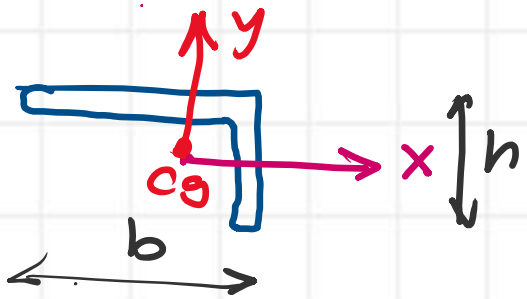
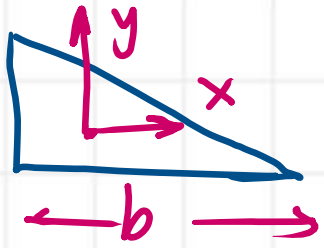
This is the Fourth Case, Where $I_x < I_y$ and I_{xy} is -Ve.

Examples for this Case

Unequal angle where b>h

Long leg is directed to the left





b>h

Case of a triangle

$I_x = \frac{bh^3}{36}$

$I_y = \frac{hb^3}{36}$

$I_{xy} = -\frac{b^2h^2}{72}$

$hb^3 > bh^3$

$b > h$

$\tan 2\theta_p = \frac{+I_x}{(I_y - I_x)/2}$

2nd qu ← 4rth quarter = -Ve

Case4 : $I_x < I_y$, I_{xy} -ve

General Equation

max

min →

$$I_{x'} = \frac{I_x + I_y}{2} + \frac{I_x - I_y}{2}\cos 2\theta - I_{xy}\sin 2\theta$$

$$I_{y'} = \frac{I_x + I_y}{2} - \frac{I_x - I_y}{2}\cos 2\theta + I_{xy}\sin 2\theta$$

(+ve, -ve)

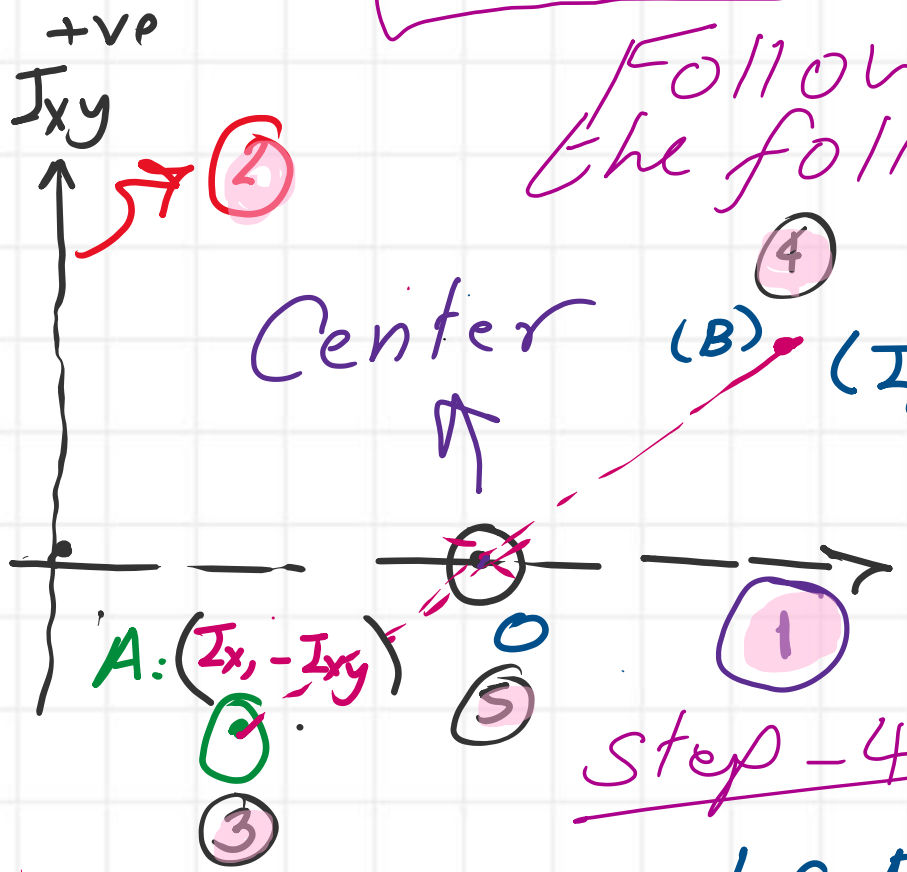
Check For $I_{x'}$ is max when Cos 2θ: -ve & sin 2θ: +ve)

: +ve + (-ve)(-) − (-)(+) Imax

For $2\phi_{P_1}$ → Cos : -ve, sin : +ve } 2nd quarter

$2\phi_{P_2}$ → Cos (+ve), sin (-ve) } 4rth quarter

Draw Mohr's circle of inertia : Case 4 : $I_x < I_y$ & I_{xy} is -ve



Follow the following steps

Step - 1

Draw a horizontal axis - x

Step - 2

Draw a vertical axis Ixy

step - 3

Locate point A (Ix, - Ixy)

step - 4

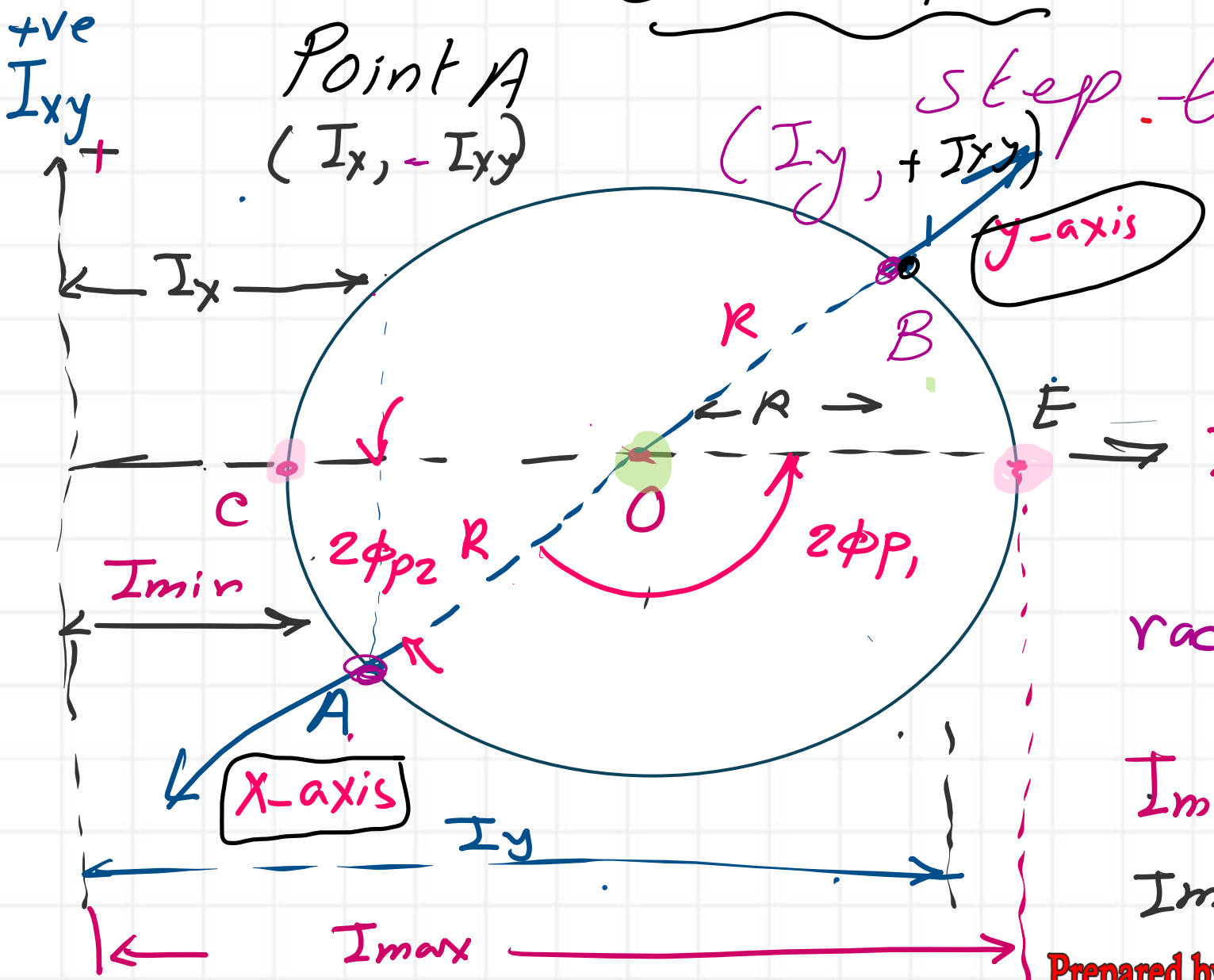
Locate point B (Iy, + Ixy)

O - A → x - axis

O - B → y - axis

Step 5 : join point A with Point B get Point O

Case-4



: Draw Circle

step-6: Draw the circle with R is = OA

point O is $\left(\frac{I_y - I_x}{2}, 0\right)$

radius $R = \sqrt{\left(\frac{I_y - I_x}{2}\right)^2 + (I_{xy})^2}$

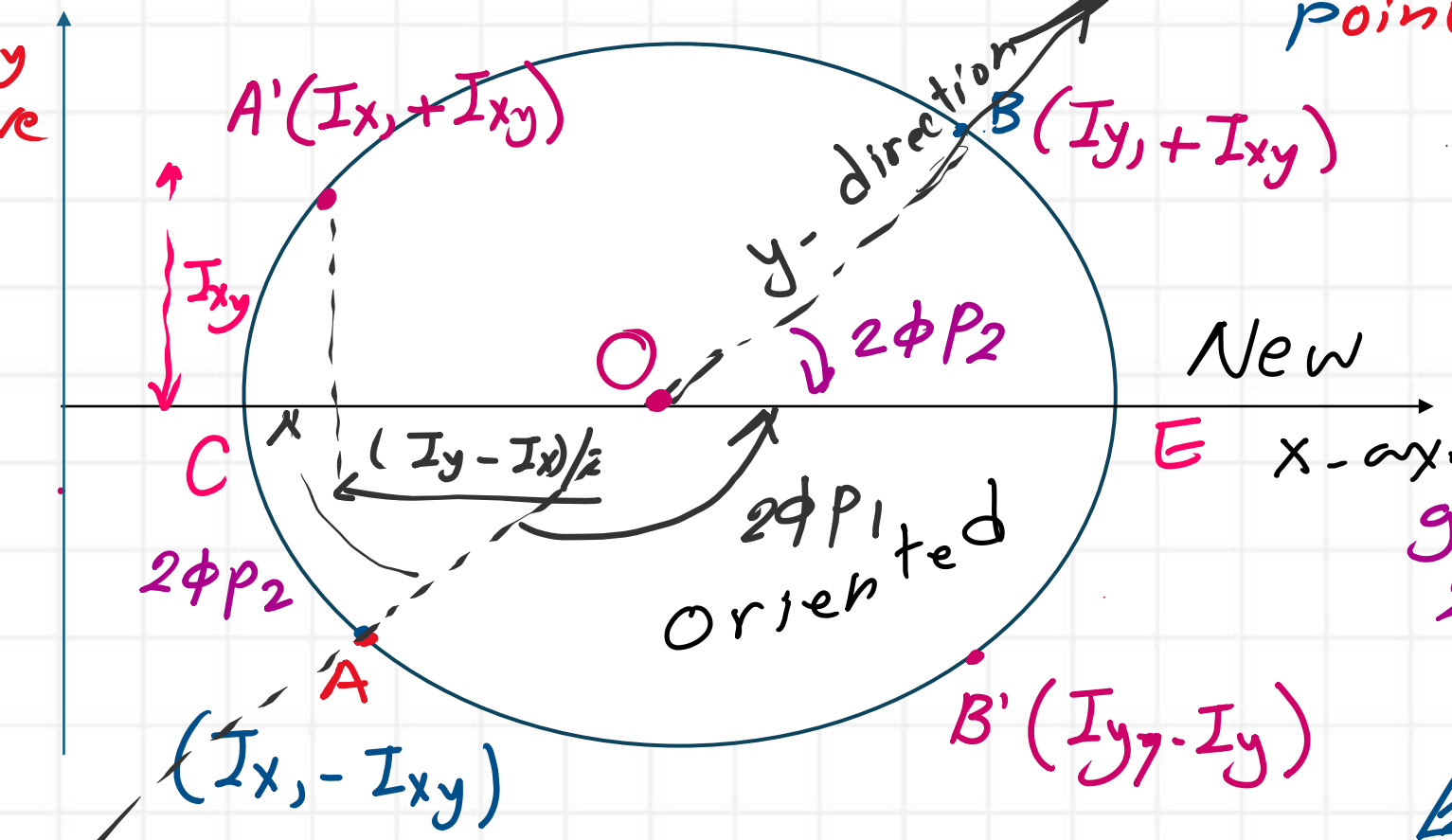
$I_{min} = \left(\frac{I_y - I_x}{2}\right) - R$

$I_{max} = \left(\frac{I_y - I_x}{2}\right) + R$

Case – 4

$I_x < I_y$, I_{xy} is -ve

X-axis is rotated by $2\phi p_1$, we need points A', B'



$$\tan 2\phi_p = \frac{I_{xy}}{\left(\frac{I_y - I_x}{2}\right)}$$

$$= \frac{-}{+} = (-)$$

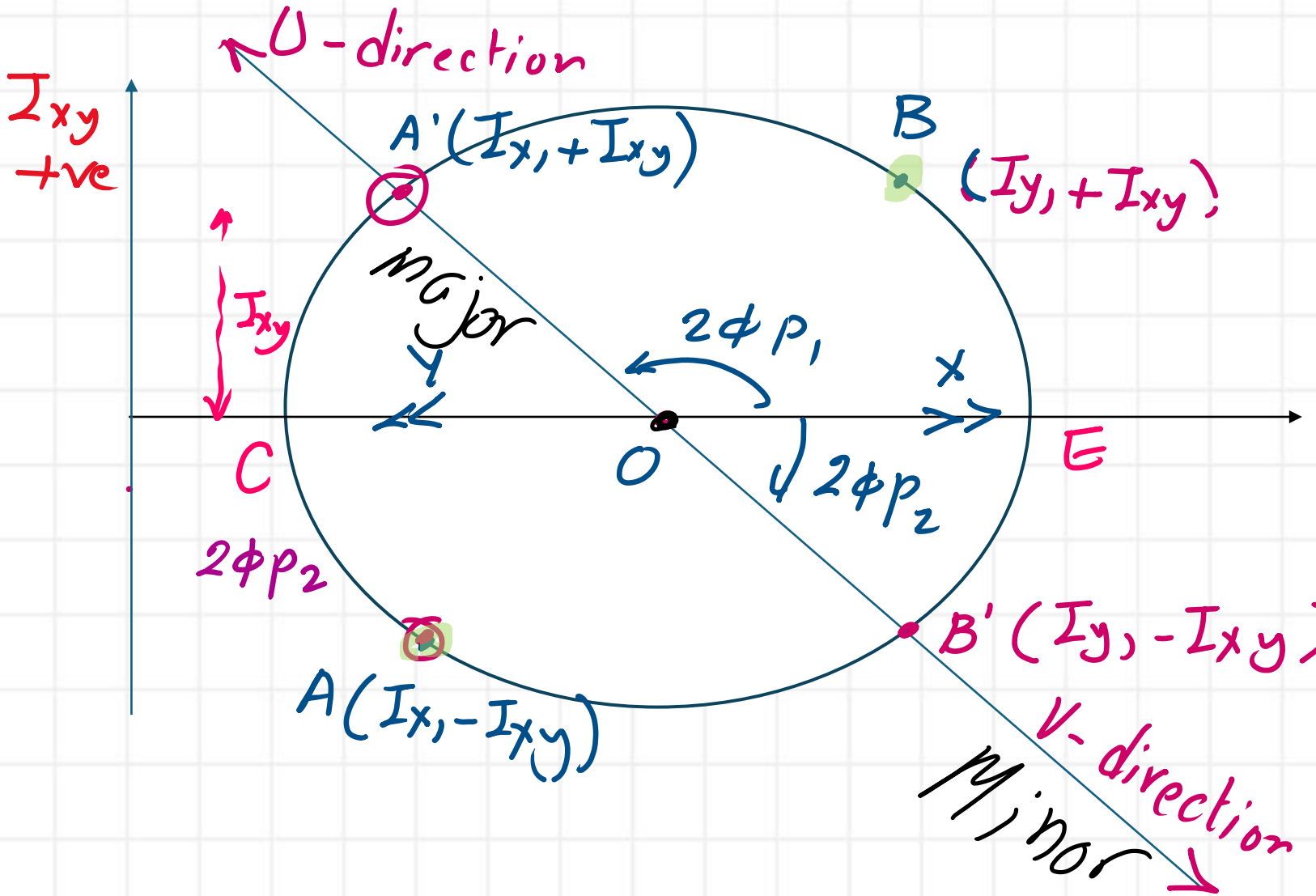
$I_x, I_y, I_{min}, I_{max}$

get $2\phi p_2$ from tan relation

get $2\phi p_1 : 180 - 2\phi p_2$

Case - 4

$I_x < I_y$, I_{xy} is -ve



Directions of U, V, Mohr's Circle

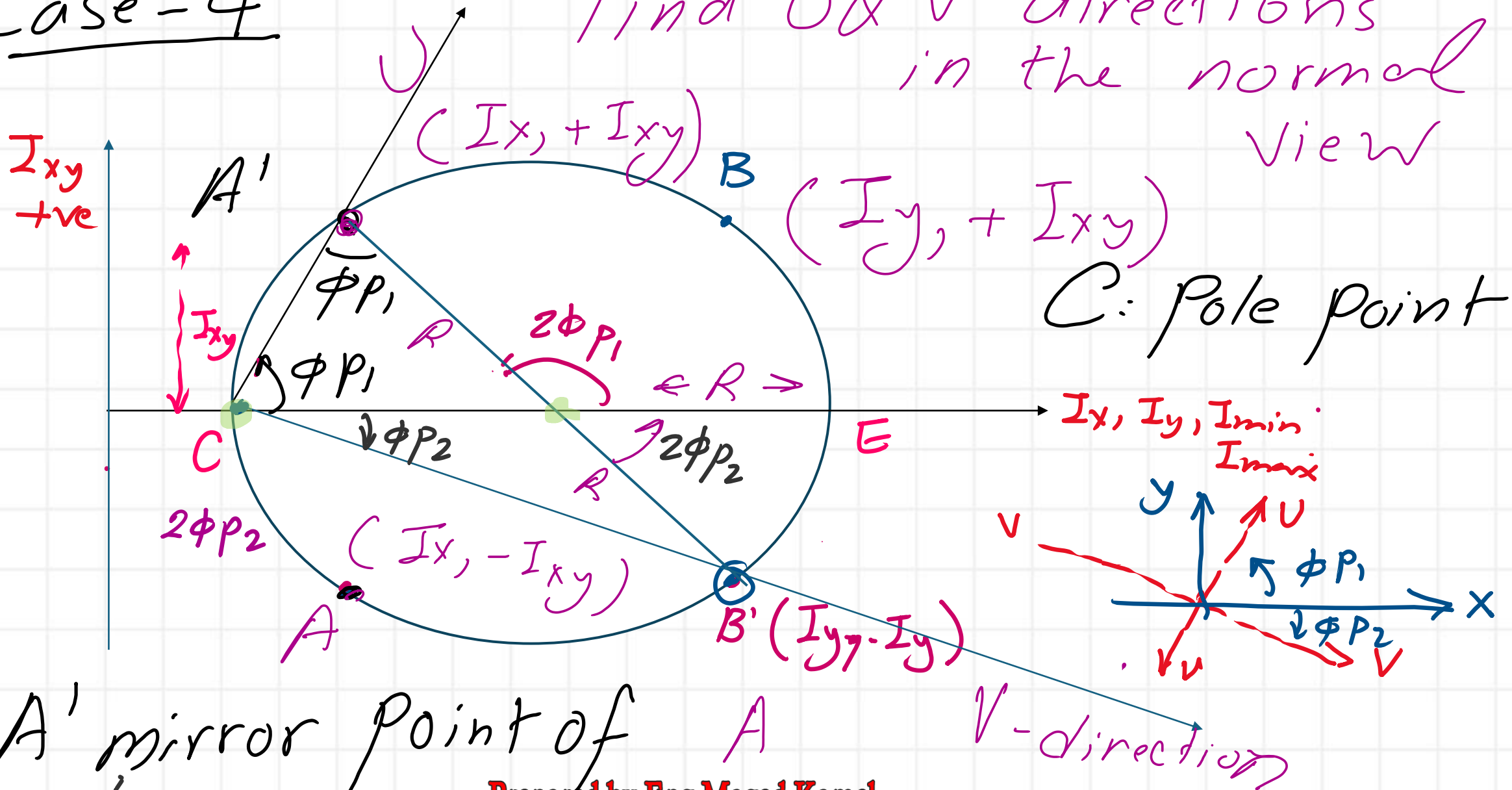
Join O with A' to get U - direction

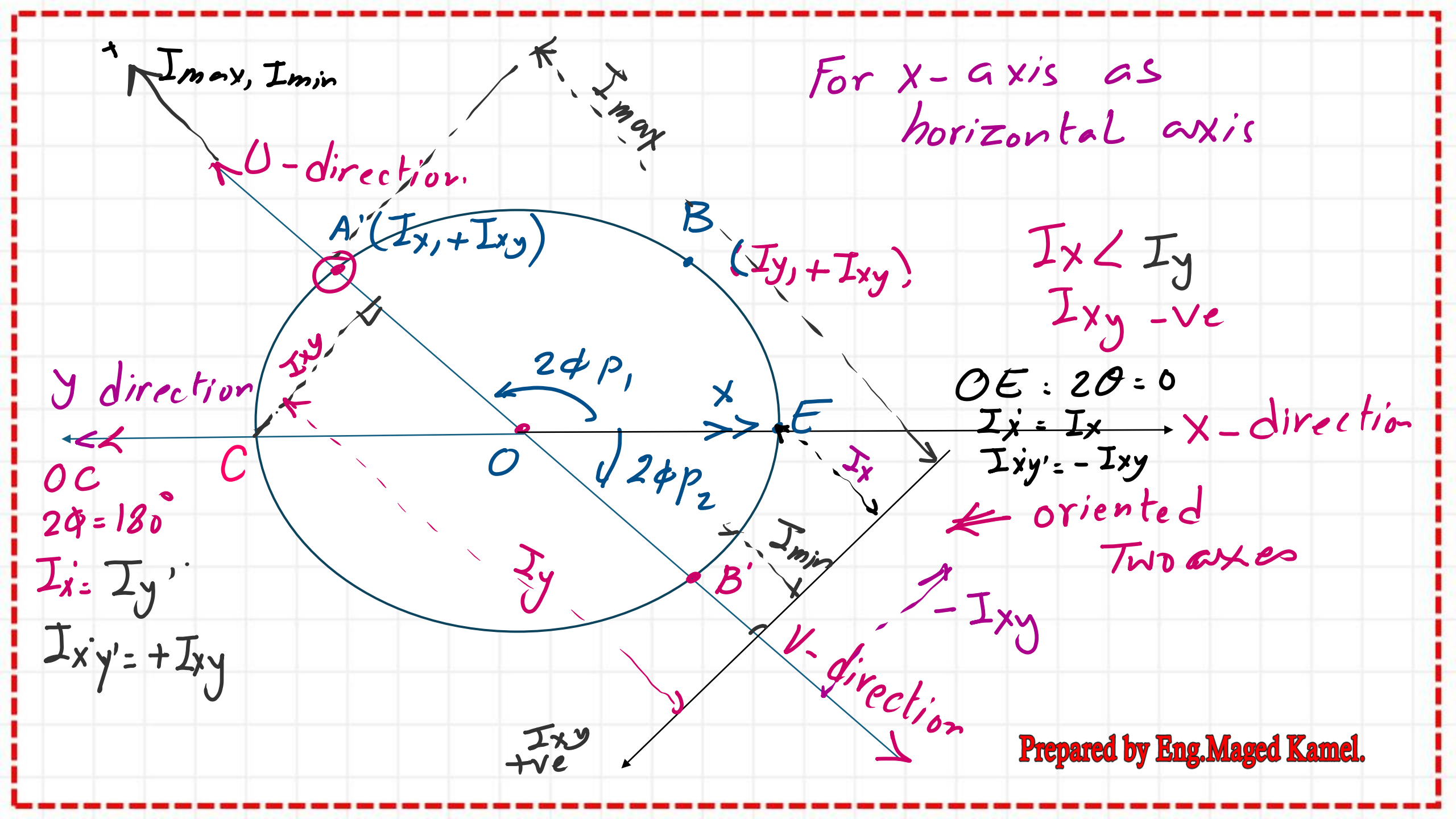
I_x, I_y, I_{min}, I_{max}

Join O with B' to get V - direction

Case-4

Find U & V directions in the normal view




Imax, Imin
Imax
For x-axis as horizontal axis
U-direction
A' (Ix, +Ixy)
B (Iy, +Ixy)
Ix < Iy
Ixy -ve
Ixy
2ϕp1
y direction
x
E
OE : 2θ = 0
Ix' = Ix
Ixy' = - Ixy
x-direction
C
O
2ϕp2
Ix
OC
2ϕ = 180°
Ix' = Iy'
Ixy' = +Ixy
Iy
B'
Imin
oriented
Two axes
-Ixy
V-direction
Ixy
+ve
Prepared by Eng.Maged Kamel.

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