Since 14 Years

# Ahir Sir

## Engineering Maths Academy

Mob. : 99045 15007

Web : www.ahirsir.com

"We Don't Speak, Our Result Speaks.."

## ALL MATHS OF DEGREE ENGINEERING (GTU)

- **Maths-1** (CALCULUS)
- **Maths-2** (VCLA)
- **Maths-3** (AEM)
- **Maths-4** (CVNM)

- The only institute which focuses on Engineering Maths in Ahmedabad since last 14 years.
- We provide the Best coaching for one of the toughest subjects of Engineering.
- All topics are covered and explained by subject experts.
- Special revision of tough and important topics..
- Doubt solving sessions during weekends.
- Special batches for D to D students.
- Exam oriented materials are provided to score best.
- Weaker students are given special attention.
- Grab this opportunity fast and assure victory.
- Our results reflects that promises we made are not fake.

**Branch - 1**

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Vastrapur, Ahmedabad - 15.

**Branch - 2**

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Ahmedabad.

# AHIR SIR ENGINEERING MATHS ACADEMY

## ALL MATHS OF DEGREE ENGINEERING (GTU)

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## TOPPERS OF LAST YEAR

| Milan | Ami | Krishna | Monika | Hemal | Vidhi | Dhwani | Amir |
|---|---|---|---|---|---|---|---|
| M-I : AA | M-I : AA | M-I : AA | M-II : AA | M-II : AA | M-II : AA | M-III : AA | M-III : AA |
| VGEC | LJ | LD | AIT | Indus | AIT | AIT | AIT |

| Pooja | Sunny | Chandani | Harshil | Sagar | Sheela | Anuradha | Rachana |
|---|---|---|---|---|---|---|---|
| M-III : AA | M-III : AA | M-IV : AA | M-IV : AA | M-IV : AA | M-IV : AA | M-IV : AA | M-IV : AA |
| Indus | AIT | AIT | VGEC | LD | AIT | AIT | AIT |

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# Ahir Sir
# (Engineering Maths Academy)
# (All Maths of Degree Engineering)

## Toppers Of 4th Sem with AA Grade

Dhruvi Modi
LJIT
SPI : 9.7

Harshayu Desai
INDUS
SPI : 9.4

Aditya Tilve
Silver Oak
SPI : 9.0

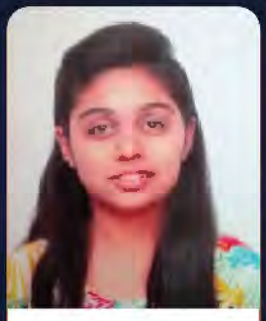
Dheer Varyani
Silver Oak
SPI : 8.6

Daewang Sharma
LJIT
SPI :7.79

Ajay Chavda
INDUS
SPI : 7.72

Payal Mistry
SAL
SPI :7.5

Shivam Rao
LJIT
SPI : 7.24



Pooja Desai
SAL
SPI : 7.0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**Branch:1**
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Achievers Academy, T-17 Raspan Arcade, Opp. Gokul Party Plot, Nikol, Ahmedabad.

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## RESULT OF 3rd SEM
## AA GRADE STUDENTS

| 9.18 SPI | 9.09 SPI | 9.00 SPI | 9.00 SPI |
|---|---|---|---|
|  |  |  |  |
| **DHRUVI MODI**<br>**LJ** | **SOLANKI KIJALKUVARBA**<br>**SVBIT** | **KISHAN**<br>**INDUS** | **HARSH**<br>**INDUS** |

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## RESULT OF 2nd SEM

| 9.87 SPI | 9.43 SPI | 9.40 SPI |
|---|---|---|
|  |  |  |
| DHRUVI MODI<br>LJ | ADITYA TILVE<br>SILVER OAK | DHEER VARYANI<br>SILVER OAK |

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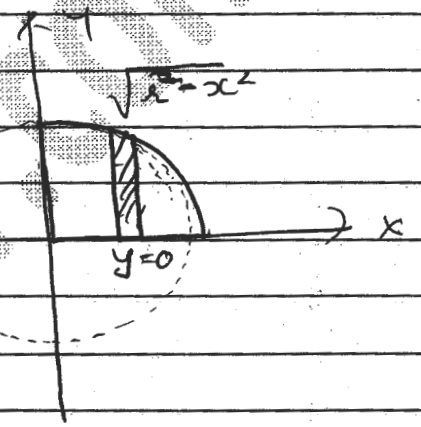
# Area of curve

## For cartesian curve

$$A = \iint dy\, dx$$

**Ex 1** Find out Area of circle $x^2+y^2=r^2$




Area of circle = 4 [Area of 1st Quadrant]

$$= 4 \int_{x=0}^{r} \int_{y=0}^{\sqrt{r^2-x^2}} dy\, dx$$

$$= 4 \int_{x=0}^{r} [y]_0^{\sqrt{r^2-x^2}}\, dx$$

$$= 4 \int_{x=0}^{r} \sqrt{r^2-x^2}\, dx$$

$$= 4 \left[ \frac{x}{2}\sqrt{r^2-x^2} + \frac{r^2}{2}\sin^{-1}\left(\frac{x}{r}\right) \right]_0^{x=r}$$

$$= 4 \left[ 0 + \frac{r^2}{2}\sin^{-1} 1 \right]$$

$$= 4 \left[ \frac{r^2}{2}(\pi/2) \right] = \pi r^2$$

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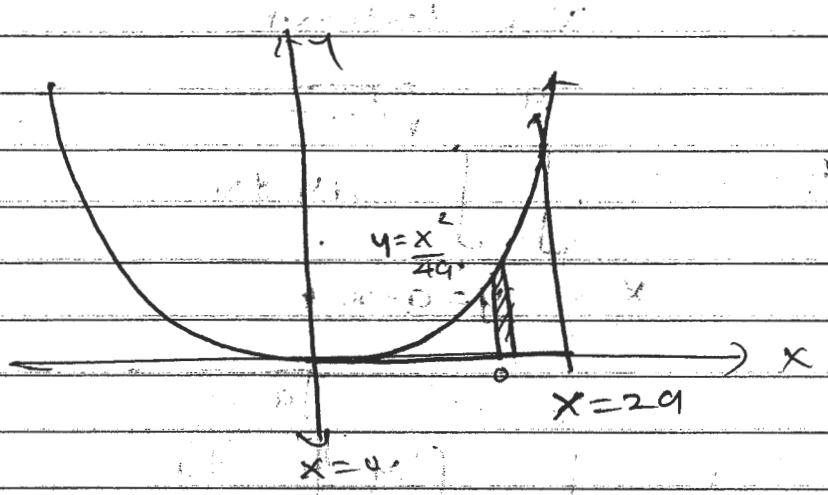
Ex 1

Find out Area bounded by $x^2 = 4ay$ and $x = 2a$ in First Quadrant.




$$A = \int_{x=0}^{2a} \int_{y=0}^{x^2/4a} dy\,dx$$

$$= \int_{x=0}^{2a} \left[ y \right]_0^{x^2/4a} dx$$

$$= \int_{x=0}^{2a} \frac{x^2}{4a}\, dx$$

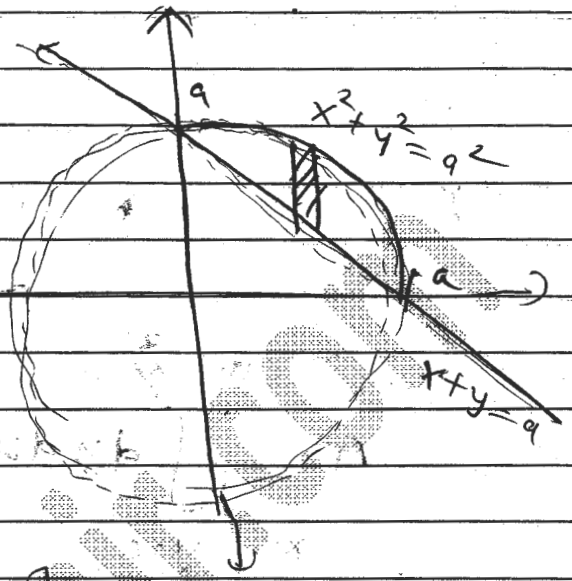
$$= \frac{1}{4a} \int_{x=0}^{2a} x^2\, dx$$

$$= \frac{1}{4a} \left( \frac{x^3}{3} \right)_0^{2a}$$

$$= \frac{1}{4a} \left[ \frac{8a^3}{3} \right]$$

$$\boxed{\text{Area} = \frac{2}{3} a^2}$$

Ex: Find out Area bounded by $x^2+y^2=a^2$ and $x+y=a$ in First Quadrant




$$\text{Area} = \int_{x=0}^{a}\int_{y=a-x}^{\sqrt{a^2-x^2}} dy\,dx$$

$$= \int_{x=0}^{a} \left[y\right]_{a-x}^{\sqrt{a^2-x^2}} dx$$

$$= \int_{x=0}^{a} \left[\sqrt{a^2-x^2} - (a-x)\right] dx$$

$$= \int_{x=0}^{a} \sqrt{a^2-x^2}\,dx - \int_{x=0}^{a} (a-x)\,dx$$

$$= \left[\frac{x}{2}\sqrt{a^2-x^2} + \frac{a^2}{2}\sin^{-1}\frac{x}{a}\right]_0^a - \left[\frac{(a-x)^2}{-2}\right]_0^a$$

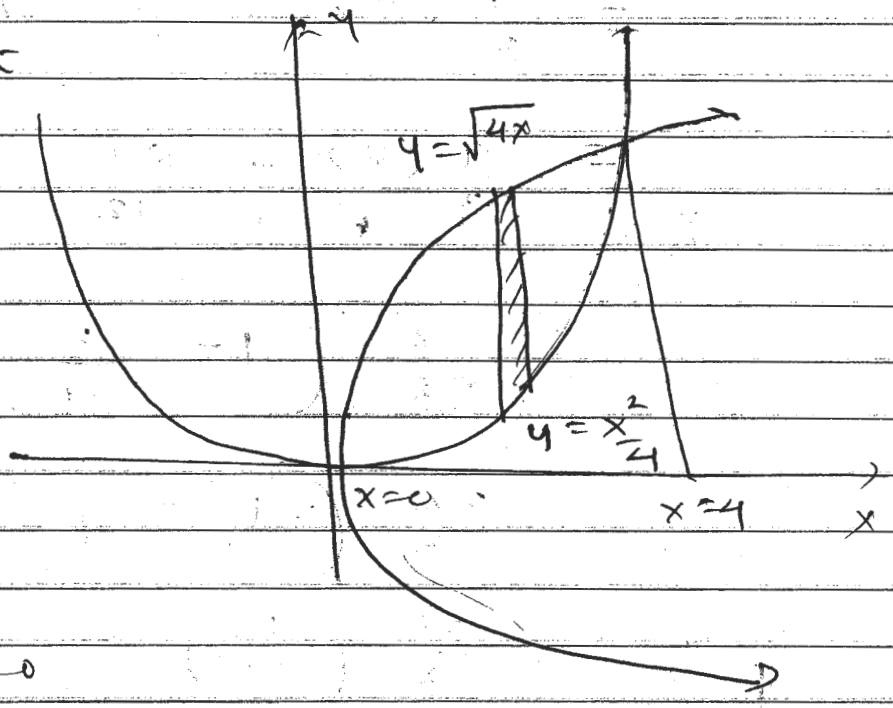
$$= \left[0 + \frac{a^2}{2}\sin^{-1}1\right] + \left[\frac{(a-x)^2}{2}\right]_0^a$$

$$= \frac{a^2}{2}\left(\frac{\pi}{2}\right) + \frac{1}{2}\left[0 - a^2\right]$$

$$= \frac{\pi a^2}{4} - \frac{a^2}{2}$$

$$\boxed{A = \frac{a^2}{2}\left(\frac{\pi}{2}-1\right)}$$

Ex:- Find out Area bounded by $y^2 = 4x$ and $x^2 = 4y$.




Intersection point

$y^2 = 4x, \quad x^2 = 4y$

$y^2 = 4x \quad \frac{x^2}{4} = y$

$\left(\frac{x^2}{4}\right)^2 = 4x$

$\frac{x^4}{16} = 4x$

$\therefore x^4 = 64x$

$x^4 - 64x = 0$

$x(x^3 - 64) = 0$

$x = 0, \quad x = 4$

$$\text{Area} = \int_{x=0}^{4} \int_{y=\frac{x^2}{4}}^{\sqrt{4x}} dy\, dx$$

$$= \int_{x=0}^{4} \left[ y \right]_{x^2/4}^{\sqrt{4x}} dx$$

$$= \int_{x=0}^{4} \left( \sqrt{4x} - \frac{x^2}{4} \right) dx$$

$$= \int_{x=0}^{4} \left( 2x^{1/2} - \frac{x^2}{4} \right) dx$$

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9 $\left[ \frac{2x^{3/2}}{3/2} - \frac{1}{4}\left(\frac{x^3}{3}\right) \right]_0^4$

$= \frac{4}{3}(4)^{3/2} - \frac{1}{12}(4)^3$

$= \frac{4}{3}(8) - \frac{64}{12}$

$= \frac{32}{3}\left(1 - \frac{2}{4}\right)$

$= \frac{32}{3}\left(1 - 1/2\right)$

$= \frac{32}{3}\left(1/2\right)$

$= \frac{16}{3}$

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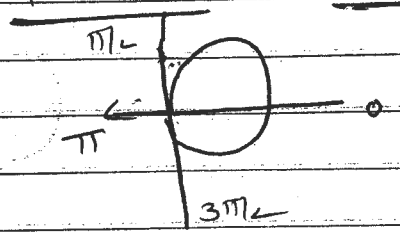
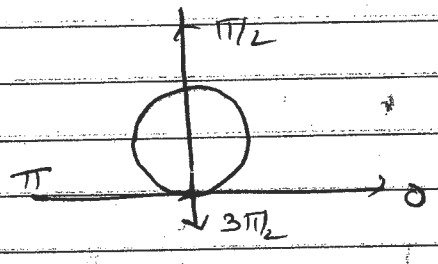
# Some Polar Curves

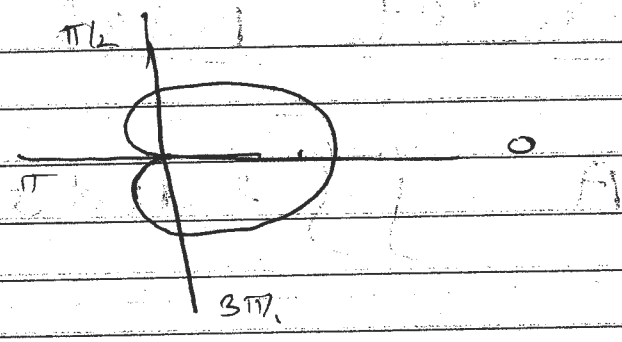
$r = a\cos\theta$



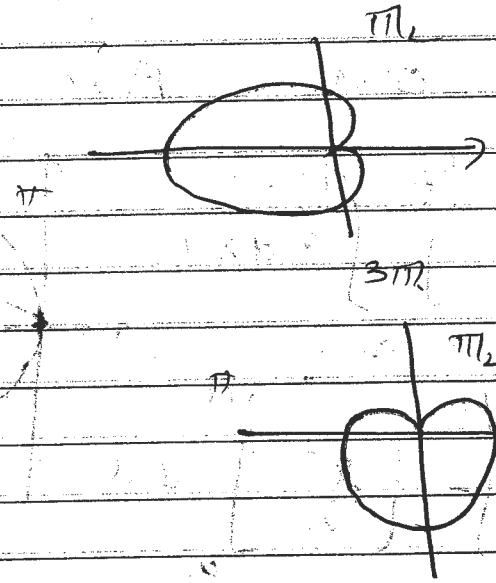

$r = a\sin\theta$




$r = a(1+\cos\theta)$



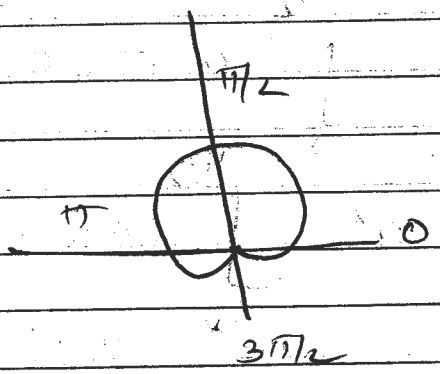

$r = a(1-\cos\theta)$



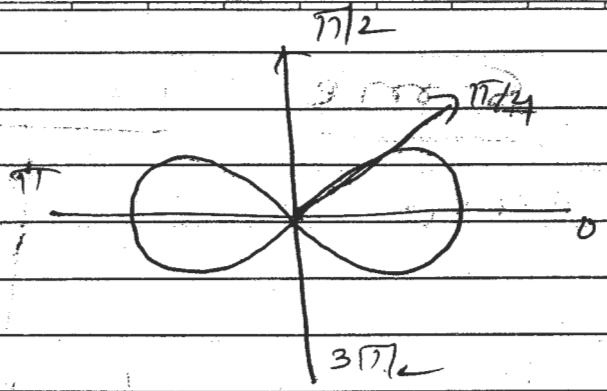

$r = a(1-\sin\theta)$




$r = a(1+\sin\theta)$



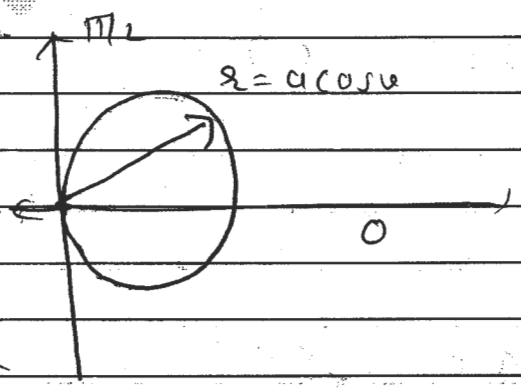
$r^2 = a^2 \cos 2\theta$




## Area of polar curves

$$A = \iint r \, dr \, d\theta$$

Ex: Find out Area of $r = a\cos\theta$




$$\text{Area} = 2 \int_0^{\pi/2} \int_{r=0}^{a\cos\theta} r \, dr \, d\theta$$

$$= 2 \int_0^{\pi/2} \left[ \frac{r^2}{2} \right]_0^{a\cos\theta} d\theta$$

$$= \int_0^{\pi/2} a^2 \cos^2\theta \, d\theta$$

$$= a^2 \int_0^{\pi/2} \cos^2\theta \, d\theta$$

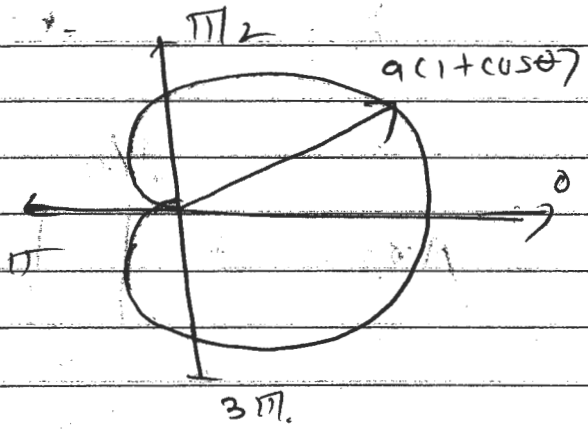
By Reduction Formula

$$= a^2 \left[\frac{1}{2}\frac{\pi}{2}\right]$$

$$\text{Area} = \frac{\pi}{4} a^2$$

(2) Find out Area of cardioid

$r = a(1+\cos\theta)$




$$\text{Area} = 2\int_0^{\pi}\int_{r=0}^{a(1+\cos\theta)} r\,dr\,d\theta$$

$$= 2\int_0^{\pi}\left[\frac{r^2}{2}\right]_0^{a(1+\cos\theta)} d\theta$$

$$= \int_0^{\pi} a^2(1+\cos\theta)^2\,d\theta$$

$$= a^2\int_0^{\pi}\left(2\cos^2\frac{\theta}{2}\right)^2 d\theta$$

$$= 4a^2\int_0^{\pi}\cos^4\frac{\theta}{2}\,d\theta$$

Let $\frac{\theta}{2} = t$

$\theta = 2t$

$d\theta = 2dt$

$\theta \to 0 \Rightarrow t \to 0$

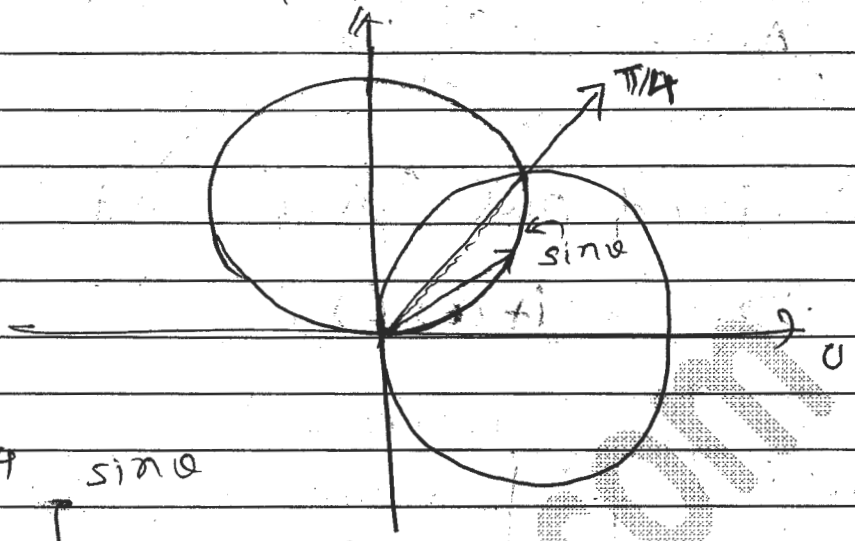
$\theta \to \pi \Rightarrow t \to \frac{\pi}{2}$

$$= 4a^2\int_{t=0}^{\pi/2}\cos^4 t\,(2dt)$$

$$= 8a^2\left[\frac{3\cdot 1}{4\cdot 2}\frac{\pi}{2}\right]$$

$$\text{Area} = \frac{\pi}{2} a^2$$

(3) Find out Area common to the circle $r = \cos\theta$ and $r = \sin\theta$




$$\text{Area} = 2\int_{\theta=0}^{\pi/4}\int_{r=0}^{\sin\theta} r\,dr\,d\theta$$

$$= 2\int_0^{\pi/4}\left[\frac{r^2}{2}\right]_0^{\sin\theta} d\theta$$

$$= \int_0^{\pi/4} \sin^2\theta\,d\theta$$

$$= \int_0^{\pi/4} \left(\frac{1-\cos 2\theta}{2}\right) d\theta$$

$$= \frac{1}{2}\left[\theta - \frac{\sin 2\theta}{2}\right]_0^{\pi/4}$$

$$= \frac{1}{2}\left[\frac{\pi}{4} - \frac{1}{2}\sin\frac{\pi}{2}\right]$$

$$= \frac{1}{2}\left[\frac{\pi}{4} - \frac{1}{2}\right]$$

$$\boxed{A = \frac{1}{4}\left(\frac{\pi}{2} - 1\right)}$$

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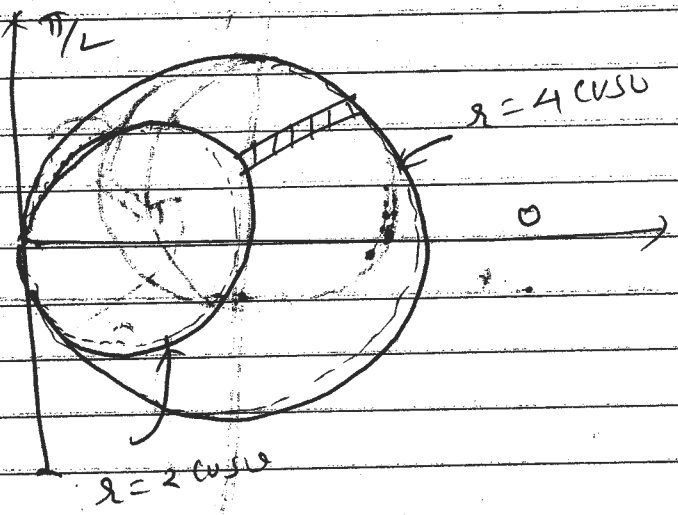
(4) Find out Area outside $r = 2\cos\theta$ and Inside $r = 4\cos\theta$




$$\text{Area} = 2\int_{0}^{\pi/2}\int_{2\cos\theta}^{4\cos\theta} r\,dr\,d\theta$$

$$= 2\int_{0}^{\pi/2}\left[\frac{r^2}{2}\right]_{2\cos\theta}^{4\cos\theta} d\theta$$

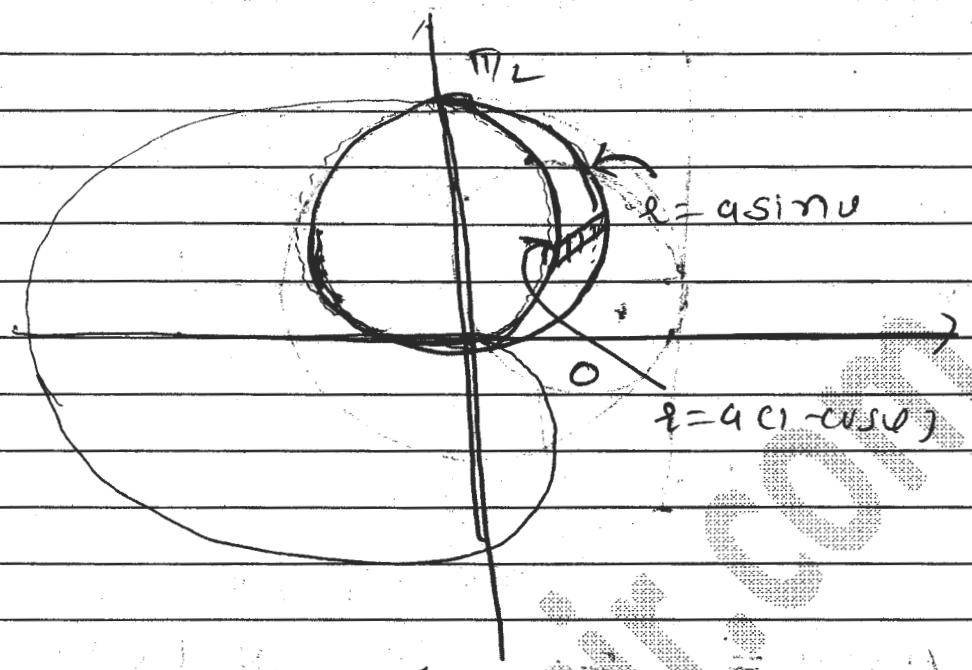
$$= \int_{0}^{\pi/2}(16\cos^2\theta - 4\cos^2\theta)\,d\theta$$

$$= 12\int_{0}^{\pi/2}\cos^2\theta\,d\theta$$

$$= 12\left(\frac{1}{2}\cdot\frac{\pi}{2}\right)$$

$$\boxed{\text{Area} = 3\pi}$$

(5) Find out Area outside $r = a\sin\theta$ and Inside $r = a(1-\cos\theta)$




$$\text{Area} = \int_0^{\pi/2} \int_{r=a(1-\cos\theta)}^{a\sin\theta} r\, dr\, d\theta$$

$$= \int_0^{\pi/2} \left[\frac{r^2}{2}\right]_{a(1-\cos\theta)}^{a\sin\theta} d\theta$$

$$= \frac{1}{2}\int_0^{\pi/2} \left[a^2\sin^2\theta - a^2(1-\cos\theta)^2\right] d\theta$$

$$= \frac{a^2}{2}\left[\int_0^{\pi/2} \left[\sin^2\theta - (1 - 2\cos\theta + \cos^2\theta)\right] d\theta\right.$$

$$= \frac{a^2}{2}\int_0^{\pi/2} \left[(\sin^2\theta - \cos^2\theta) + 2\cos\theta - 1\right] d\theta$$

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$$\frac{a^2}{2}\left[\left(\frac{1}{2}\frac{\pi}{2}-\frac{1}{2}\frac{\pi}{2}\right)+\left[2\sin\theta-\theta\right]_0^{\pi/2}\right]$$

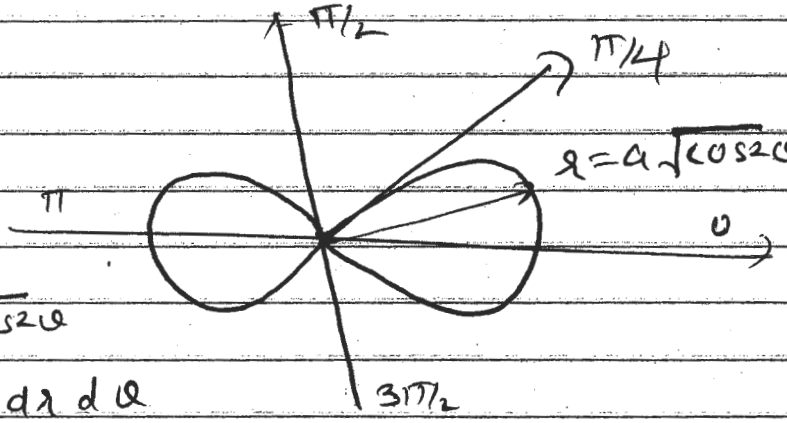
$$=\frac{a^2}{2}\left[0+\left(2\sin\frac{\pi}{2}-\frac{\pi}{2}\right)\right]$$

$$=\frac{a^2}{2}\left[2-\frac{\pi}{2}\right]$$

$$\text{Area}=a^2\left(1-\frac{\pi}{4}\right)$$

Find out Area of lemniscate

$r^2=a^2\cos2\theta$




$$\text{Area}=4\int_0^{\pi/4}\int_{r=0}^{a\sqrt{\cos2\theta}} r\,dr\,d\theta$$

$$=4\int_0^{\pi/4}\left[\frac{r^2}{2}\right]_0^{a\sqrt{\cos2\theta}}d\theta$$

$$=2\int_0^{\pi/4}a^2\cos2\theta\,d\theta$$

$$=2a^2\left[\frac{\sin2\theta}{2}\right]_0^{\pi/4}=a^2\left[\sin\frac{\pi}{2}-0\right]$$

$$=a^2$$

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