Line Graphs Questions for NMAT

Instructions
For the following questions answer them individually

Question 1

The area, in sq. units, enclosed by the lines $x = 2, y = \mid x - 2 \mid + 4$, the X-axis and the Y-axis is equal to

A 10

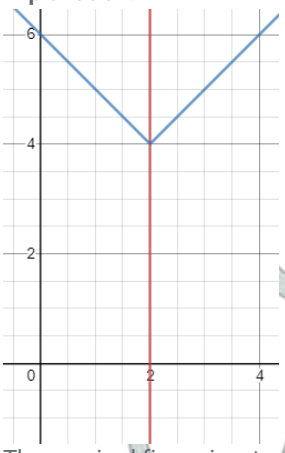
B 6

C 8

D 12

Answer: A

Explanation:



The required figure is a trapezium with vertices A(0,0), B(2,0), C(2,4) and D(0,6)

AB = 2 BC = 4 and AD = 6

Area of trapezium = $\frac{1}{2}(sum\ of\ the\ opposite\ sides) \cdot height = \frac{1}{2}(4+6) \cdot 2 = 10$

Question 2

Determine the value(s) of "a" for which the point (a, a^2) lies inside the triangle formed by the lines: 2x+ 3y= 1, x+ 2y=3 and 5x-6y= 1

A (-3,-1) ⋃ (1/2, 1)

B (-∞, 1/3) ⋃ (1/2, ∞)

C (-3/2,-1) ⋃ (1/2, 1)

D (-∞, 1) ⋃ (1/3, 6)

E None of the above

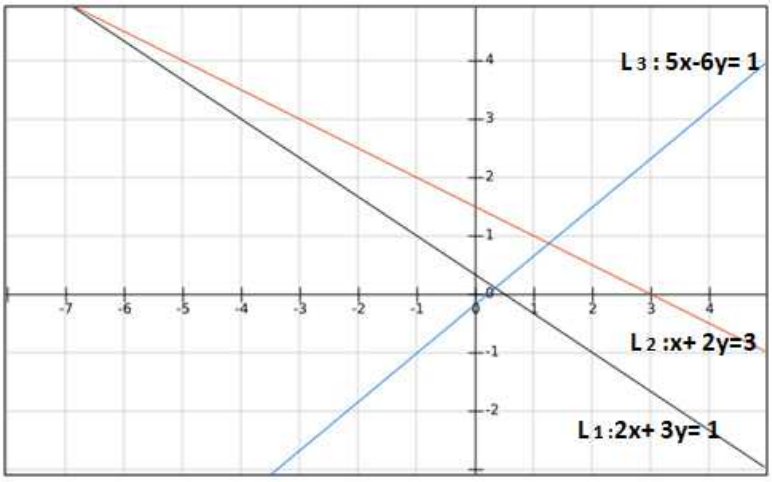
Answer: C

Explanation:
Let us draw the diagram first,

Let L_1: 2x+ 3y -1 = 0

L_2: x+ 2y -3 = 0

L_3: 5x-6y- 1 = 0



With respect to L_1, we can see that the point (a, a^2) lies within the triangle and (0, 0) are opposite side. Therefore,

$L_{(a,a^2)} * L_{(0,0)} < 0$

$\Rightarrow (2a + 3a^2 - 1)(-1) < 0$

$\Rightarrow (3a^2 + 2a - 1) > 0$

$\Rightarrow a < -1$ or $a > \frac{1}{3}$ ... (1)

With respect to L_2, we can see that the point (a, a^2) lies within the triangle and (0, 0) are on the same side. Therefore,

$L_{(a,a^2)} * L_{(0,0)} > 0$

$\Rightarrow (a + 2a^2 - 3)(-3) > 0$

$\Rightarrow (2a^2 + a - 3) < 0$

$\Rightarrow \frac{-3}{2} < a < 1$ ... (2)

With respect to L_3, we can see that the point (a, a^2) lies within the triangle and (0, 0) are on the same side. Therefore,

$L_{(a,a^2)} * L_{(0,0)} > 0$

$\Rightarrow (5a - 6a^2 - 1)(-1) > 0$

$\Rightarrow (6a^2 - 5a + 1) > 0$

$\Rightarrow a < \frac{1}{3}$ or $a > \frac{1}{2}$ ... (3)

From equation (1), (2) and (3) we can say that

$a \in (-3/2,-1) \cup (1/2, 1)$. Hence, option C is the correct answer.

Question 3

When the curves $y = log_{10}x$ and $y = x^{-1}$ are drawn in the x-y plane, how many times do they intersect for values $x \geq 1$?

A Never

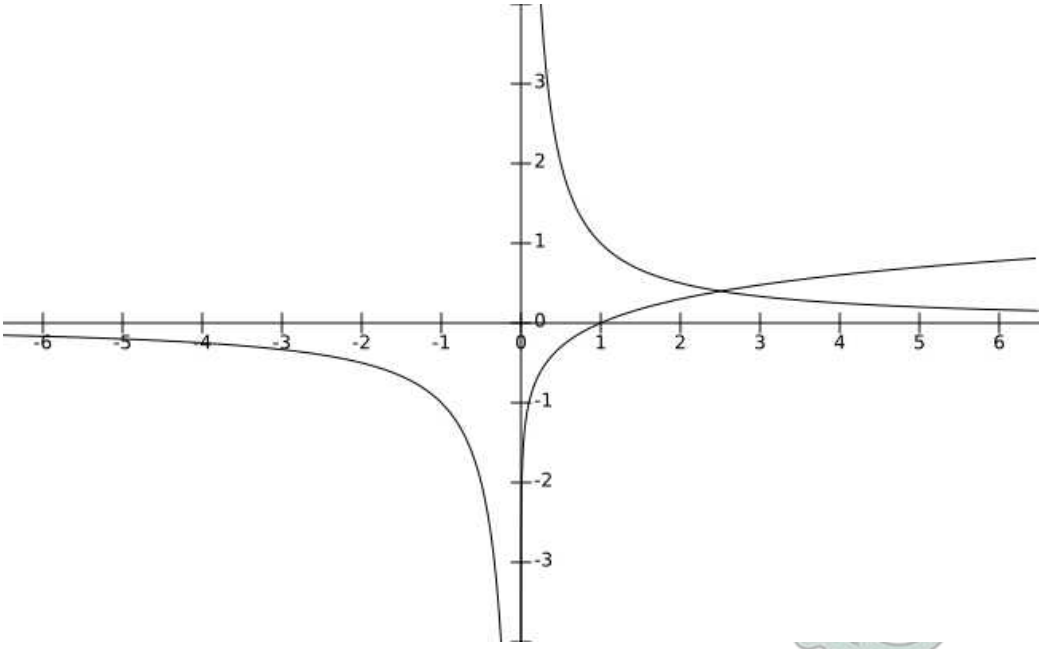
B Once

C Twice

D More than twice

Answer: B

Explanation:
Graph of logx goes on increasing in 1st quadrant and graph of 1/x goes no decreasing with both intersecting only once



Question 4

In the X-Y plane, the area of the region bounded by the graph of |x+y| + |x-y| = 4 is

A 8

B 12

C 16

D 20

Answer: C

Explanation:
If the moduli are removed, the equations formed are

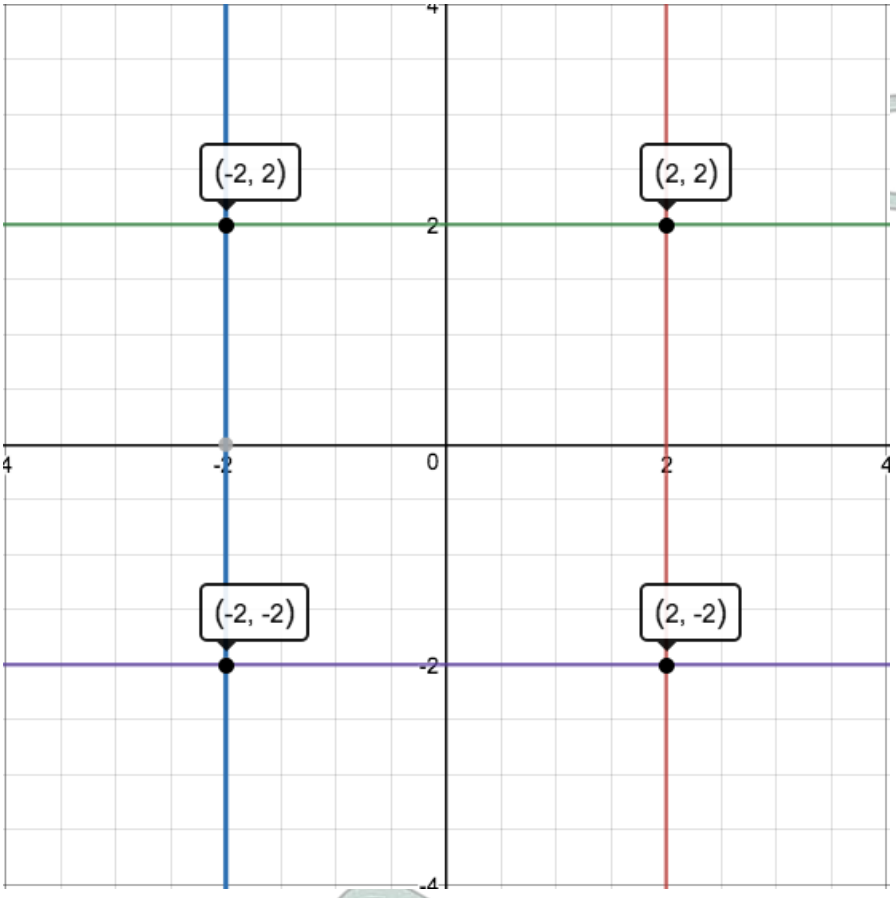
x+y+x-y = 4 => x=2

x+y-x+y = 4 => y =2

-x-y+x-y = 4 => y=-2

-x-y-x+y = 4 => x=-2

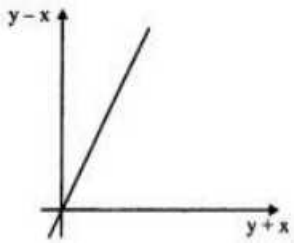
The area enclosed by these equations is a square with vertices at (2,2), (-2,2), (-2,-2), (2,-2) as shown in figure.



The required area = 4*4 = 16

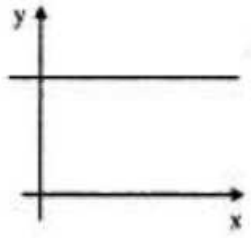
Question 5

The graph of y - x (on the y axis) against y + x (on the x axis) is as shown below. (All graphs in this question are drawn to scale and the same scale and the same scale has been used on each axis.)

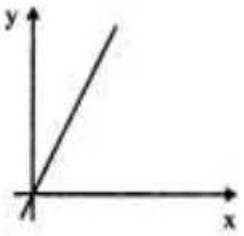


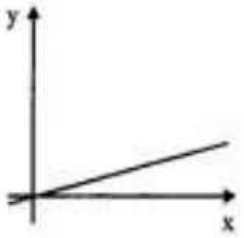
Which of the following shows the graph of y against x?

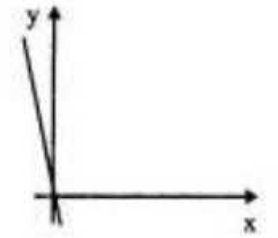
A



B



C 

D 

Answer: D

Explanation:
For a normal graph with y and x-axis, the equation of the line passing through the origin is y =mx where m is the slope of the line.

m is +ve if the angle made by the line with the x-axis is < 90°

$\therefore$ The equation of the line in the given graph would be y-x = k(y+ x) since the axes are y-x and y+x and the line is passing through the origin.

k > 1 because the angle is greater than 45°

$y = \frac{k(x+1)}{1-k}$

Since k>1

Therefore y<0 for x>-1 and y>0 for x<-1

Option d correctly satisfy this condition

Question 6

The number of real-valued solutions of the equation $2^x + 2^{-x} = 2 - (x-2)^2$ is:

A 1

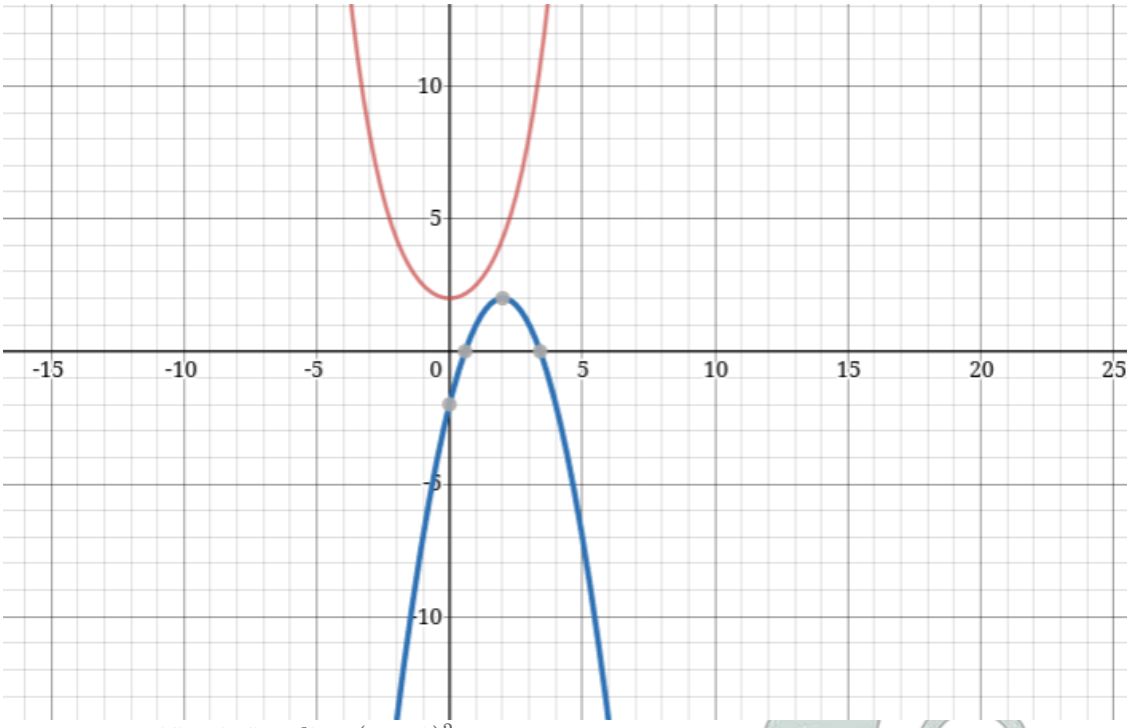
B 2

C infinite

D 0

Answer: D

Explanation:



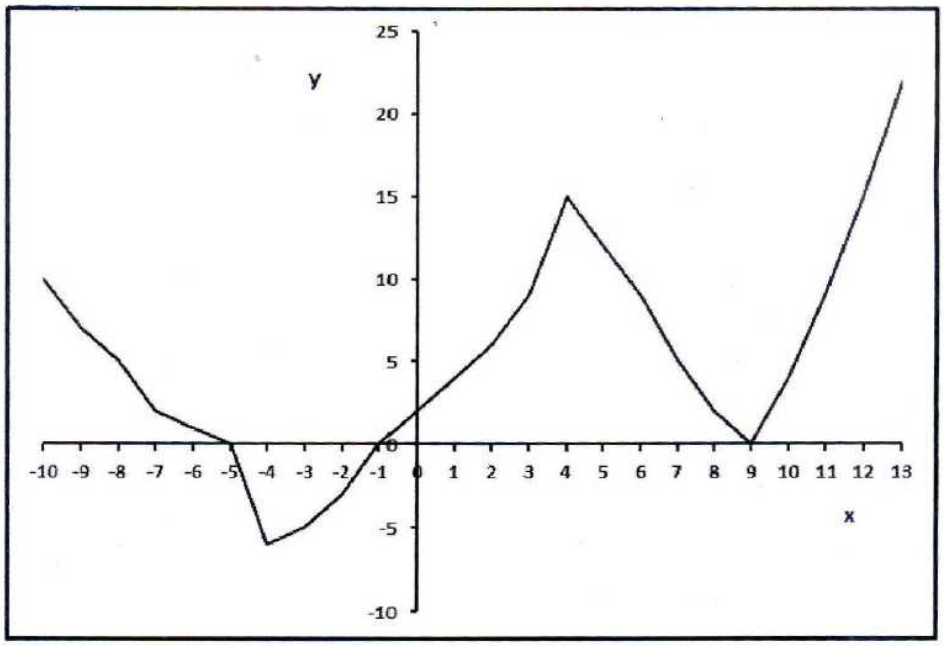
The graphs of $2^x + 2^{-x} and 2 - (x-2)^2$ never intersect. So, number of solutions=0.

Alternate method:

We notice that the minimum value of the term in the LHS will be greater than or equal to 2 {at x=0; LHS = 2}. However, the term in the RHS is less than or equal to 2 {at x=2; RHS = 2}. The values of x at which both the sides become 2 are distinct; hence, there are zero real-valued solutions to the above equation.

Question 7

The figure below shows the graph of a function f(x). How many solutions does the equation f(f(x)) = 15 have?



A 5

B 6

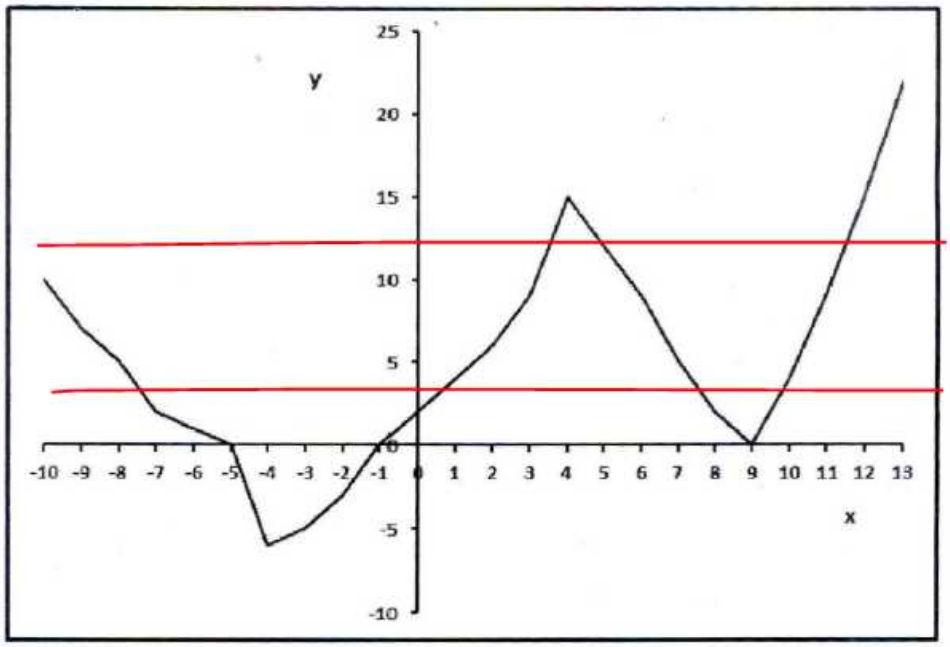
C 7

D 8

E cannot be determined from the given graph

Answer: C

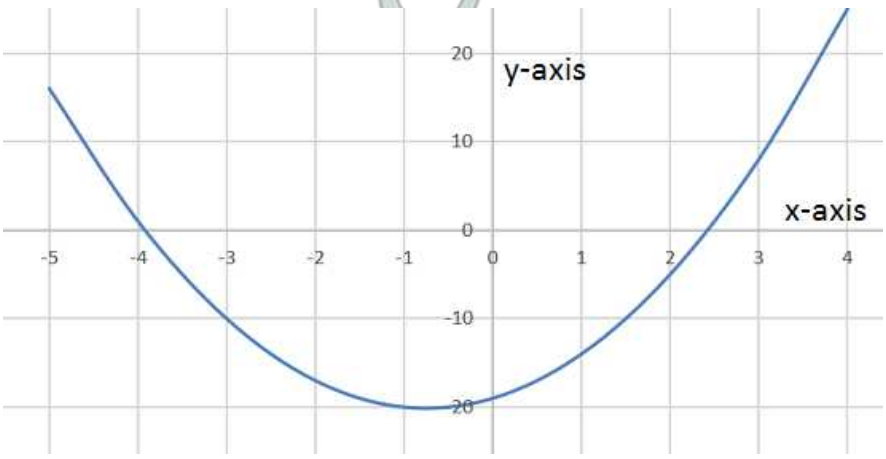
Explanation:
It has been given that f(f(x)) = 15.
From the graph, we can see that the value of f(4) = 15 and f(12) = 15
Therefore, f(x) can be 4 or 12.



When f(x) = 4, x can take 4 values
When f(x) = 12, x can take 3 values.
Therefore, there are 4+3 = 7 solutions in total.
Therefore, option C is the right answer.

Question 8

Find the equation of the graph shown below.



A y = 3x - 4

B y = $2x^2$ - 40

C x = $2y^2$ - 40

D y = $2x^2$ + 3x - 19

E $x = 2y^2 + 3x - 19$

Answer: D

Explanation:
When x = -3, y = -10
This is satisfied only in option D.

Hence, option D is the correct answer.

Question 9

Let g(x) = max(5 - x, x + 2). The smallest possible value of g(x) is

A 4.0

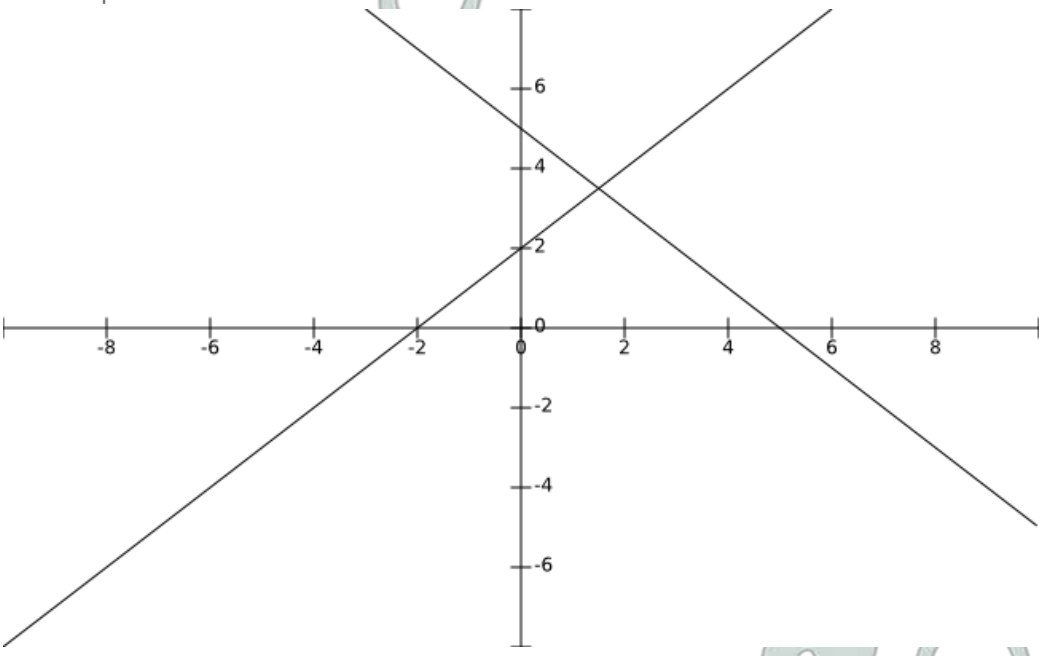
B 4.5

C 1.5

D None of the above

Answer: D

Explanation:
Smallest possible value would be at 5-x = x+2 i.e. x= 1.5 as shown



Substituting we get smallest value as 3.5.

Question 10

The area bounded by the three curves |x+y| = 1, |x| = 1, and |y| = 1, is equal to:

A 4

B 3

C 2

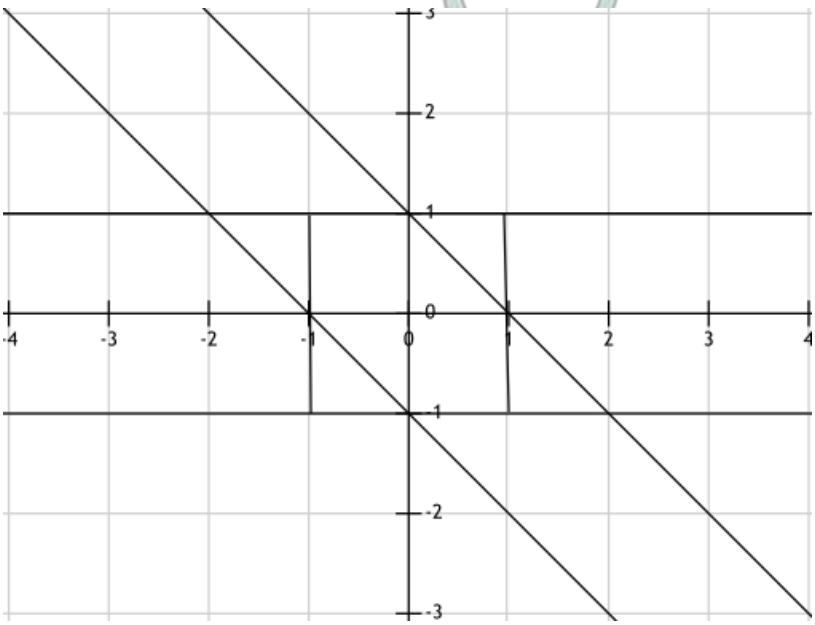
D 1

Answer: B

Explanation:

|x| = 1 and |y| = 1 form a square of area = 2*2 = 4 sq units

|x+y| = 1 forms a set of parallel lines cutting the axes at (1,0), (0,1), (-1,0) and (0,-1). The graph is as shown:



The area bounded by the three curves is 2*2 - 1/2*1*1*2 = 4 - 1 = 3 sq units