MATHS MICRO-PROJECT

M.H. SABOO SIDDIK POLYTECHNIC, MUMBAI

COMPUTER ENGINEERING

CO-2I

TOPIC: TO FIND AREA OF IRREGULAR SHAPE USING INTEGRATION

PREPARED BY:

19408: Zumair Dabir

19417: Sanskriti Mahadik

19422: Ashfaque Shaikh

19429: Shagufa Shaikh

UNDER THE GUIDANCE OF:

MS. HALEEMA ANSARI

Symbol of
Secularism & National Integration

Anjuman-I-Islam's

M.H SABOO SIDDIK POLYTEHNIC

(UNIT-Full Time Diploma)

8,Saboo Siddik Polytechnic Road,Byculla,Mumbai-78

CERTIFICATE

THIS TO CERTIFIY THAT Ms Sanskriti Mahadik 19417
Ms. Shagufa Shaikh 19429
Mr. Ashfaque Shaikh 19422
Mr. Zumair Dabir 19408

Of 1st Year/2nd Sem Diploma in **Computer Engineeing** has completed the term work Satisfactory in the subeject **Applied Mathematics** as prescribed by ,Maharashtra State Board of Technical Education,Mumbai

Place: **Mumbai**
Date: **13TH March 2020**

Lecturer **Head of Dept.** **Principal**

ANNEXURE 2

Evaluation Sheet for Micro Project

Academic Year:2019-20**Name of Faculty:**Ms. Haleema Ansari

Course: Computer Engineering**Course Code:**22224

Semester:2nd

Title of the Micro Project: Volume of irregular shapes using integration

Cos Outcomes Addressed by the Micro Project:

1. Apply the concept of Integration to find area of irregular shapes.
2. Learned the concept of revolution

Major Learning Outcomes Achieved by the students doing the Project:

a) **Practical Outcomes:** Solve Problems based on finding area of irregular shapes usinf Integration.

b) **Unit Outcomes in Cognitive Domain:** Invoke the concept of integration to Find the Area of irregular shape using Integration.

c) **Outcomes in Effective Domain:**____

d) **Comments / Suggestions about Team Work /Leadership/interpersonal Commenicaton (if any)**

Communication has improved among Group Members

Roll No.	Student's Name	Marks out of 6 for Performance in group activity	Marks out of 4 for Performance in Oral/Presentation	Total out of 10
19408	Zumair Dabir			
19417	Sanskriti Mahadik			
19422	Ashfaque Shaikh			
19429	Shagufa Shaikh			

Name & Signature of Faculty

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RATIONALE:

This Core Technological studies can be understood with the help of potential of mathematics. This Course is being introduced in the Diploma to provide mathematical background. The Course will give the insight to understand and analyse the engineering problems scientifically using Integration. This subject Enhances the multidimensional, logical thinking and reasoning capabilities. It also improves the systemic approach in the computer programming language.

Aims / Benefits of this Micro Project:

Using integral calculus, we can compute the area of irregular shape using integration. Provided they are solids of revolution or solids with known cross sections, and the edge or revolving line of the solids can be expressed as a function.

Course Outcomes Achieved:

Apply the concept of Integration to Find area of irregular Shapes using integration.

Literature Review:

- Apostol, Tom M. (1967), Calculus, Vol. 1: One-Variable Calculus with an Introduction to Linear Algebra (2nd ed.), Wiley, ISBN 9780471-00005-1
- Bourbaki, Nicolas (2004), Integration I, Springer Verlag, ISBN 3540-41129-1. In particular chapters III and IV.
- Burton, David M. (2005), The History of Mathematics: An Introduction (6th ed.), McGraw-Hill, p. 359, ISBN 978-0-073051895
- Cajori, Florian (1929), A History Of Mathematical Notations

  Volume II, Open Court Publishing, pp. 247–252, ISBN 978-048667766-8

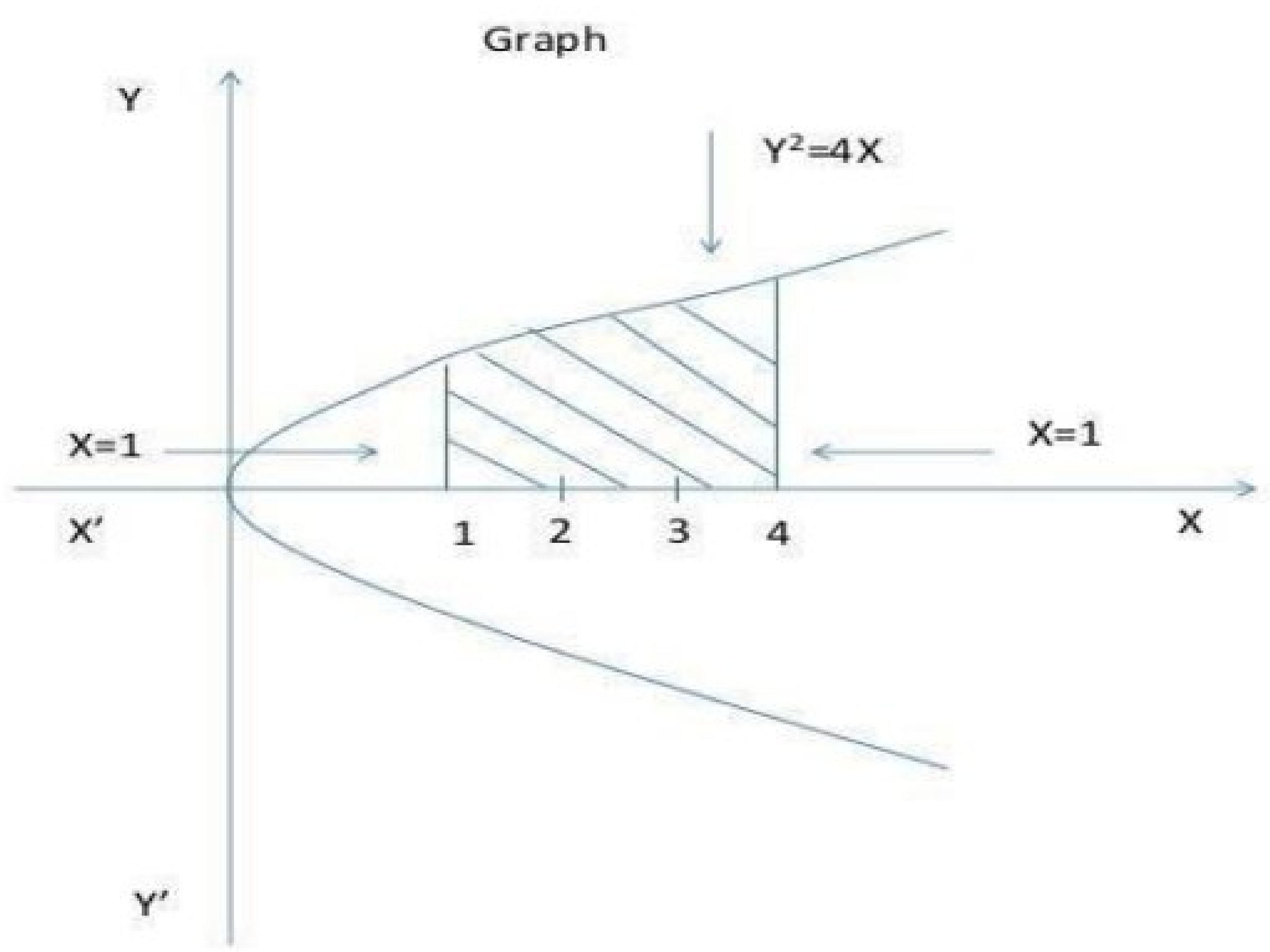
DEFINITION:

- In mathematics, an integral assigns numbers to functions in a way that can describe displacement, area, volume, and other concepts that arise by combining infinitesimal data. Integration is one of the two main operations of calculus, with its inverse operation, differentiation, being the other. Given a function *f* of a real variable *x* and an interval [*a*, *b*] of the real line.

- This definite integral can be interpreted informally as the signed area of the region in the *xy*-plane that is bounded by the graph of *f*, the *x*-axis and the vertical lines *x* = *a* and *x* = *b*. The area above the *x*-axis adds to the total and that below the *x*-axis subtracts from the total.

- The operation of integration, up to an additive constant, is the inverse of the operation of differentiation. For this reason, the term *integral* may also refer to the related notion of the antiderivative, a function *F* whose derivative is the given function *f*. In this case, it is called an indefinite integral.

HOW TO FIND AREA OF IRREGULAR SHAPE USING INTEGRATION?



Q. Find the area bounded by the curve, x=axis and the given lines.
$Y^2=4x$, $x=1$, $x=4$

Ans :

$Y^2 = 4x$
$Y=2x$

$A=\int_1^4 y\,dx$

$=\int_1^4 2\sqrt{x}\,dx$

$2 \times \frac{2}{3}(x^{\frac{3}{2}})_1^4$

$\frac{28}{3}$ sq.units

○ ***Actual Methodology Followed:***

DAY 1: Our Respected Subject Teacher made a group of 4 members and gave the topic

Day 2: We Distributed the work among group members.

Day 3: Gathered information about the topic and started preparing the chart.

Day 4: Completed the Chart.

Day 5: Started making Report according to the proper defined format.

Day 6: Completed the Report.

Day 7: Cleared the doubts regarding to our project with th respected Subject teacher.

Day8: Successfully Completed the chart and Report and submitted to the Teacher.

○ *Actual Resources Used:*

Sr. No	Name of Resources / Materials	Specifications	Qty.
1.	Chart	A4 Size Max.	1
2.	Paper	A4 Size	1
3.	Computer	with Microsoft Word and Internet	1

○ *Output of the Micro-Project:*

- **Formula to find the area of irregular shape using Integration.**

○ *Skill Developed / Learning Outcomes:*

Thus, from this Micro-Project, we learned about the application of Integration to find area of irregular shape.

○ *Applications of this Micro Project:*

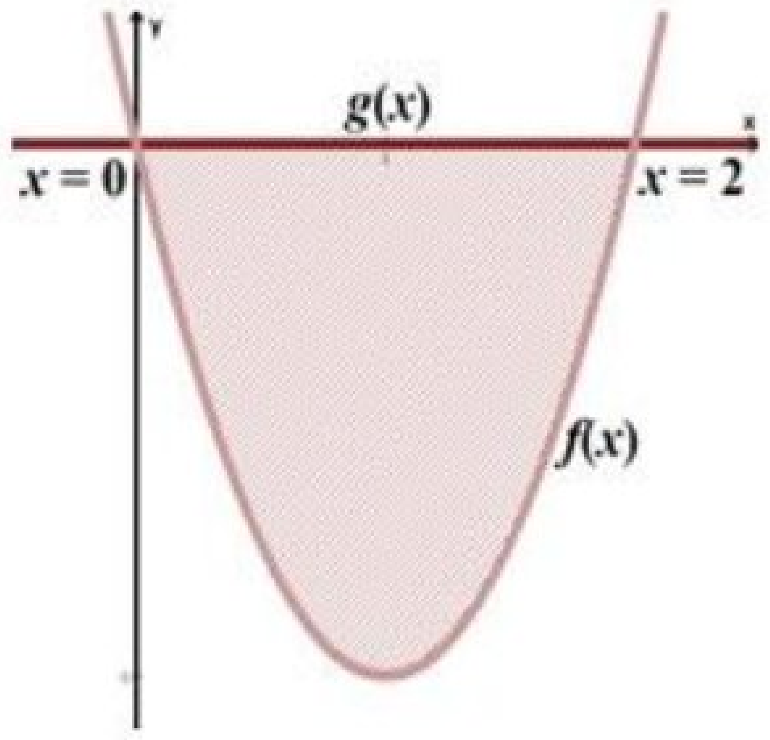
Here some examples of application of integration :

1. Your phone is running because of some Calculus,
2. Your fan is running because of AC which is a form of Calculus,
3. air conditioners work on the heat flow principles which involve Calculus,
4. Your bike's engine is working on the principles of conversion of energy from chemical to heat to mechanical which needed a way lot more Calculus than you imagined,
5. You travel in planes which are created on the principles of Aerodynamics whose key concept would again be Calculus,
6. Your ironing boxes, bulbs might have had some Calculus induced in them before they are in front of you.
7. Okay, this proves it. Every machine made thing/item required a machine. But Calculus is used to design those machines. So basically, it is goddamn EVERYWHERE!

Integration Area Problem and Solution

Set up the **definite integral** that gives the following area (don't solve):

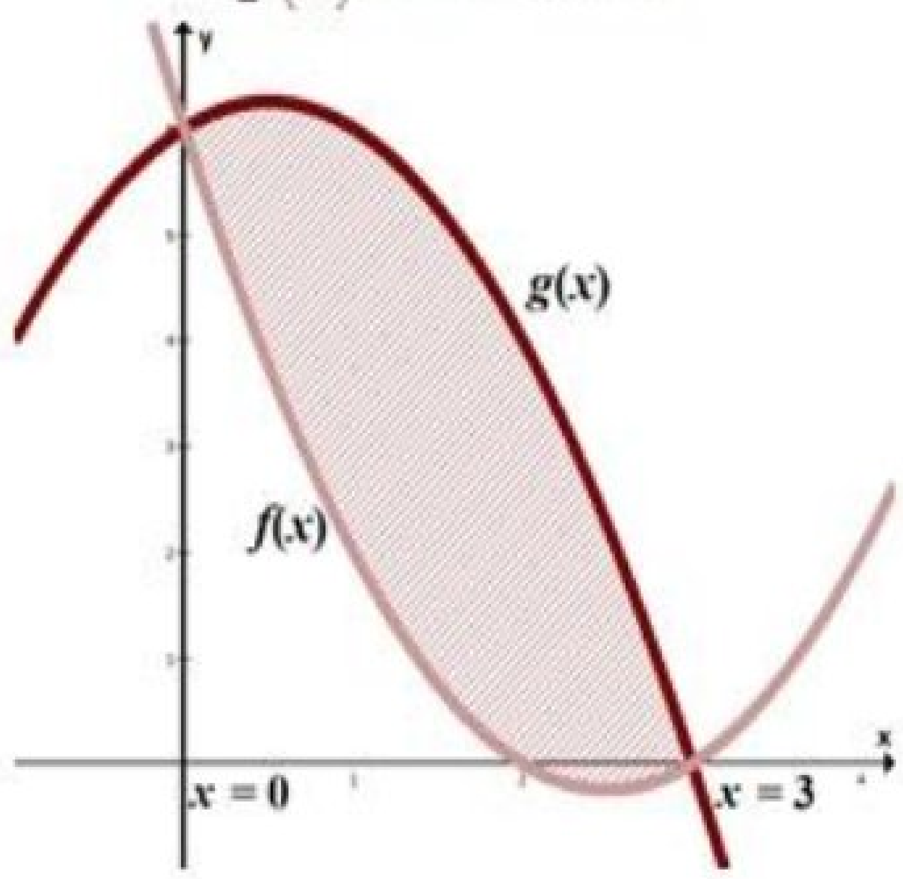
$$f(x)=x^2-2x$$
$$g(x)=0$$



Solution: $\int_0^2\left[0-\left(x^2-2x\right)\right]dx=-\int_0^2\left(x^2-2x\right)dx$

Set up and solve the **definite integral** that gives the following area:

$$f(x)=x^2-5x+6$$
$$g(x)=-x^2+x+6$$



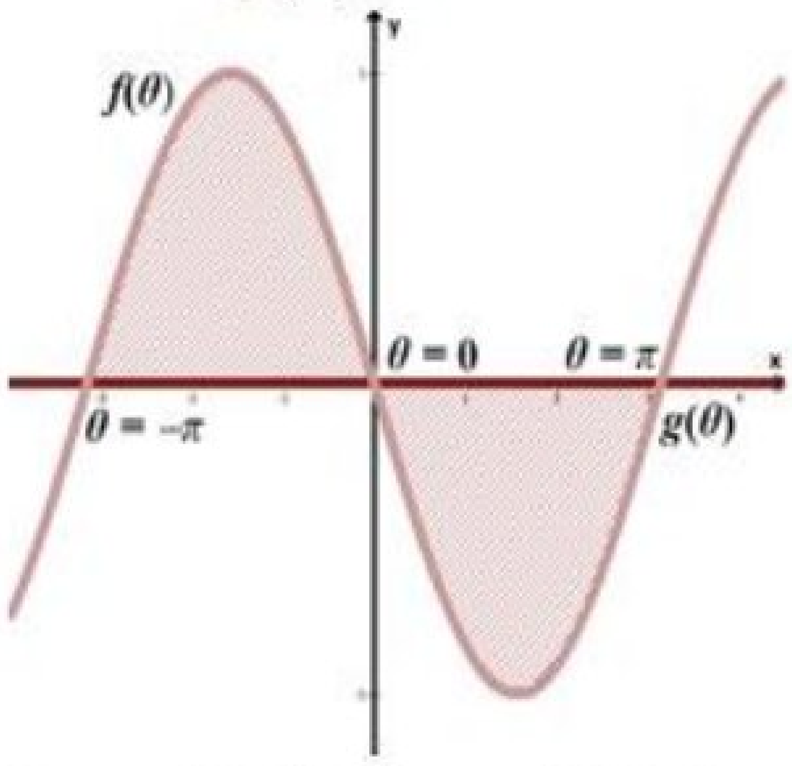
Solution:

$$\int_0^3\left[\left(-x^2+x+6\right)-\left(x^2-5x+6\right)\right]dx=\int_0^3\left(-2x^2+6x\right)dx$$

$$=\left[-\frac{2}{3}x^3+3x^2\right]_0^3=\left(-\frac{2}{3}(3)^3+3(3)^2\right)-\left(-\frac{2}{3}(0)^3+3(0)^2\right)=9$$

Set up and solve the **definite integral** that gives the following area (don't solve):

$$f(\theta)=-\sin\theta$$
$$g(\theta)=0$$



Solution: We need to divide graph into two separate integrals, since from $-\pi$ to 0, $f(\theta)\geq g(\theta)$, and from 0 to π, $g(\theta)\geq f(\theta)$:

$$\int_{-\pi}^{0}(-\sin\theta-0)\,d\theta+\int_0^{\pi}\left[0-(-\sin\theta)\right]d\theta=\int_{-\pi}^{0}(-\sin\theta)\,d\theta$$

$$+\int_0^{\pi}(\sin\theta)\,d\theta=\left[\cos x\right]_{-\pi}^{0}+\left[-\cos x\right]_0^{\pi}=\cos(0)$$

$$-\cos(-\pi)+\left[-\cos(\pi)+\cos(0)\right]=1-(-1)+(1+1)=4$$

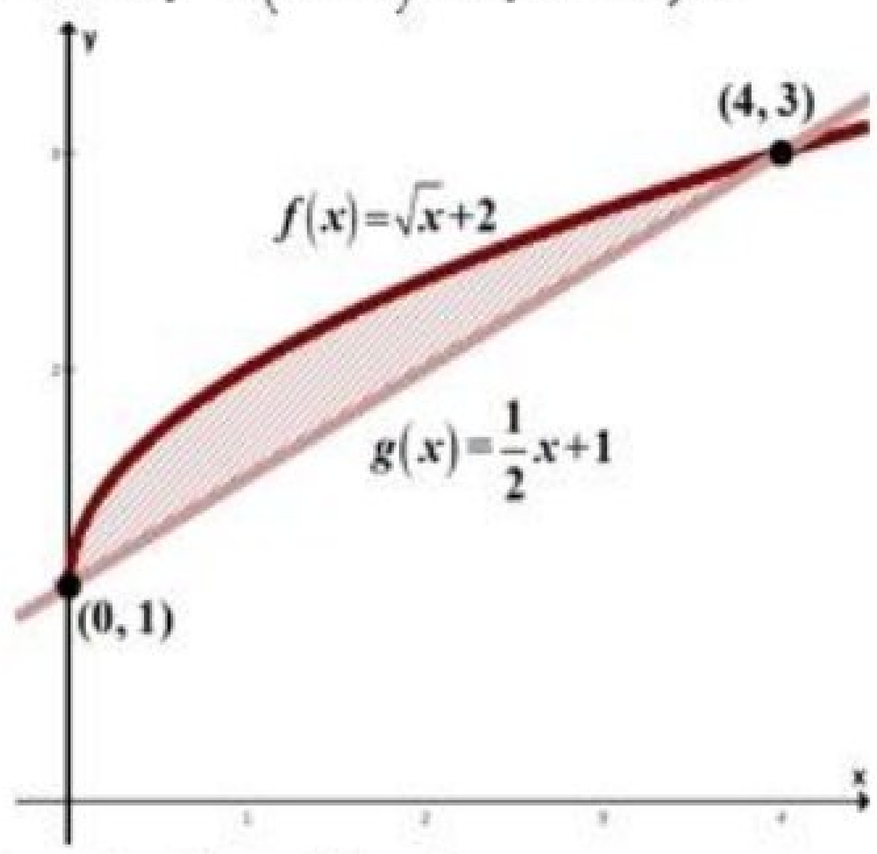
Sketch the region bounded by the graphs, and **find the area**:

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

Solution: Let's draw the curves and set them equal to each other to see where the limits of integration will be:

$$\sqrt{x}+1=\frac{1}{2}x+1;\ \ \sqrt{x}=\frac{1}{2}x;\ \ x=\frac{x^2}{4};\ \ 4x=x^2$$

$$x^2-4x=0;\ \ x(x-4)=0;\ \ x=\mathbf{0,\ 4}$$



Now let's integrate from 0 to 4:

$$\int_0^4\left[\left(\sqrt{x}+1\right)-\left(\frac{1}{2}x+1\right)\right]dx=\int_0^4\left(x^{\frac{1}{2}}-\frac{x}{2}\right)dx$$

$$=\left[\frac{2}{3}x^{\frac{3}{2}}-\frac{1}{4}x^2\right]_0^4=\left[\frac{2}{3}(4)^{\frac{3}{2}}-\frac{1}{4}(4)^2\right]-0=\frac{4}{3}$$

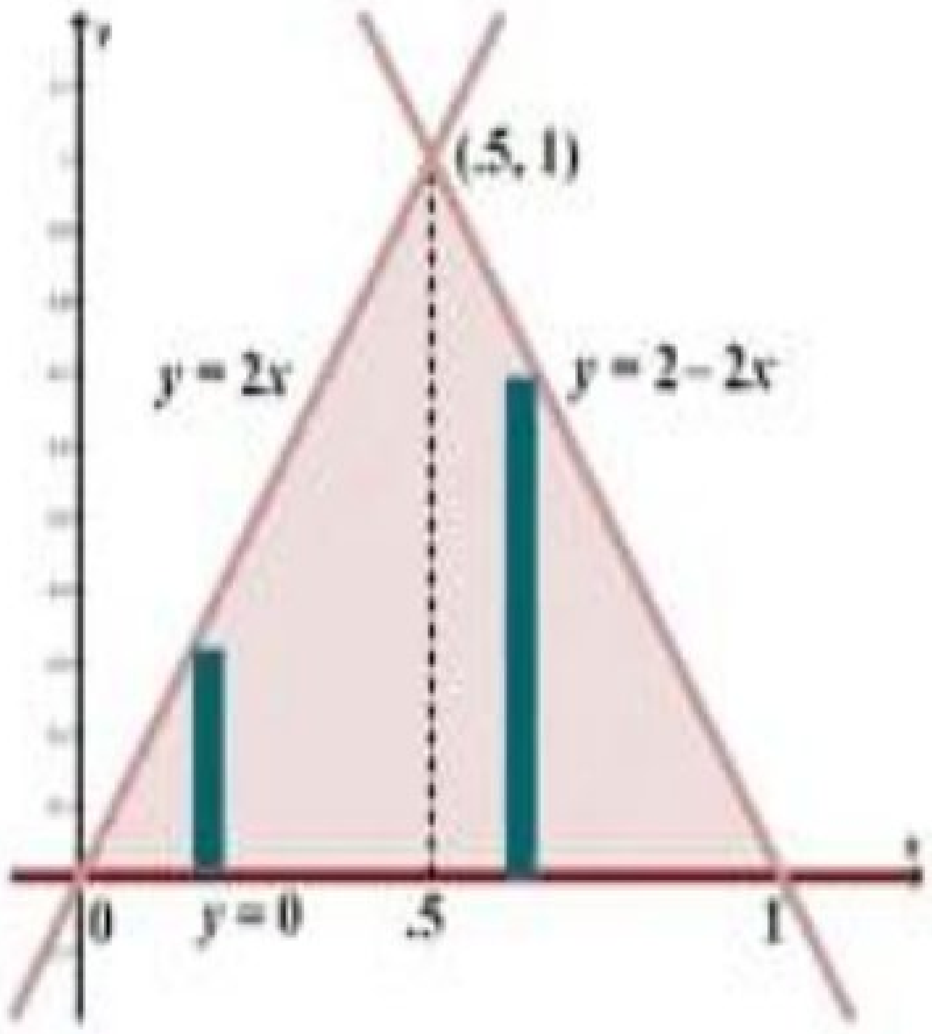
Integration Area Problem Rotated Around x-axis

Sketch the region bounded by the graphs and **find the area, with respect to** x:

$$y=2x,\ y=2-2x,\ y=0$$

Solution: Draw the three lines and set equations equal to each other to get the limits of integration.

We need to divide the graph into two separate integrals, since the function "on top" changes from "$2x$" to "$2-2x$" at $x=.5$. (We can also get the intersection by setting the equations equal to each other: $2x=2-2x;\ x=.5$). We see x-intercepts are 0 and 1.



The two separate integrals are from the intervals 0 to .5, and .5 to 1. (This area, a triangle, is $\frac{1}{2}bh=\frac{1}{2}\cdot 1\cdot 1=.5$.)

Integrating, we get this same area:

$$\int_0^{.5}(2x-0)dx+\int_{.5}^{1}\left[(2-2x)-0\right]dx=\int_0^{.5}2x\,dx+\int_{.5}^{1}(2-2x)\,dx$$

$$=x^2\Big]_0^{.5}+\left[2x-x^2\right]_{.5}^{1}=(.5)^2-0+$$

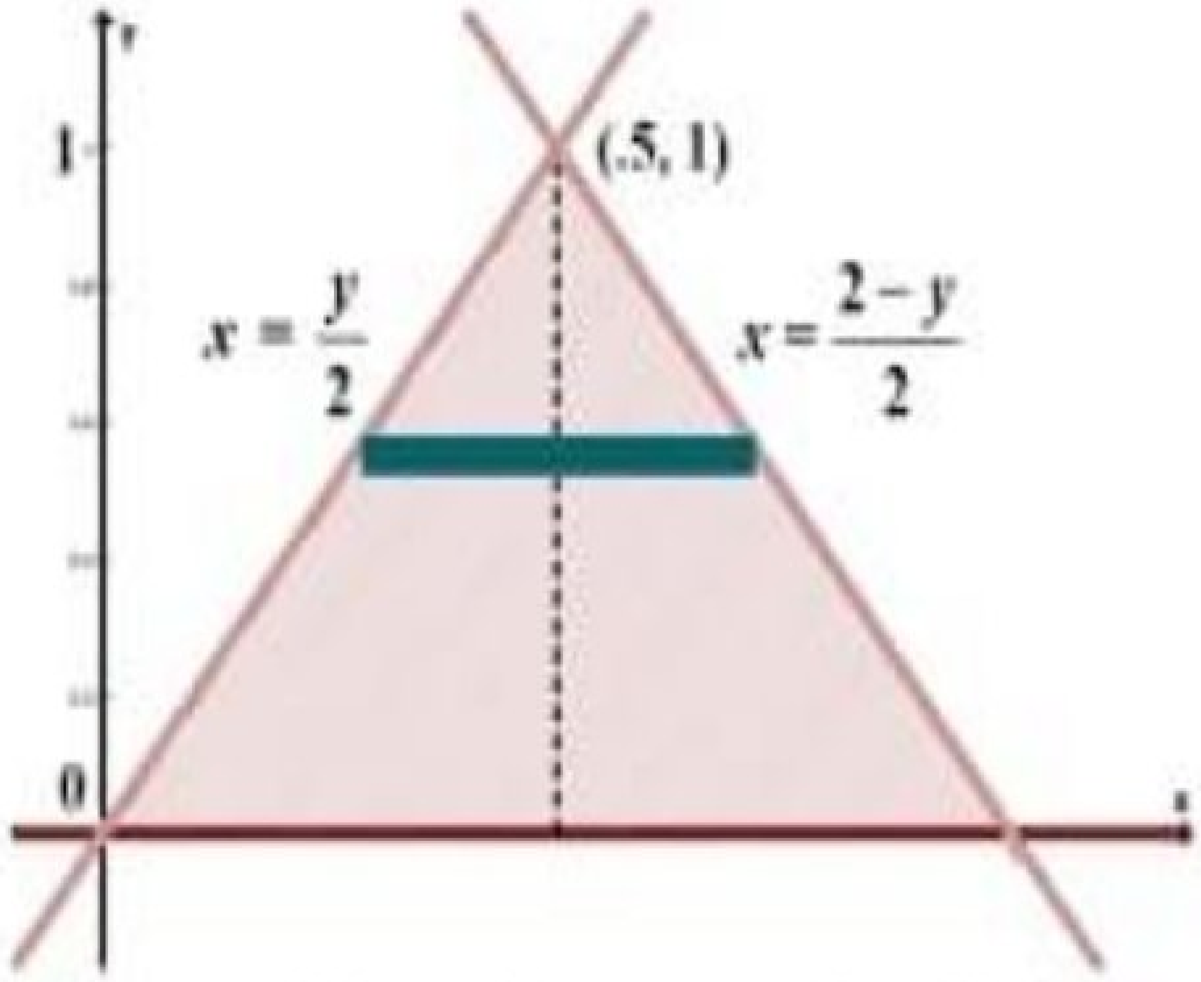
$$\left(2(1)-(1)^2\right)-\left(2(.5)-(.5)^2\right)=.5$$

Integration Area Problem Rotated Around y-axis

Sketch the region bounded by the graphs and **find the area, with respect to** y:

$$y=2x,\ y=2-2x,\ y=0$$

Solution:



If we use horizontal rectangles, we need to take the **inverse** of the functions to get x in terms of y, so we have $x=\frac{y}{2}$ and $x=\frac{2-y}{2}$. We'll integrate up the y-axis, from 0 to 1.

Now we have one integral instead of two (note the y interval is from down to up, and the subtraction of functions is from right to left):

$$\int_0^1\left(\frac{2-y}{2}-\frac{y}{2}\right)dy=\frac{1}{2}\int_0^1(2-2y)\,dy=\frac{1}{2}\left[2y-y^2\right]_0^1=\frac{1}{2}(1-0)=.5$$

Note that some find it easier to think about flipping the graph (technically flipping around the x axis, and rotating it 90° counterclockwise) which will yield its inverse. Then integrate with respect to x: