Treasure Hunt Solution:

By Prakul Ramesh

Level 1 and 2:

For level 1 and 2, we find the treasure in the third guess. Co-ordinates are entered twice for testing and with the third guess, the treasure is found.

Level 3:

Diagonal shaded:

There are two cases here:

1. **Example 1: (Case of the input of step 1 is >12)**
2. **Example 2: (Case of the input of step 1 is <13)**

The number of guesses to find the treasure is 4. Co-ordinates are entered thrice for testing and with the fourth guess, the treasure is found.

Horizontal Shaded:

There are two cases here:

1. **Example 1: (Case of the input of step 1 is <13)**
2. **Example 2: (Case of the input of step 1 is >12)**

   The number of guesses to find the treasure is 4. Co-ordinates are entered thrice for testing and with the fourth guess, the treasure is found.

Vertical Shaded:

There are two cases here:

1. **Example 1: (Case of the input of step 1 is <13)**
2. **Example 2: (Case of the input of step 1 is >12)**

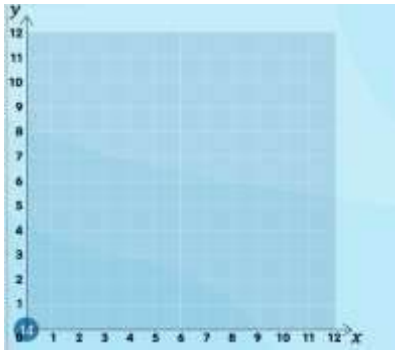
The number of guesses to find the treasure is 4. Co-ordinates are entered thrice for testing and with the fourth guess, the treasure is found.

Detailed steps with examples are given below for all the three levels:

Level 1 and 2:

Step 1: Choose the left bottom most point and enter the test co-ordinates.
Reason: We choose a corner on the grid, because this will get us all the possibilities to locate the treasure in one diagonal line.

For this example, test co-ordinates are (0,0)

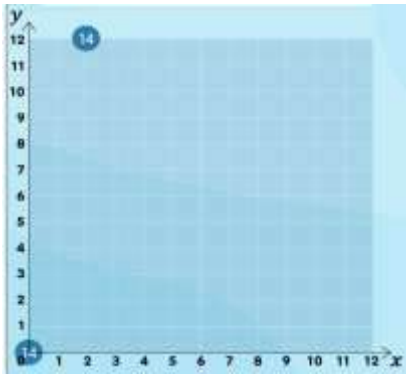


Step 2: Move the number of steps upwards as per the input you received for step 1:

Note: If the input is > 12, go upwards 12 steps along the y-axis, and then go rightwards along the x-axis, for [(input of step 1) -12] step(s). Then enter the test co-ordinates we land on:

Reason: We choose one of the corner points which lie on the imaginary diagonal line, which is on one edge/corner of the grid. This makes elimination process of the points easier and also helps us to locate the treasure easily. If we choose any other co-ordinate on the diagonal line (from center or other part of the line), instead of the corner co-ordinate, we may need an extra move to locate the treasure.

For this example, test co-ordinates are (2,12)
(Move 14 steps as per the input of step 1 → 12steps upwards from (0,0), land on (0,12) & (14-12=2) 2 steps on the right horizontally). So, we land on **(2,12)**



Step 3: Finding the Treasure

i) From the test coordinate of Step-2:

a. Add x by (input of step-2 ÷ 2)

b. Subtract y by (input of step-2 ÷ 2)

c. Choose and enter the point you got to find the treasure.

Reason: We know that the treasure is along the imaginary diagonal line. To travel one point on the diagonal line, we need to move 2 steps, i.e, change x by 1 and change y by 1 (or) change x by -1 and change y by -1 and so on. Hence, we use the formula of (step 2 value divide by 2).

For this example,
The test coordinates of step 2 were (2,12)
Add x by (input of step-2 ÷ 2)
= (14 ÷ 2)
= 7
⇒ [2+7] =x-axis value
⇒9=x-axis value

Subtract y by (input of step-2 ÷ 2)
= (14 ÷ 2)
= 7
⇒ [12-7] =y-axis value
⇒5=y-axis value
The treasure coordinates are (9,5)



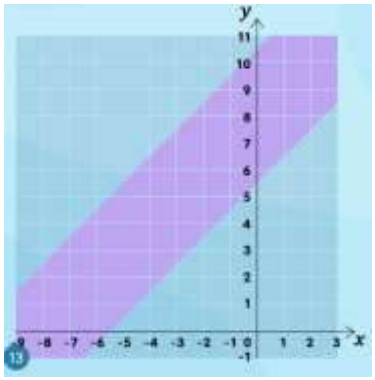
Level 3:

Diagonal shaded:

Example 1: (Case of the input of step 1 is >12)

Step 1: Choose the bottom corner in the shaded part.

Example 1: For this example, choose test co-ordinates as (-9, -1) (input of step 1 is greater than 12)

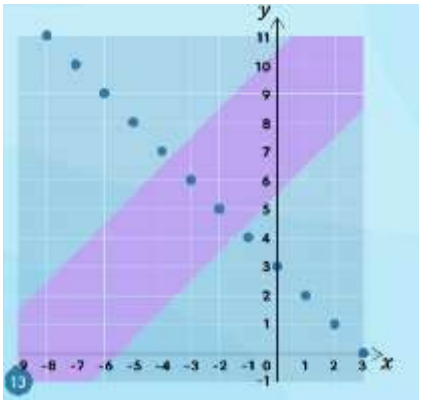


Step 2: Mark all the possible points. To mark the points:

a) If >12,
   i) Go upwards 12 steps from the test co-ordinates of step 1, then we go [(input of step 1) - 12] steps horizontally in the opposite direction from the bottom corner which we chose in step 1. (If we choose left bottom corner, go towards right and vice versa). Mark the step we land on.
   Example 1: For this example, we go 12 steps upwards along the y-axis from (-9, -1). We land on (-9,11). From here, as we chose the left bottom corner in step 1, we move towards the right of the grid horizontally, [(13-12) = 1] step. Then we land on (-8,11).

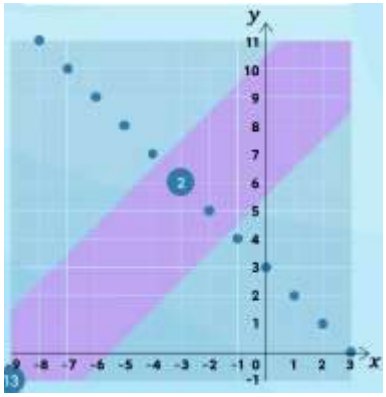
   ii) Again, from the test co-ordinates of step 1, go horizontally 12 steps in the opposite direction of the point we chose in step 1. (If we choose the left bottom corner, go towards the right and vice versa). Then go [(input of step 1) - 12] steps upwards and then mark the point we land on.
   Example 1: For this example, we go 12 steps horizontally in the right side of the grid, along the x-axis from (-9, -1). We land on (3, -1). From here, move upwards on the y-axis, [(13-12) = 1] step. Then we land on (3,0)

   iii) Imagine a diagonal line connecting the points we marked. Mark all the points passing through the imaginary line.
   Example 1: For this example, we marked (-8,11) and (3,0). Mark all the in-between diagonal co-ordinates on the imaginary line like
   (-7,10), (-6,9), (-5,8), (-4, 7), (-3, 6), (-2,5), (-1, 4), (0,3), (1,2) and (2,1)



Step 3: Choose one of the marked points in the shaded part and test the co-ordinates to receive the input.

Example 1: For this example, choose (-3, 6) which falls in the shaded part and test them. We receive the input as 2.



Step 4: Eliminate the other marked points using the input received in step 3.

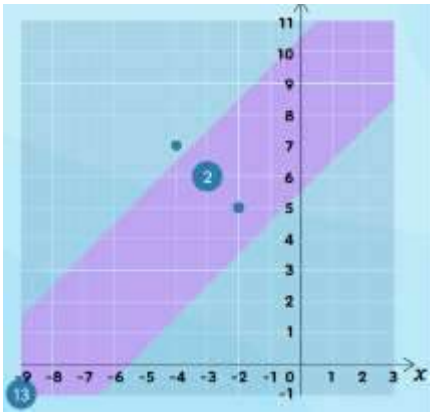
Elimination Method:

From the test co-ordinate of step 3, move [(input of step 3) ÷2] steps towards the right corner along the imaginary diagonal, erase all the other marked points, except the point we land on, in the right-hand side of the shaded part.

Example 1: Input of step 3 is 2. For this example, from (-3, 6), move 1 step [(2 ÷2) =1step) on the diagonal line. So, we land on (-2,5) when we moved 1 step downwards on the diagonal line.

From the test co-ordinate of step 3, then move [(input of step 3) ÷2] steps towards the left corner along the imaginary diagonal, erase all the other marked points, except the point we land on, in the left-hand side of the shaded part.

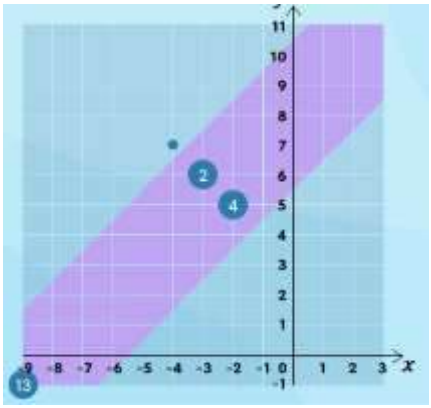
Example 1: Input of step 3 is 2. Similarly, do on the other side of the diagonal line. For this example, from (-3, 6), move 1 step [(2 ÷2) =1step) on the other side of diagonal line. So, we land on (-4,7) when we move 1 step upwards on the diagonal.

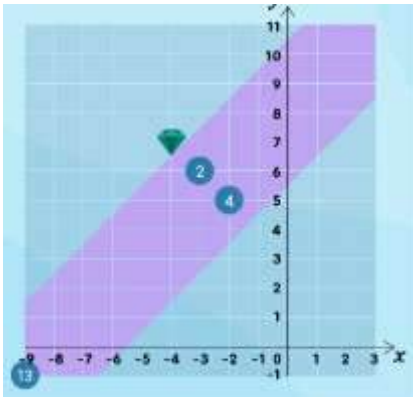


Step 5: then,

a) If there is only one marked point remaining outside the shaded area, then choose that co-ordinates of the point to find the treasure.

Example 1: For this example, Choose the treasure co-ordinate as (-4,7)

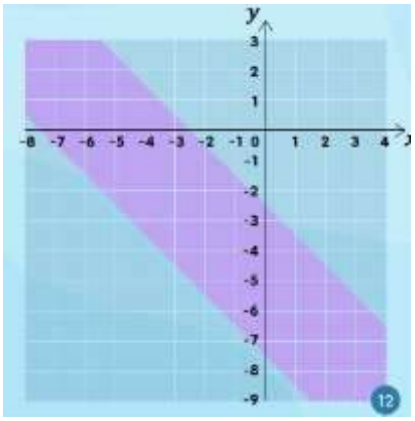




Example 2: (Case of the input of step 1 is <13)

Step 1: Choose the bottom corner in the shaded part.

Example 2: For this example, choose test co-ordinates as (4, -9) ((input of step 1 is less than 13)



Step 2: Mark all the possible points. To mark the points:

a) If <13,

i) From the test co-ordinate of step 1, go upwards the number of steps based on the input received from step 1. Mark the step we land on.

Example 2: For this example, from (4, -9), we have to move 12 steps up on the y-axis and we land on (4,3). Mark a point on (4,3)

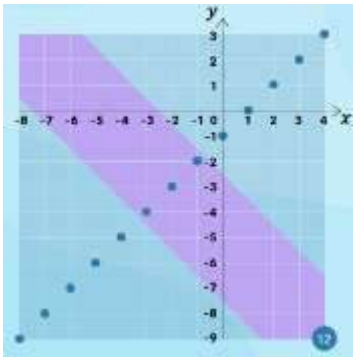
ii) Again, From the test co-ordinate of step 1, go horizontally step 1 input steps in the opposite direction. (If we choose the left bottom corner, go towards the right and vice versa). Mark the step we land on.

Example 2: For this example, from (4, -9), we have to move 12 steps up on the x-axis horizontally and we land on (-8, -9). Mark a point on (-8, -9).

iii) Imagine a diagonal line connecting the points we marked. Mark all the points passing through the imaginary line.

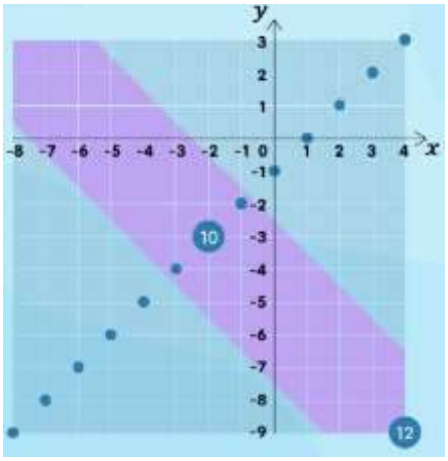
Example 2: Between (4,3) and (-8, -9), draw an imaginary diagonal line and mark all the below co-ordinates.

(3,2), (2,1), (1,0), (0, -1), (-1, -2), (-2, -3), (-3, -4), (-4, -5), (-5, -6), (-6, -7) and (-7, -8)



Step 3: Choose one of the marked points in the shaded part and test the co-ordinates to receive the input.

Example 2: Enter test co-ordinate as (-2, -3) and we received input as 10 steps away.



Step 4: Eliminate the other marked points using the input received in step 3.

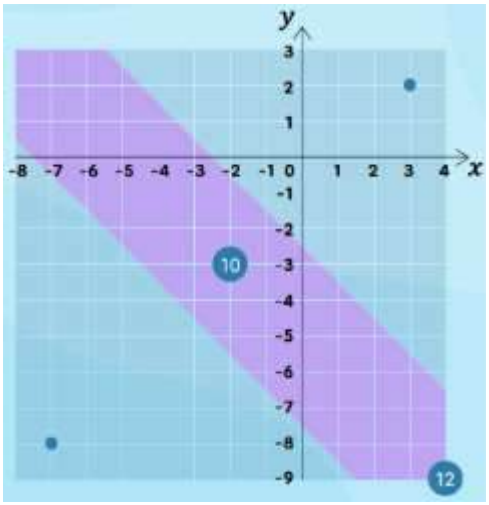
Elimination Method:

From the test co-ordinate of step 3, move [(input of step 3) ÷2] steps towards the right corner along the imaginary diagonal, erase all the other marked points, except the point we land on, in the right-hand side of the shaded part.

Example 2: Input of step 3 is 10. From (-2, -3), move 5 steps [(10 ÷2) =5 steps] on one side of the diagonal line. We land on (3, 2) when we moved 5 steps upwards from (-2, -3).

From the test co-ordinate of step 3, then move [(input of step 3) ÷2] steps towards the left corner along the imaginary diagonal, erase all the other marked points, except the point we land on, in the left-hand side of the shaded part.

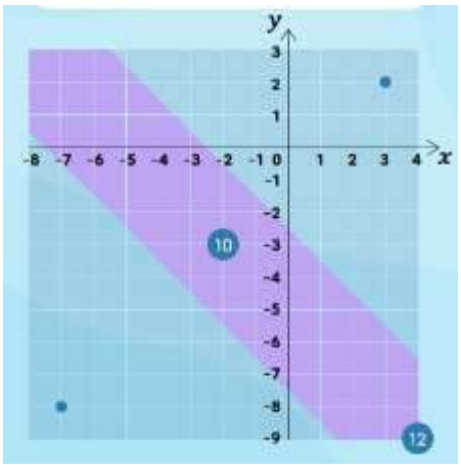
Example 2: Input of step 3 is 10. From (-2, -3), move 5 steps [(10 ÷2) =5 steps] on the diagonal line. We land on (-7, -8) on other side of the diagonal line when we moved 5 steps downwards from (-2, -3).



Step 5: then,

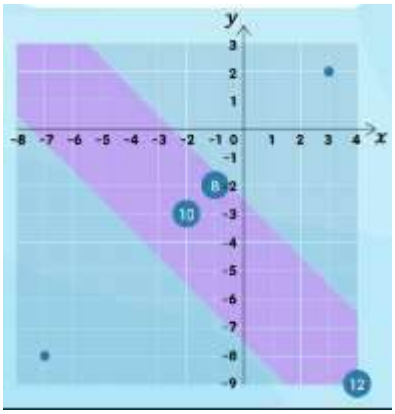
a) If there are two points remaining outside the shaded area,

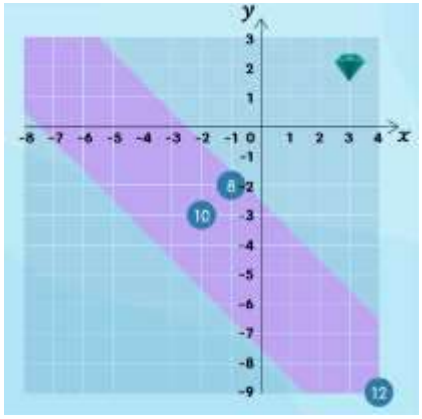
   i) Then draw an imaginary diagonal line connecting them, and identify the center (which will be found inside the shaded part of the grid).
   Example 2: The center based on the imaginary diagonal line for this example which connects the two marked points is (-2, -3)



   ii) Now, we must move one step forward or backward along the imaginary line from the center which we found in the step above and choose that as a test co-ordinate, so that the marked points are non - equidistant from the point we choose as test-coordinate.
   Note: make sure to choose a test co-ordinate that is inside the shaded part.
   Example 2: When we move + or – one step from the center, we can choose (-1, -2) or (-3, -4) as test co-ordinates to receive the input for finding the treasure.

   iii) Now, using the input we receive, eliminate the other marked point to find the treasure.
   Example 2: We used (-1, -2) and received input as 8. Our treasure co-ordinate when we move 8 steps on the grid is (3,2). We can eliminate our other marked point (-7, -8).





Our treasure co-ordinate is (3,2) for example 2.

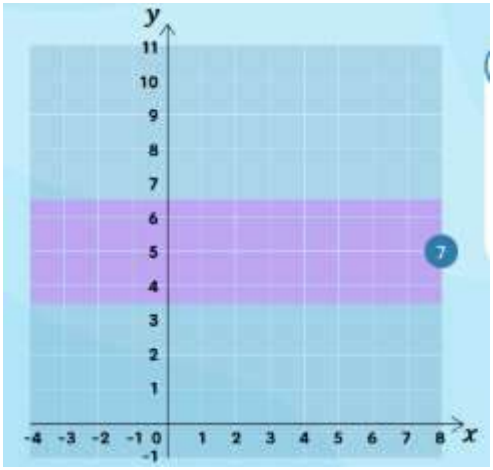
Horizontal shaded:

Example 1: (Case of the input of step 1 is <13)

Step 1: Choose the center in the rightmost column.

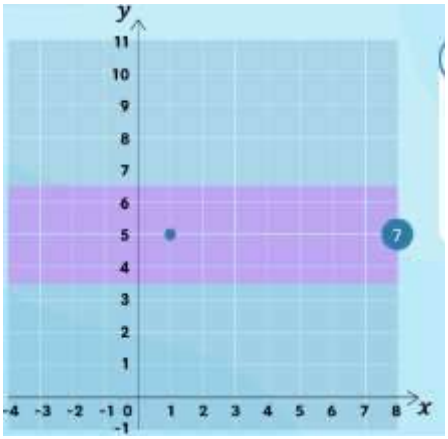
Reason: A corner co-ordinate gives us 1 in 144 possibilities, and the corner co-ordinate is out of the shaded part as well. In case, we get a wrong guess, then the system does not allow us to take another guess in the grid for the problem. Hence, we chose centre of the rightmost column(edge) of the grid. Same reason holds good for vertical shaded as well.

Example 1: Center for the example 1 is (8,5)



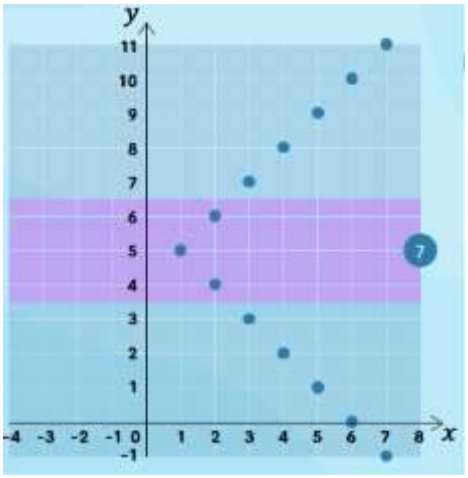
Step 2: Mark all the points that could be the treasure.

a) If input of step-1 < 13:
   i) Go horizontally backward (input of step1) steps on the center co-ordinates of step 1, and mark the point you land on.
   Example 1: For this example, move 7 steps from (8,5) horizontally and we land on (1,5)



ii) From that point, keep going diagonally on either side - towards the top-right corner and bottom right corner. Mark all the points on the imaginary diagonal line.

Example 1: For this example, from (1,5), mark all the points as follows on the diagonal line on either side -> (2,6), (3,7), (4,8), (5,9), (6,10), and (7,11) on one side of the diagonal. (2,4), (3,3), (4,2), (5,1), (6,0) and (7, -1) on the other side of the diagonal.

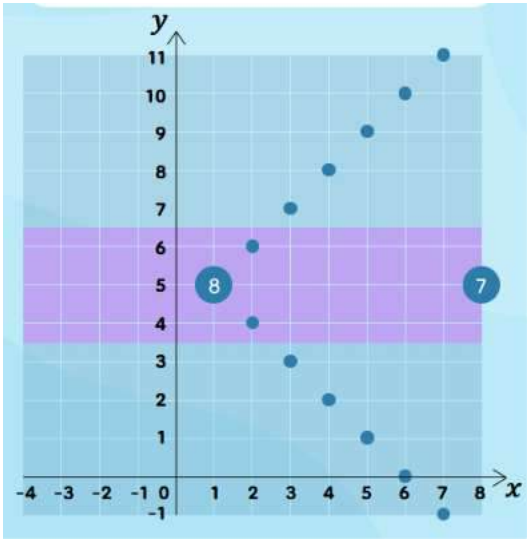


Step 3:

a) If input of step-1 < 13:

i) Enter the co-ordinates for the point you land on, if you go horizontally backwards (input of step1) steps from the center of the rightmost column.

Example 1: For this example, from (8,5) move 7 steps backwards horizontally and we land on (1,5).



Step 4: Now eliminate the other possibilities.

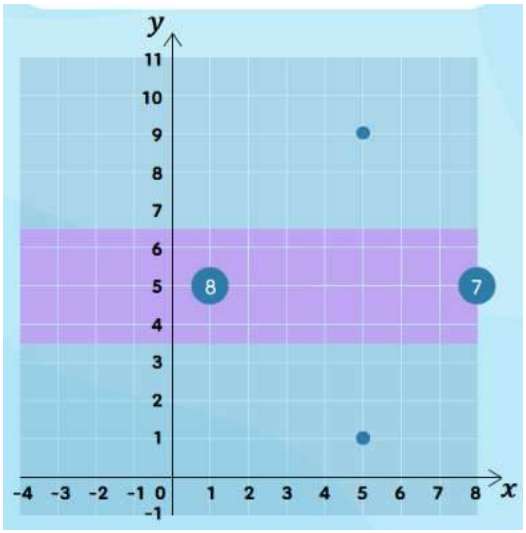
a) If input of step1 <13,

i) Move [(input of step 3) ÷2] steps from the test co-ordinates of step3 towards the bottom-right corner, erase all the other marked points, except the point we land on (in the bottom side of the shaded part).

Example 1: For this example, input of step 3 is 8. Divide it by 2, we get 4. From (1,5) move 4 steps on one side of the diagonal line towards the bottom right corner and we land on (5,1)

ii) From the test co-ordinates of step3, move [(input of step 3) ÷2] steps towards the top-right corner, erase all the other marked points, except the point we land on. (in the top side of the shaded part)

Example 1: For this example, input of step 3 is 8. Divide it by 2, we get 4. From (1,5) move 4 steps on the other side of the diagonal line towards the top right corner and we land on (5,9)



Step 5: Now that we have two points, draw an imaginary line connecting them. Locate the center point on the line (which will be found in the shaded part).

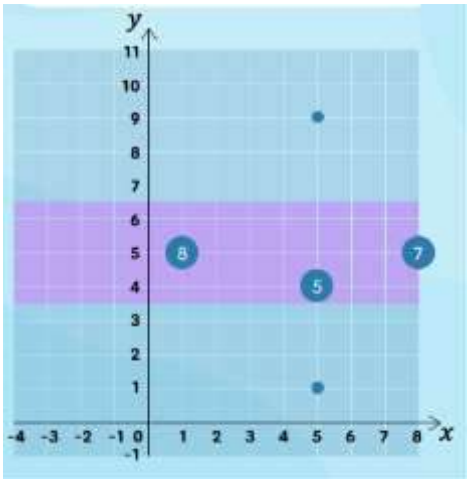
Example 1: Our co-ordinates are (5,1) and (5,9). Center for this example is (5,5).

Step 6: Move one point upwards or downwards from the center along the imaginary line (note that, the chosen point must be inside the shaded part).

Example 1: Center for this example is (5,5). We can choose one of the two points for finding the treasure -> (5,4) or (5,6)

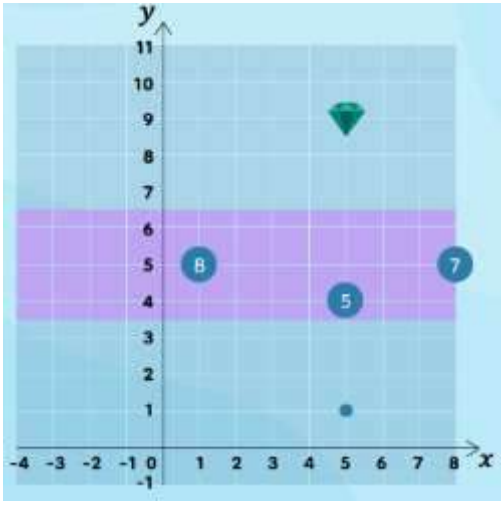
Step 7: Choose that test coordinate and enter it.

Example 1: We chose (5,4) and received input as 5.



Step 8: Now, using the input we receive, eliminate the other marked point to find the treasure.

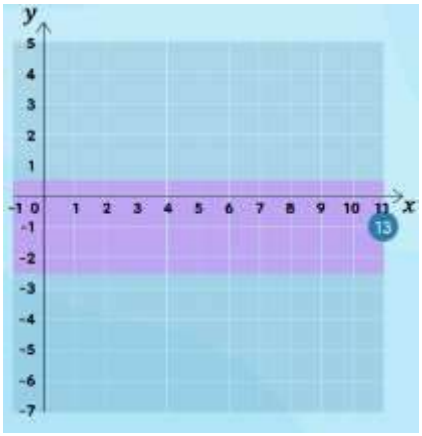
Example 1: Moving 5 steps, our treasure co-ordinate is (5,9). We eliminated the other marked point.



Example 2: (Case of the input of step 1 is >12)

Step 1: Choose the center in the rightmost column.

Example 2: Center of example 2 is (11, -1)



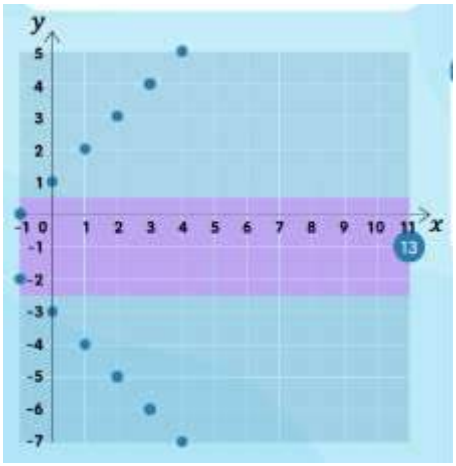
Step 2: Mark all the points that could be the treasure.

a) If input of step 1>12:
   i) From the test co-ordinate of step 1, go horizontally backward 12 steps and then go upward [Input of step 1 -12] steps and mark the point you land on.
   Example 2: Test co-ordinates of step 1 were (11, -1). We need to move 12 steps backward horizontally on the x-axis from that point. We land on (-1, -1). From here, move upwards 1 step (13-12=1 step) on y axis. We land on (-1,0).

   ii) From that point keep going diagonally towards the top-right corner. Mark all the points on the imaginary diagonal line.
   Example 2: From (-1,0), mark all the co-ordinates on the imaginary diagonal line towards top right corner. The co-ordinates are (0,1), (1,2), (2,3), (3,4) and (4,5).

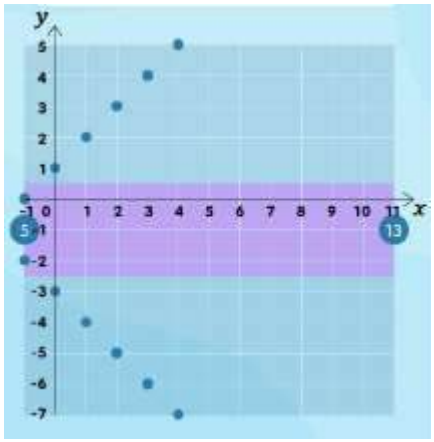
   iii) From the test co-ordinate of step 1, go horizontally backward 12 steps and then go downwards [Input of step 1 -12] steps and mark the point you land on.
   Example 2: Test co-ordinates of step 1 were (11, -1). We need to move 12 steps backward horizontally on the x-axis from that point. We land on (-1, -1). From here, move downwards 1 step (13-12=1 step) on y axis. We land on (-1, -2).

   iv) From that point keep going diagonally towards the bottom-right corner. Mark all the points on the imaginary diagonal line.
   Example 2: From (-1, -2), mark all the co-ordinates on the imaginary diagonal line towards the bottom right corner.
   The co-ordinates are (0, -3), (1, -4), (2, -5), (3, -6) and (4, -7).



Step 3:

a) If input of step 1>12:
   i) Enter the co-ordinates for the point you land on, if you go horizontally backward 12 steps from the center of the rightmost column.
   Example 2: For this example, from (11, -1) move horizontally backwards 12 steps and we land on (-1, -1)



Step 4: Now eliminate the other possibilities.

a) If input of step1 >12,
   i) From the test co-ordinates of step3, go downwards [(input of step1)-12] steps
   Example 2: From (-1, -1), move 1 step (13-12=1) downwards and we land on (-1, -2).

   ii) Then from that point proceed $\left(\left[\text{(Input of step3)}-\{\text{(input of step1)}-12\}\right]\div 2\right)$ step(s) diagonally towards the bottom right corner. Erase all the marked points on the bottom side of the shaded part, except the point we land on.
   Example 2: From (-1,-2), move the number of steps as per the formula above

$$\left(\left[\text{(Input of step3)}-\{\text{(input of step1)}-12\}\right]\div 2\right) = \left(\left[5-\{13-12\}\right]\div 2\right)$$

$$= \left(\left[5-\{1\}\right]\div 2\right) = \left(\left[4\right]\div 2\right) = 2$$

Move 2 steps diagonally from (-1, -2) on one side towards the bottom right corner and we land on **(1, -4)**

iii) From the test co-ordinates of step3, go upwards [(input of step1)-12] steps

Example 2: From (-1, -1), move 1 step (13-12=1) upwards and we land on (-1, 0).

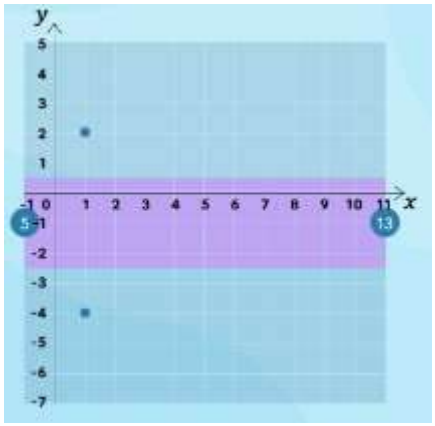
iv) Then from that point proceed $\left(\left[\text{(Input of step3)}-\{\text{(input of step1)}-12\}\right]\div 2\right)$ step(s) diagonally towards the top right corner. Erase all the marked points on the top side of the shaded part, except the point we land on.

Example 2: From (-1, 0), move the number of steps as per the formula above

$$\left(\left[\text{(Input of step3)}-\{\text{(input of step1)}-12\}\right]\div 2\right) = \left(\left[5-\{13-12\}\right]\div 2\right)$$

$$= \left(\left[5-\{1\}\right]\div 2\right) = \left(\left[4\right]\div 2\right) = 2$$

Move 2 steps diagonally from (-1, 0) on other side towards the top right corner and we land on **(1, 2)**



Step 5: Now that we have two points, draw an imaginary line connecting them. Locate the center point on the line (which will be found in the shaded part).

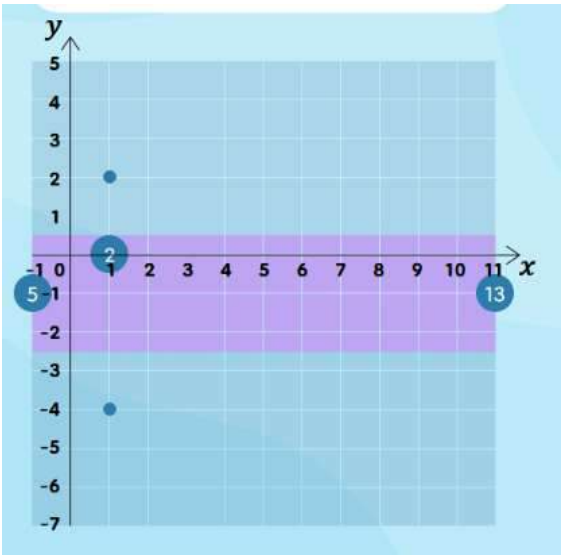
Example 2: Our co-ordinates are (1, -4) and (1,2). Center for this example is (1, -1).

Step 6: Move one point upwards or downwards from the center along the imaginary line (note that, the chosen point must be inside the shaded part).

Example 2: Center for this example is (1, -1). We can choose one of the two points for finding the treasure -> (1,0) or (1, -2)

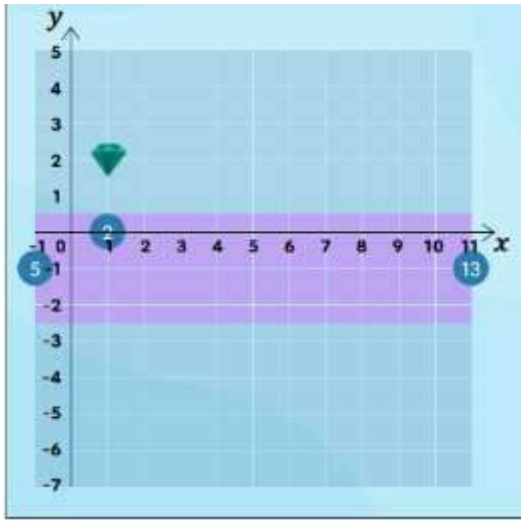
Step 7: Choose that test coordinate and enter it.

Example 2: We chose (1,0) and received input as 2.



Step 8: Now, using the input we receive, eliminate the other marked point to find the treasure.

Example 2: Moving 2 steps, our treasure co-ordinate is (1,2). We eliminated the other marked point.

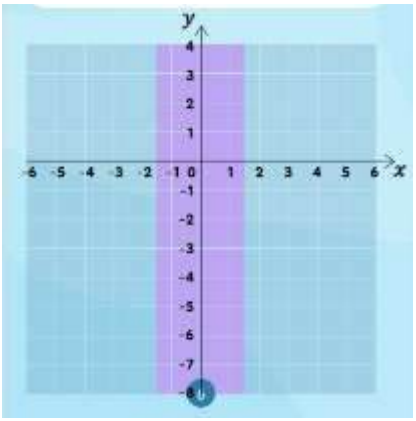


Vertical Shaded Part:

Example 1: (Case of the input of step 1 is <13)

Step 1: Choose the center at the bottom of the grid.

Example 1: For this example, we chose the center as (0, -8) and we received the input as 6.



Step 2: Mark all the points that could be the treasure.

a) If input of step-1 < 13:

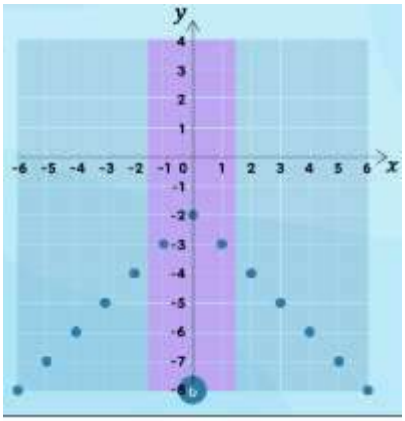
i) Go upwards (input of step1) steps on the center line from the test co-ordinates of step 1 and mark the point you land on.

Example 1: From (0, -8) move 6 steps upwards on the y-axis and we get to land on (0, -2). Mark the co-ordinate (0, -2)

ii) From that point, keep going diagonally on either side - towards the bottom-right corner and bottom left corner. Mark all the points on the imaginary diagonal line.

Example 1: For this example, from (0, -2), mark all the points as follows on the diagonal line on either side -> (1, -3), (2, -4), (3, -5), (4, -6), (5, -7) and (6, -8) on one side of the diagonal.

(-1, -3), (-2, -4), (-3, -5), (-4, -6), (-5, -7) and (-6, -8) on the other side of the diagonal.

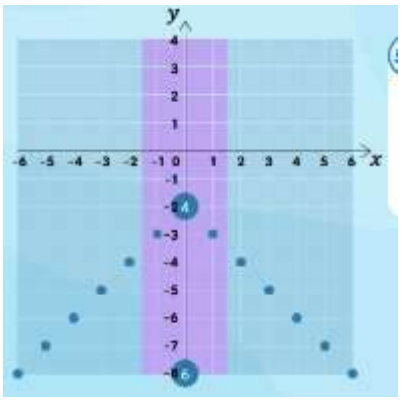


Step 3:

a. If input of step-1 < 13,

i. enter the test co-ordinates for the point you land on - if you go upwards (input of step1) steps from the center of the bottom of the grid.

Example 1: From (0, -8) move 6 steps upwards on the y-axis and we get to land on (0, -2). Mark the co-ordinate (0, -2) and enter it to receive an input.



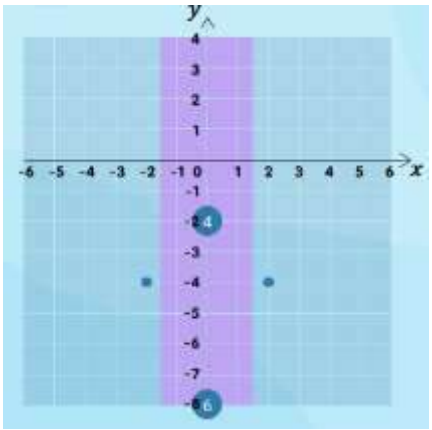
Step 4: Now eliminate the other possibilities.

a. If input of step1 <13,
   i. Move [(input of step 3) ÷2] steps from the test co-ordinates of step3 towards the bottom-right corner, erase all the other marked points, except the point we land on (in the right side of the shaded part).

   Example 1: We received input as 4 for the test co-ordinate (0, -2). Divide 4 by 2 and we get 2 steps. From (0, -2) move 2 steps diagonally towards bottom right and we land on a point (2, -4). Keep only that point and erase the other points on the right-hand side.

   ii. From the test co-ordinates of step3, move [(input of step 3) ÷2] steps towards the bottom-left corner, erase all the other marked points, except the point we land on. (in the left side of the shaded part)

   Example 1: We received input as 4 for the test co-ordinate (0, -2). Divide 4 by 2 and we get 2 steps. From (0, -2) move 2 steps diagonally towards bottom left and we land on a point (-2, -4). Keep only that point and erase the other points on the left-hand side.



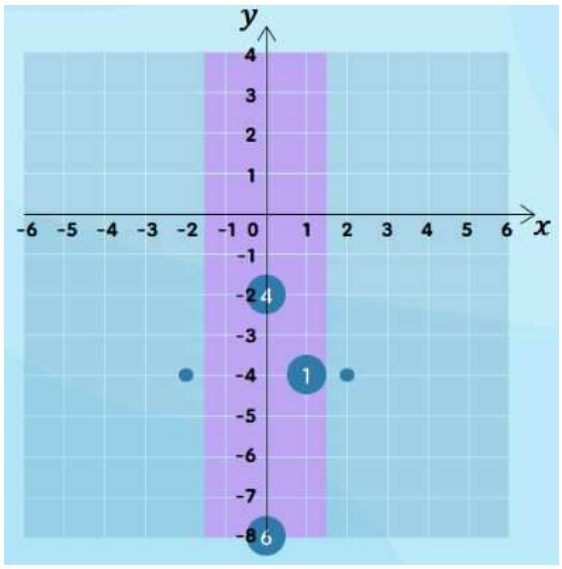
Step 5: Now that we have two points, draw an imaginary line connecting them. Locate the center point on the line (which will be found in the shaded part).

Example 1: Our co-ordinates are (2, -4) and (-2, -4). Center for the two points is (0, -4)

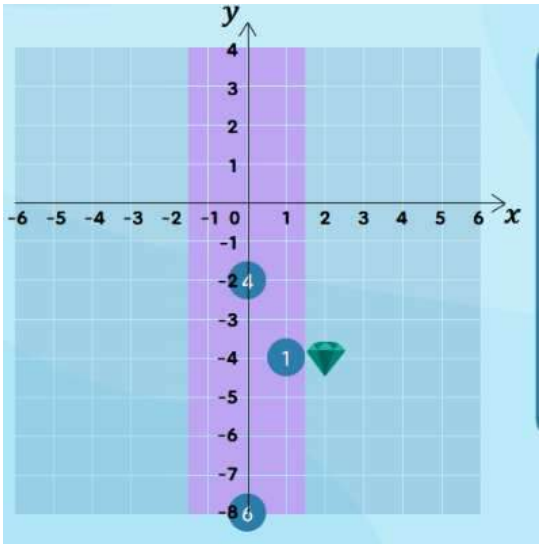
Step 6: Move one point left or right from the center along the imaginary line (note that, the chosen point must be inside the shaded part).

Example 1: Center for this example is (0, -4). We can choose one of the two points for finding the treasure -> (-1, -4) or (1, -4)

Step 7: Choose that test coordinate and enter it.
Example 1: We chose (1, -4) and received input as 1.



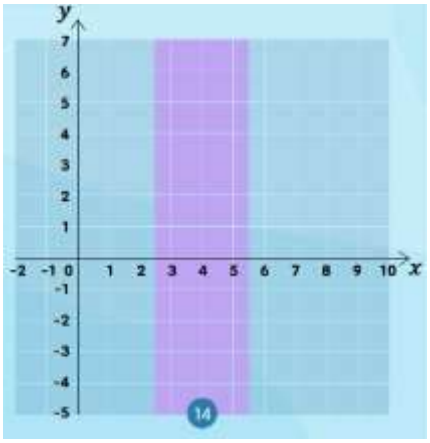
Step 8: Now, using the input we receive, eliminate the other marked point to find the treasure.
Example 1: Moving 1 step, our treasure co-ordinate is (2, -4). We eliminated the other marked point.



Example 2: (Case of the input of step 1 is >12)

Step 1: Choose the center at the bottom of the grid.

Example 2: For this example, we chose the center as (4, -5) and we received the input as 14.



Step 2: Mark all the points that could be the treasure.

a) If input of step 1>12:

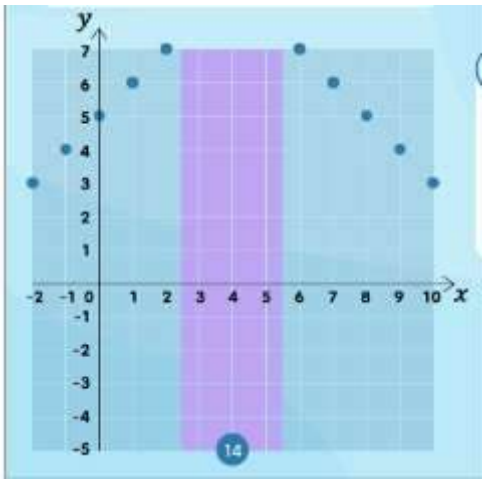
i) From the test co-ordinate of step 1, go vertically upwards 12 steps and then go right [Input of step 1 -12] steps and mark the point you land on.
Example 2: Input we received from step 1 is 14 for (4, -5) test co-ordinates. We must go 12 steps upwards from (4, -5) on the y-axis. We land on (4,7). We have to move 2 steps (14-12 = 2 steps) on the right and we land on (6,7).

ii) From that marked point keep going diagonally towards the bottom right corner. Mark all the points on the imaginary diagonal line.
Example 2: From (6,7) move diagonally towards the right corner. Mark the other co-ordinates -> (7,6), (8,5), (9,4) and (10,3).

iii) From the test co-ordinate of step 1, go vertically upward 12 steps and then go left [Input of step 1 -12] steps and mark the point you land on.
Example 2: Input we received from step 1 is 14 for (4, -5) test co-ordinates. We must go 12 steps upwards from (4, -5) on the y-axis. We land on (4,7). We have to move 2 steps (14-12 = 2 steps) on the left and we land on (2,7).

iv) From that point keep going diagonally towards the bottom-left corner. Mark all the points on the imaginary diagonal line.

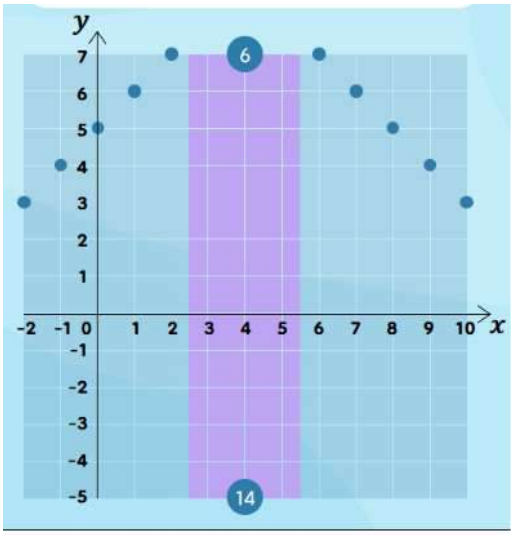
Example 2: From (2,7) move diagonally towards the left bottom corner. Mark the other co-ordinates -> (1,6), (0,5), (-1,4) and (-2,3).



Step 3:

a) If input of step 1>12:
    i. Enter the test co-ordinates for the point you land on, if you go upward 12 steps from the center of the bottom of the grid.

Example 2: From (4, -5) move 12 steps upwards on the y-axis and we get to land on (4, 7). Mark the co-ordinate (4, 7) and enter it to receive an input.



Step 4: Now eliminate the other possibilities.

a) If input of step1 >12,
    i) From the test co-ordinates of step3, go right [(input of step1)-12] steps

Example 2: From (4,7), move 2 steps (14-12=2 steps) on the right and we land on (6, 7).

ii) Then from that point proceed $\left(\left[\text{(Input of step3)}-\{\text{(input of step1)}-12\}\right]\div 2\right)$ step(s) diagonally towards the bottom right corner. Erase all the marked points on the right side of the shaded part, except the point we land on.

Example 2: From (6,7), move the number of steps as per the formula above

$$\left(\left[\text{(Input of step3)}-\{\text{(input of step1)}-12\}\right]\div 2\right) = \left(\left[6-\{14-12\}\right]\div 2\right)$$

$$= \left(\left[6-\{2\}\right]\div 2\right) = \left(\left[4\right]\div 2\right) = 2$$

Move 2 steps diagonally from (6, 7) on one side towards the bottom right corner and we land on **(8,5)**

iii) From the test co-ordinates of step3, go left [(input of step1)-12] steps

Example 2: From (4,7), move 2 steps (14-12=2 steps) on the left and we land on (2, 7).

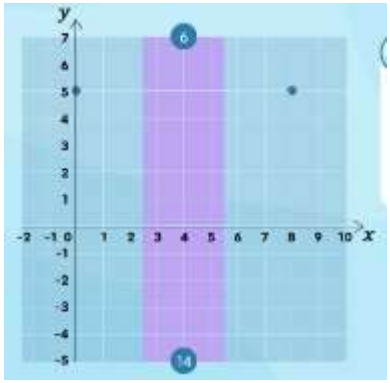
iv) Then from that point proceed $\left(\left[\text{(Input of step3)}-\{\text{(input of step1)}-12\}\right]\div 2\right)$ step(s) diagonally towards the bottom left corner. Erase all the marked points in the left side of the shaded part, except the point we land on.

Example 2: From (2,7), move the number of steps as per the formula above

$$\left(\left[\text{(Input of step3)}-\{\text{(input of step1)}-12\}\right]\div 2\right) = \left(\left[6-\{14-12\}\right]\div 2\right)$$

$$= \left(\left[6-\{2\}\right]\div 2\right) = \left(\left[4\right]\div 2\right) = 2$$

Move 2 steps diagonally from (2, 7) on other side towards the bottom left corner and we land on **(0,5)**

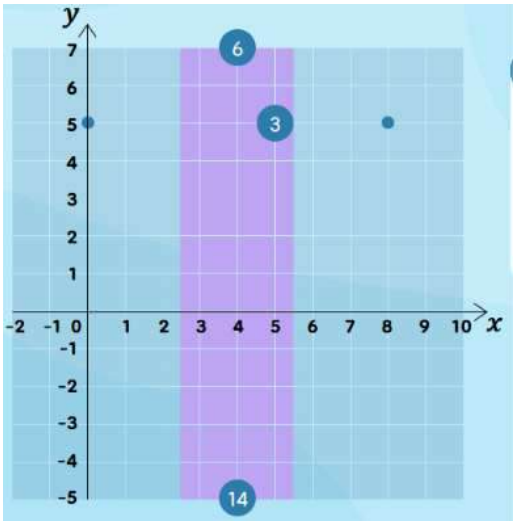


Step 5: Now that we have two points, draw an imaginary line connecting them. Locate the center point on the line (which will be found in the shaded part).

Example 2: Our co-ordinates are (0.5) and (8,5). Center for the two points is (4,5)

Step 6: Move one point left or right from the center along the imaginary line (note that, the chosen point must be inside the shaded part).
Example 2: Center for this example is (4, 5). We can choose one of the two points for finding the treasure -> (5,5) or (3, 5)

Step 7: Choose that test coordinate and enter it.
Example 2: We chose (5,5) and received input as 3.



Step 8: Now, using the input we receive, eliminate the other marked point to find the treasure.
Example 2: Moving 3 steps, our treasure co-ordinate is (8, 5). We eliminated the other marked point.

