SUBMITTED BY

SOHAIL AHMED.

ID 7907

SECTION A.

SUBJICT MOS II

SUBMITTED TO

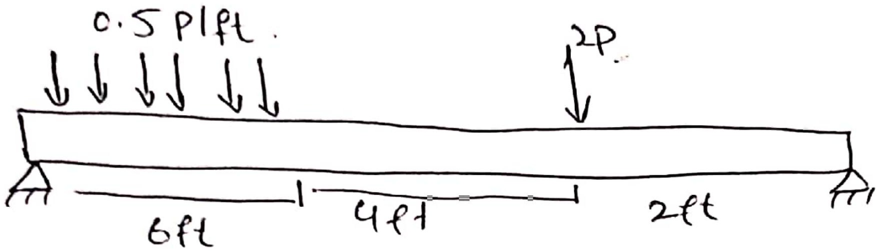
ENGR. SAQIB.

DATE 16-04-2020

ANSWER TO GIVEN QUESTION. (P1)

WHERE P IS CONSIDER OUR ID LAST TWO DIGIT.

→ My ID is 7907. So ~~My~~ ~~I~~ put the value of P is 07.

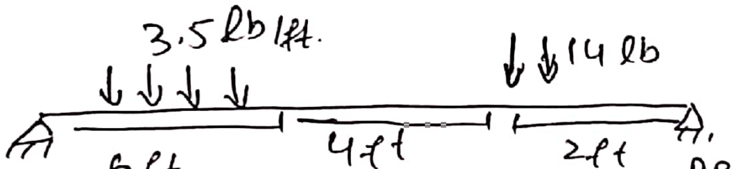


So we get.

$\Rightarrow$ $2P = 2 \times 07 = 14$ while

$\Rightarrow$ $0.5 \times 07 \Rightarrow 3.5$

☆ FREE BODY DIAGRAM :-



☆ SUPPORT REACTION :- As we know that

$\Sigma F_y = 0 \quad \uparrow^{+} \downarrow^{-}$

$R_A + R_B = 17.5 lb \quad \because 3.5 + 14 = 17.5$

Now

$\Sigma M = 0 \quad \circlearrowleft^{+} \circlearrowright^{-}$

$RB \times 12 - 14 \times 10 - 21 \times 3$

$\boxed{RB = 16.91 lb}$

(P2)

Where

$R_A + R_B = 17.5$

$R_A = 17.5 - 16.91$

$\boxed{R_A = 0.59\ lb}$

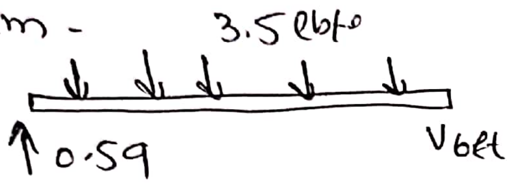
$\therefore$ $R_A + R_B = 17.5$

$0.59 + 16.91 = 17.5$

$\Rightarrow$ $17.5\ lb = 17.5\ lb$

Hence In equilibrium.

★ $\Rightarrow$ Now Shear force at change point of beam -



So

Shearforce at 6ft from left support -

$\Sigma F_y = 0$ $\uparrow^-$ $\downarrow^+$

$\rightarrow$ $V_{6ft} - 0.59 + 3.5 \times 6 = 0$

$V_{6ft} + 20.41 = 0$

$\boxed{V_{6ft} = -20.41\ lb}$

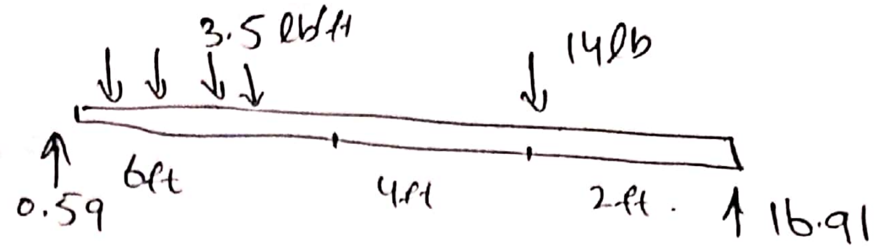
$\Rightarrow$ Now I find Shear force at V_{10ft}.

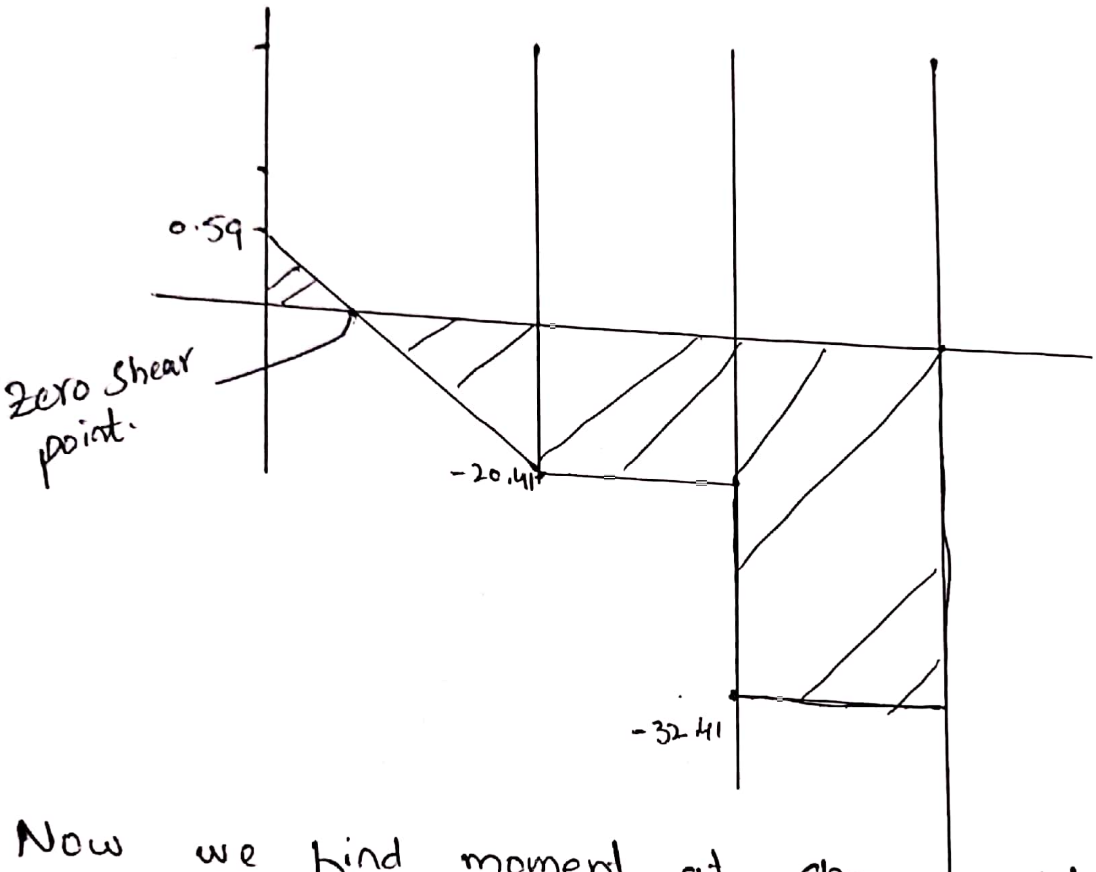
$\Sigma F_y = 0$ $\uparrow^-$ $\downarrow^+$

$-0.59 + 21 + 12 + V_{10ft} = 0$

$\boxed{V_{10ft} = -32.41}$ lb

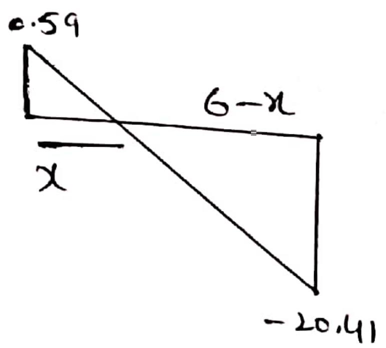
P3





⇒ Now we find moment at change point.

Find zero shear point.



$$\frac{0.59}{x} = \frac{+20.41}{(6-x)}$$

$\rightarrow$ $0.59(6-x) = 20.41x$

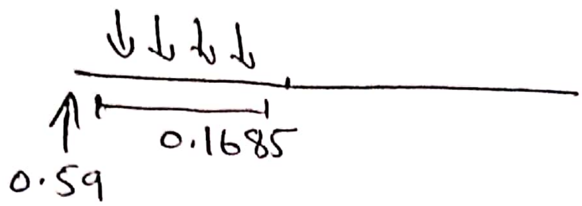
$\rightarrow$ $3.54 - 0.59x = 20.41x.$

$3.54 = 20.41x + 0.59x.$

$$\frac{3.54}{21} = \frac{21x}{21} \Rightarrow \boxed{x = 0.1685} \text{ ft}$$

Now we will find moment at Section of 0.1685ft from R_A.

(P4)



$$\Sigma M_{0.1685} = 0$$

$$M_{0.1685} + 0.59 \times 0.1685 - 21\left(\frac{0.1685}{2}\right) = 0.$$

$$M_{0.1685} + 0.0994 - 1.7692 = 0$$

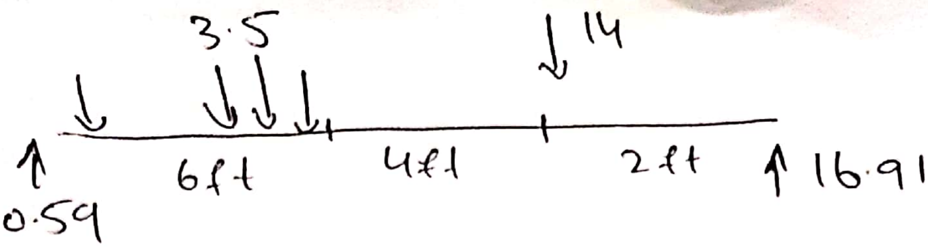
$$\boxed{M_{0.1685} = 1.698} \text{ lb}$$

$\Rightarrow$ $\Sigma M = 0$

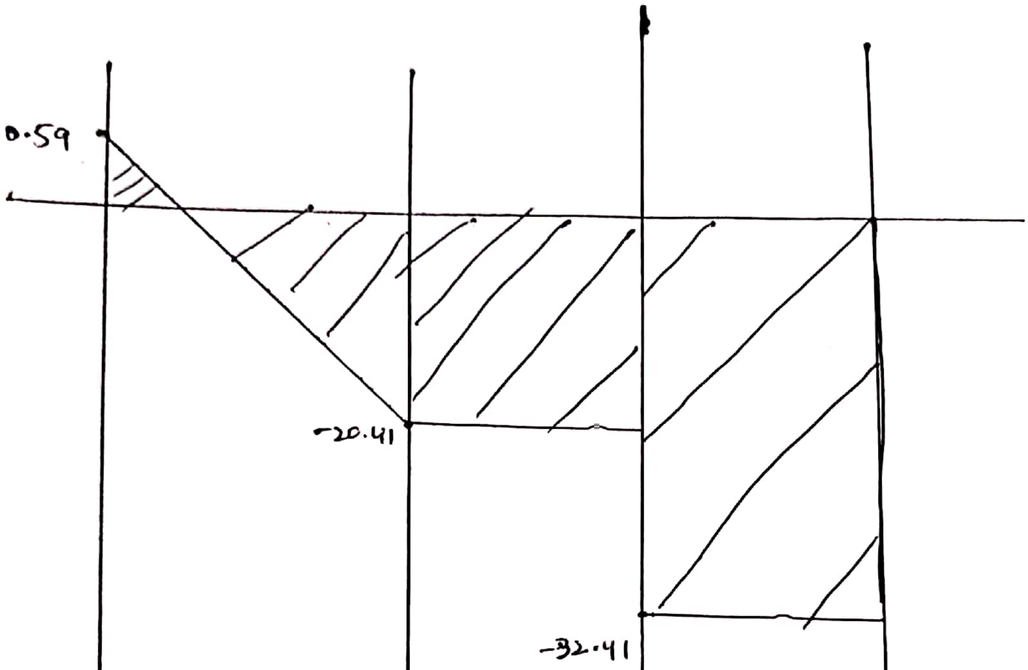
$$M_{6ft} + 0.59 \times 6 - 3.5 \times 6 \times 3$$

$$\boxed{M_{6ft} = 59.46} \text{ lb}$$

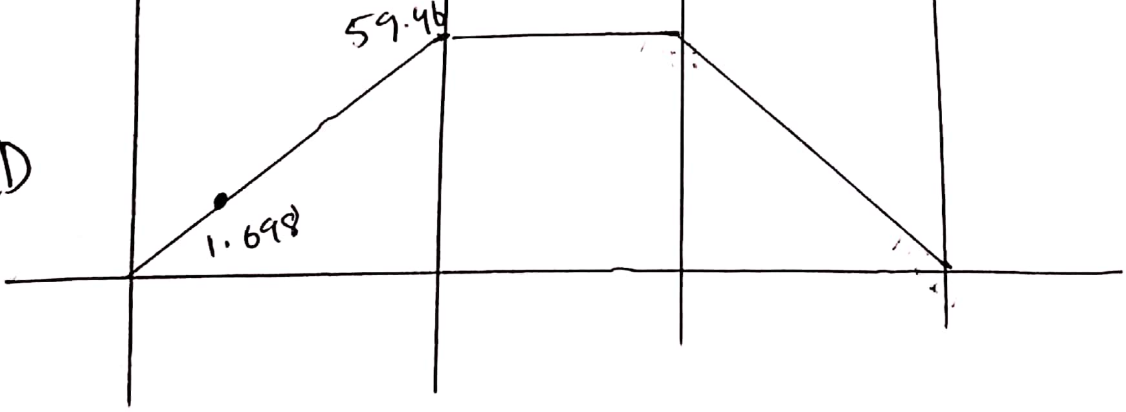
P5



SFD



BMD



Shear stress :

P6

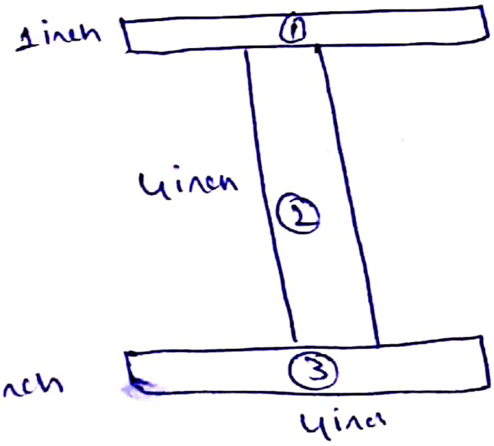
As per Question The maximum Shear stress $\tau = \frac{VQ}{It}$ occure where the maximum Shear force is 16.91 lb

So,

To find the Shear Stress we have the following formula.

$$\tau = \frac{VQ}{It}$$

So we will find the moment of intia.



→ we will find the centriod by following formula.

$$\bar{y} = \frac{A_1 y_1 + A_2 y_2 + A_3 y_3}{A_1 + A_2 + A_3}$$

$A_1 = 4 \times 1 = 4.$

$A_2 = 4 \times 1 = 4.$

$A_3 = 4 \times 1 = 4$

$$\bar{y} = \frac{4 \times 0.5 + 4 \times 3 + 4 \times 5.5}{4+4+4.}$$

$$\bar{y} = 3''$$

Moment of interia. (P-7)

No	$A(in^2)$	$I_x(in)$	$d=(\bar{y}-y_1)$ $(\bar{y}-y^2)(\bar{y}-y^3)$.
①	4	$\frac{4\times(1)^2}{12}$	$=0.333$
②	4	$\frac{1\times(4)^3}{12}$	$=5.333$
③	4	$\frac{4\times(1)^3}{12}$	$=0.333$

(Now 'd').

① $d=(\bar{y}-y_1) = 3-0.5 = 2.5$

② $d=\bar{y}-y_2 = 3-3 = 0.$

③ $d = 3-5.5 = -2.5$

Now d^2.

① $4\times(2.5)^2 = 25.$

② $4\times(0)^2 = 0$

③ $4\times(-2.5)^2 = 25$

Now

$$I_x = I_x + Ad^2$$

① $0.333+25 = 25.333$

② $5.333+0 = 5.333$

③ $0.333+25 = 25.333.$

Total

$$I = I_{x_1} + I_{x_2} + I_{x_3}$$

$$\boxed{I = 55.99 in^2}$$

Now shear stress (P3)

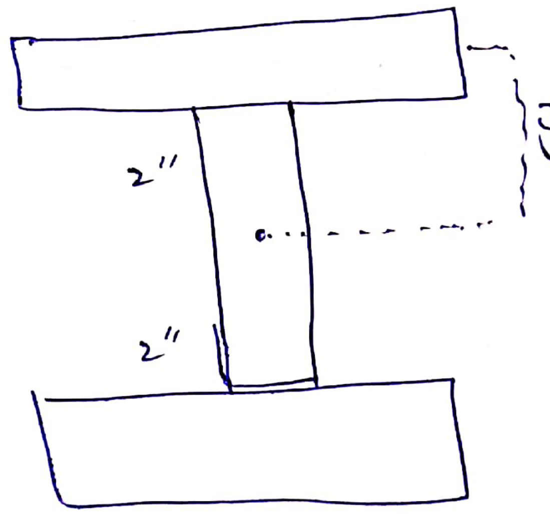
$$\tau = \frac{VQ}{Ib}$$

$V_{max} = 16.91 lb$

$Q = \bar{y}A$

while $b =$ breath of the fiber.

→ Shear stress at point c located at centre of uniformly distributed load so 1 inch below the Top fiber.



$\bar{y} = 2+0.5 = 2.5$

$A = 1\times4 = 4$

$Q = 4\times2.5 = 10$

As we know that

$$t = \frac{VQ}{Ib}$$

$$t = \frac{(16.91)(10)}{(55.996)(4)}$$

$\boxed{t = 0.7549 \, psi}$

To Find flexural stress,

(P9)

$$\sigma = \frac{MY}{I}$$

where M is maximum moment in B.M.D.

$M = 59.46$ lb

$$\sigma = \frac{(59.46)(2)}{55.996}$$

$$\boxed{\sigma = 2.1237 \text{ psi}}$$

So we know that shear stress at point c is

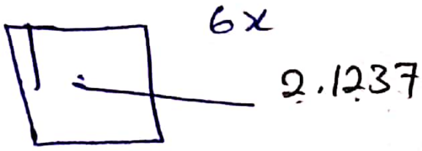
$t = 0.07549$ psi

&

Flexural stress at point c is

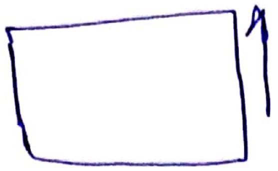
$\sigma = 2.1237$ psi

Now consider 'c' is a planner element

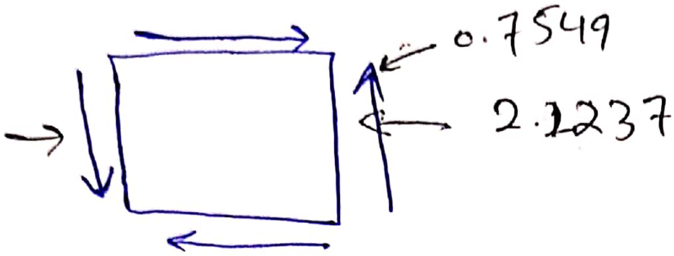


2.1237 psi is compressive because point c lies in compression zone of Beam cross section.

Now Shear Stress is



Showing combine stress on 2D element.



Now we can find the stress state consider of point 'C' at a degree of 20° on clockwise.

$\sigma_x = -2.1237$ psi

$\sigma_y = 0$

$\tau_{xy} = 0.7549$ psi

$\sigma_{x'} = ?$

$\sigma_{y'} = ?$

$\tau_{x'y'} = ?$

As we know that

$$\sigma_{x'} = \frac{\sigma_x + \sigma_y}{2} + \frac{\sigma_x - \sigma_y}{2} \cos\theta + \tau_{xy} - \sin\theta .$$

As we know that.

$$\sigma_{x'} = \frac{\sigma_x + \sigma_y}{2} + \frac{\sigma_x - \sigma_y}{2} \cos\theta + \tau_{xy} \sin\theta .$$

(P11)

$$\tau_{x'y'} = -\frac{\sigma_x - \sigma_y}{2}\sin 2\theta + \tau_{xy}\cos 2\theta$$

$$\sigma_{y'} = \frac{\sigma_x + \sigma_y}{2} - \frac{\sigma_x - \sigma_y}{2}\cos 2\theta - \tau_{xy}\sin 2\theta$$

$\Rightarrow$ **For $\sigma_{x'}$**

$$\sigma_{x'} = \frac{2.1237+0}{2} + -\frac{2.1237-0}{2}\cos(2(-20)) + (0.7549)\sin(2(-20))$$

$$\sigma_{x'} = 1.06185 + (-0.8134) + (-0.4852).$$

$\Rightarrow$ $\sigma_{x'} = -0.23675$ psi Compression.

For $\sigma_{y'}$

$$\sigma_{y'} = -\frac{2.1237+0}{2} - \frac{(-2.1237)-0}{2}\cos 2(-20) - (0.7549)\sin 2(-20)$$

$$= -1.06185 + 0.8134 + 0.4852.$$

$$\boxed{\sigma_{y'} = 0.23655 \text{ psi}}$$ Tension

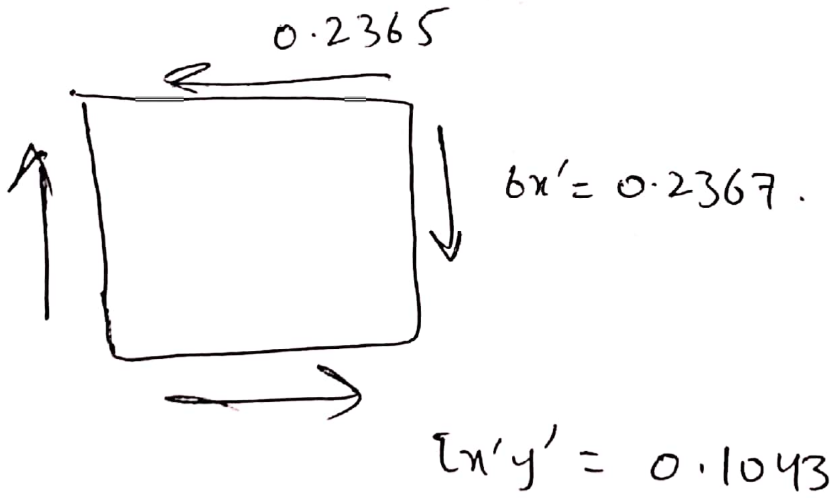
$$\tau_{x'y'} = -\frac{\sigma_x - \sigma_y}{2} \sin 2\theta + \tau_{xy} \cos 2\theta$$

$$= -\frac{(-2.1237-0)}{2} \sin 2(-20) + 0.7549 \cos 2(-20)$$

$$= -0.6825 + 0.5782 .$$

$$\tau_{x'y'} = +0.1043 \text{ psi}$$

→ Now the New stress state after 20° Clockwise rotation is.



Now we will find its principle stress.

$$\sigma_{12} = \frac{\sigma_x + \sigma_y}{2} \pm \sqrt{\left(\frac{\sigma_x - \sigma_y}{2}\right)^2 + (\tau_{xy})^2}$$

$$= -\frac{2.1237}{2} \pm \sqrt{\left(\frac{-2.1237}{2}\right)^2 + (0.7549)^2}$$

$$= -1.06185 \pm 1.3028 .$$

$\sigma_y = \sigma_1 = -1.06185 + 1.3028$

$= 1.24095$

$\rightarrow \sigma_x = \sigma_2 = -1.06185\ 1.3028.$

$\Rightarrow -2.36465.$

Max in plane Shear Stress.

$$\tau_{xy} = \sqrt{\left(\frac{\sigma_x - \sigma_y}{2}\right)^2 + \tau_{xy}^2}$$

$$= \sqrt{\left(-\frac{2.1237}{2}\right)^2 + (0.7549)^2}$$

$$\sqrt{1.1275 + 0.5698.}$$

$$\boxed{\tau_{xy} = 1.3028\,psi}$$

The co-ordinate of circle can be find by this

$$\left(\frac{6x+6y}{2}, 0\right)$$

Centre coordinate.

$$(h, k) = \left(\frac{-2.1237}{2}, 0\right)$$

$$= (-1.06185, 0)$$

Now to find radius of mohr, circle,

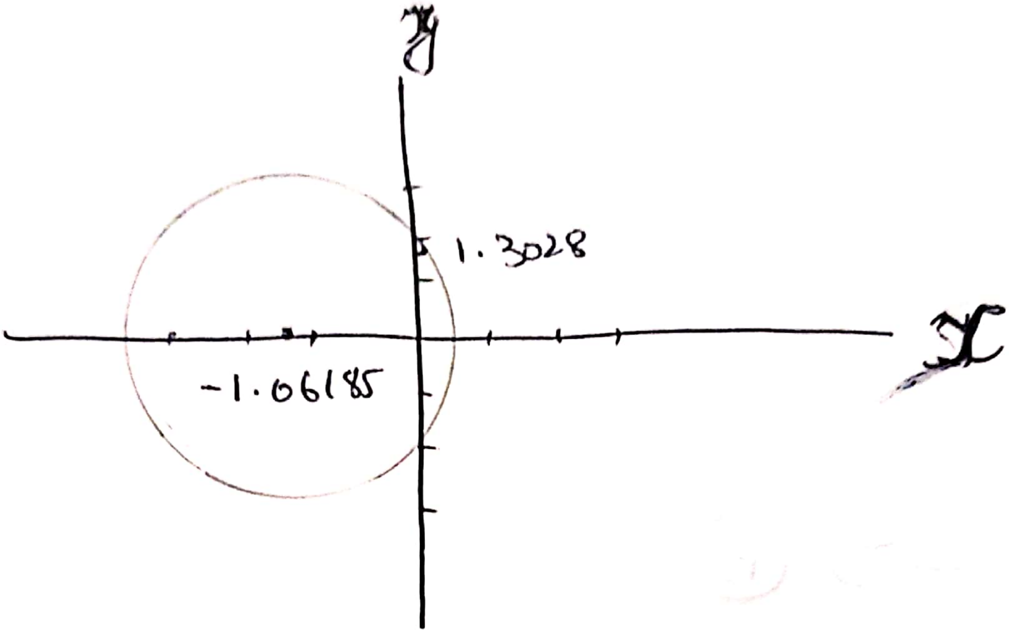
$$r = \sqrt{\left(\frac{6x+6y}{2}\right)^2 + \tau_{xy}^2}$$

$$r = \sqrt{\left(\frac{2.1237}{2} - 0\right)^2 + [(0.7549)]^2}$$

$$r = \sqrt{1.1275 + 0.5698}$$

$$\boxed{r = 1.302804667}$$

Scanned with CamScanner


y
1.3028
x
-1.06185