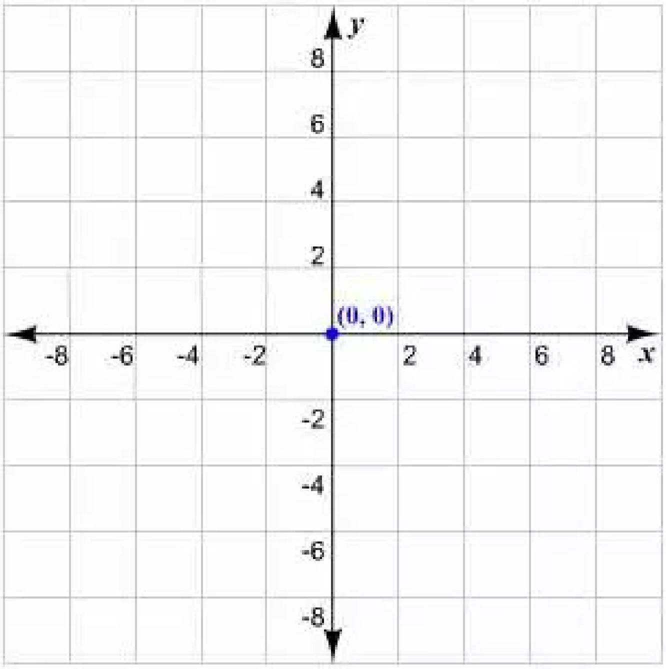
then we will shift the graph 2 unit right to obtain the graph of $y=-f(x-2)$ and at last we will shift the graph 5 units downward to draw the graph of $y=-f(x-2)-5$.



Answer 7e.

Step 1 The given function is of the form $y = a|x|$, where (0, 0) is the vertex of the function's graph.

Plot this vertex.



Step 2 Use symmetry to find two more points.
Substitute any value, say, 2 for y in the given function.
$2 = 2|x|$

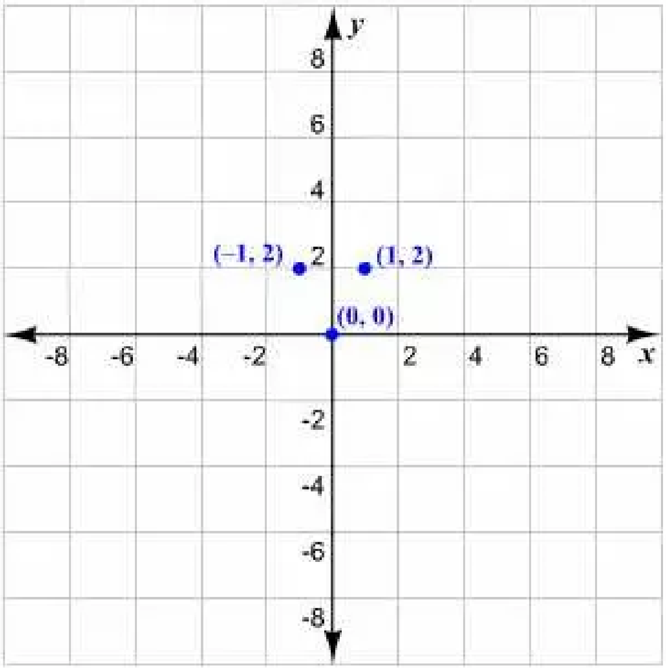
Divide both the sides by 2.

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

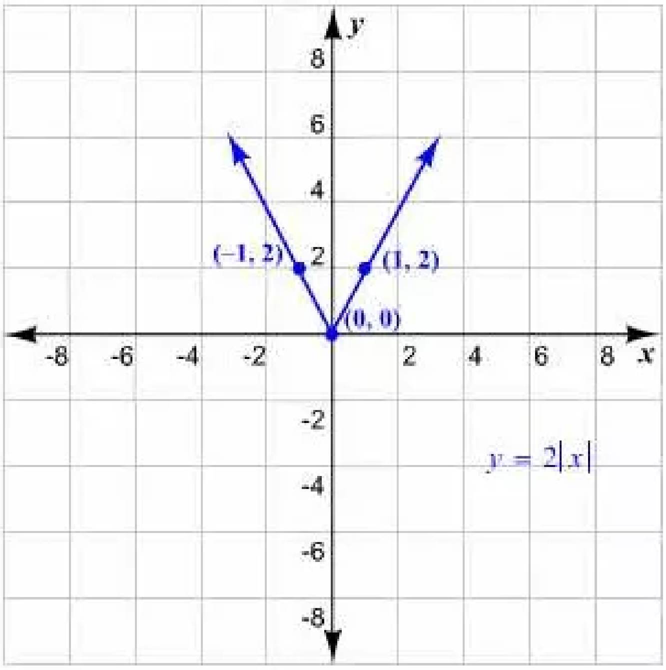
$$1 = |x|$$

We get two values for x: 1 and −1. The two points are (1, 2) and (−1, 2).

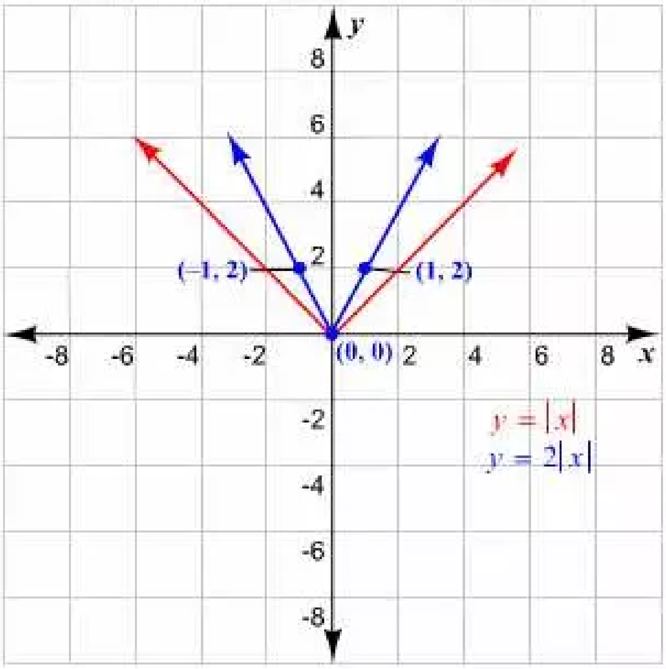
Plot these points on the graph.



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



Step 4 Similarly, graph $y = |x|$ on the same axis.



It is clear from the figure that the graph of $f(x) = 2|x|$ is the graph of $y = |x|$ vertically stretched by a factor 2.

Answer 7gp.

The required graph of the function $y = 2 \cdot f(x+3) - 1$ is the graph of $y = f(x)$ shrunk vertically by a factor of 2 and then translated left 3 units and down 1 unit.

Graph $y = 2 \cdot f(x+3) - 1$. The resulting coordinates of the graph of $y = 2 \cdot f(x+3) - 1$ are listed in a table.

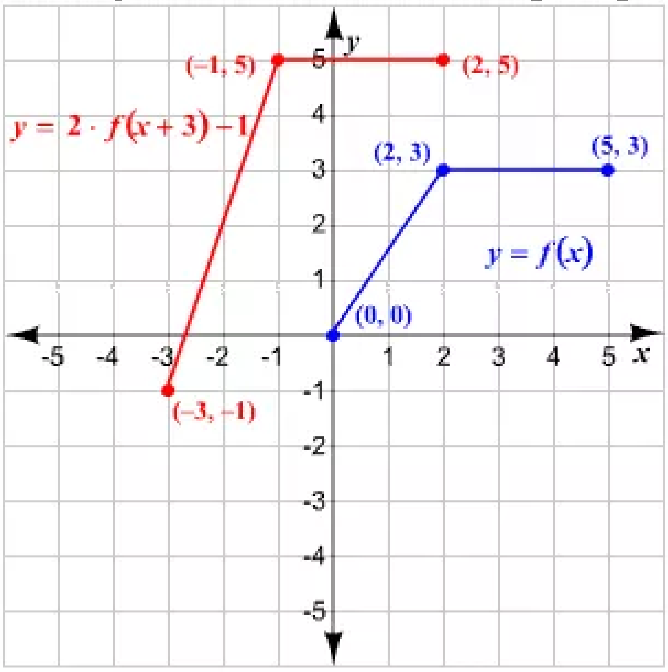
$y = f(x)$

x	y
2	3
0	0
5	3

$y = 2 \cdot f(x+3) - 1$

x	y
−1	5
−3	−1
2	5

Plot the points and connect them using straight line segments.



Answer 8e.

The given function is,

$$f(x) = -3|x| \qquad \ldots\ldots (1)$$

We need to graph the function and compare with the graph $y = |x|$.

The standard function is of the form $y = a|x-h|+k$, where the vertex is (h,k) and the graph is symmetry about $x = h$.

Comparing the given function with the standard form, we have the vertex as

$$(h,k) = (0,0)$$

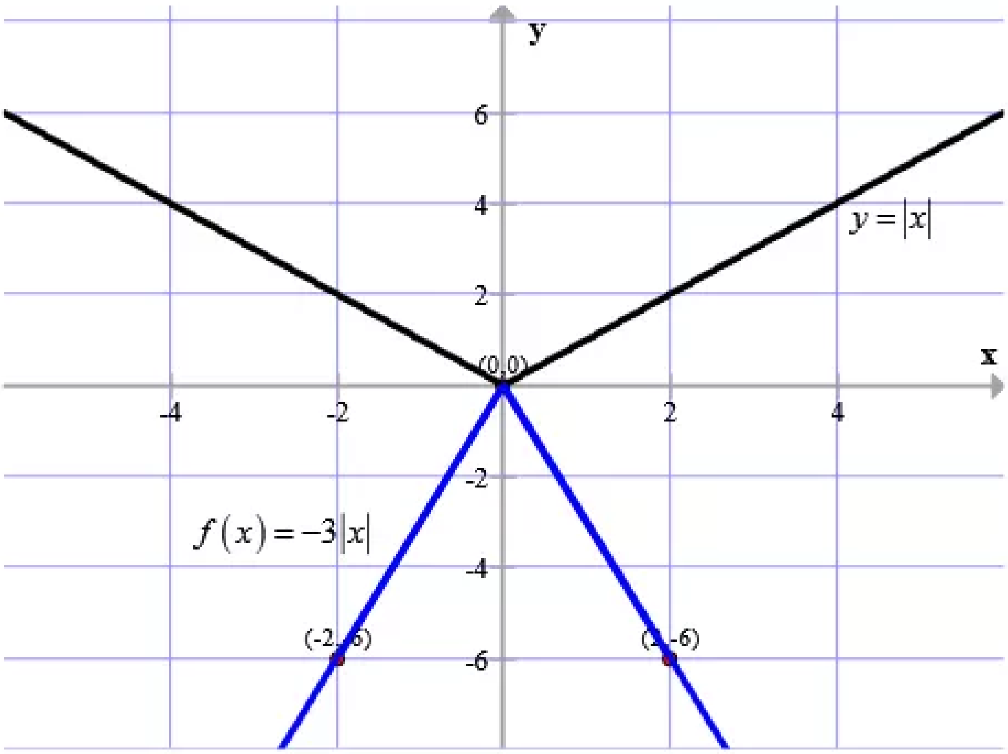
The graph of (1) is symmetric about $x = 0$ and the graph is V-shaped.

By putting 2 for x in the equation (1), we have

$$f(x) = -6$$

Now we plot the point $(2,-6)$ on the graph and by using symmetry we plot another point as $(-2,-6)$. Then we connect the points with a V-shaped graph.

The graph is as follows:



Now we compare this graph with the graph of the equation $y=|x|$.

The graph of $f(x)=-3|x|$ is the graph of $y=|x|$ vertically stretched by a factor 3 and then reflected in the x-axis.

Answer 8ep.

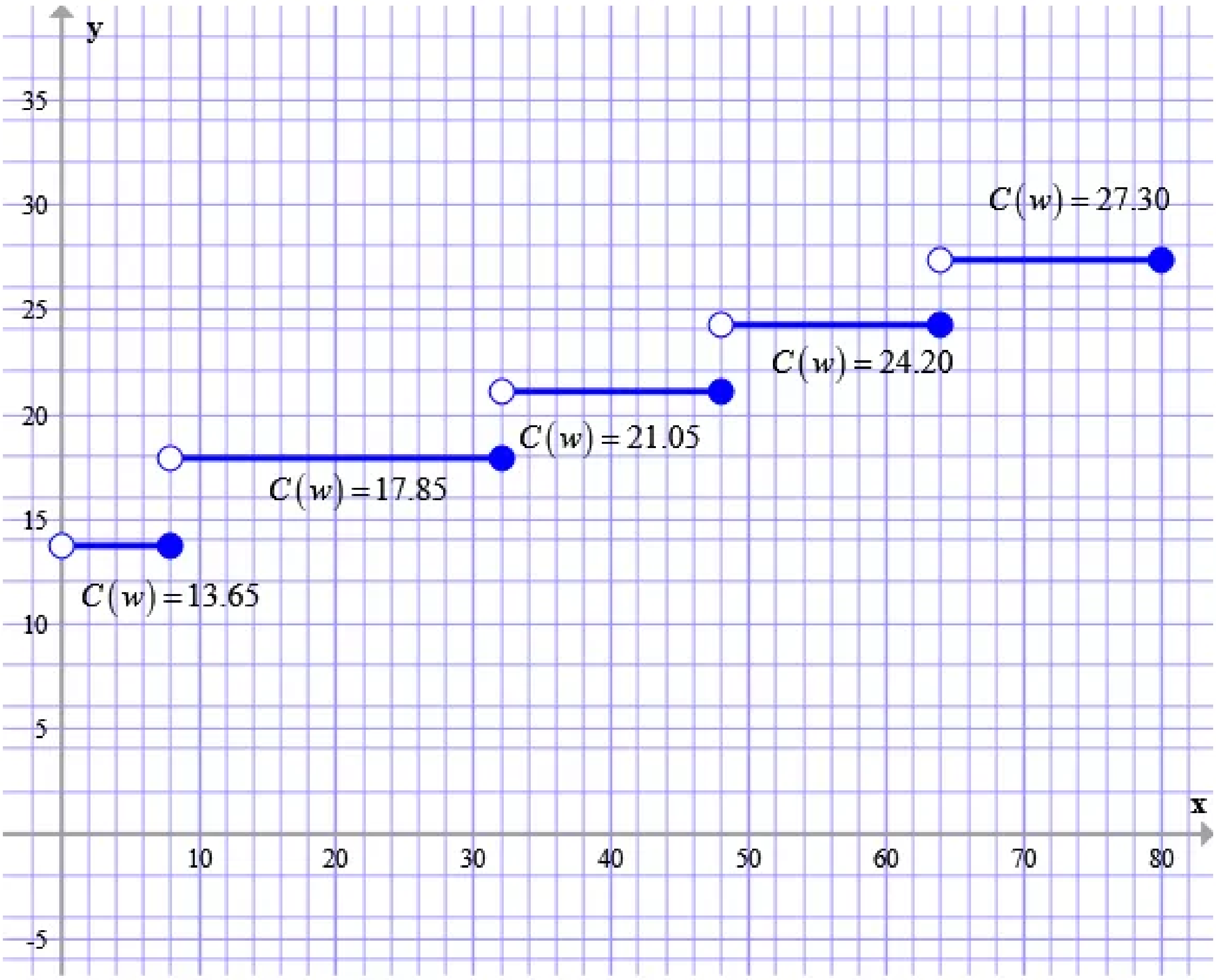
The given function of cost is,

$$C(w)=\begin{cases} 13.65, \text{ if } 0<w\leq 8 \\ 17.85, \text{if } 8<w\leq 32 \\ 21.05, \text{if } 32<w\leq 48 \\ 24.20, \text{if } 48<w\leq 64 \\ 27.30, \text{if } 64<w\leq 80 \end{cases}$$

(a)

We need to draw the graph of the given function.

For the condition $0 < w \leq 8$, we draw the graph $C(w) = 13.65$ from right of $x = 0$ to $x = 8$. For the condition $8 < w \leq 32$, we draw the graph $C(w) = 17.85$ from right of $x = 8$ to $x = 32$. For the condition $32 < w \leq 48$, we draw the graph $C(w) = 21.05$ from right of $x = 32$ to $x = 48$. For the condition $48 < w \leq 64$, we draw the graph $C(w) = 24.20$ from right of $x = 48$ to $x = 64$. For the condition $64 < w \leq 80$, we draw the graph $C(w) = 27.30$ from right of $x = 64$ to $x = 80$.



(b)

We need to calculate the cost to send a parcel weighing 2 pounds 9 ounces.

Since 1 pound=16 ounces, we have

The weight of the parcel is 41 ounces.

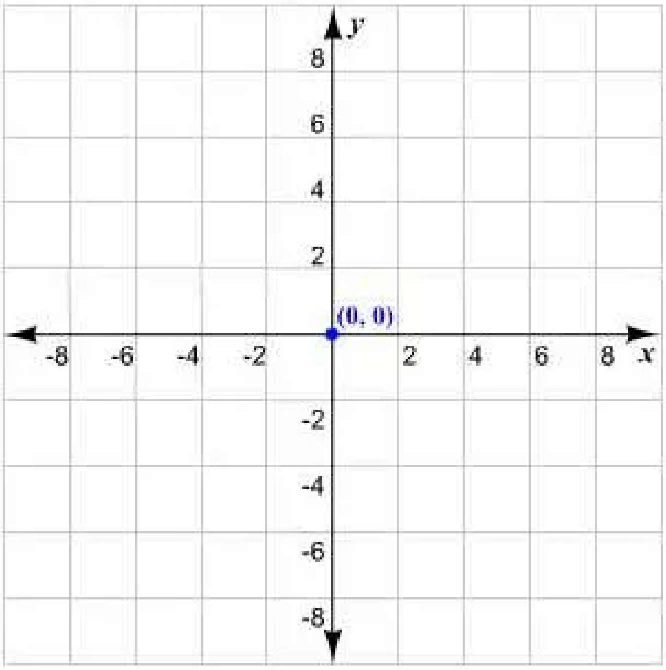
Therefore this weight will fall in the range $32 < w \leq 48$ and the function is $C(w) = 21.05$.

Hence the cost to send a parcel weighing 2 pounds 9 ounces is $\boxed{21.05\text{ dollars}}$.

Answer 9e.

Step 1 The given function is of the form $y = a|x|$, where (0, 0) is the vertex of the function's graph.

Plot this vertex.



Step 2 Use symmetry to find two more points. For this, substitute a negative value for y in the given function. This is because the function $y = -\frac{1}{3}|x|$ will always give a negative value as $|x|$ is always positive.

Substitute -1 for y.

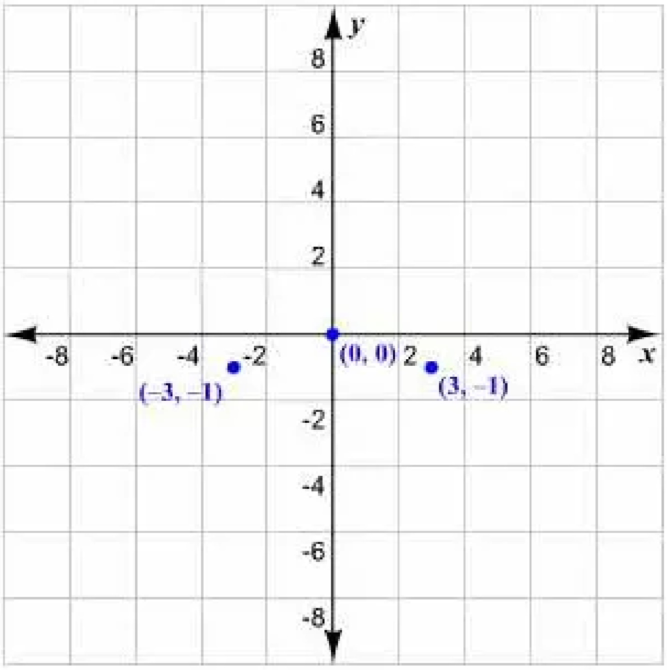
$$-1 = -\frac{1}{3}|x|$$

Multiply both sides by -3.

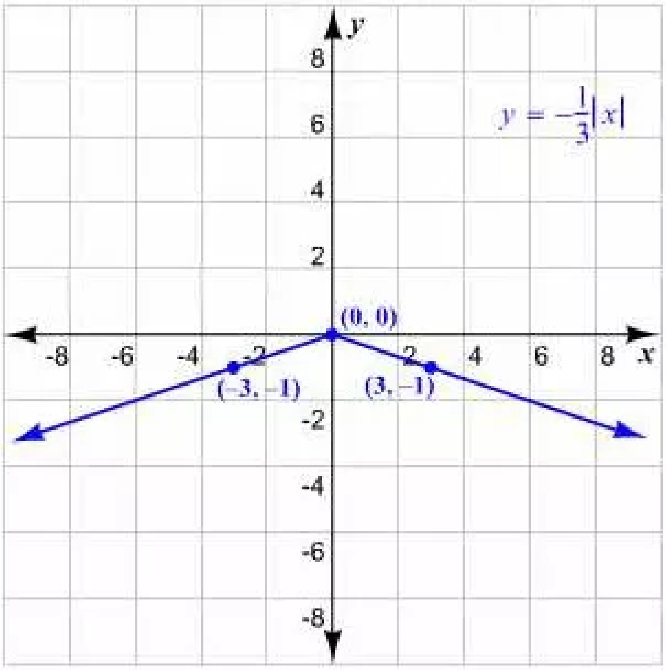
$$(-1)(-3) = -\frac{1}{3}|x|(-3)$$
$$3 = |x|$$

We get two values for x: 3 and -3. The two points are $(3, -1)$ and $(-3, -1)$.

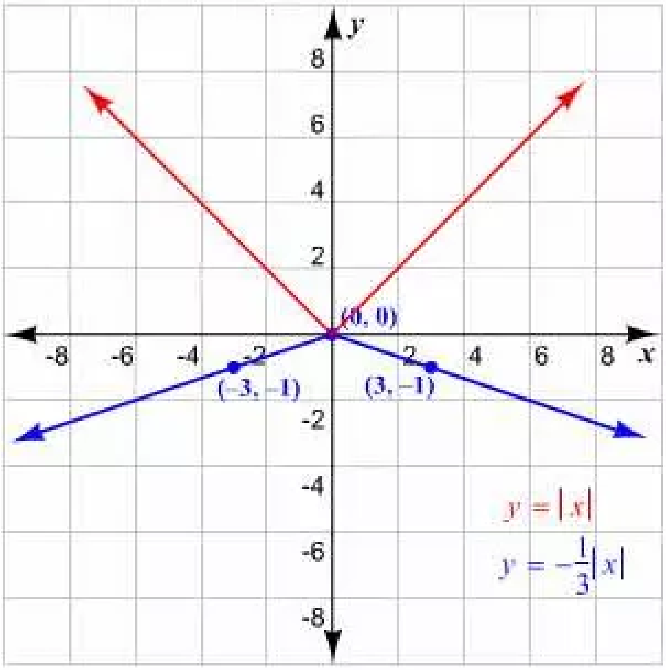
Plot these points on the graph.



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



Step 4 Similarly, graph $y = |x|$ on the same axis.



It is clear from the figure that the graph of $y = -\frac{1}{3}|x|$ is the graph of $y = |x|$ vertically shrunk by a factor of $\frac{1}{3}$ and then reflected in the x-axis.

Answer 9ep.

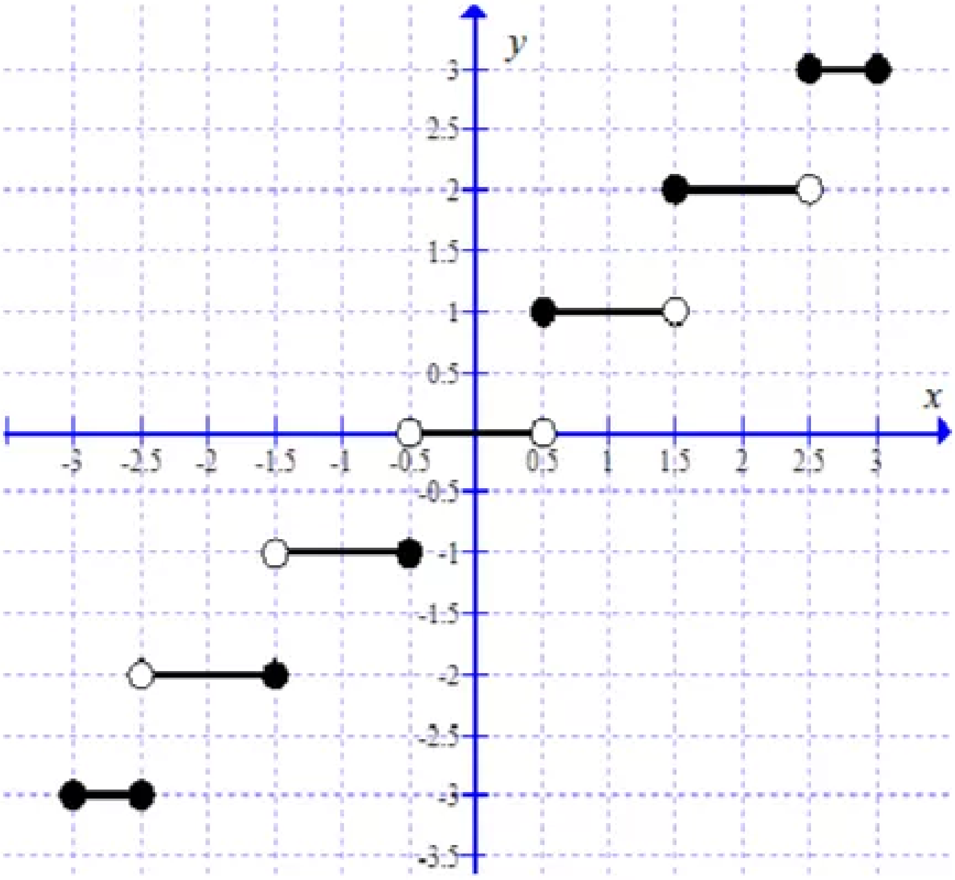
Consider the output $f(x)$ is the input x rounded to the nearest integer.

(if the decimal part of x is 0.5,then x is rounded up when x is positive and x is rounded down when x is negative).

The output of $f(x)$ is shown below for the input $-3 \le x \le 3$ to the nearest integer.

$$
\begin{aligned}
f(x) &= -3 && \text{if } -3 \le x \le -2.5 \\
&= -2 && \text{if } -2.5 < x \le -1.5 \\
&= -1 && \text{if } -1.5 < x \le -0.5 \\
&= 0 && \text{if } -0.5 < x < 0.5 \\
&= 1 && \text{if } 0.5 \le x < 1.5 \\
&= 2 && \text{if } 1.5 \le x < 2.5 \\
&= 3 && \text{if } 2.5 \le x \le 3
\end{aligned}
$$

The graph of $f(x)$ is show below:



Answer 10e.

The given function is,

$$y = \frac{3}{4}|x| \qquad \text{...... (1)}$$

We need to graph the function and compare with the graph $y = |x|$.

The standard function is of the form $y = a|x-h|+k$, where the vertex is (h,k) and the graph is symmetry about $x = h$.

Comparing the given function with the standard form, we have the vertex as

$$(h,k) = (0,0)$$

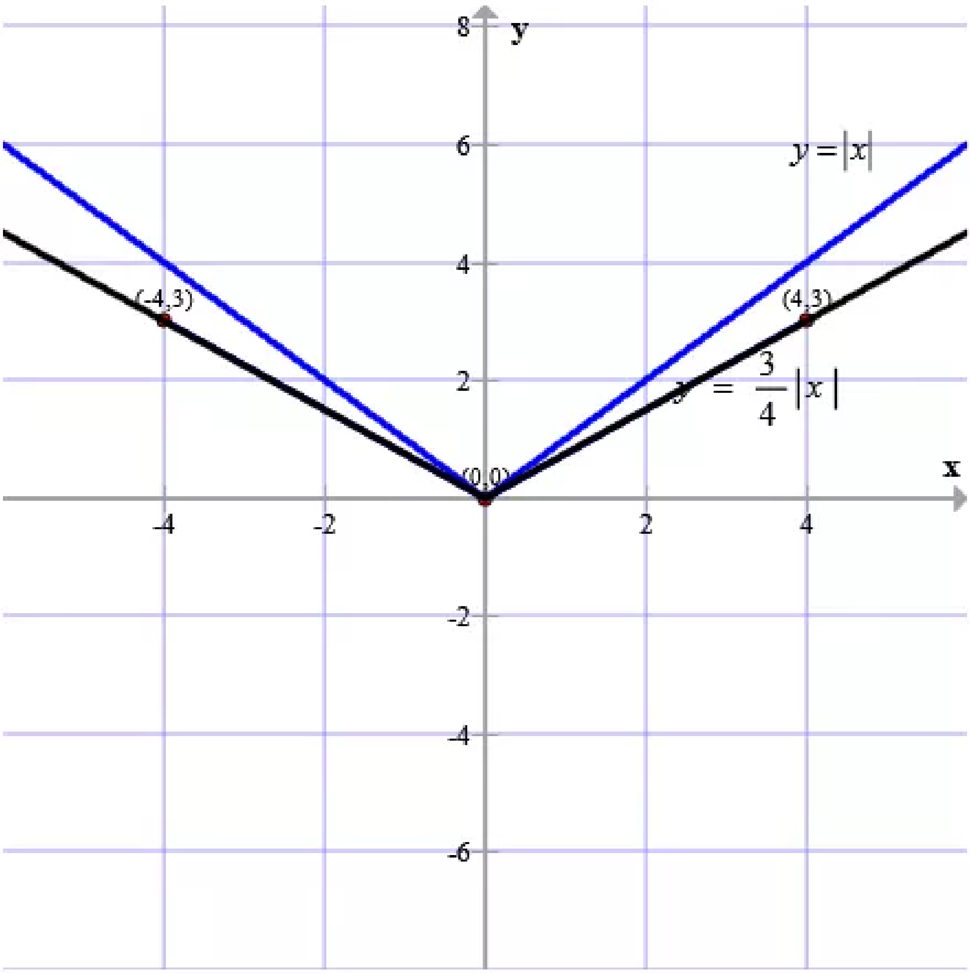
The graph of (1) is symmetric about $x = 0$ and the graph is V-shaped.

By putting 4 for x in the equation (1), we have

$$y = 3$$

Now we plot the point $(4,3)$ on the graph and by using symmetry we plot another point as $(-4,3)$. Then we connect the points with a V-shaped graph.

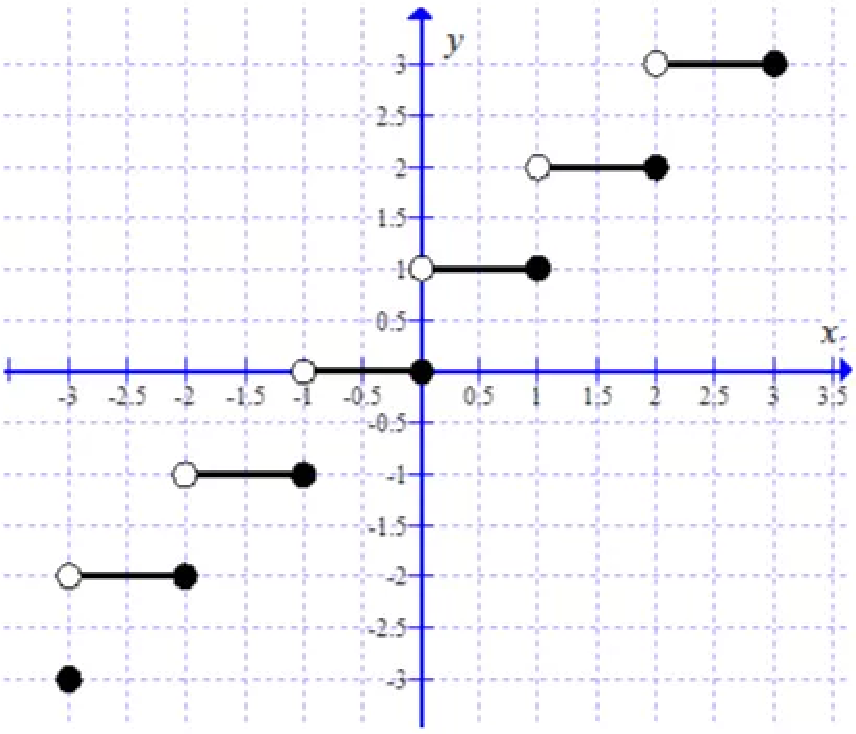
The graph is as follows:



Now we compare this graph with the graph of the equation $y = |x|$.

The graph of $y = \frac{3}{4}|x|$ is the graph of $y = |x|$ vertically shrunk by a factor of $\frac{3}{4}$. The graph has vertex $(0,0)$ and passes through $(4,3)$and $(-4,3)$.

The graph of $f(x)$ is show below:

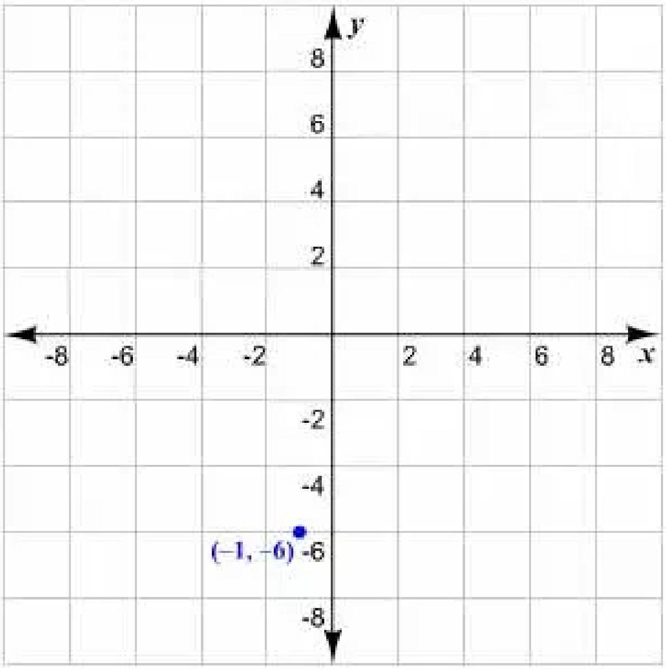


Answer 11e.

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

We get the value of h as -1 and that of k as -6. The vertex is $(-1, -6)$.

Plot the vertex.



Step 2 Use symmetry to find two more points.
Substitute any value, say, 0 for y in the given function.

$$0 = 2|x + 1| - 6$$

Add 6 to both the sides of the equation.

$$0 + 6 = 2|x + 1| - 6 + 6$$
$$6 = 2|x + 1|$$

Divide both the sides by 2.

$$\frac{6}{2} = \frac{2|x + 1|}{2}$$
$$3 = |x + 1|$$

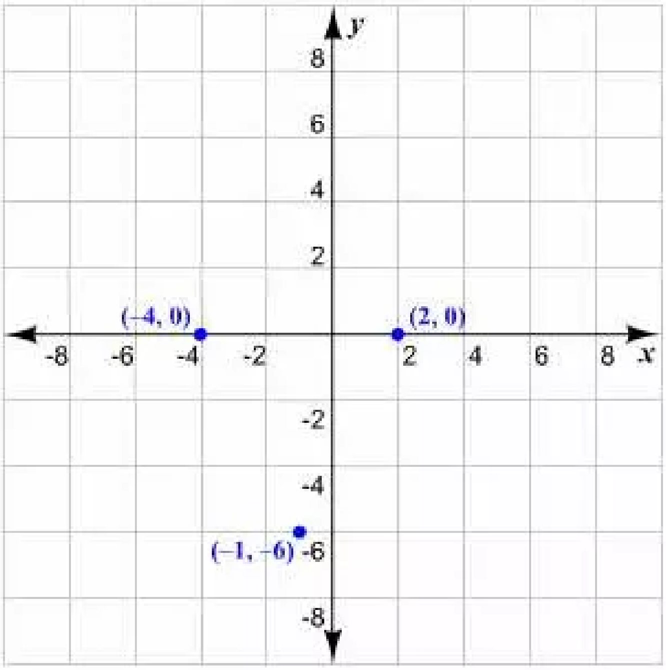
We get $x + 1 = 3$ and $x + 1 = -3$.

Subtract 1 from both the sides of the two equations.

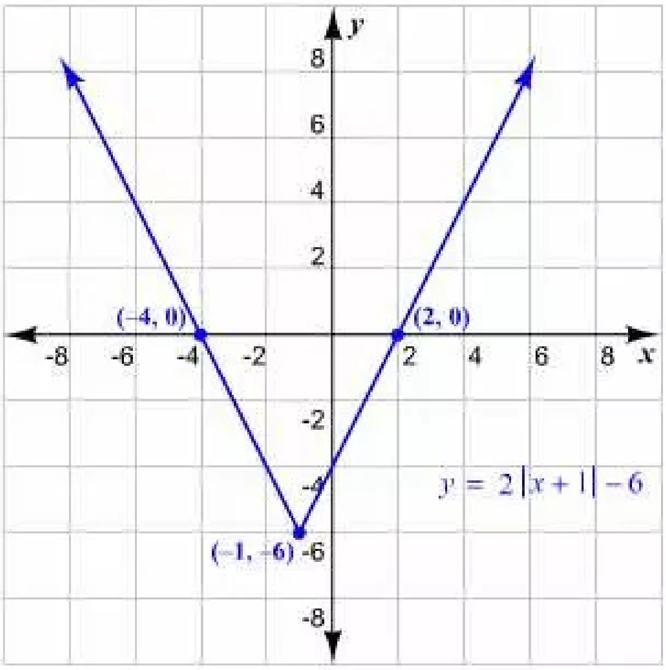
$$x + 1 - 1 = 3 - 1 \quad \text{and} \quad x + 1 - 1 = -3 - 1$$
$$x = 2 \quad \text{and} \quad x = -4$$

The two points are $(2, 0)$ and $(-4, 0)$.

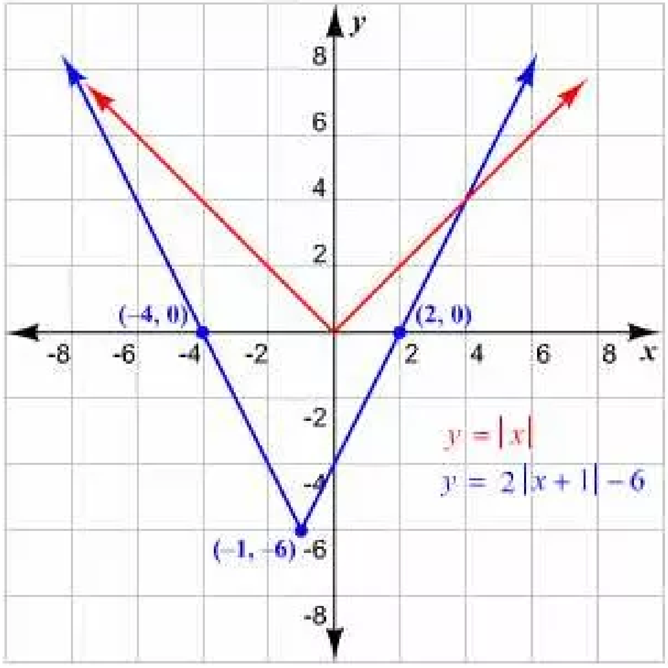
Plot these points on the graph.



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



Step 4 Similarly, graph $y = |\ x\ |$ on the same axis.



It is clear from the figure that the graph of $y = 2|x + 1| - 6$ is the graph of $y = |x|$ vertically stretched by a factor 2, and translated left 1 unit and down 6 units.

Answer 12e.

The given function is,

$$f(x) = -4|x+2| - 3 \qquad \text{...... (1)}$$

We need to graph the function and compare with the graph $y = |x|$.

The standard function is of the form $y = a|x-h| + k$, where the vertex is (h, k) and the graph is symmetry about $x = h$.

Comparing the given function with the standard form, we have the vertex as

$$(h, k) = (-2, -3)$$

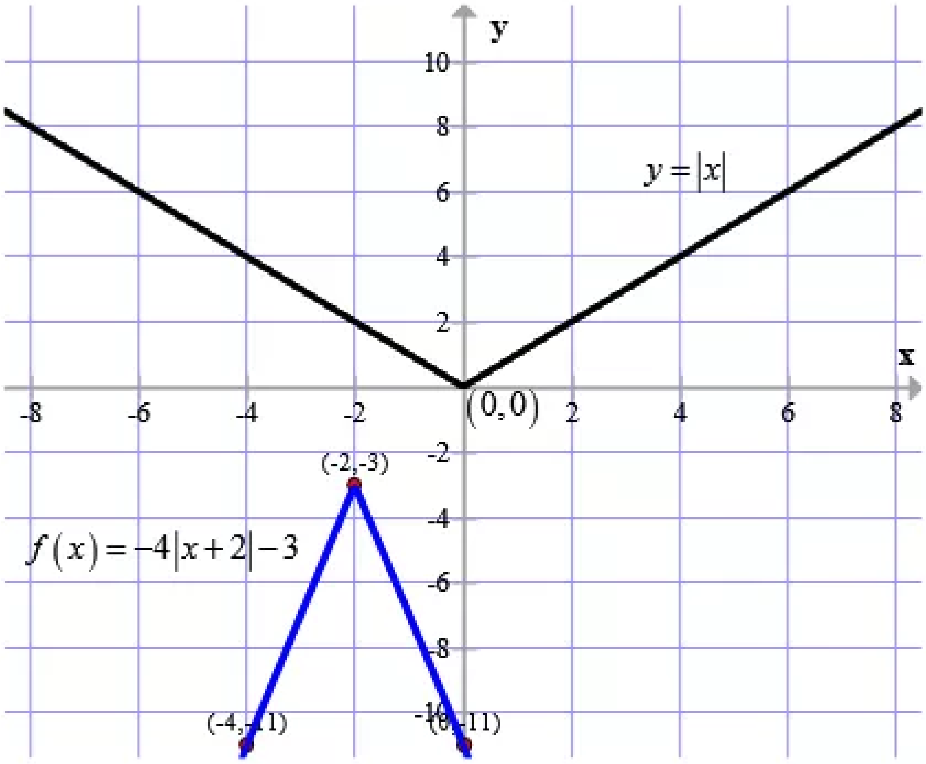
The graph of (1) is symmetric about $x + 2 = 0$ and the graph is V-shaped.

By putting 0 for x in the equation (1), we have

$$y = -11$$

Now we plot the point $(0, -11)$ on the graph and by using symmetry we plot another point as $(-4, -11)$. Then we connect the points with a V-shaped graph.

The graph is as follows:



Now we compare this graph with the graph of the equation $y=|x|$.

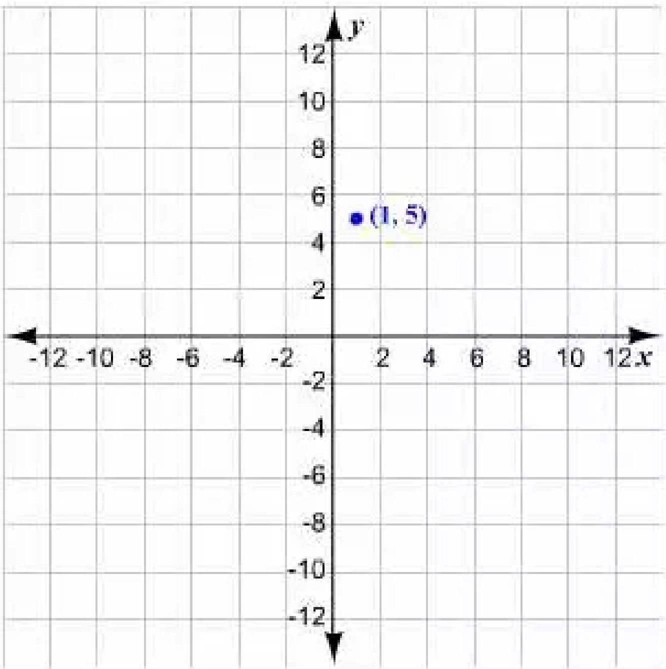
The graph of $f(x)=-4|x+2|-3$ is the graph of $y=|x|$ stretched vertically by a factor 4, then reflected in the x-axis, and finally translated left 2 units and down 3 units.

Answer 13e.

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

We get the value of h as 1 and that of k as 5. The vertex is (1, 5).

Plot the vertex.



Step 2 Use symmetry to find two more points.
Substitute any value, say, 0 for y in the given function.

$$0 = -\frac{1}{2}|x-1|+5$$

Subtract 5 from both the sides of the equation.

$$0-5 = -\frac{1}{2}|x-1|+5-5$$

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

Multiply both sides by -2.

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

$$10 = |x-1|$$

We get $x-1=10$ and $x-1=-10$.

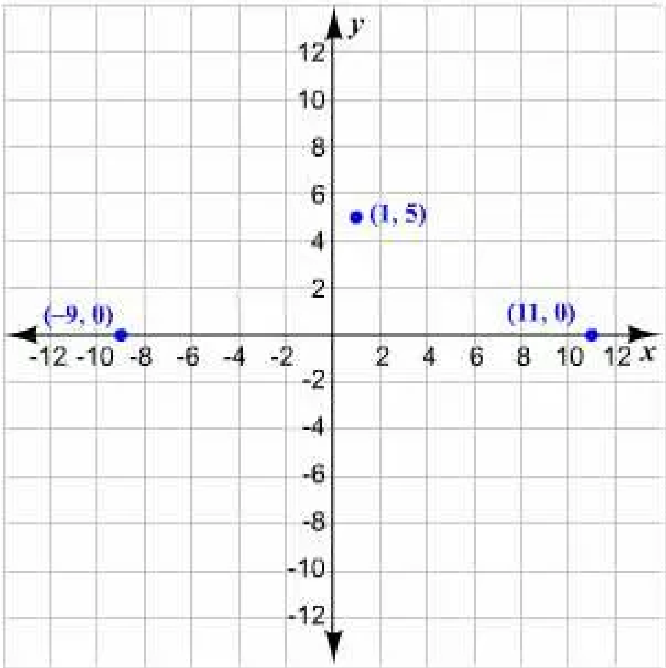
Add 1 to both the sides of the two equations.

$x-1+1 = 10+1$ and $x-1+1 = -10+1$

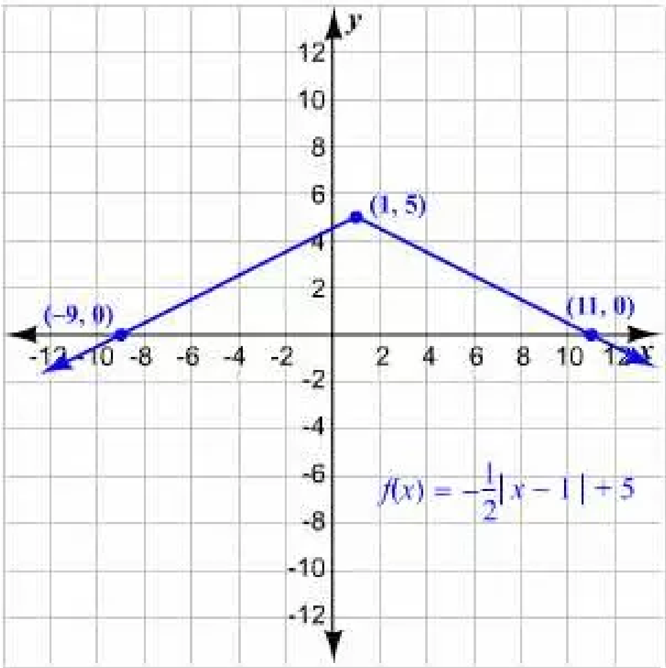
$x = 11$ and $x = -9$

The two points are (11, 0) and (–9, 0).

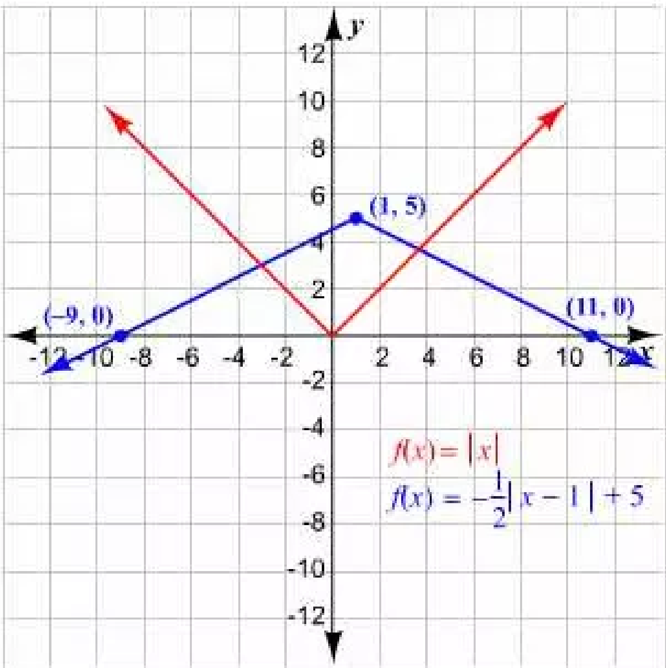
Plot these points on the graph.



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



Step 4 Similarly, graph $y = |x|$ on the same axis.



It is clear from the figure that the graph of $y = -\frac{1}{2}|x-1| + 5$ is the graph of $y = |x|$ vertically shrunk by a factor of $\frac{1}{2}$, translated 1 unit to the right and up 6 units, and finally reflected in the x-axis.

Answer 14e.

The given function is,

$$f(x)=\frac{1}{4}|x-4|+3 \qquad \text{...... (1)}$$

We need to graph the function and compare with the graph $y=|x|$.

The standard function is of the form $y=a|x-h|+k$, where the vertex is (h,k) and the graph is symmetry about $x=h$.

Comparing the given function with the standard form, we have the vertex as

$$(h,k)=(4,3)$$

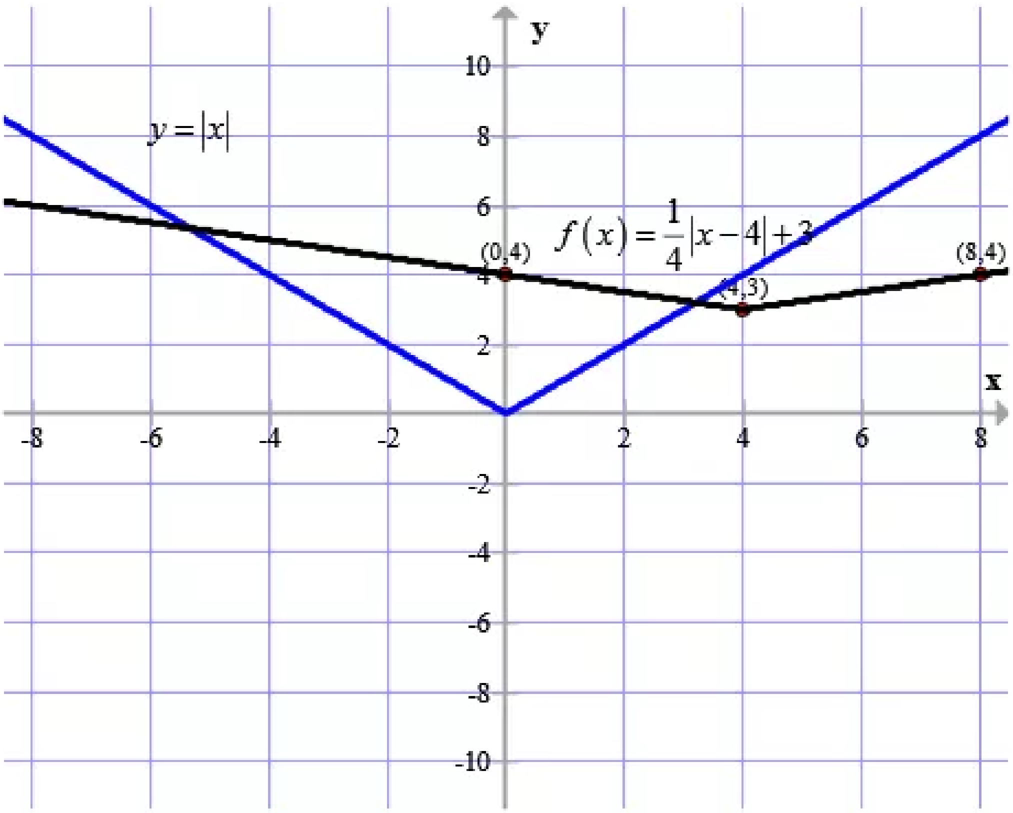
The graph of (1) is symmetric about $x=4$ and the graph is V-shaped.

By putting 0 for x in the equation (1), we have

$$f(x)=4$$

Now we plot the point $(0,4)$ on the graph and by using symmetry we plot another point as $(8,4)$. Then we connect the points with a V-shaped graph.

The graph is as follows:



Now we compare this graph with the graph of the equation $y=|x|$.

The graph of $f(x)=\frac{1}{4}|x-4|+3$ is the graph of $y=|x|$ vertically shrunk by a factor $\frac{1}{4}$ and translated right 4 units and up 3 units.

Answer 15e.

We know that the general form of an absolute value function is $y=a|x-h|+k$, where (h, k) is the vertex of the function's graph.

From the given graph, we note that the vertex is (0, 0). Thus, the value of h is 0 and that of k is 0.

Substitute 0 for h, and 0 for k in the general form.

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

$$y = a|x|$$

One of the coordinates $(1, -3)$ is given. Substitute 1 for x, and -3 for y in the equation.

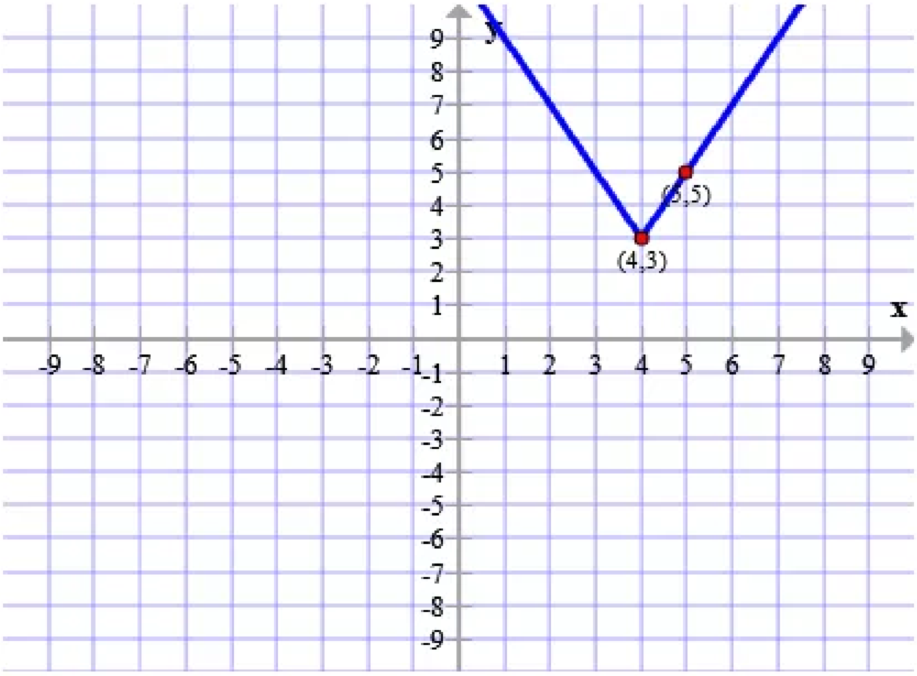
$$-3 = a|1|$$

$$-3 = a$$

Therefore, the required equation of the given graph is $y=-3|x|$.

Answer 16e.

We need to write the equation for the given graph.



The given graph is V-shaped. Therefore the standard equation is of the form,

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

From the graph, we have

The vertex of the equation is $(h,k)=(4,3)$ the graph passes through the point $(5,5)$.

The standard equation is of the form $y=a|x-h|+k$, where the vertex is (h,k).

So, the equation using the vertex $(4,3)$ is,

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

Now by substituting the co-ordinate of (x,y) as $(5,5)$ in the equation (1) to get the value of a.

$$y=a|x-4|+3$$
$$5=a|5-4|+3$$
$$a=2$$

By putting the value of a in the equation (1), we have

$$y=a|x-4|+3$$
$$y=2|x-4|+3$$

Therefore the final equation for the given graph is $\boxed{y=2|x-4|+3}$.

Answer 17e.

We know that the general form of an absolute value function is $y = a|x-h|+k$, where (h, k) is the vertex of the function's graph.

From the given graph, we note that the vertex is (0, 0). Thus, the value of h is 0 and that of k is 0.

Substitute 0 for h, and 0 for k in the general form.

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

One of the coordinates (–3, 1) is given. Substitute –3 for x, and 1 for y in the equation.

$$1 = a|-3|$$
$$1 = 3a$$

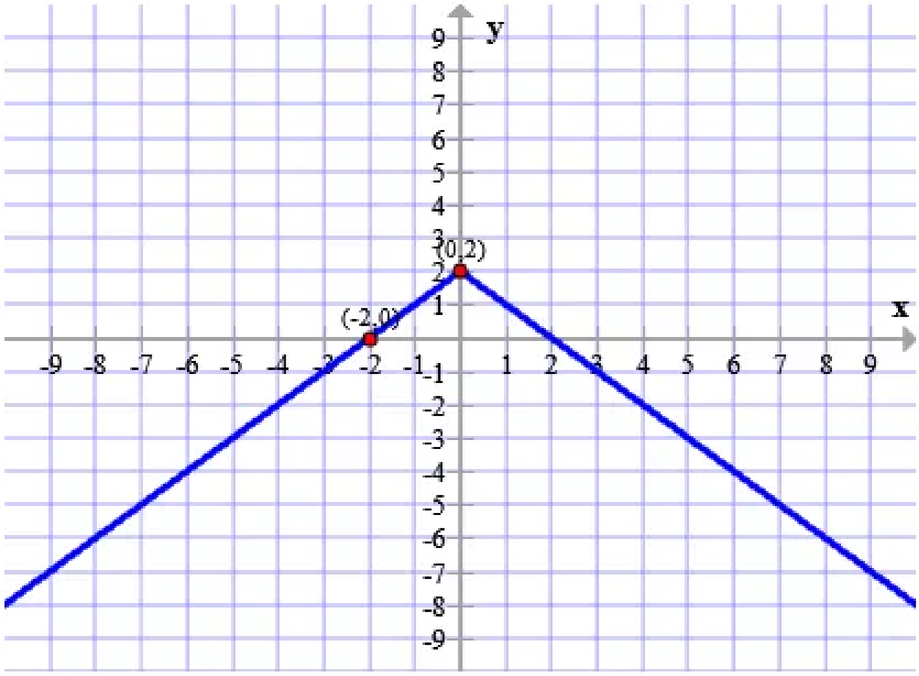
Divide both the sides by 3.

$$\frac{1}{3} = \frac{3a}{3}$$
$$\frac{1}{3} = a$$

Therefore, the required equation of the given graph is $y = \frac{1}{3}|x|$.

Answer 18e.

We need to write the equation for the given graph.



The given graph is V-shaped. Therefore the standard equation is of the form,

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

From the graph, we have

The vertex of the equation is $(h,k)=(0,2)$ and the graph passes through the point $(-2,0)$.

So, the equation using the vertex $(0,2)$ is,

$$y = a|x|+2 \quad \text{...... (1)}$$

Now by substituting the co-ordinate of (x,y) as $(-2,0)$ in the equation (1) to get the value of a.

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

$$0 = a|-2|+2$$

$$a = -1$$

Therefore the final equation for the given graph is $\boxed{y=-|x|+2}$.

Answer 19e.

We know that the general form of an absolute value function is $y = a|x - h| + k$, where (h, k) is the vertex of the function's graph.

From the given graph, we note that the vertex is $(-2, -1)$. Thus, the value of h is 2 and that of k is -1.

Substitute -2 for h, and -1 for k in the general form.

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

One of the coordinates $(0, 0)$ is given. Substitute 0 for x, and 0 for y in the equation.

$$0 = a|0 + 2| - 1$$
$$0 = 2a - 1$$

Add 1 to both the sides of the equation.

$$0 + 1 = 2a - 1 + 1$$
$$1 = 2a$$

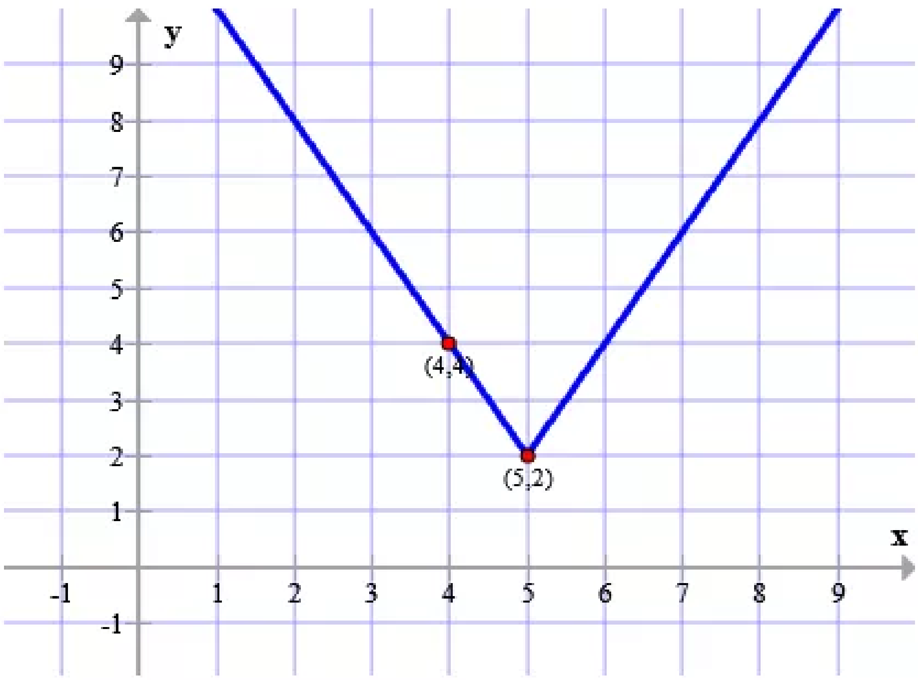
Divide both the sides by 2.

$$\frac{1}{2} = \frac{2a}{2}$$
$$\frac{1}{2} = a$$

Therefore, the given graph has the equation $y = \frac{1}{2}|x + 2| - 1$.

Answer 20e.

We need to write the equation for the given graph.



The given graph is V-shaped. Therefore the standard equation is of the form,

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

From the graph, we have

The vertex of the equation is $(h,k)=(5,2)$ and the graph passes through the point $(4,4)$.

So, the equation of the graph using the vertex $(5,2)$ is,

$$y = a|x-5|+2 \qquad \text{...... (1)}$$

Now by substituting the co-ordinate of (x,y) as $(4,4)$ in the equation (1) to get the value of a.

$$y = a|x-5|+2$$

$$4 = a|4-5|+2$$

$$a = 2$$

By putting the value of a in the equation (1), we have

$$y = a|x-5|+2$$

$$y = 2|x-5|+2$$

Therefore the final equation for the given graph is $\boxed{y = 2|x-5|+2}$.

Answer 21e.

The required graph of the function $y = f(x+2)-3$ is the graph of $y = f(x)$ translated left 2 units and down 3 units.

Graph $y = f(x+2)-3$. Find the coordinates of the required graph by subtracting 2 from each x-coordinate of $y = f(x)$, and then subtracting 3 from each y-coordinate.

The resulting coordinates of the graph of the function $y = f(x+2)-3$ are listed in a table.

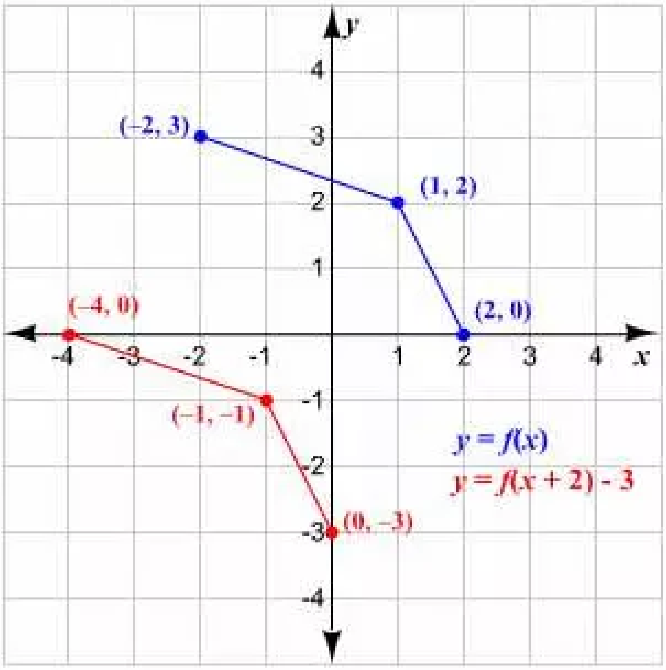
$y = f(x)$

x	y
−2	3
1	2
2	0

$y = f(x+2)-3$

x	y
−4	0
−1	−1
0	−3

Plot the points and connect them using straight line segments.

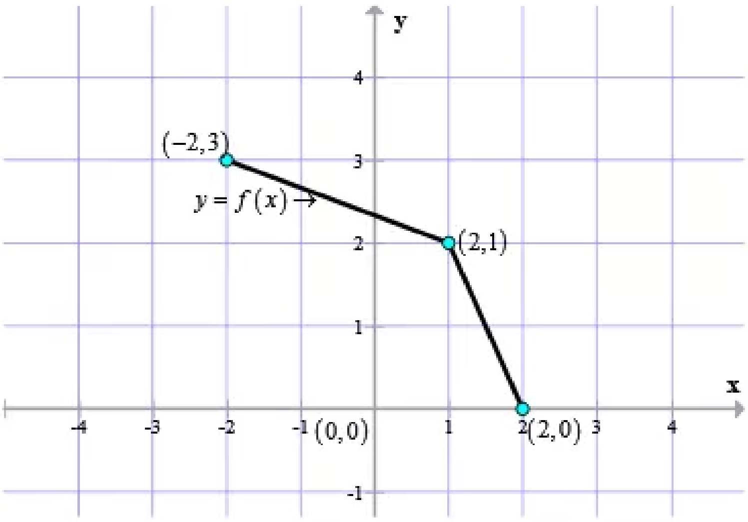


Answer 22e.

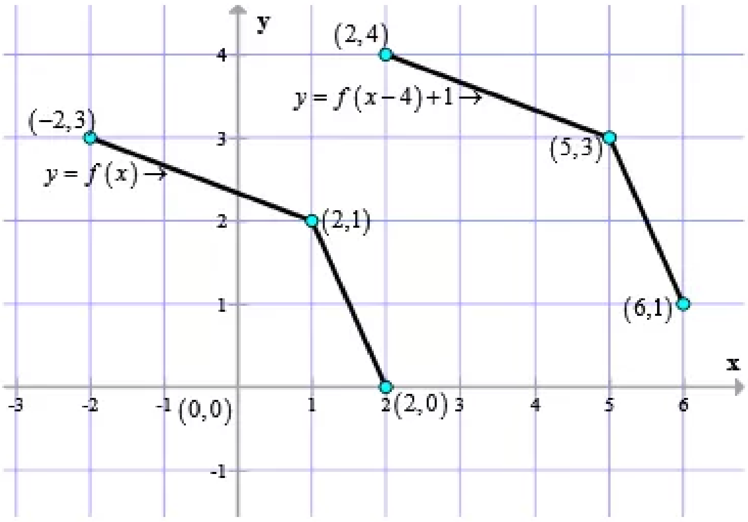
The given function is:

$$y=f(x-4)+1$$

Here at first we will draw the graph of $y=f(x)$.



Now we will shift the graph 4 unit right to obtain the graph of $y=f(x-4)$ and at last we will shift the graph 1 units upward to draw the graph of $y=f(x-4)+1$.



Answer 23e.

The required graph of the function $y = \frac{1}{2} \cdot f(x)$ is the graph of $y = f(x)$ shrunk vertically by a factor of $\frac{1}{2}$.

Graph $y = \frac{1}{2} \cdot f(x)$. Find the coordinates of the required graph by multiplying each y-coordinate by $\frac{1}{2}$.

The resulting coordinates of the graph of the function $y = \frac{1}{2} \cdot f(x)$ are noted in a table.

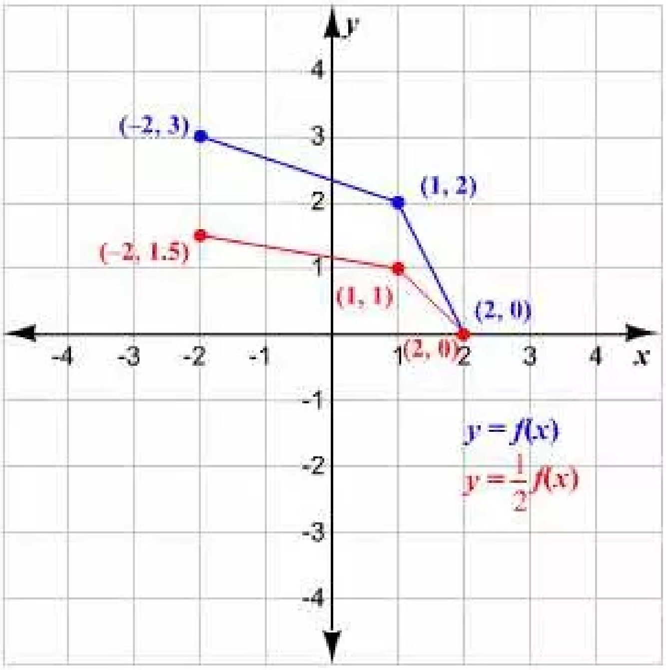
$y = f(x)$

x	y
−2	3
1	2
2	0

$y = \frac{1}{2} \cdot f(x)$

x	y
−2	1.5
1	1
2	0

Plot the points and connect them using straight line segments.



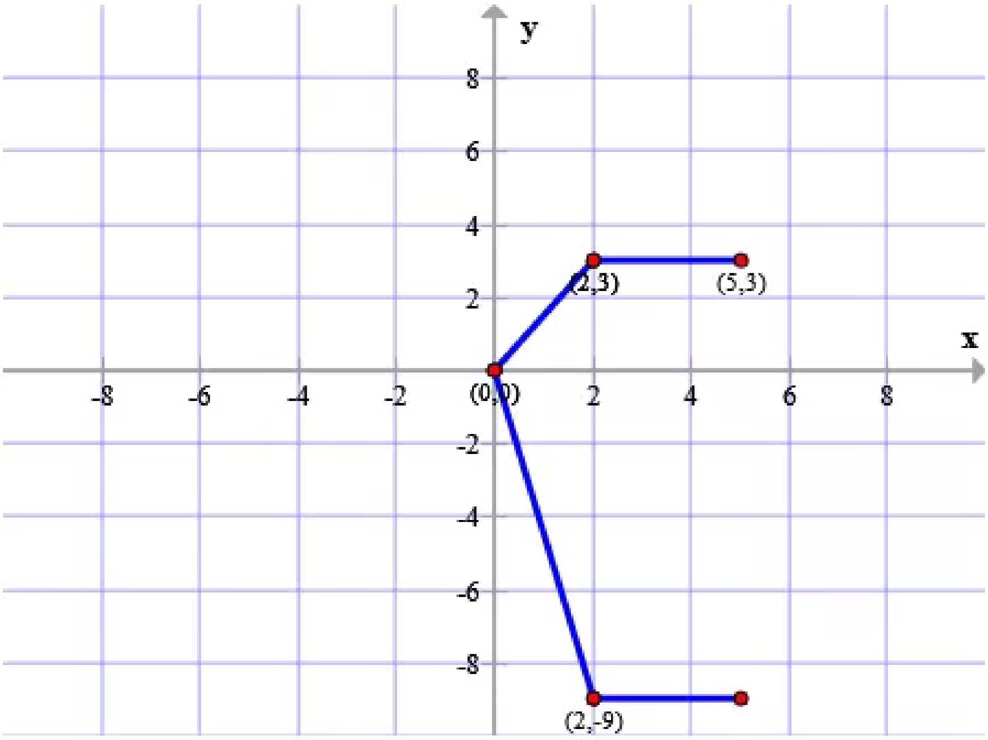
Answer 24e.

We need to draw the graph of the following function by using the graph of $y = f(x)$.

$$y = -3 \cdot f(x)$$

The graph of $y = -3 \cdot f(x)$ is the graph of $y = f(x)$ vertically stretched by a factor of 3 and reflected in the x axis. The graph has vertex $(0,0)$. To draw the graph, we multiply the y-coordinate of each labeled point on the graph of $y = f(x)$ by -3 and connect their images.

The graph of the given equation is as follows:



Answer 25e.

The required graph of the function $y = -f(x-1) + 4$ is the graph of $y = f(x)$ reflected in the x-axis, and then translated right 1 unit and up 4 units.

Graph $y = -f(x-1) + 4$. For this, first reflect the graph of $y = f(x)$ by reflecting its coordinates. The coordinates of the reflected image, $y = -f(x)$, are shown in table.

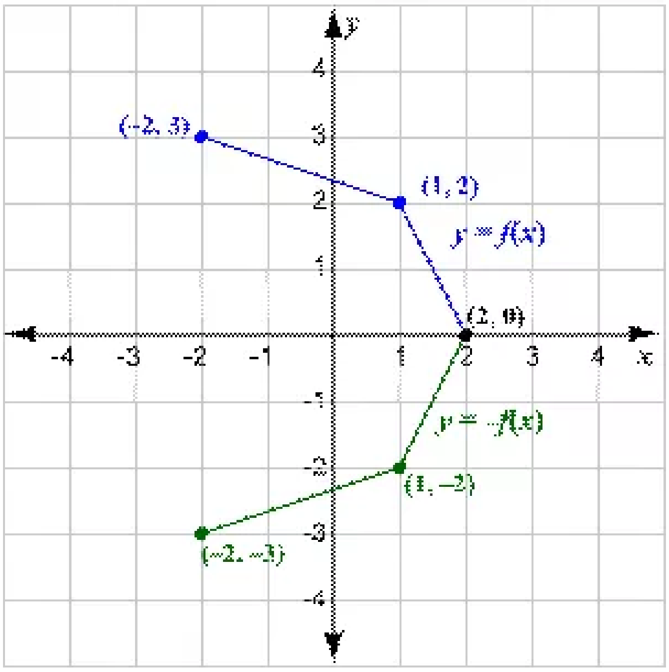
$y = f(x)$

x	y
-2	3
1	2
2	0

$y = -f(x)$

x	y
-2	-3
1	-2
2	0

Plot the points and connect them using straight dashed lines.



Next, we have to find the coordinates of the required graph by adding 1 to each x-coordinate of $y = -f(x)$ and then adding 4 to each y-coordinate.

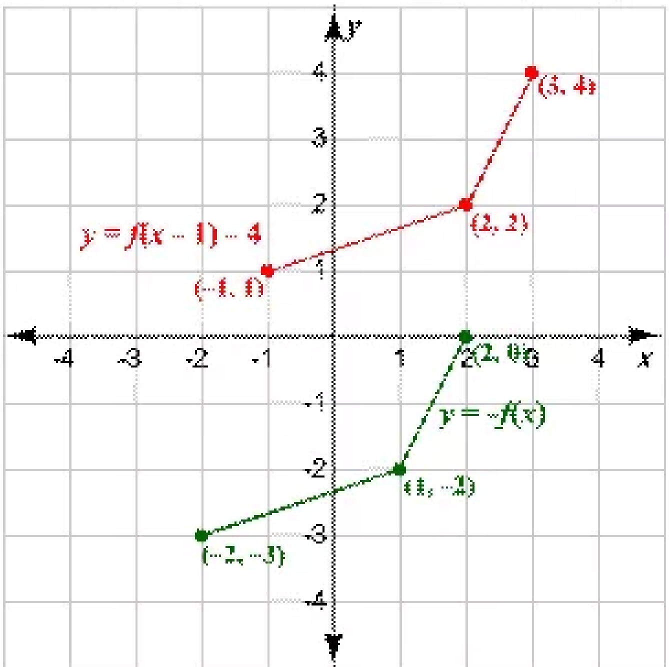
The resulting coordinates of the graph of the function $y = -f(x - 1) + 4$ are noted in a table.

$y = -f(x)$ $\qquad$ $y = f(x - 1) + 4$

x	y
-2	-3
1	-2
2	0

x	y
-1	1
2	2
3	4

Plot the points and connect them using straight line segments.

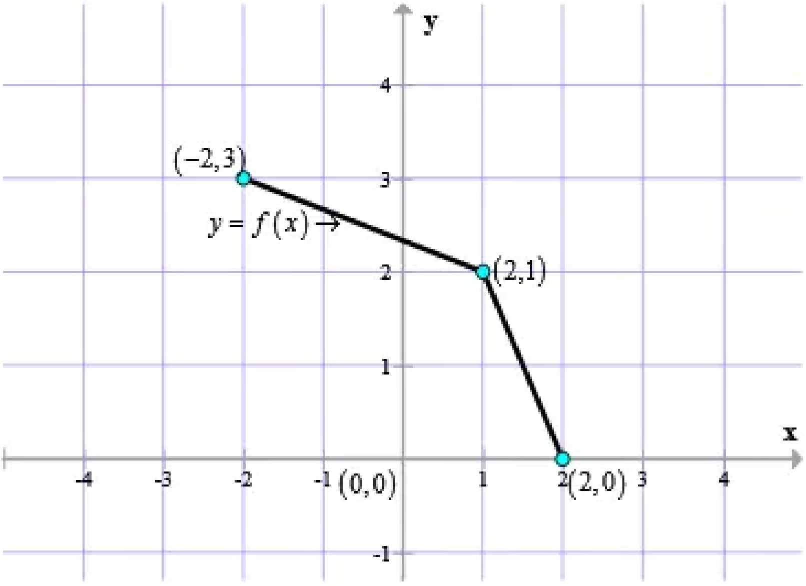


Answer 26e.

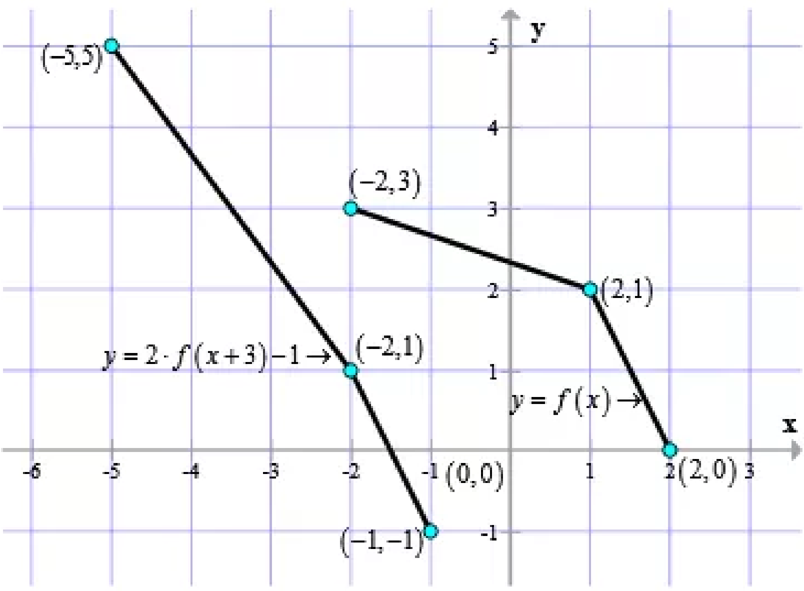
The given function is:

$$y = 2 \cdot f(x+3) - 1$$

Here at first we will draw the graph of $y = f(x)$.



Now we will shift the graph 3 unit left to obtain the graph of $y = f(x+3)$ and at last we will streched 2 times $y = f(x+3)$ and shift the graph 1 units downward to obtain the graph of $y = 2 \cdot f(x+3) - 1$.



Answer 27e.

Consider $f(x) = |x|$. Thus, the required function becomes $y = |x|$. Graph $y = |x|$.

Find some points to draw the graph. Substitute 1 for y in $y = |x|$ to find a point on the graph.

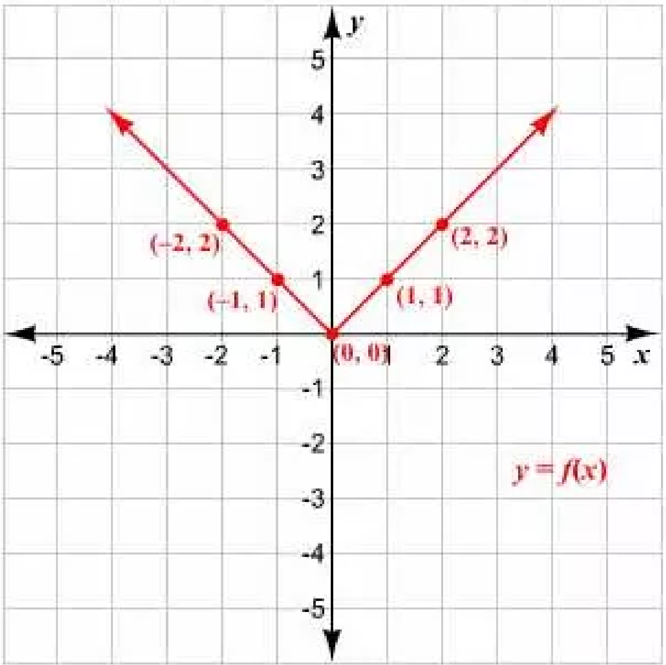
$1 = |x|$

Thus, we get two values for x: 1 and -1.

Similarly find some more points and list them in a table.

x	y
-2	2
-1	1
0	0
1	1
2	2

Plot the points and connect them using straight line segments.



a. The required graph of the function $y = f(x + 3) - 4$ is the graph of $y = f(x)$ translated left 3 units and down 4 units.

Find the coordinates of $y = f(x + 3) - 4$ by subtracting 3 from the x-coordinates of $y = f(x)$, and 4 from the y-coordinates.

The resulting coordinates of the graph of the function $y = f(x + 3) - 4$ are listed in a table.

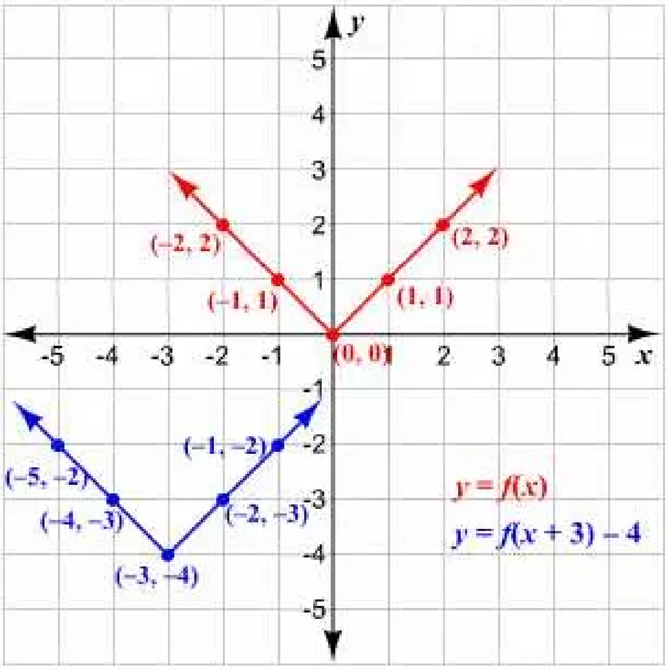
$y = f(x)$

x	y
−2	2
−1	1
0	0
1	1
2	2

$y = f(x + 3) - 4$

x	y
−5	−2
−4	−3
−3	−4
−2	−3
−1	−2

Plot the points and connect them using straight line segments.



b. The required graph of the function $y = 2 \cdot f(x)$ is the graph of $y = f(x)$ stretched vertically by a factor of 2.

Graph $y = 2 \cdot f(x)$. Find the coordinates of the required graph by multiplying the y-coordinates of $y = f(x)$ by 2.

The resulting coordinates of the graph of the function $y = 2 \cdot f(x)$ are listed in a table.

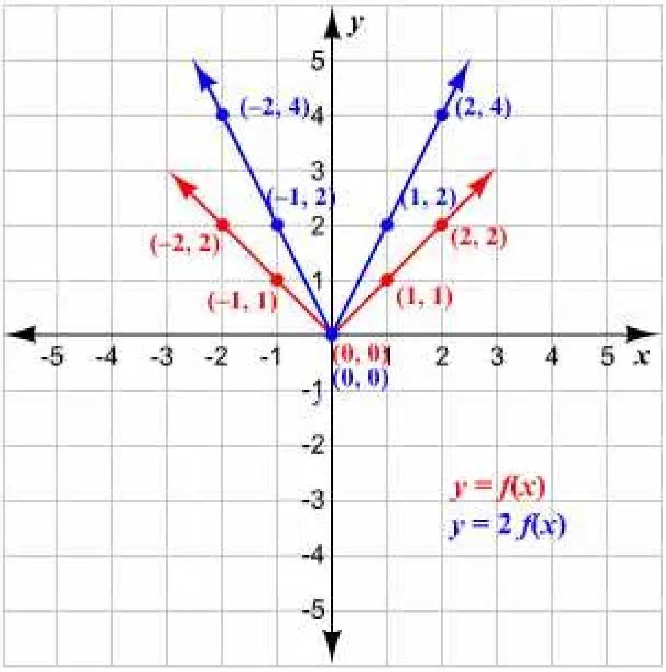
$y = f(x)$

x	y
−2	2
−1	1
0	0
1	1
2	2

$y = 2 \cdot f(x)$

x	y
−2	4
−1	2
0	0
1	2
2	4

Plot the points and connect them using straight line segments.



c. The required graph of the function $y = -f(x)$ is the graph of $y = f(x)$ reflected in the x-axis.

Find the coordinates of $y = -f(x)$ by multiplying the y-coordinates of $y = f(x)$ by -1. The coordinates of the reflected image, $y = -f(x)$, are shown in a table.

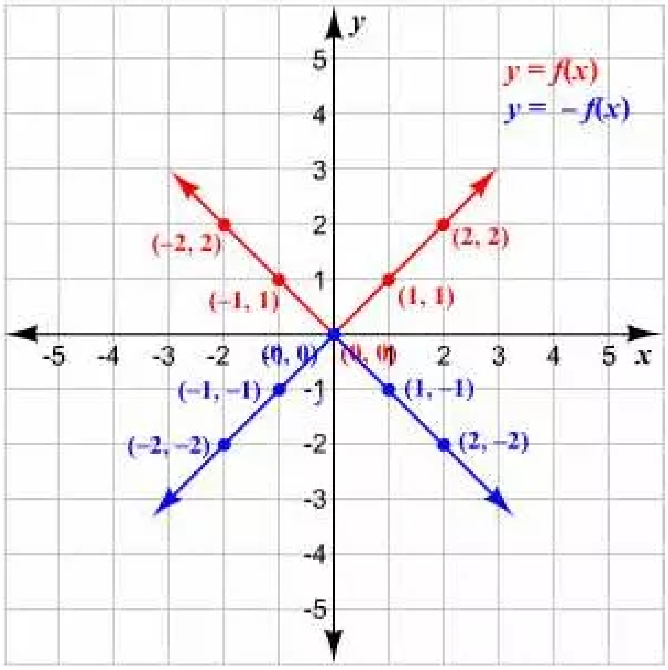
$y = f(x)$

x	y
-2	2
-1	1
0	0
1	1
2	2

$y = -f(x)$

x	y
-2	-2
-1	-1
0	0
1	-1
2	-2

Plot the points and connect them using straight line segments.



Answer 28e.

It is give that the highest point on the graph of $y = f(x)$ is $(-1,6)$. We have to find out the highest point on the graph $y = 4 \cdot f(x-3)+5$.

Now to find out the x coordinate of the highest point on the graph $y = 4 \cdot f(x-3)+5$ we have to add 3 unit to the x coordinate of the highest point of the graph $y = f(x)$. Therefore the x coordinate of the point is:

$$-1+3=2$$

Again $f(x)$ is stretched 4 times and shifted 5 unit upward, therefore the y coordinate of the point is:

$$4\times 6+5=29$$

Therefore the highest point on the graph $y = 4 \cdot f(x-3)+5$ is:

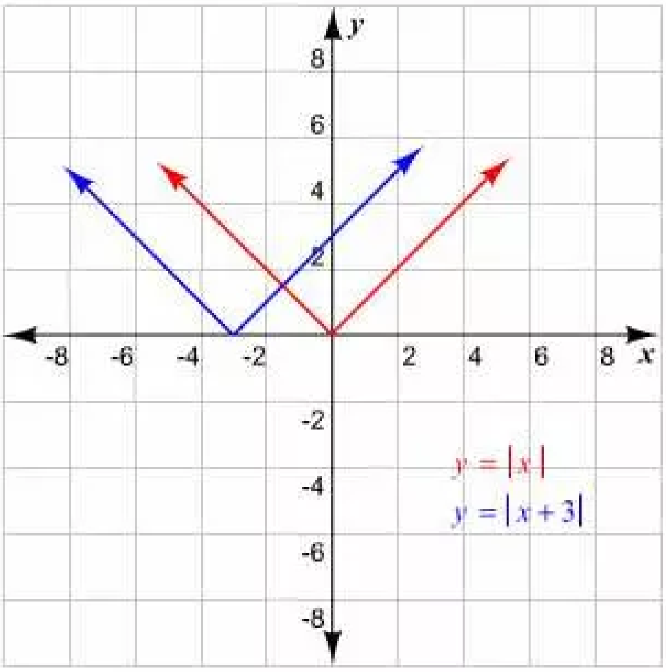
(D). $(2,29)$

Answer 29e.

We know that the graph of $y = |x+3|$ is the graph of $y = |x|$ translated 3 units left.

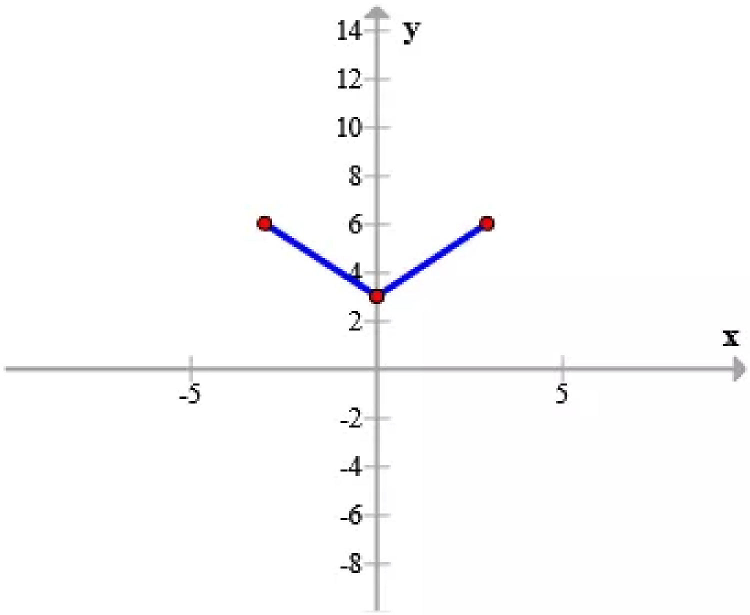
From the given graph, we note that the graph of $y = |x|$ is translated 3 units right. However, the graph of $y = |x+3|$ must be the graph of $y = |x|$ translated 3 units to the left.

Thus, correcting the graph we get the graph of $y = |x+3|$ as shown in the figure.



Answer 30e.

The given graph for the equation $y = |x+3|$ is,



We need to describe and correct the graph.

The given graph is V-shaped. Therefore the standard equation is of the form,

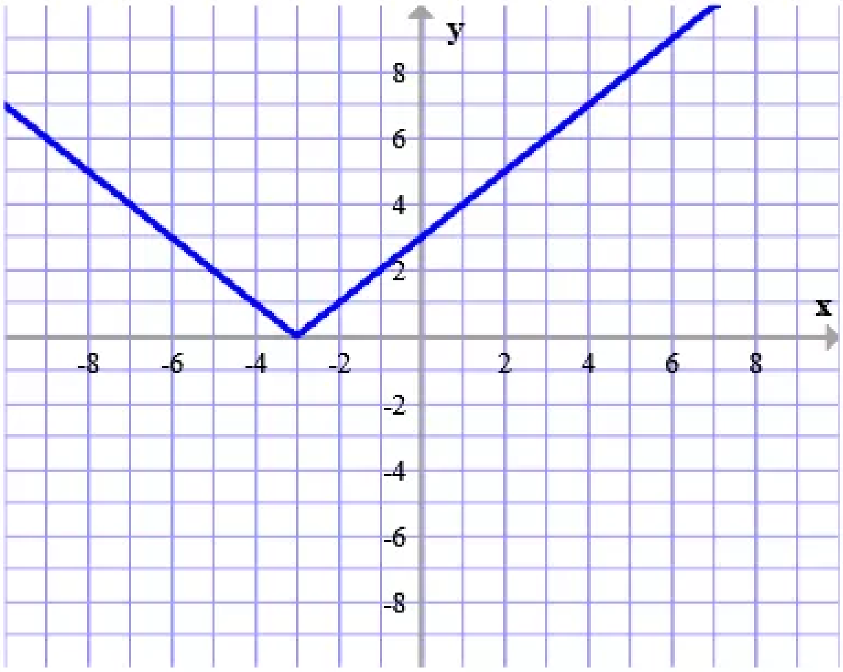
$y = a|x-h|+k$, where the vertex is (h,k).

By comparing the standard equation with the given equation, we have the vertex as:

$(h,k)=(-3,0)$

But in the given graph, the co-ordinate of the vertex is $(0,3)$.

The corrected graph of the given equation is,



Answer 31e.

We know that the general form of the function is $y = a|x-h|+k$, where (h, k) is the vertex of the function.

From the given graph, we note that the vertex is (0, 0). Thus, the value of h is 0 and of k is 0.

Substitute 0 for h and k in the general form.

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

$y = a|x|$

One of the coordinates is $(2, -3)$. Substitute 2 for x, and -3 for y in the equation.

$$-3 = a|2|$$
$$-3 = 2a$$

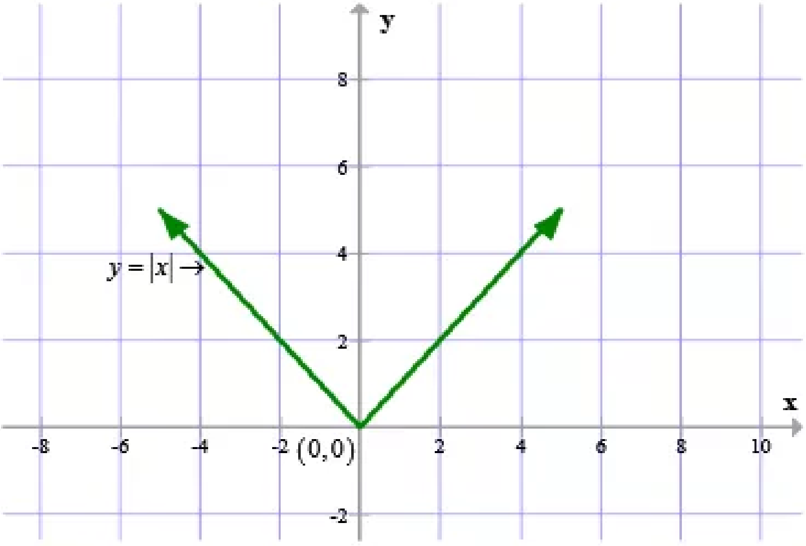
Divide both the sides by 2.

$$\frac{-3}{2} = \frac{2a}{2}$$
$$-\frac{3}{2} = a$$

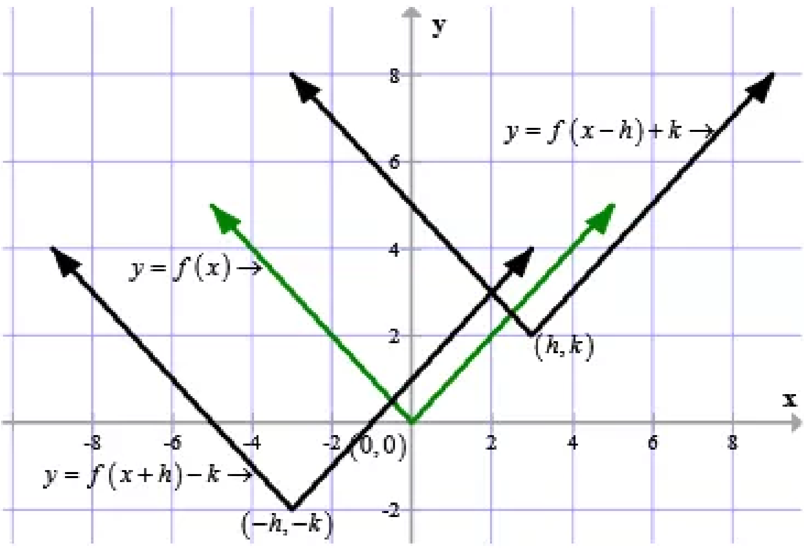
Therefore, the required equation of the given graph is $y = -\frac{3}{2}|x|$. This matches with the equation in **choice D**.

Answer 32e.

Consider the graph of $y = f(x) = |x|$ as shown below.



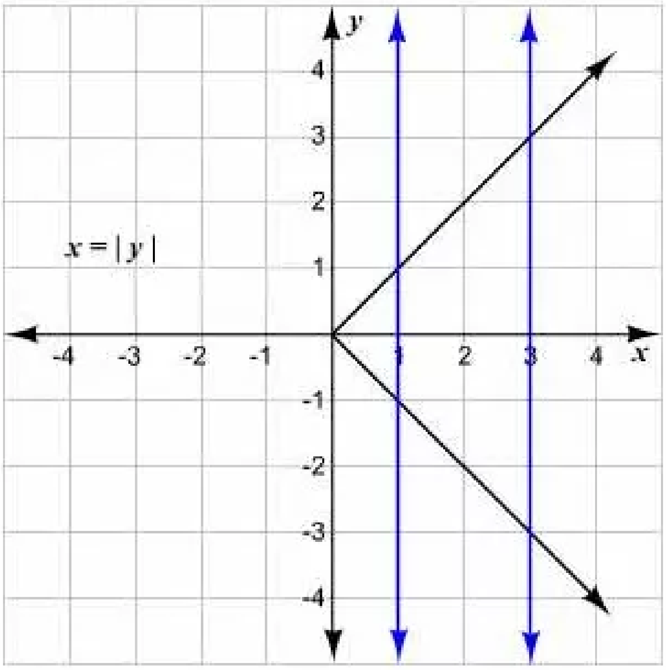
Now we will draw the graph of $y = f(x-h)+k$ and $y = f(x+h)-k$. This indicates that in $y = f(x-h)+k$ the x coordinate is shifted to the right side by h unit and y coordinate is shifted vertically upward by k unit; in $y = f(x+h)-k$ the x coordinate is shifted to the left side by h unit and y coordinate is shifted vertically downward by k unit as shown in the graph.



Answer 33e.

According to the vertical line test, a relation is not a function if any vertical line drawn through the graph of the relation intersects the graph at more than one point.

Draw two verticals line in the given graph and check whether any of these lines intersect the graph at more than one point.



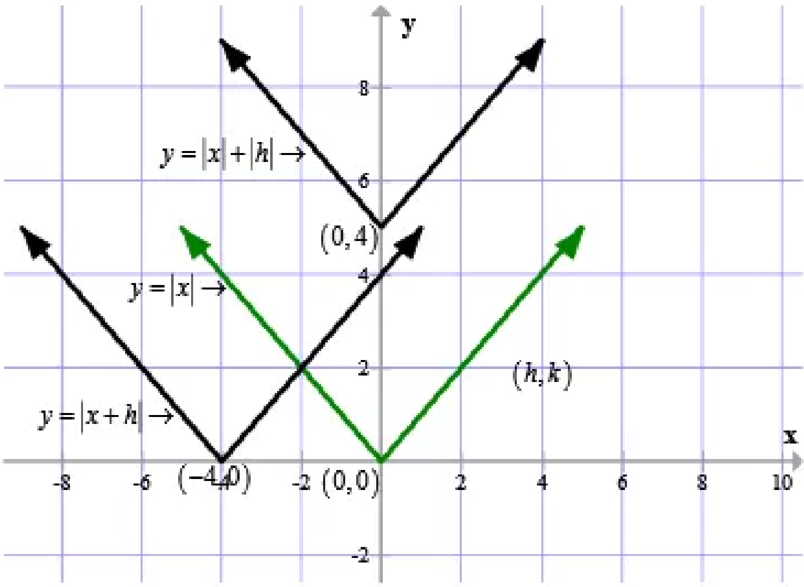
We note that the vertical lines intersect the graph of the relation at more than one point.

Therefore, the given relation is not a function.

Answer 34e.

In general $|x+h| = |x| + |h|$ is not true.

The graph of $y = |x|$, $y = |x| + |h|$ and $y = |x+h|$ are shown below.



Now from the graph we can easily verify that $y = |x+h|$ shifted the graph $y = |x|$ horizontally left by h unit and the graph $y = |x| + |h|$ shifted the graph $y = |x|$ vertically upward by h unit. Therefore $|x+h| = |x| + |h|$ is not always true.

Answer 35e.

The graph of $y=a|x-h|+k$ passes through the points $(-2,4)$ and $(4,4)$.
To find the possible value of h and k, which is the vertex of the line.
The vertex is the highest or lowest value of a line reflected.
$y=a|x-h|+k$ is passing through $(-2,4)$, therefore

$4=a|-2-h|+k$ Substituting $(x,y)=(-2,4)$

Substituting the value $(x,y)=(4,4)$ in the equation $y=a|x-h|+k$, we get

$4=a|4-h|+k$

Solving the following equation we get,

$4=a|-2-h|+k$ ...... (1)

$4=a|4-h|+k$ ...... (2)

Subtracting (1) from (2) we get,

$a|4-h|-a|-2-h|=0$

$a(|4-h|-|-2-h|)=0$

$a=0$ or $|4-h|-|-2-h|=0$

Then,

$4-h=\pm(-2-h)$

$4-h=(-2-h)$ Considering + sign

$4-h=-2-h$

$4=-2$ false

Again,

$4-h=\pm(-2-h)$

$4-h=-(-2-h)$ Considering − sign

$4-h=2+h$

$2=2h$

$h=1$

Putting $h=1$ in the equation $4=a|4-h|+k$, we get

$4=a|4-1|+k$ Since $h=1$

$4=3a+k$

$k=4-3a$

Therefore, for the arbitrary value of a, suppose $a=1,2,3...$, we get

$k=4-3\times1$ Suppose $a=1$

$=1$

$k=4-3\times2$ Suppose $a=2$

$=4-6$

$=-2$

Hence, when $a=1,2,3...$ the possible values are $\boxed{h=1 \text{ and } k=4-3a}$

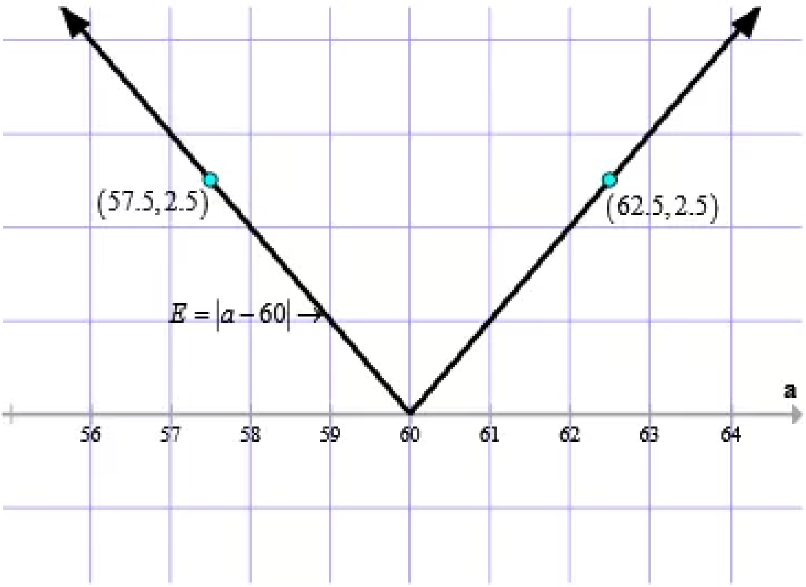
And when $a=0$, $\boxed{h \text{ may be any arbitrary value and } k=4}$.

Answer 36e.

It is given that the speedometer reads the car speed as 60 miles per hour.
The error of the speedometer determined as:

$E = |a - 60|$ where a is the actual speed of the car.

The graph of $E = |a - 60|$ is shown below.



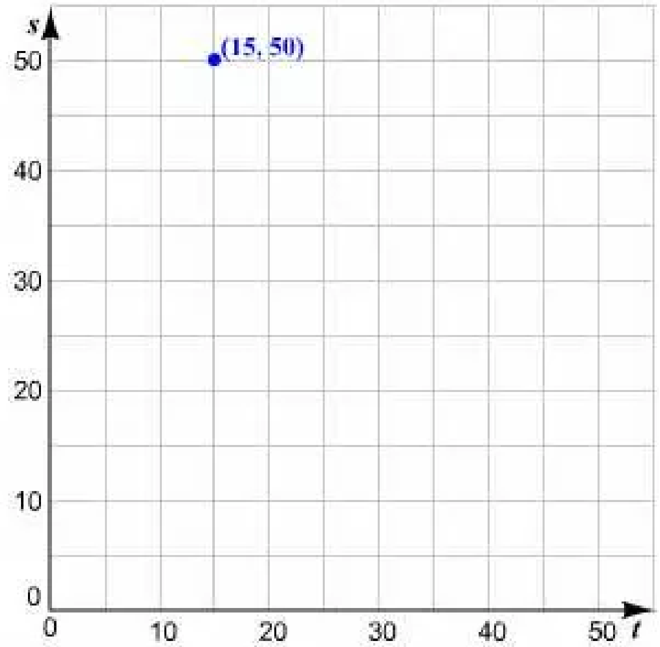
Now from the graph we can easily verify that at $a = 62.5$ and 57.5, the E value is 2.5.
Therefore the a value is $\boxed{57.5}$ or $\boxed{62.5}$

Answer 37e.

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 15 and of k as 50. Thus, the vertex of the given function is (15, 50).

Plot the vertex.



Step 2 Use symmetry to find two more points.

Substitute any value, say, 20 for s in the given function.

$20 = -2|t - 15| + 50$

Subtract 50 from both the sides of the equation.

$$20 - 50 = -2|t - 15| + 50 - 50$$
$$-30 = -2|t - 15|$$

Divide both the sides by -2.

$$\frac{-30}{-2} = \frac{-2|t - 15|}{-2}$$
$$15 = |t - 15|$$

We get $t - 15 = 15$ and $t - 15 = -15$.

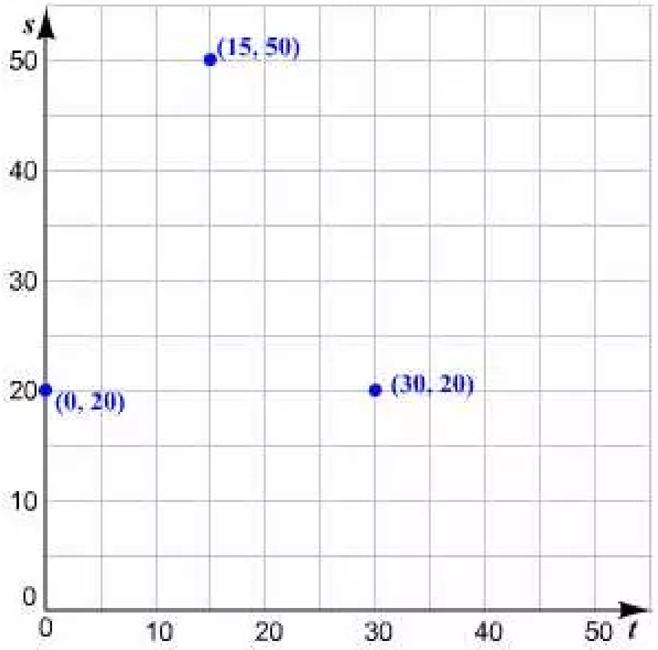
Add 15 to both the sides of the two equations.

$t - 15 + 15 = 15 + 15$ and $t - 15 + 15 = -15 + 15$

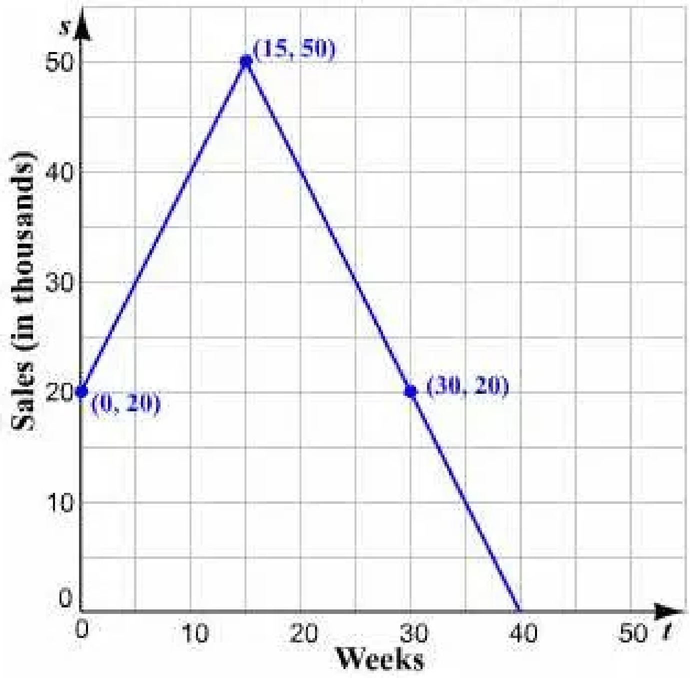
$t = 30$ and $t = 0$

The two points are (30, 20) and (0, 20).

Plot these points on the graph.



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

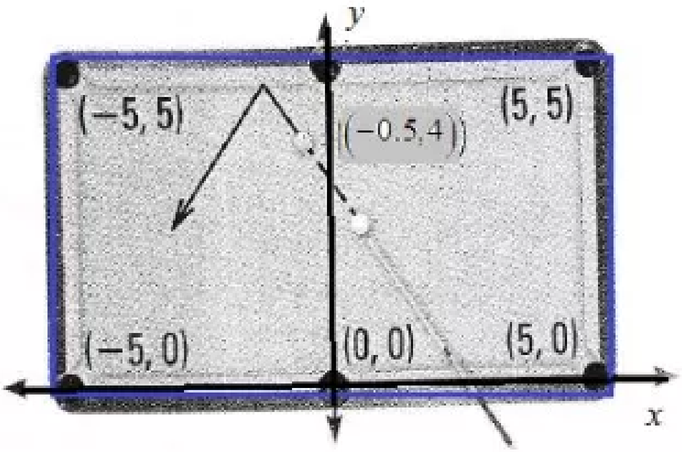


From the graph, we note that the highest value for s, which is the weekly sales of the shoes, is 50,000. Therefore, the greatest number of pairs of shoes sold in one week is 50.000.

Answer 38e.

(a)

Considering the figure:



The vertex of the path is $(-1.25, 5)$, the ball passing through the point $(-0.5, 4)$ of the path.

The equation of line of the vertex (h, k) is $y = a|x - h| + k$.

We need to find the equation of the path of the ball.

The equation, $y = a|x - h| + k$ is passing through $(-0.5, 4)$, therefore

$4 = a|-0.5 - h| + k$ Substituting $(x, y) = (-0.5, 4)$

Substituting the value $(h,k)=(-1.25,5)$ in the equation $y=a|x-h|+k$, we get

$$4=a|-0.5-(-1.25)|+5$$
$$4-5=a|-0.5+1.25|$$
$$-1=a|0.75|$$
$$a=\frac{1}{\pm 0.75}$$
$$=\pm\frac{100}{75}$$ 100 is multiplied in numerator and denominator
$$=\pm\frac{4}{3}$$

Substituting $a=\pm\frac{4}{3}$ we get the equation as,

$$\boxed{y=\pm\frac{4}{3}|x+1.25|+5}$$

(b)

The point $(-5,0)$ is the pocket of the pool table. We will make the shot if $(-5,0)$ satisfies the equation of the path

$$y=\pm\frac{4}{3}|x+1.25|+5$$

Now substituting $(-5,0)$ we get,

$$0=\pm\frac{4}{3}|5+1.25|+5$$
$$0=\pm\frac{4}{3}(6.25)+5$$ False

Since $(-5,0)$ does not satisfy the equation therefore we $\boxed{\text{do not}}$ make the shot.

Answer 39e.

We know that the general form of an absolute value function is $y=a|x-h|+k$, where (h, k) is the vertex of the function.

From the figure, we note that the vertex is (69, 140). Thus, the value of h is 69 and of k is 140.

Substitute 69 for h, and 140 for k in the general form.
$y=a|x-69|+140$

The coordinates (0, 0) and (138, 0) are given. Substitute one of the coordinates in the equation.

Let us substitute 0 for x, and 0 for y in the equation.

$$0 = a|0 - 69| + 140$$

$$0 = 69a + 140$$

Subtract 140 from both the sides.

$$0 - 140 = 69a + 140 - 140$$

$$-140 = 69a$$

Divide both the sides by 69.

$$\frac{-140}{69} = \frac{69a}{69}$$

$$-\frac{140}{69} = a$$

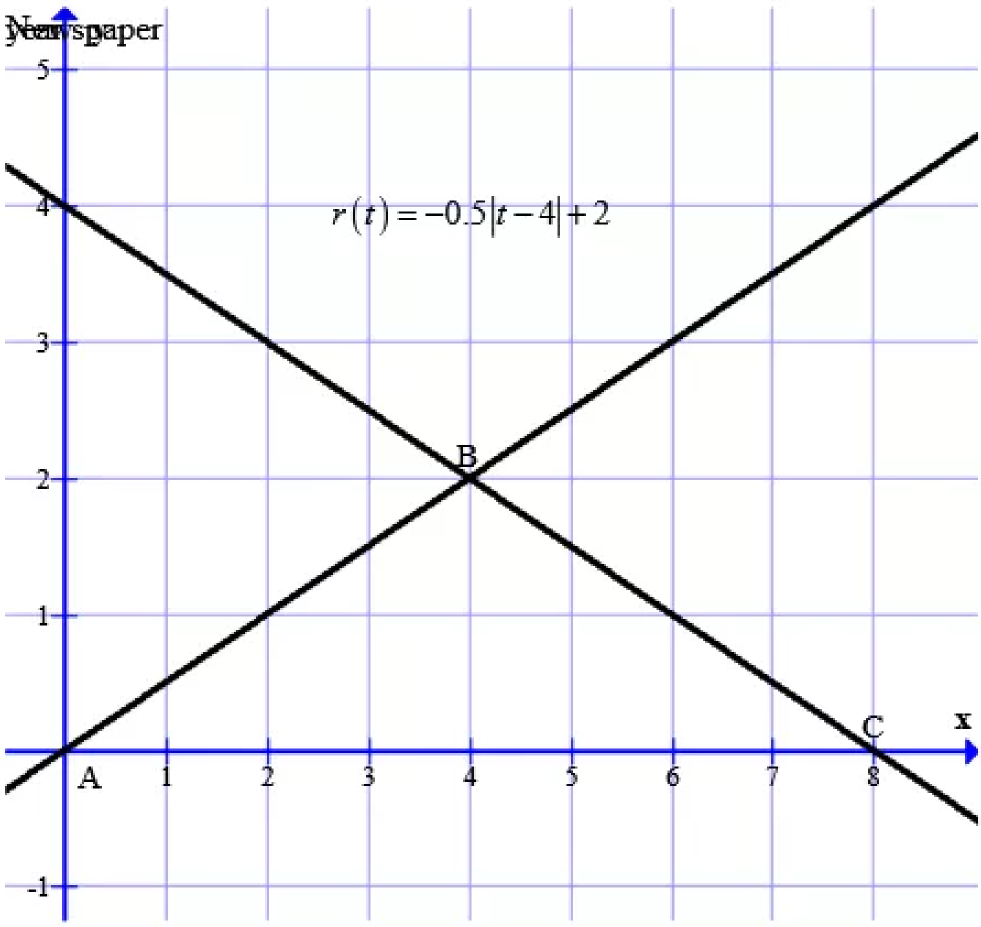
Therefore, the required absolute value function of the inverted V-portion of the tower is $y = -\frac{140}{69}|x - 69| + 140$.

Answer 40e.

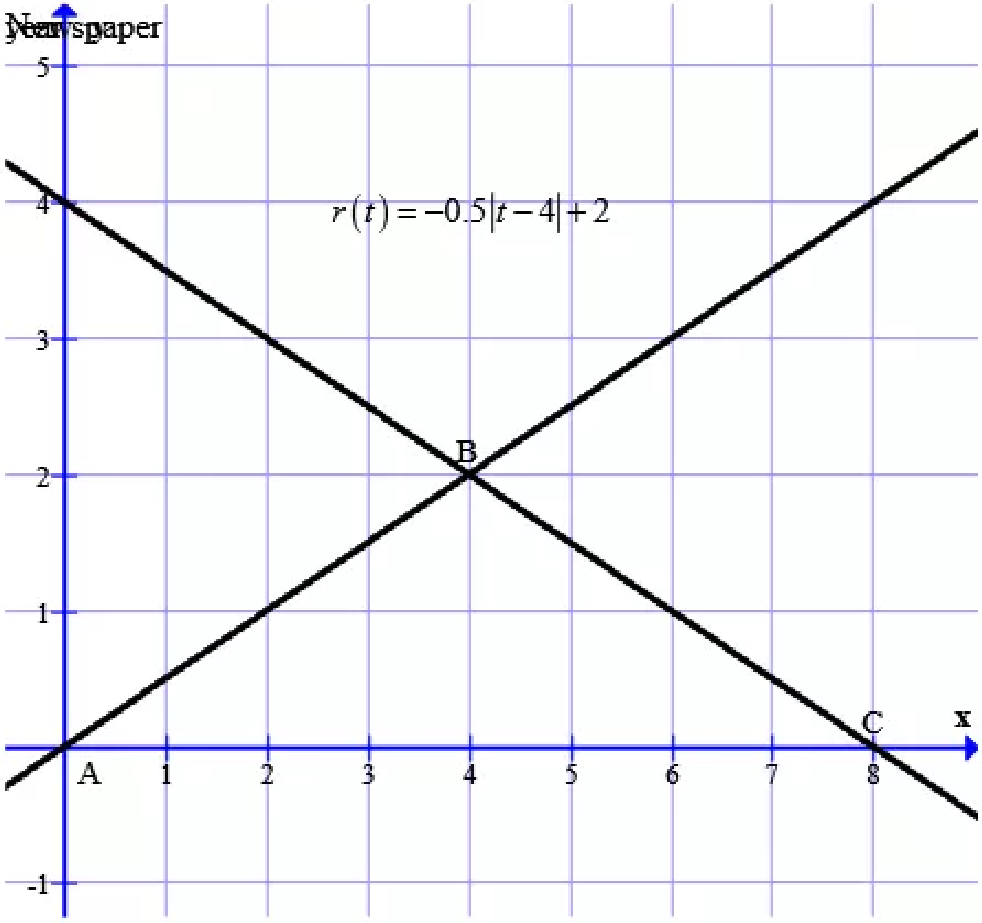
Given that a snowstorm begins with light snow that increases to very heavy snow before decreasing again. The snowfall rate r, inches per hour is given by $r(t) = -0.5|t-4|+2$ where t is the time in hours.

(a)

The graph of the given equation has been drawn below:



(b)
Considering the graph below:



The snowfall is heaviest at $t = \boxed{4\text{hours}}$ and the maximum snowfall rate is $r(t) = \boxed{2\text{inches}}$.

(c)
The total snowfall is given by the area of the triangle ABC formed by the graph of $r(t)$ and the $t-$axis.

Therefore, the total snowfall is $\frac{1}{2}\times 8\times 2 \quad \left[\frac{1}{2}\times\text{base}\times\text{altitude}\right] = \boxed{8\,\text{square inches}}$.

Answer 41e.

a. The distance of the truck from the transmitter at time $t = 0$ is 90 miles. We know that the distance traveled by the truck is $60t$, where 60 miles per hour is the speed of the truck and t is the time traveled. Thus, the distance $d(t)$ of the truck from the transmitter as it travels is $90 - 60t$.

Substitute 3 for t in $d(t) = 90 - 60t$.

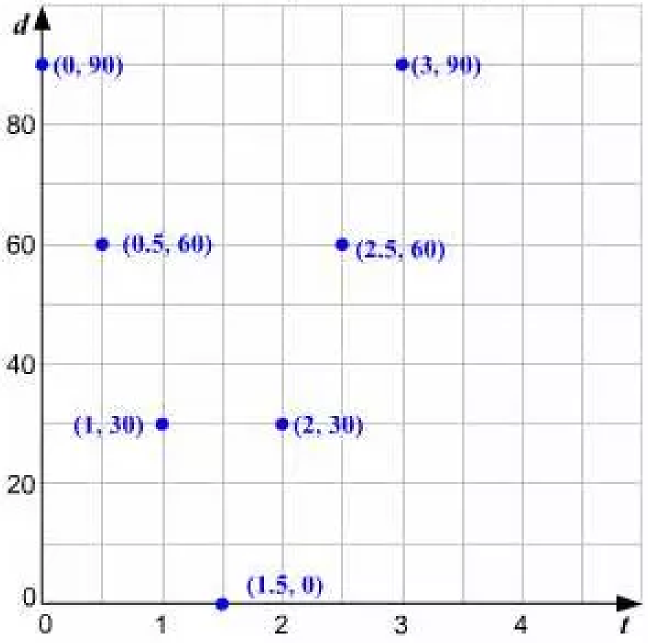
$$d(3) = 90 - 60(3)$$
$$= -90$$

Since distance cannot be negative, we take this value as 90. This is because the truck is now traveling away from the transmitter. Thus, the distance $d(t)$ of the truck from the transmitter after 3 h is 90 miles.

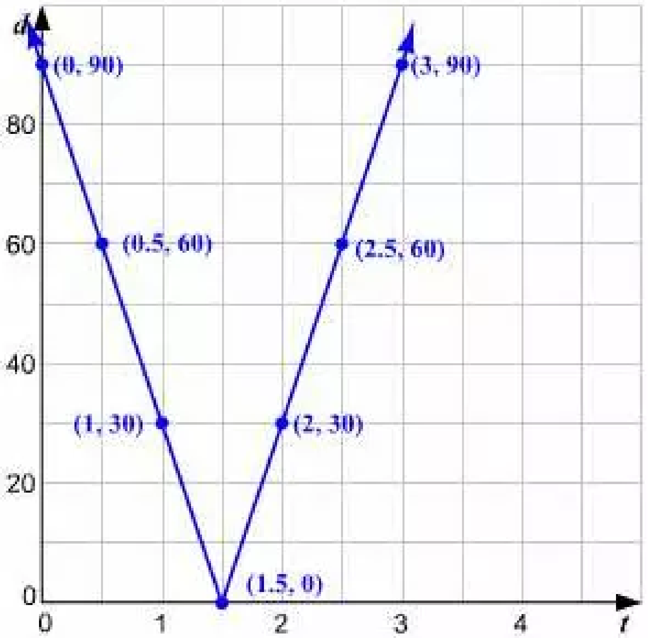
Similarly, substitute the remaining values of t to find the distance $d(t)$ of the truck from the transmitter at these times. The values are listed in a table.

t	0	0.5	1	1.5	2	2.5	3
d	90	60	30	0	30	60	90

b. Plot the points from part **a** on the graph.



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



c. We know that the general form of an absolute value function is $y = a|x - h| + k$, where (h, k) is the vertex of the function.

From the graph, we note that the vertex is (1.5, 0). Thus, the value of h is 1.5 and of k is 0.

Substitute 1.5 for h, and 0 for k in the general form.

$$d = a|t - 1.5| + 0$$

$$d = a|t - 1.5|$$

Take one of the coordinates (0, 90). Substitute 90 for d, and 0 for t in the equation.

$$90 = a|0 - 1.5|$$

$$90 = 1.5a$$

Divide both the sides by 1.5.

$$\frac{90}{1.5} = \frac{90a}{1.5}$$

$$60 = a$$

Thus, the required equation is $d = 60|t - 1.5|$.

From the given figure we note that the range of the transmitter is 50 miles. For the truck to be within the range of the transmitter, d must be less than or equal to 50.

Replace d with $60|t - 1.5|$ in $d \leq 50$.

$$60|t - 1.5| \leq 50$$

Divide both sides by 60.

$$\frac{60|t - 1.5|}{60} \leq \frac{50}{60}$$

$$|t - 1.5| \leq \frac{5}{6}$$

We get $t - 1.5 \leq -\frac{5}{6}$ and $t - 1.5 \leq \frac{5}{6}$.

Consider the first in equality. Add 1.5 to both the sides.

$$t - 1.5 + 1.5 \geq -\frac{5}{6} + 1.5$$

$$t \geq \frac{2}{3}$$

Now, consider the second inequality. Add 1.5 to both the sides.

$$t - 1.5 + 1.5 \le \frac{5}{6} + 1.5$$

$$t \le \frac{7}{3}$$

Thus, we get $\frac{2}{3} \le t \le \frac{7}{3}$ as the driving times for which the truck is within the range of the transmitter.

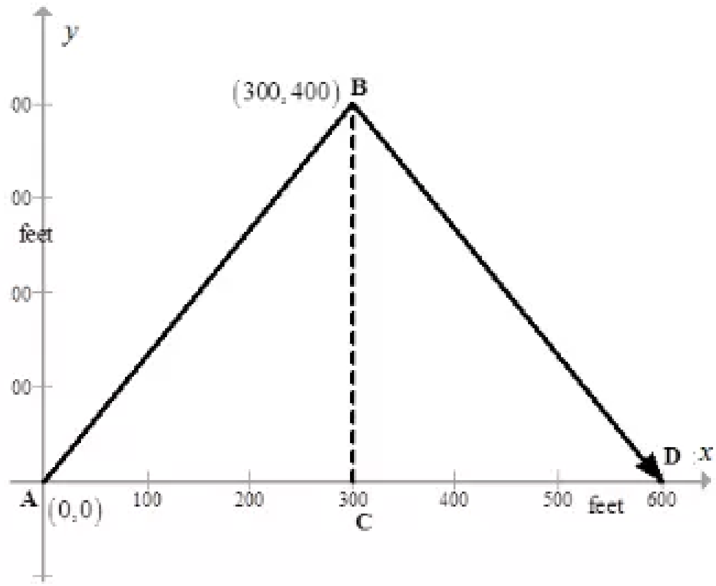
Answer 42e.

Consider the equation of the hiker that walks up and down a hill in a cross section is modeled as

$$y = -\frac{4}{3}|x - 300| + 400.$$

From the equation the vertex is $(300, 400)$.

The graph is shown below:



The hiker moved in between the interval $0 \le x \le 600$.

As shown in figure the hiker walks up from $(0,0)$ to $(300, 400)$.

And down a hill from $(300, 400)$ to $(600, 0)$.

As shown in figure, ΔABC and ΔBCD are two right angle triangle.

Therefore we can apply Pythagoras theorem to find the distance AB and BD.

Then, considering ΔABC we have,

$$AB^2 = AC^2 + CB^2$$

$$AB = \sqrt{AC^2 + CB^2}$$

$$= \sqrt{(300)^2 + (400)^2}$$

$$= \sqrt{90000 + 160000}$$

$$= \sqrt{250000}$$

$$= 500$$

Therefore $AB = 500$ feet

Similarly $BD = 500$ feet

Therefore, the hiker walks total distance of $AB + BD = (500 + 500)$ feet

$$= \boxed{1000 \text{ feet}}$$

In the interval $0 \le x \le 600$.

Answer 43e.

Add 17 to each side of the inequality.

$$5x - 17 + 17 \ge 13 + 17$$

$$5x \ge 30$$

Divide each side by 5.

$$\frac{5x}{5} \ge \frac{30}{5}$$

$$x \ge 6$$

Thus, the solutions are all real numbers greater than or equal to 6.

Graph $x \ge 6$. A solid dot is used at 6 to indicate that 6 is also a solution.

Answer 44e.

The given equation is,

$$8 - 3x > -13$$

We need to solve the inequality and graph the solution.

To isolate the variable x, we add -8 in both sides of the inequality $8 - 3x > -13$, we have

$$8 - 3x > -13$$

$$8 - 3x + (-8) > -13 + (-8)$$

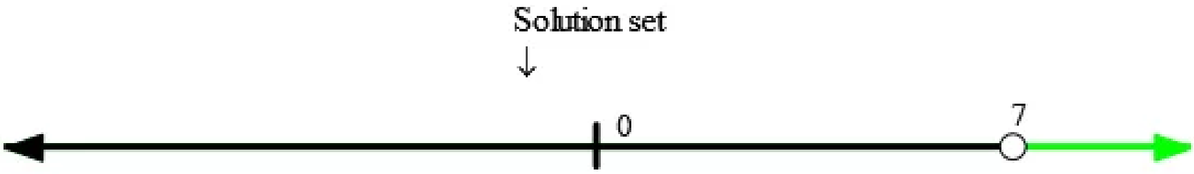
$$-3x > -21$$

$$-x > -7 \qquad [\text{Dividing by 3 in both sides}]$$

$$x < 7$$

Therefore, the solution set is $(-\infty, 7)$

The graph of the given inequality is as follows:



Answer 45e.

Subtract $2x$ from each side of the inequality.

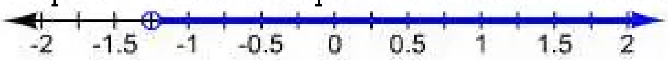
$$2x - 5 - 2x < 6x + 9 - 2x$$
$$-5 < 4x$$

Divide each side by 4.

$$\frac{-5}{4} < \frac{4x}{4}$$
$$-1.25 < x$$

Thus, the solutions are all real numbers greater than -1.25.

Graph $x > -1.25$. An open dot is used at -1.25 to indicate that -1.25 is not a solution.



Answer 46e.

The given equation is,

$$4x + 6 \le x - 18$$

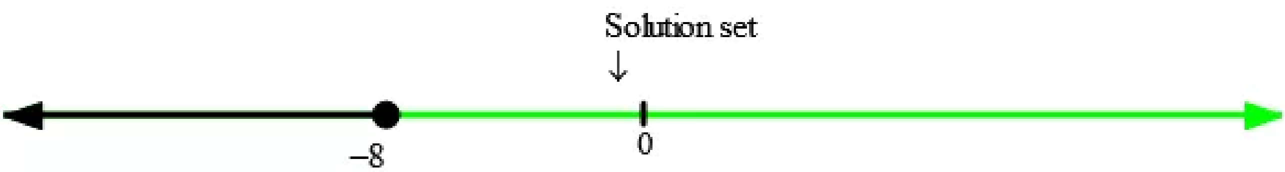
We need to solve the inequality and graph the solution.

Now we will isolate the variable x. Therefore, we have

$$4x + 6 \le x - 18$$
$$4x - x \le -18 - 6 \quad [\text{Taking } x \text{ to the left side and 6 to the right side}]$$
$$3x \le -24$$
$$x \le -8 \quad [\text{Divided by 3 in both sides}]$$

Therefore, the solution set is $(-\infty, -8]$

The graph of the given inequality is as follows:



Answer 47e.

Subtract 5 to each expression.

$11+5 \le 2x-5+5 \le 25+5$

$16 \le 2x \le 30$

Divide each part by 2.

$\frac{16}{2} \le \frac{2x}{2} \le \frac{30}{2}$

$8 \le x \le 15$

Thus, the solutions are all real numbers greater than or equal to 8 and less than or equal to 15.

Graph $8 \le x \le 15$. Solid dots are shown at 8 and 15 to indicate that 8 and 15 are part of the solution.

Answer 48e.

The given inequalities are,

$x+5 \le -1$ or $x-3 > 4$

We need to solve the inequality and graph the solution.

Now we will isolate the variable x in the first inequality. Therefore, we have

$x+5 \le -1$

$x+5-5 \le -1-5$ [By adding -5 in both sodes]

$x \le -6$

We will isolate the variable x in the second inequality. Therefore, we have

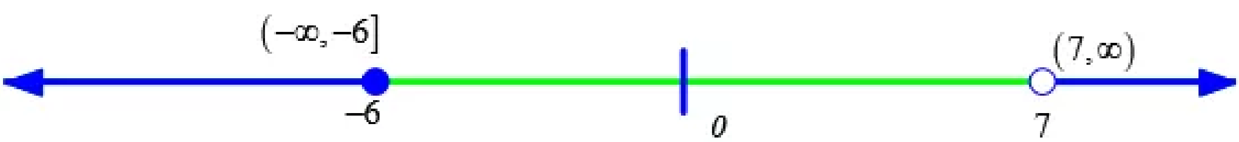
$x-3 > 4$

$x-3+3 > 4+3$ [By adding 3 in both sides]

$x > 7$

Therefore, the solution set is $\boxed{x = (-\infty, -6] \cup (7, \infty)}$

The graph of the given inequality is as follows:



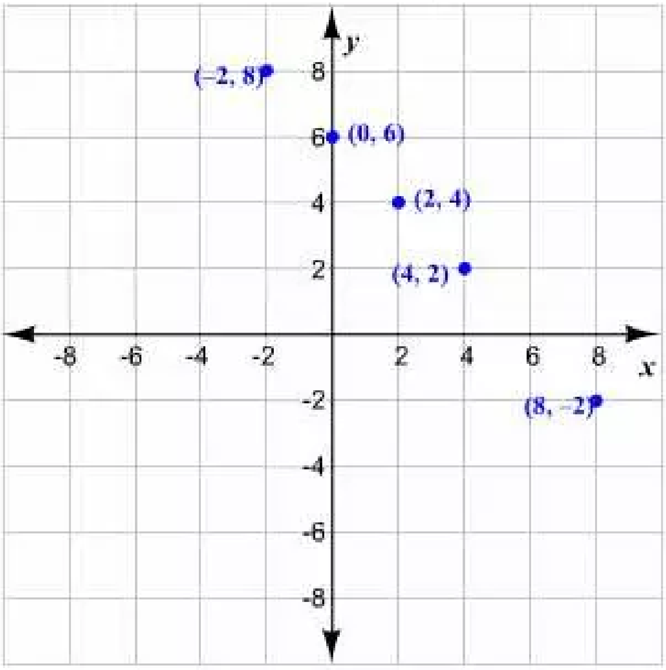
Answer 49e.

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

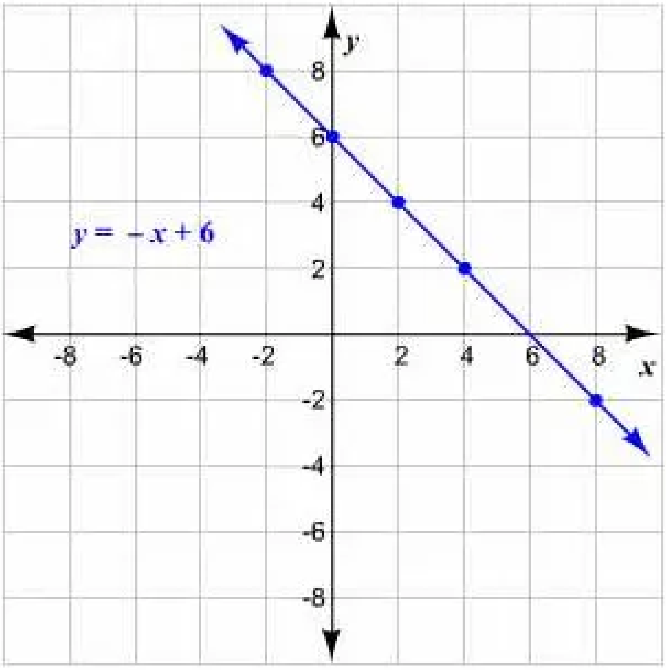
x	-2	0	2	4	8
$y = -x + 6$	8	6	4	2	-2

The points are $(-2, 8)$, $(0, 6)$, $(2, 4)$, $(4, 2)$ and $(8, -2)$.

Plot the points on a coordinate plane.



Connect the points with a straight line to get the graph of the given equation.



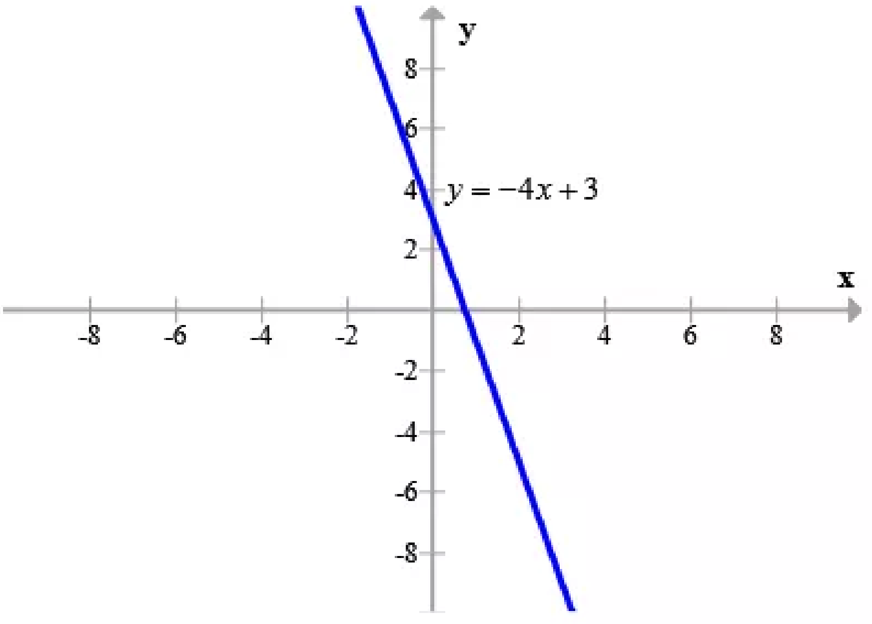
Answer 50e.

The given equation is,

$$y = -4x + 3$$

We need to draw the graph for the given equation.

The graph of the given equation is as follows:



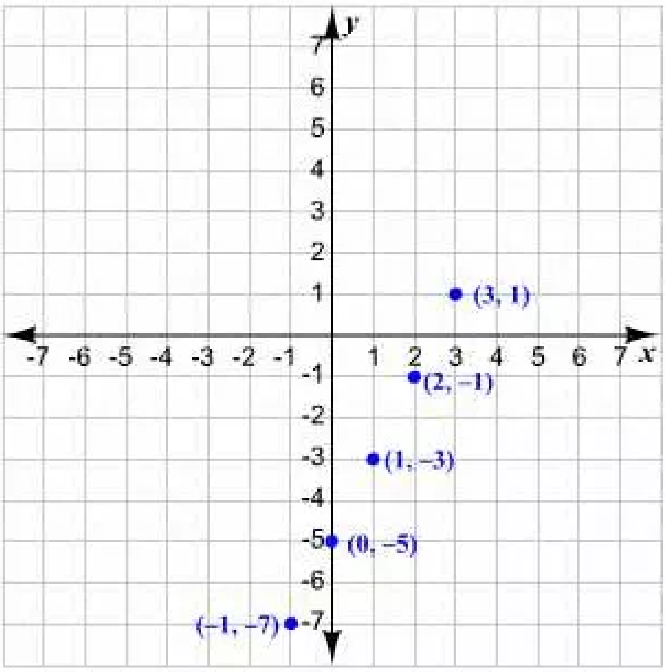
Answer 51e.

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

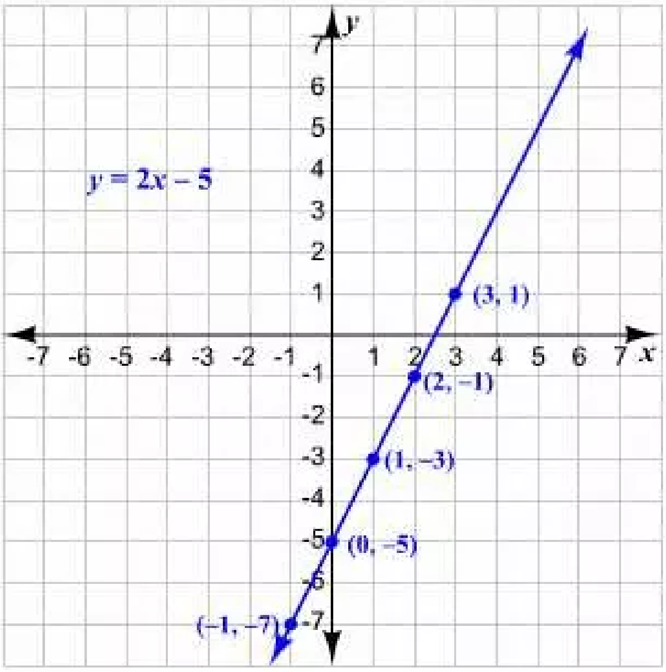
x	-1	0	1	2	3
$y = 2x - 5$	-7	-5	-3	-1	1

The points are $(-1, -7)$, $(0, -5)$, $(1, -3)$, $(2, -1)$ and $(3, 1)$.

Plot the points on a coordinate plane.



Connect the points with a straight line to get the graph of the given equation.



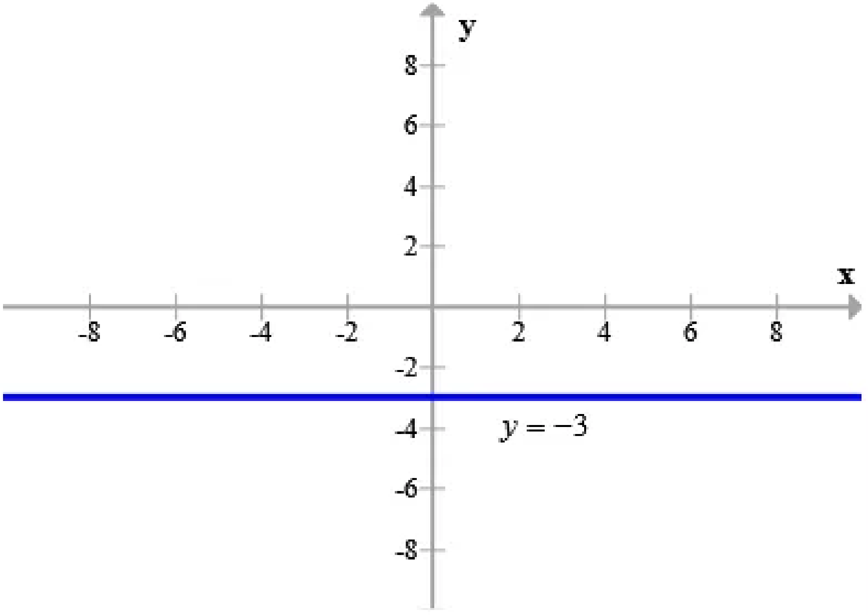
Answer 52e.

The given equation is,

$$y = -3$$

We need to draw the graph for the given equation.

The graph of the given equation is as follows:



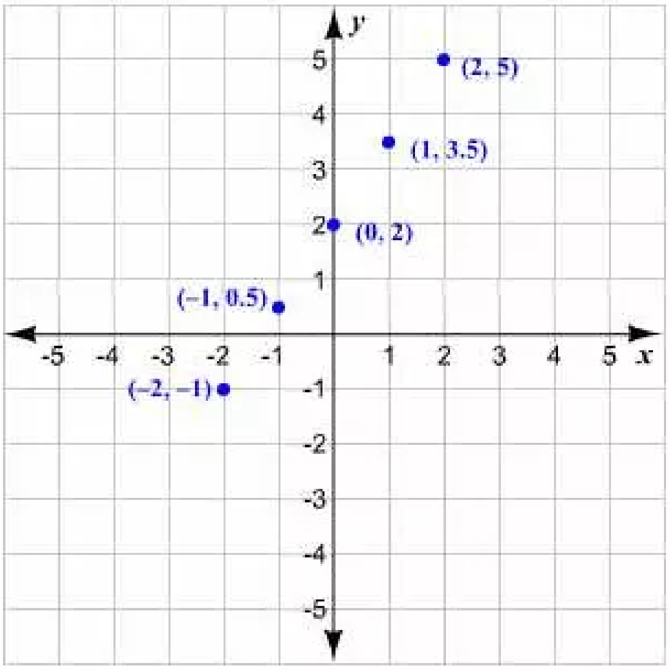
Answer 53e.

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

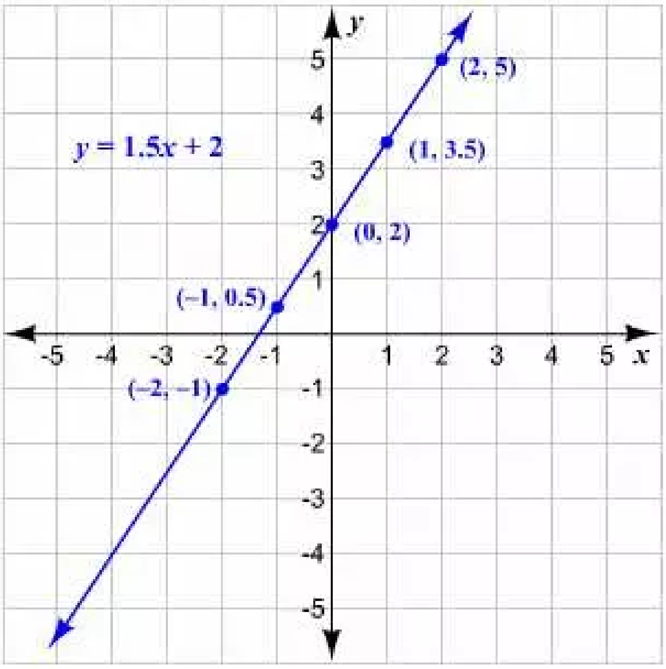
x	-2	-1	0	1	2
$y = 1.5x + 2$	-1	0.5	2	3.5	5

The points are $(-2, -1)$, $(-1, 0.5)$, $(0, 2)$, $(1, 3.5)$ and $(2, 5)$.

Plot the points on a coordinate plane.



Connect the points with a straight line to get the graph of the given equation.



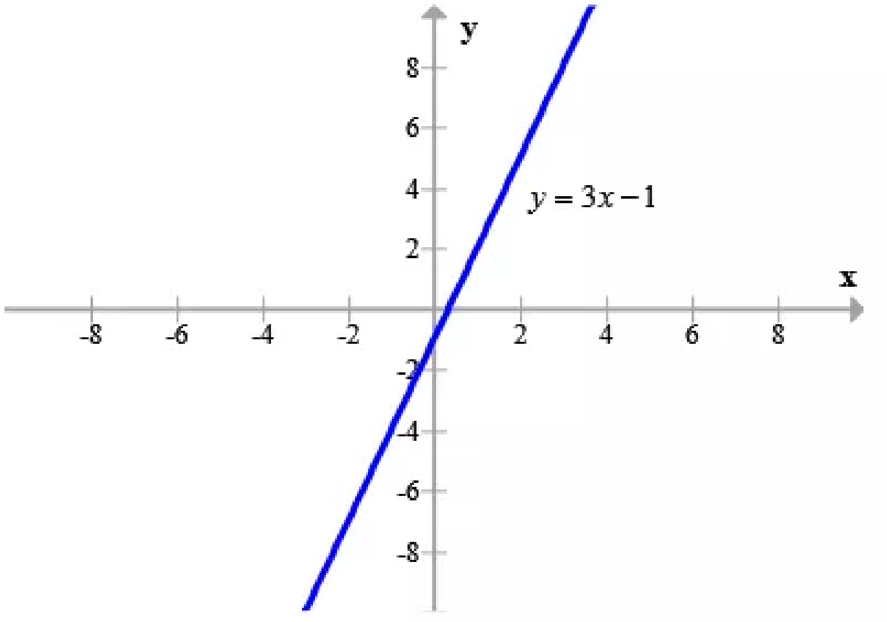
Answer 54e.

The given equation is,

$$y = 3x - 1$$

We need to draw the graph for the given equation.

The graph of the given equation is as follows:



Answer 55e.

Since d varies directly with r, the direct variation equation for r and d is $d = ar$.

Substitute 420 for d, and 9500 for r.

$420 = a\,(9500)$

Divide each side by 9500 to solve for a.

$$\frac{420}{9500} = \frac{9500a}{9500}$$

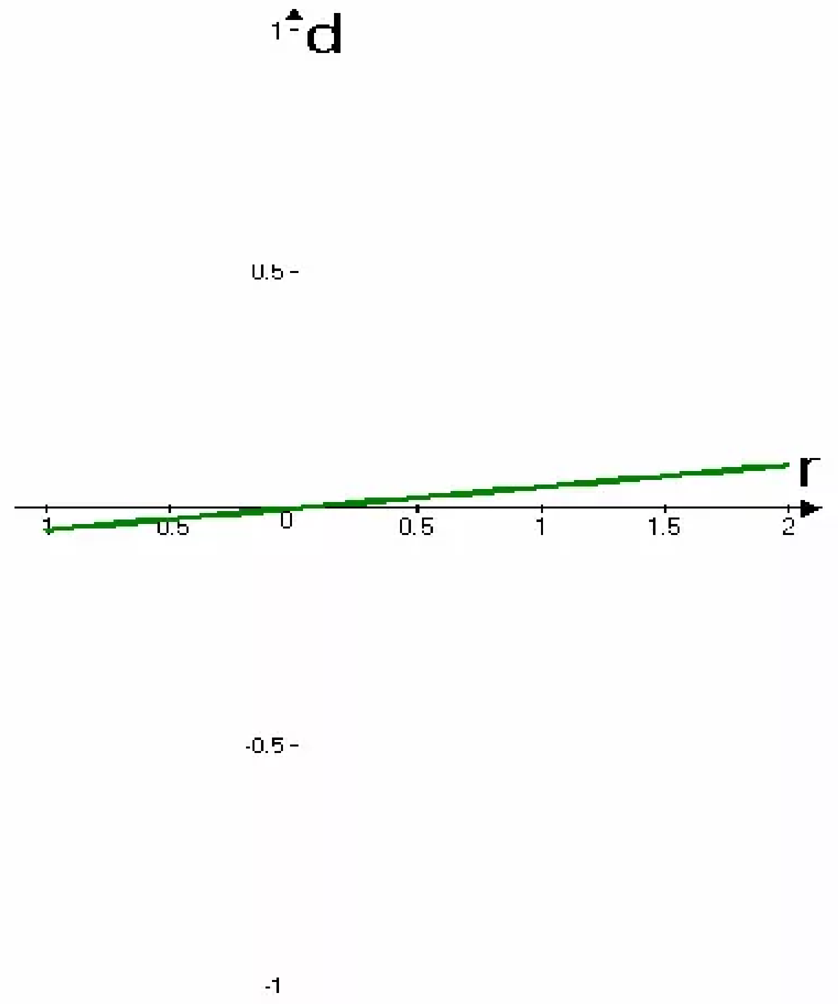
$$\frac{21}{475} = a$$

The value of a is $\frac{21}{475}$.

Replace a with $\frac{21}{475}$ in $w = ad$.

$$d = \frac{21}{475}r$$

The direct variation equation that relates d and r is $d = \frac{21}{475}r$.



d
1
0.5
-0.5
-1
r
-1
-0.5
0
0.5
1
1.5
2