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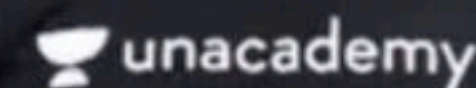
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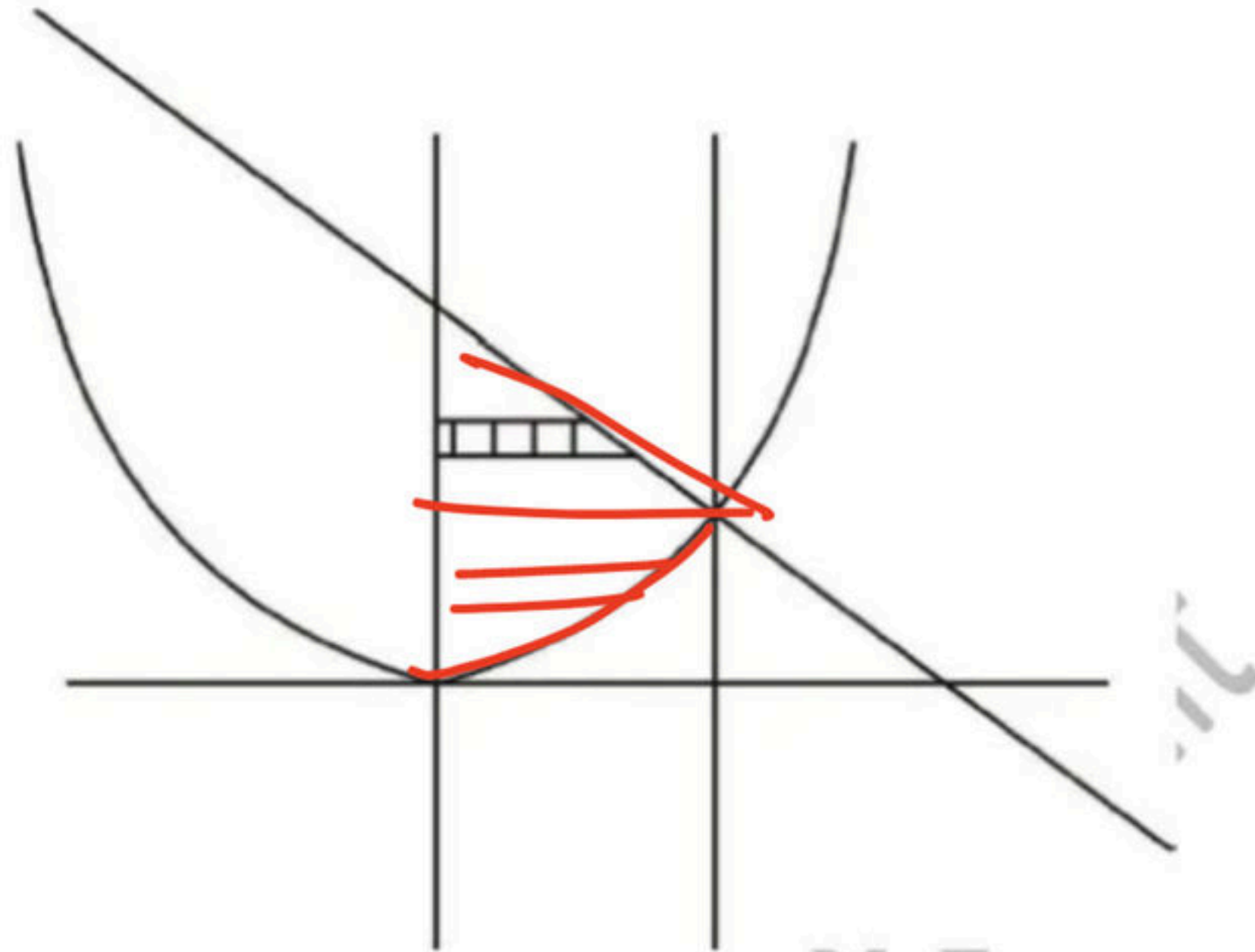
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## Change of order in mixed region

We know that if strip move on more than two curve then the region is called mixed region.

**Example :**



Then for double integration, we divide into simple region.



$$\int_0^{2a} \int_{\frac{x^2}{4a}}^{3a-x} f(x,y) dy dx$$

$x=0$   $y=\frac{x^2}{4a}$

$$\frac{x=0}{x=2a}$$

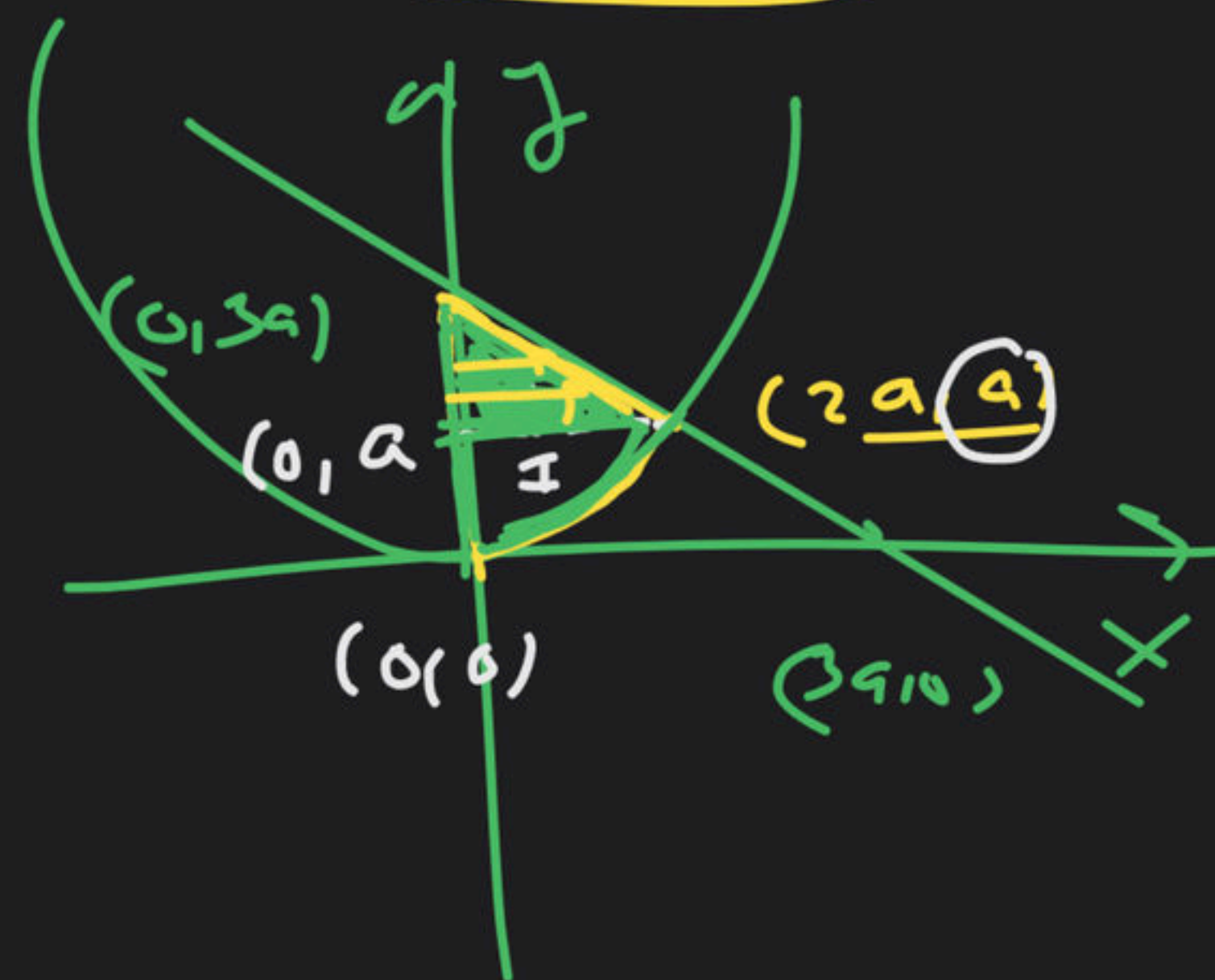
$$\frac{y=x^2/4a}{y=3a-x} \quad | \quad \underline{\underline{y^2=4xy}}$$

$y+3a=x$

$$\int_0^a \int_0^{2\sqrt{ay}} f(x,y) dx dy + \int_a^{3a} \int_0^{3a-y} f(x,y) dx dy$$

$y=0$   $x=0$   $y=a$   $x=0$

$I$   $II$



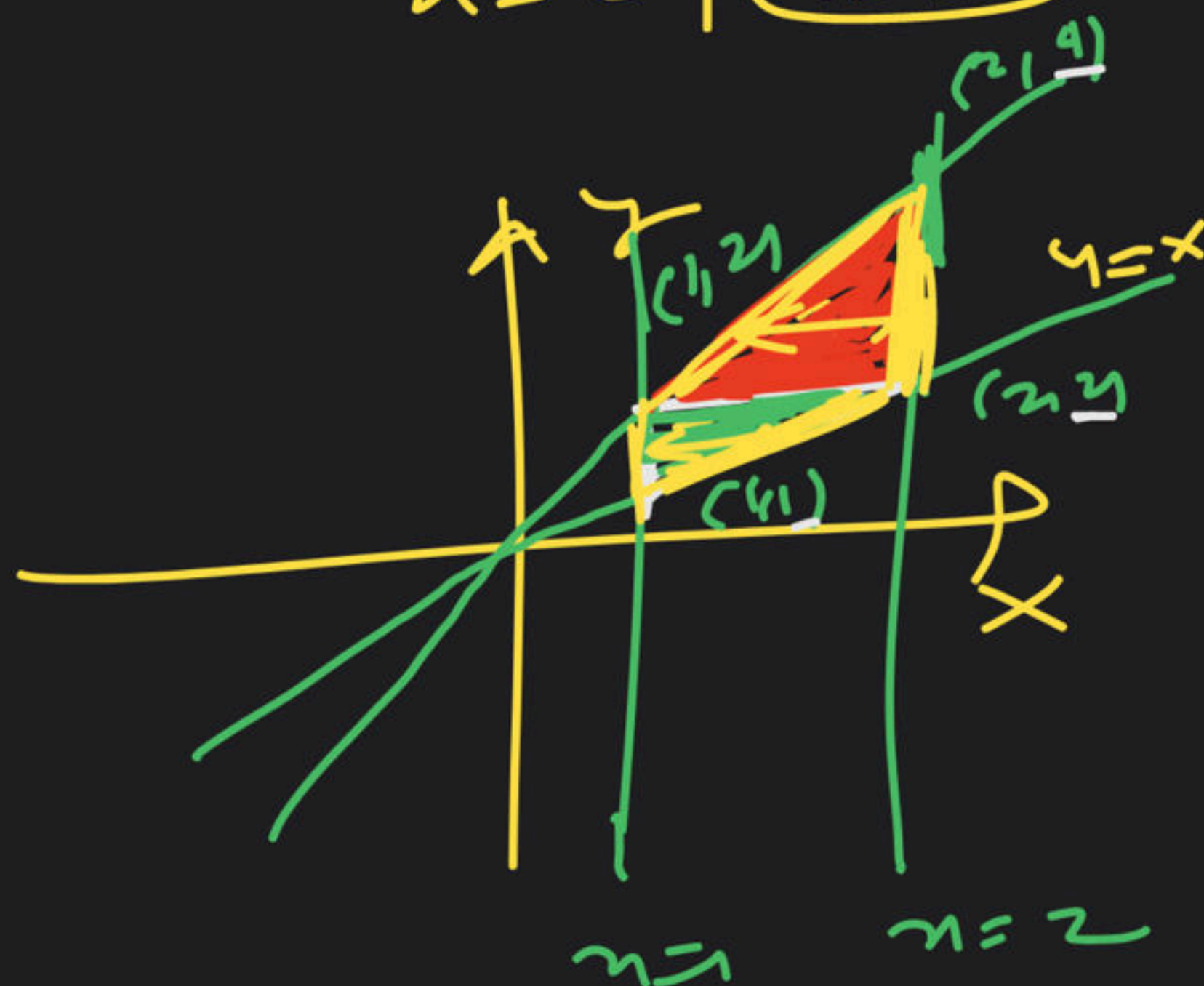
$$\int_1^2 \int_{x=1}^{y=2} f(x,y) dy dx$$

$$\int_1^2 \int_{x=1}^y f(x,y) dx dy + \int_2^4 \int_{x=y/2}^2 f(x,y) dx dy$$

I

$$x=1 \quad | \quad y=x$$

$$x=2 \quad | \quad \textcircled{y=2x}$$





Q1. Change the order of integration  $\int_0^1 \int_{x-1}^{\sqrt{1-x^2}} f(x, y) dy dx$ .

IIT-JAM-2010

(a)  $\int_0^1 \int_0^{\sqrt{1-y^2}} f(x, y) dx dy + \int_{-1}^0 \int_0^{1+y} f(x, y) dx dy$

(b)  $\int_0^1 \int_0^{\sqrt{1-y^2}} f(x, y) dx dy - \int_{-1}^0 \int_0^{1+y} f(x, y) dx dy$

(c)  $\int_0^1 \int_0^{1+y} f(x, y) dx dy - \int_{-1}^0 \int_0^{1+y} f(x, y) dx dy$

(d) None of these

$x=0$

$x=1$

$y=x$

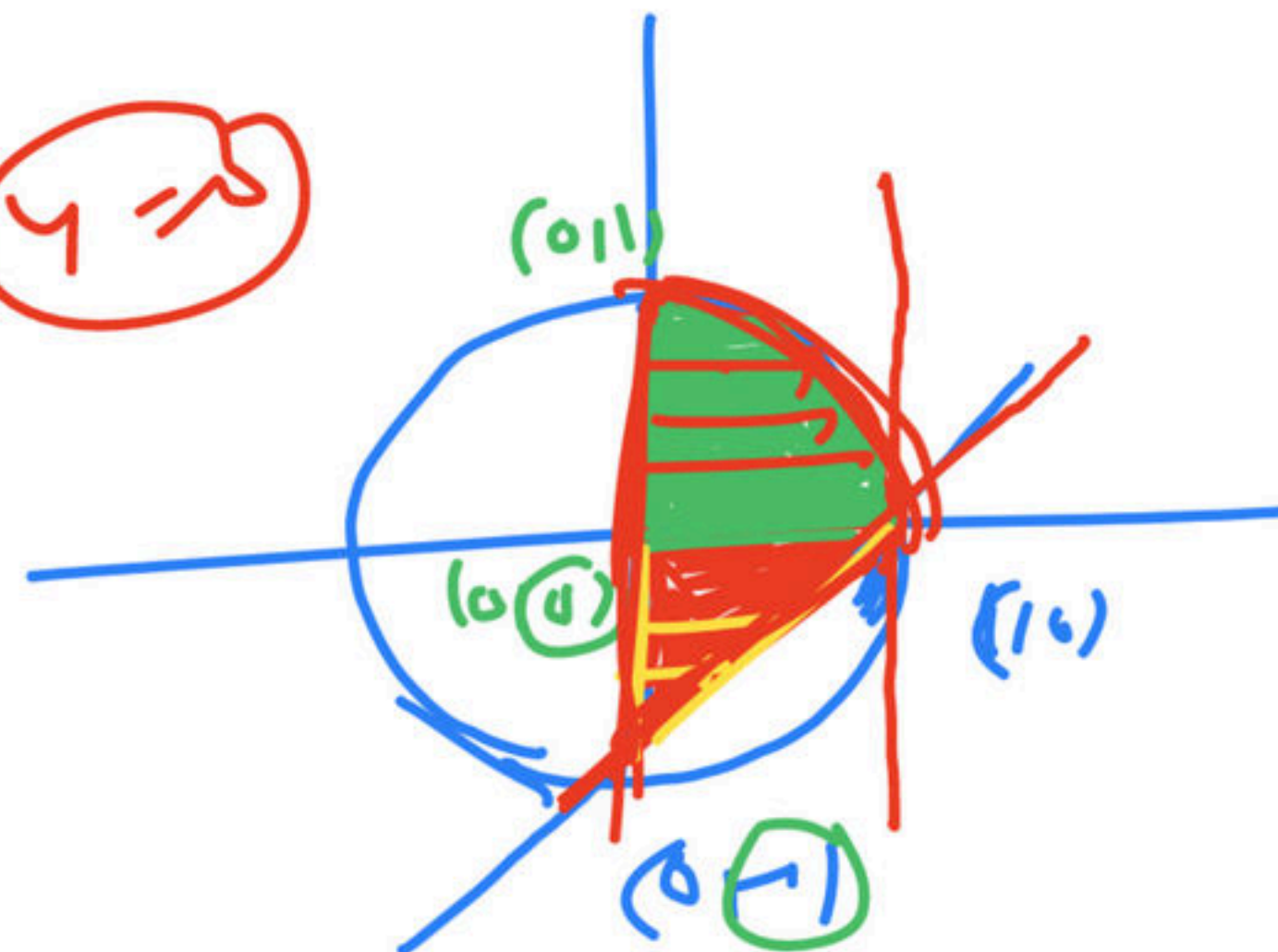
$y=\sqrt{1-x^2}$

$x-y=1$

$x^2+y^2=1$

$y=0$   $x=0$

$y=x$





Q2. The value of  $\int_0^{\pi/2} \int_{\pi/2}^{\pi} \frac{\sin x}{x} dx dy + \int_{\pi/2}^{\pi} \int_{\pi/2}^{\pi} \frac{\sin x}{x} dx dy$

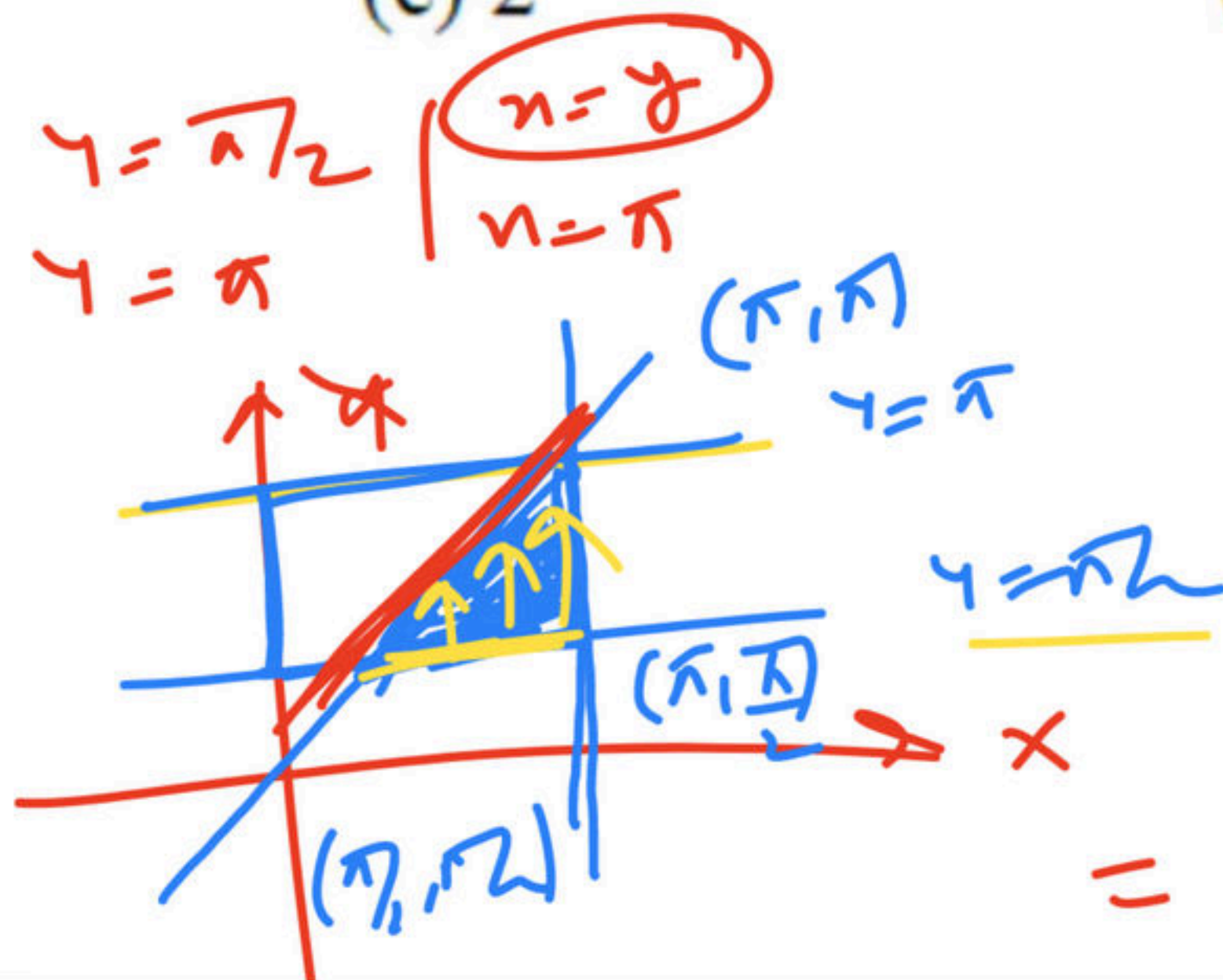
IIT-JAM-2007

(a) 0

(b) 1

(c) 2

(d) 3



$$\int_{\pi/2}^{\pi} \int_{\pi/2}^{\pi} \frac{\sin x}{x} dx dy + \int_{\pi/2}^{\pi} \int_{\pi/2}^{\pi} \frac{\sin x}{x} dx dy$$

$$\frac{\pi}{2} \int_{\pi/2}^{\pi} \frac{\sin x}{x} dx + \int_{\pi/2}^{\pi} \frac{\sin x}{x} (y) \pi/2 dx$$

$$\frac{\pi}{2} \int_{\pi/2}^{\pi} \frac{\sin x}{x} dx + \int_{\pi/2}^{\pi} (x - \pi/2) \frac{\sin x}{x} dx$$

$$= -(\cos x)_{\pi/2}^{\pi} = -(5\pi - 3\pi/2)$$



Q3. Change the order of integration in  $\int_{-1}^2 \int_{-x}^{2-x^2} f(x, y) dy dx$ .

IIT-JAM – 2010

(a)  $\int_{-1-\sqrt{2-y}}^2 \int_{\sqrt{2-y}}^1 f(x, y) dx dy - \int_{-2}^1 \int_{-y}^{\sqrt{2-y}} f(x, y) dx dy$

(b)  $\int_{1-\sqrt{2-y}}^2 \int_{\sqrt{2-y}}^1 f(x, y) dx dy + \int_0^1 \int_{-y}^{\sqrt{2-y}} f(x, y) dx dy$

(c)  $\int_{-\sqrt{2-y}}^2 \int_{\sqrt{2-y}}^1 f(x, y) dx dy + \int_{-2}^1 \int_{-y}^{\sqrt{2-y}} f(x, y) dx dy$

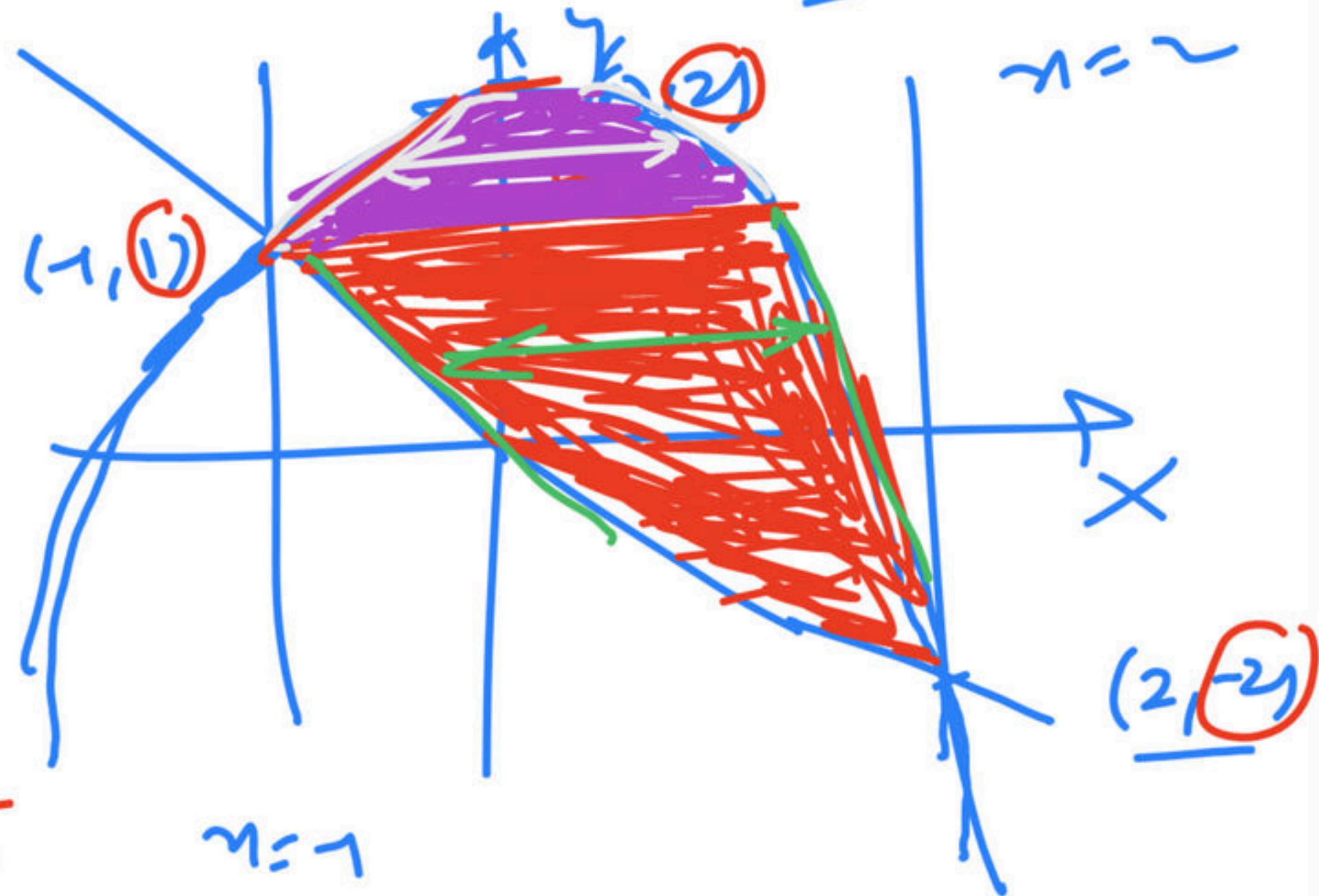
(d) None of these

Handwritten notes:

$$\begin{aligned} x=1 & \quad y=-x \\ x=2 & \quad y=2-x^2 \\ y^2 &= 2-y \\ y^2 &= -(1-y) \end{aligned}$$

Handwritten note:

$$y = 2 - \sqrt{2-x}$$



Handwritten note:

$$y = -1$$

Handwritten notes:

$$\begin{aligned} & 2 - \sqrt{2+y} \\ & + \int_1^2 \int_{-\sqrt{2-y}}^{\sqrt{2-y}} f(x, y) dx dy \end{aligned}$$

Handwritten notes:

$$\begin{aligned} & y = -2 \\ & y = -x \end{aligned}$$



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- MODERN ALGEBRA



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Q4. Change the order of  $\int_0^1 \int_0^{1/x} \frac{y}{(1+xy)^2(1+y^2)} dy dx$

(a)  $\int_0^1 \int_0^\infty \frac{y}{(1+xy)^2(1+y^2)} dx dy + \int_1^\infty \int_0^{1/y} \frac{-y}{(1+xy)^2(1+y^2)} dx dy$

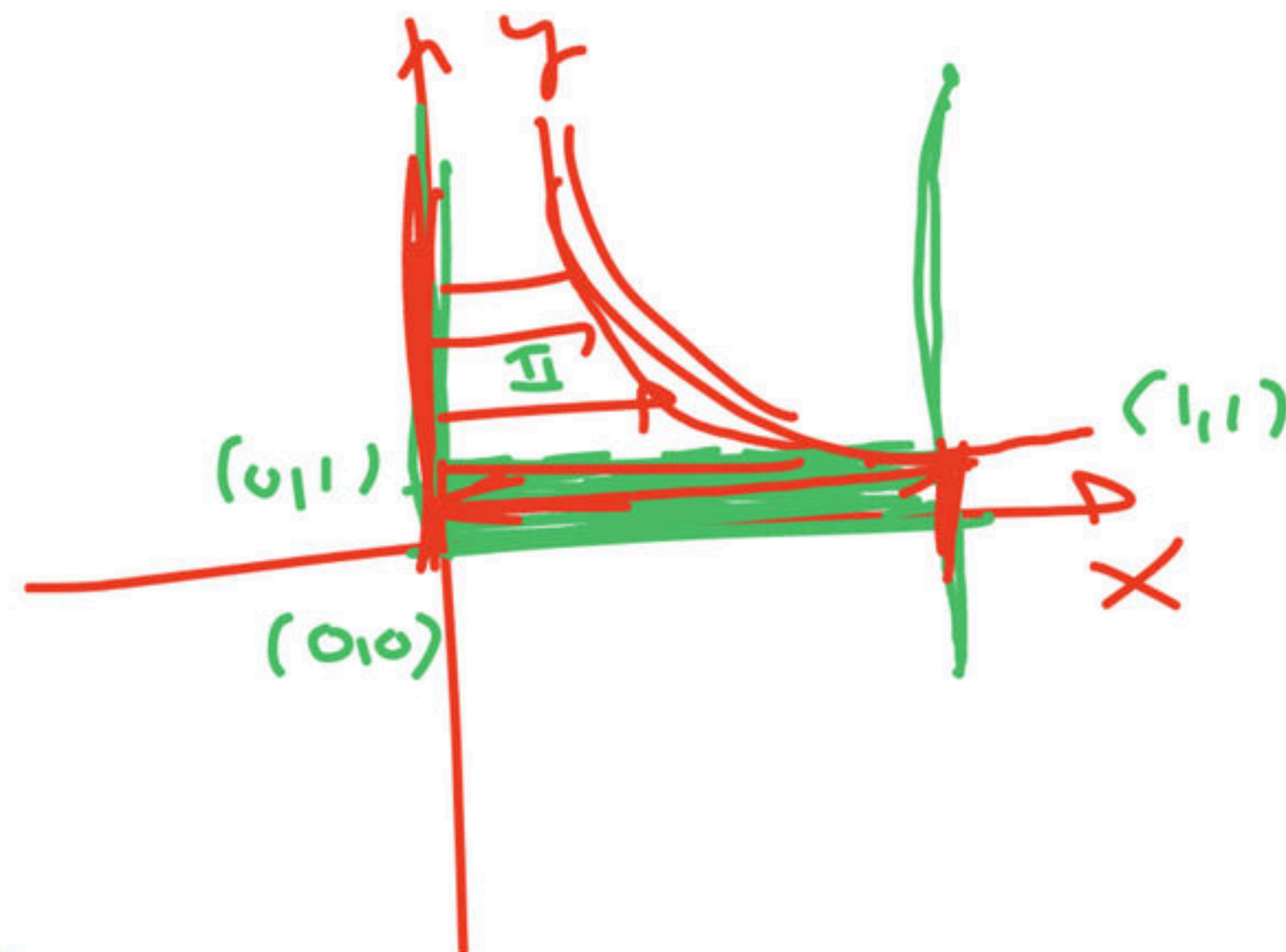
(b)  $\int_0^1 \int_0^1 \frac{y}{(1+xy)^2(1+y^2)} dx dy + \int_1^\infty \int_0^{1/y} \frac{y}{(1+xy)^2(1+y^2)} dx dy$

(c)  $\int_0^1 \int_0^1 \frac{y}{(1+xy)^2(1+y^2)} dx dy - \int_1^\infty \int_0^{1/y} \frac{y}{(1+xy)^2(1+y^2)} dx dy$

(d) None of these

$x=0$   $y=\infty$   
 $x=1$   $y=1/x$

$xy=1$



$\int_0^1 \int_0^1$   
 $y=0$   $x=0$

$+ \int_1^\infty \int_0^{1/y}$   
 $y=1$   $x=0$



Q5. Change the order of integration in  $\int_0^{2a} \int_{x^2/4a}^{3a-x} f(x, y) dy dx$ .

(a)  $I = \int_0^a \int_0^{\sqrt{4ay}} f(x, y) dx dy + \int_a^{3a} \int_0^{3a-y} f(x, y) dx dy$

(b)  $I = \int_0^a \int_0^{\sqrt{4ay}} f(x, y) dx dy - \int_a^{3a} \int_0^{3a-y} f(x, y) dx dy$

(c)  $I = \int_0^a \int_0^{a-y} f(x, y) dx dy + \int_a^{3a} \int_0^{3a-y} f(x, y) dx dy$

(d) None of these



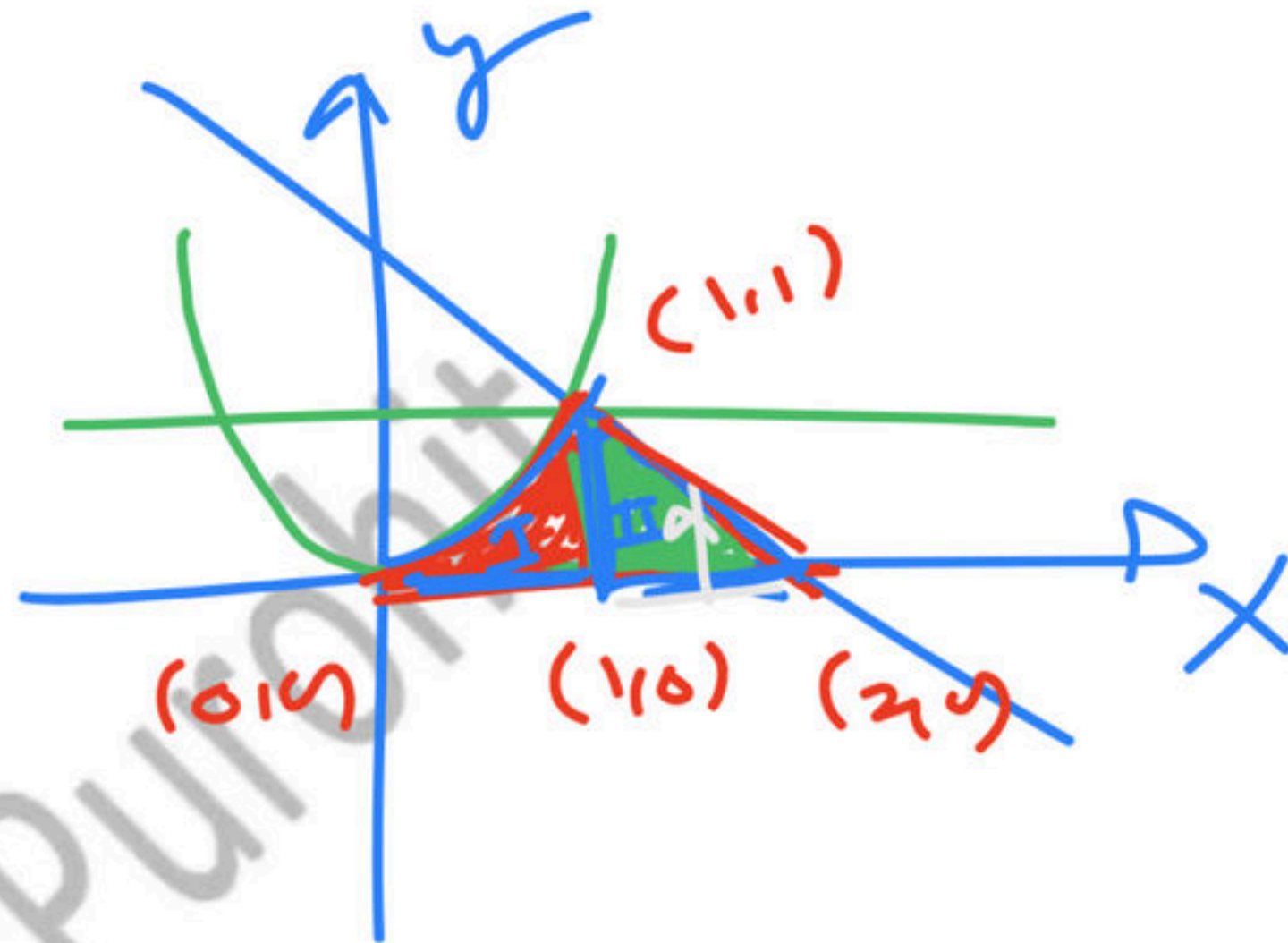
Q6 Change the order of double integration  $I = \int_0^1 \int_{\sqrt{y}}^{2-y} f dx dy$

(a)  $I = \int_0^1 \int_0^{x^2} f dy dx - \int_1^2 \int_0^{2-x} f dy dx$

(b)  $I = \int_0^1 \int_0^{x^2} f dy dx + \int_1^2 \int_0^{2-x} f dy dx$

(c)  $I = \int_0^1 \int_0^{x^2} f dy dx + \int_0^1 \int_0^{x^2 2-x} f dy dx$

(d) None of these



$y=0$   
 $y=1$

$x=0$   
 $x=2-y$   
 $x+y=2$   
 $y^2=x$

$x=0$   
 $y=0$

$x=1$   
 $y=0$

$x=2-y$



**Q7.** Change the order of integration in the double integral

$$\int_{-1}^2 \left( \int_{-x}^{2-x^2} f(x, y) dy \right) dx \quad \text{IIT-JAM - 2011}$$

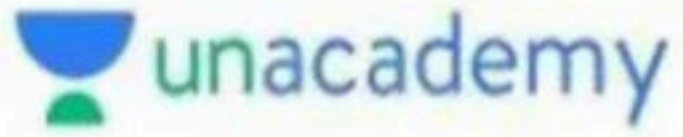
$$(a) \quad I = \int_{-2}^1 \left( \int_{-y}^{\sqrt{2-y}} f(x, y) dx \right) dy - \int_1^2 \left( \int_{-\sqrt{2-y}}^{\sqrt{2-y}} f(x, y) dx \right) dy$$

$$(b) \quad I = \int_{-2}^1 \left( \int_{-y}^{\sqrt{2-y}} f(x, y) dx \right) dy + \int_1^2 \left( \int_{-\sqrt{2-y}}^{\sqrt{2-y}} f(x, y) dx \right) dy$$

$$(c) \quad I = \int_0^1 \left( \int_{-y}^{\sqrt{2+y}} f(x, y) dx \right) dy + \int_0^2 \left( \int_{-\sqrt{2-y}}^{\sqrt{2-y}} f(x, y) dx \right) dy$$


(d) None of these





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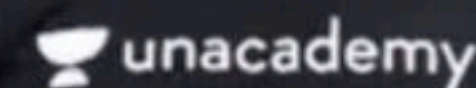
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