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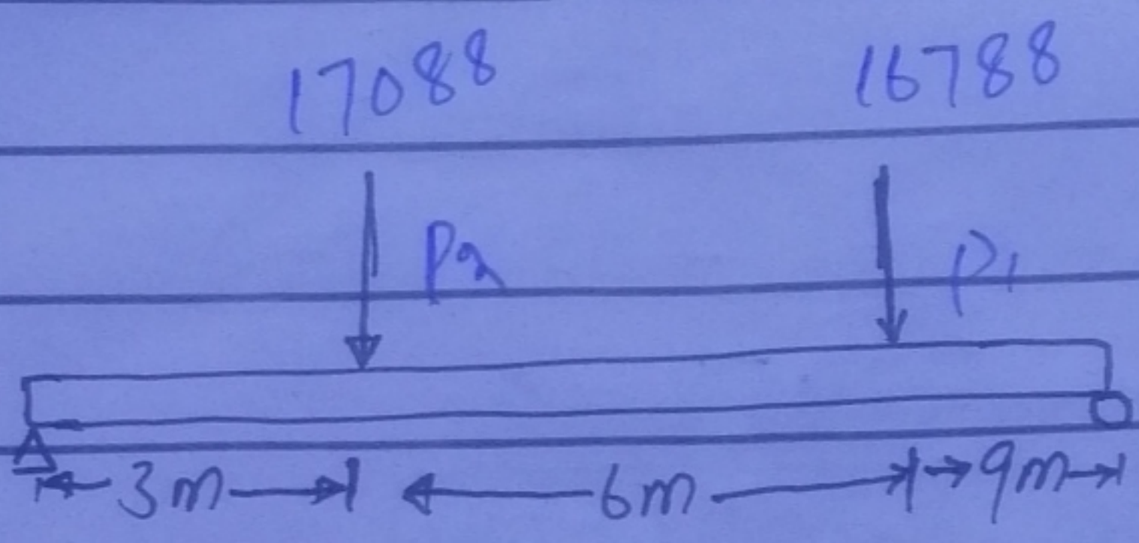
Name: [redacted] Ziaullah ID: 16588.

Section: B Dept: Civil Engineering.

Paper: Engineering mechanics.

Q No 1



Sol

$P_1 = 200 + \text{Student ID}$

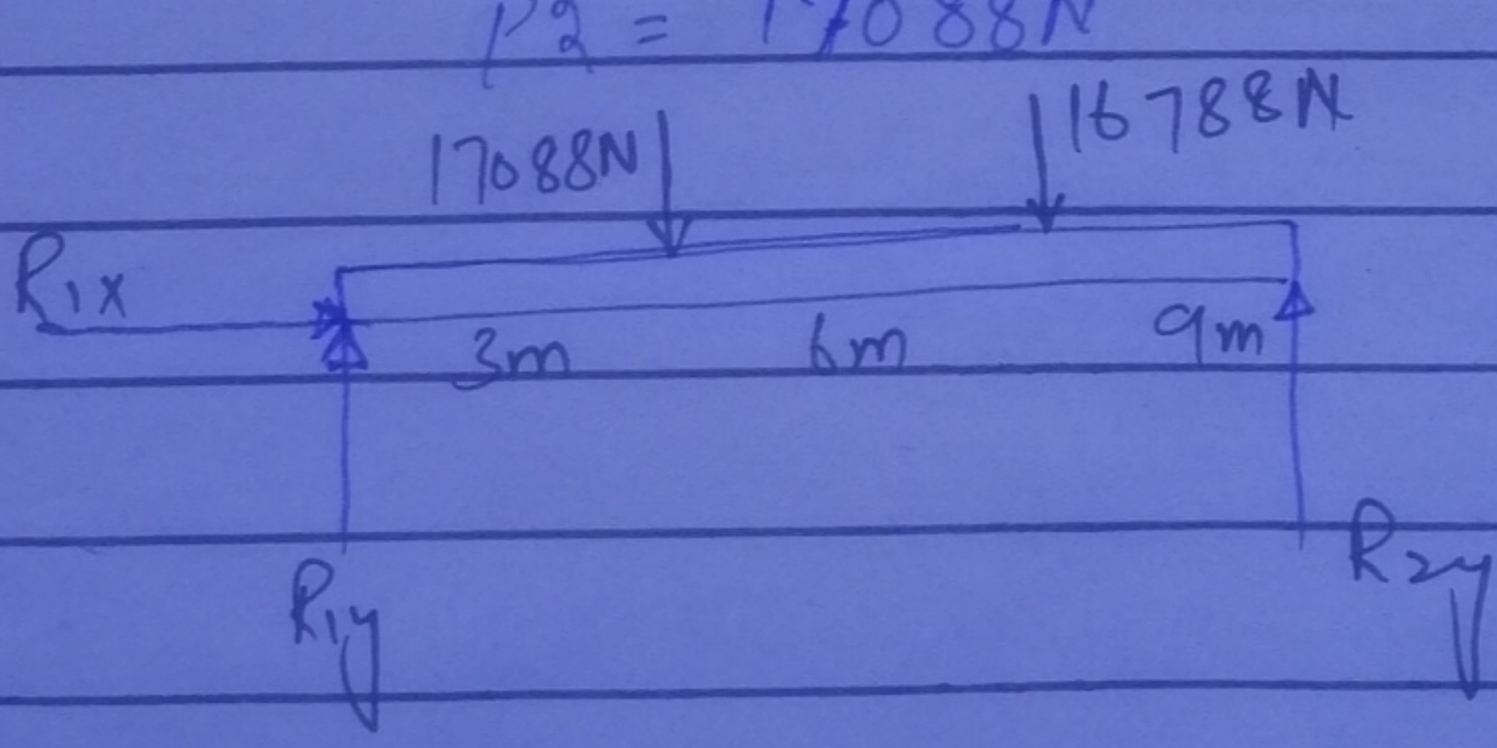
$P_1 = 200 + 16588$

$P_1 = 16788N$

$P_2 = 500 + \text{student ID}$

$P_2 = 500 + 16588$

$P_2 = 17088N$



$R_{1x} = 0$

$R_{1y} + R_{2y} = 16788 - 17088 = 0 \quad \text{---(i)}$

$\therefore (R_{2y} \times 18) - (16788 \times 9) - (17088 \times 3) = 0$

$18R_{2y} - 151092 - 51264 = 0$

$18 R_{2y} - 202356 = 0$

$R_{2y} = \frac{202356}{18}$

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$R_{2y} = 11242 - N$

put the value of R_{2y} in equation we get.

$$R_{1y} + R_{2y} - 16788 - 17088 = 0$$

$$R_{1y} + 11242 - 33876 = 0$$

$$R_{1y} - 22454 = 0$$

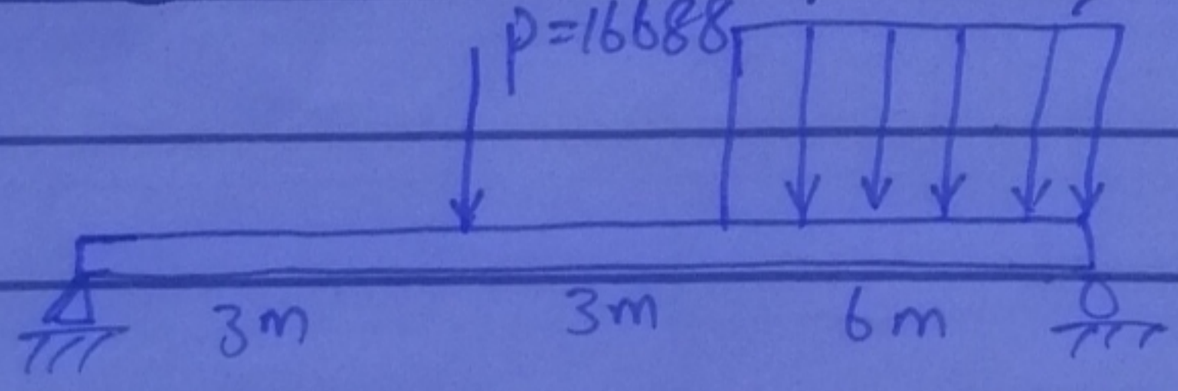
$$R_{1y} = 22454N$$

So

$R_{1x} = 0 - N$ $R_{1y} = 22454N$ $R_{2y} = 11242 - N$

ON02.

Sol.



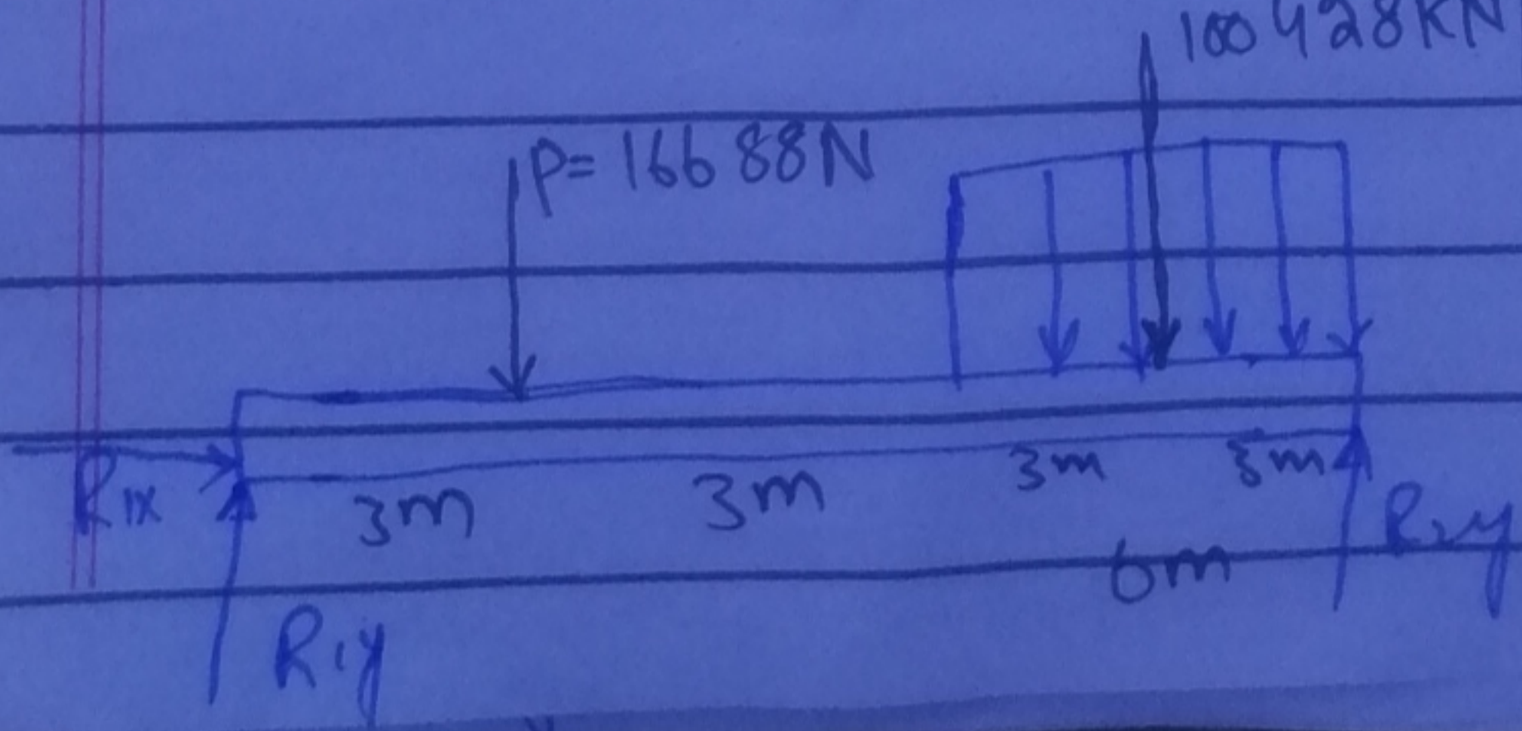
$P = 100 + \text{Student ID}$

$P = 100 + 16588 = 16688N$

$UDL = 150 + \text{Student ID}$.

$= 150 + 16588 = 16738N$

$P_1 = \text{Resultant of UDL} = 16738 \times 6 = 100428 KN/m$



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$R_{1x} = 0\text{-}N$

$R_{1y} + R_{2y} - 16688 - 100428 = 0$ —— (1)

$\Sigma M = 0$

$(R_{2y} \times 12) - (16688 \times 3) - (100428 \times 9) = 0$

$12\ R_{2y} - 50064 - 903852 = 0$

$12\ R_{2y} - 953916 = 0$

$R_{2y} = \frac{953916}{12}$

$R_{2y} = 79493\text{-}N$

put the value of R_{2y} in equation (1) we get.

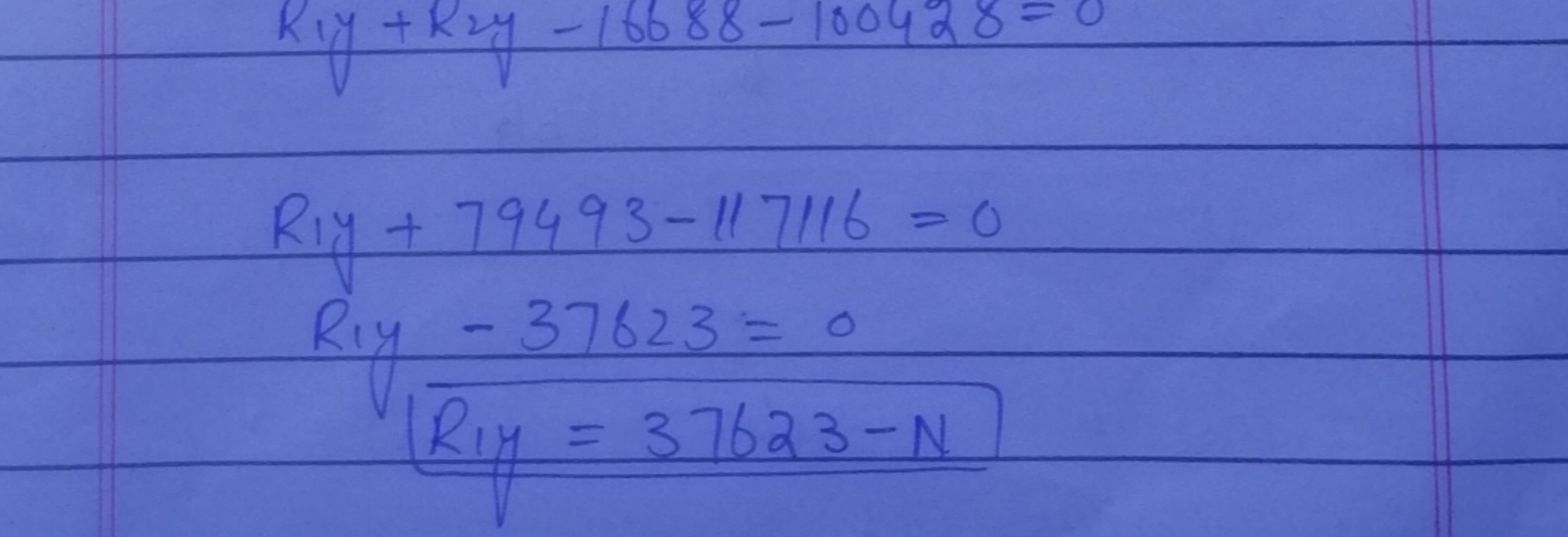
$R_{1y} + R_{2y} - 16688 - 100428 = 0$

$R_{1y} + 79493 - 117116 = 0$

$R_{1y} - 37623 = 0$

$R_{1y} = 37623\text{-}N$

$R_{1x} = 0\,N$ $R_{1y} = 37628\text{-}N$ $R_{2y} = 79493\text{-}N$



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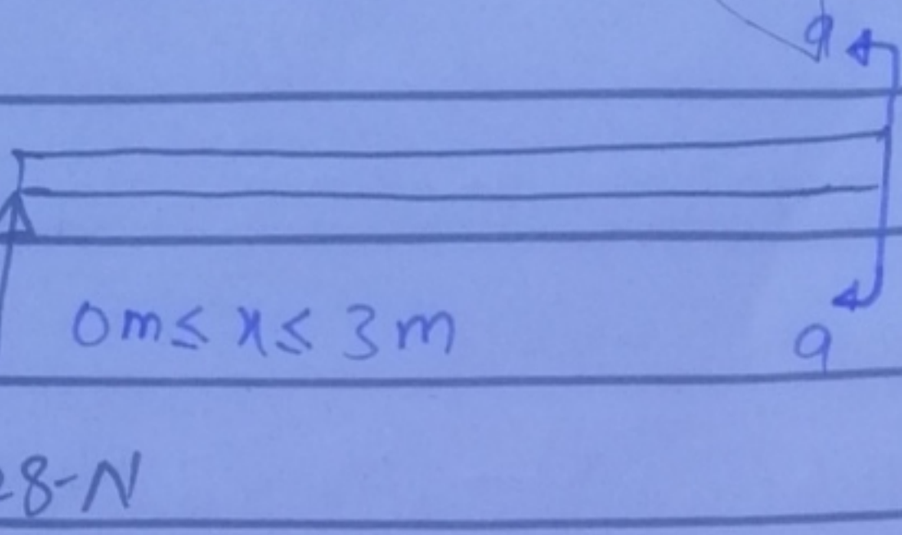


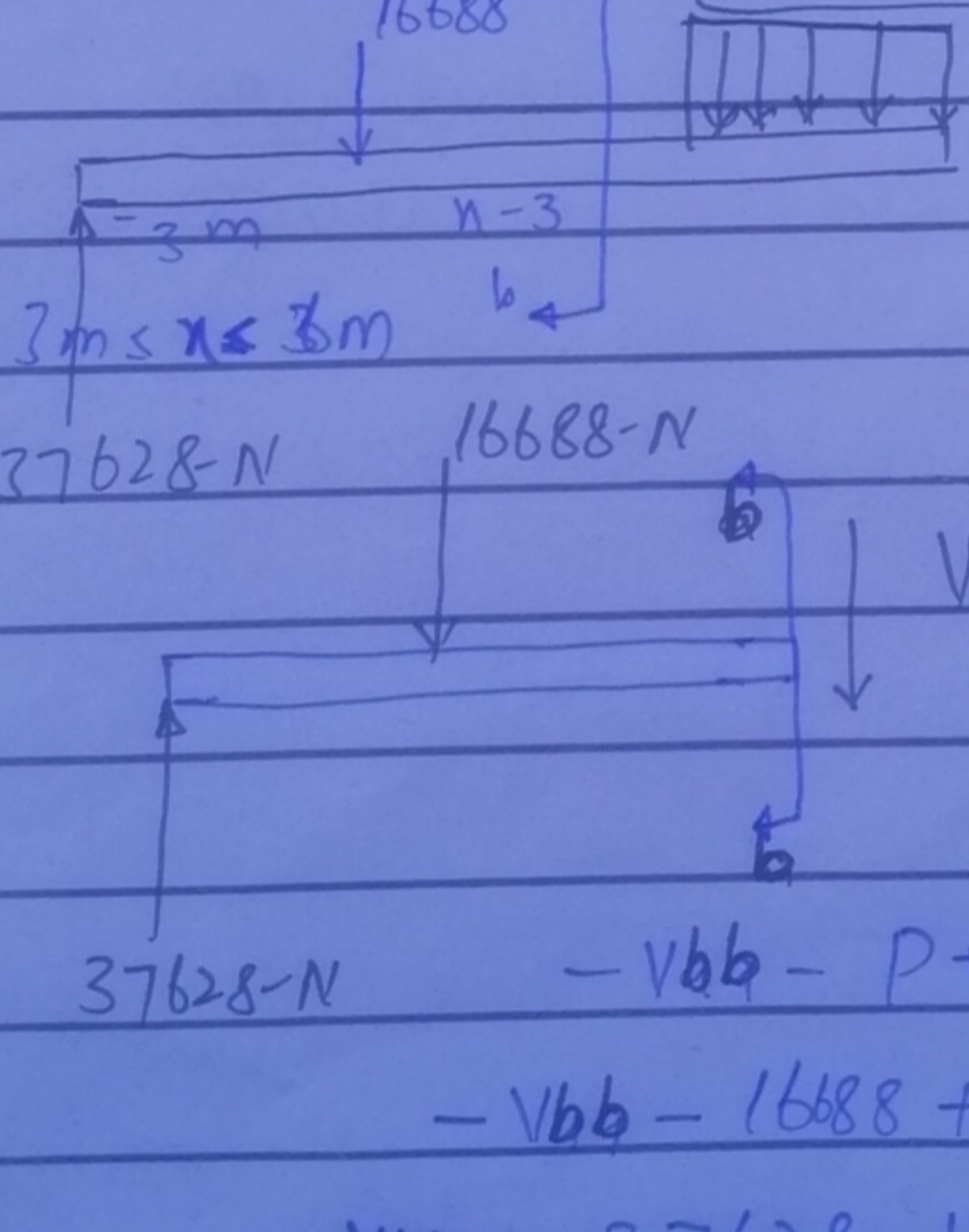
Sumattion $\leftarrow$ $\sum F_y = 0$

$$-V_{qq} + 37628 = 0$$

$$V_{qq} = 37628.$$

at $x = 0$ $\quad V_{qq} = 37628\text{-N}$

at $x = 3$ $\quad V_{qq} = 37628\text{-N}$



$$-V_{bb} - P + 37628 = 0$$

$$-V_{bb} - 16688 + 37628$$

$$V_{bb} = 37628 - 16688$$

$$V_{bb} = 20940.$$

at $x = 3$ $\quad V_{bb} = 20940\text{N}$

at $x = 6$ $\quad V_{bb} = 20940\text{-N}$

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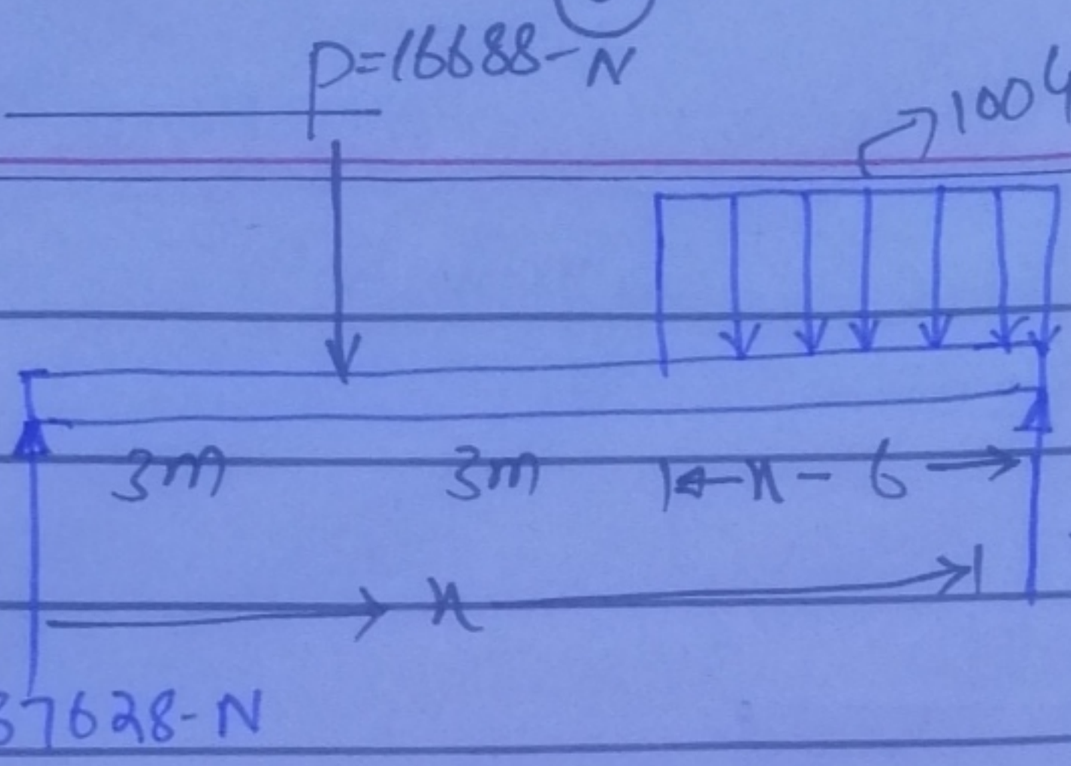
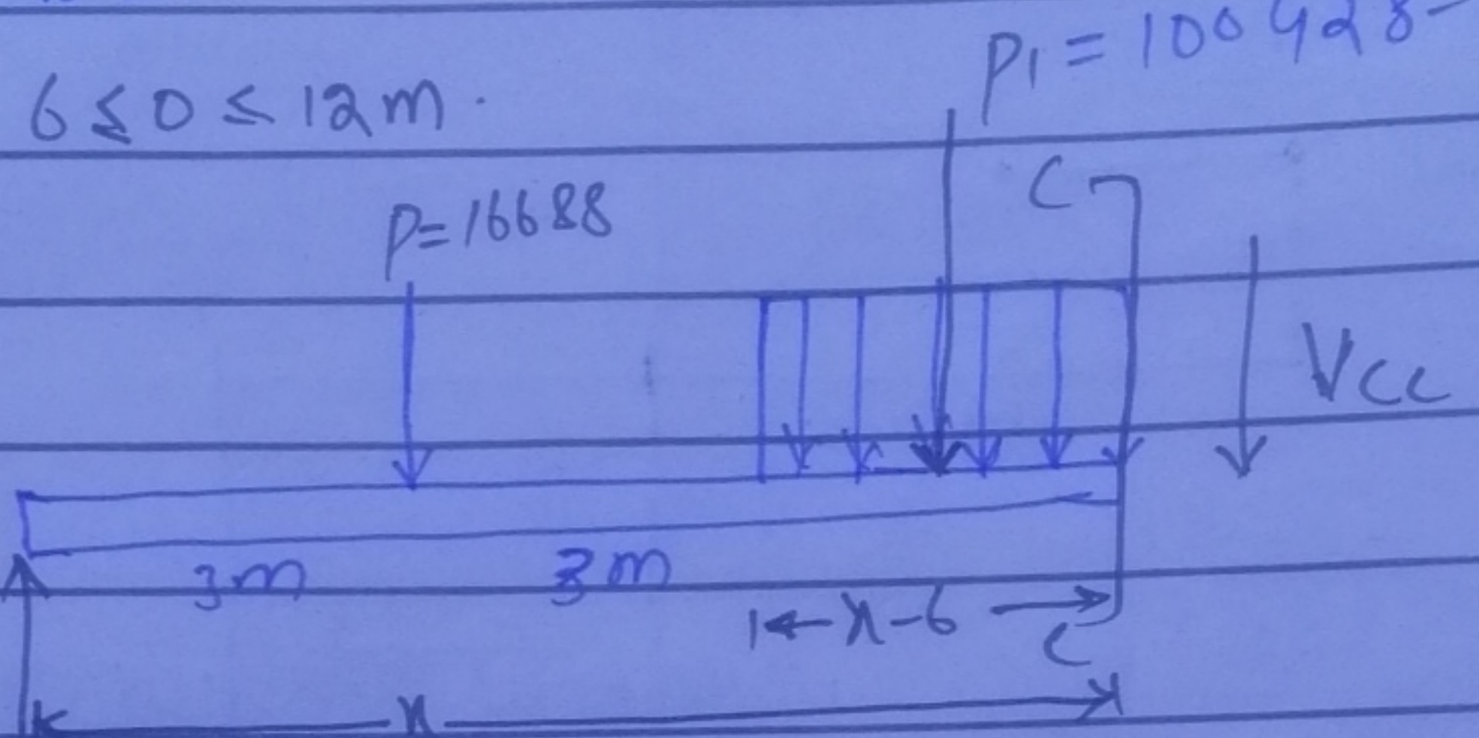
(5)



$6 \leq 0 \leq 12m$.



$P_1 = 100428x(x-6)$

$P = 100428x - 602568$

$-Vcc - P_1 - P + 37628 = 0$

$-Vcc - 100428x - 602568 - 16688 + 37628 = 0$

$Vcc = 37628 - 16688 - 602568 - 100428x$

$Vcc = 37628 - 619256 - 100428x$

$Vcc = -100428x - 581628$

at $x = 6$ $\quad Vcc = -1184196$-N

at $x = 12$ $\quad Vcc = -1786764$-N

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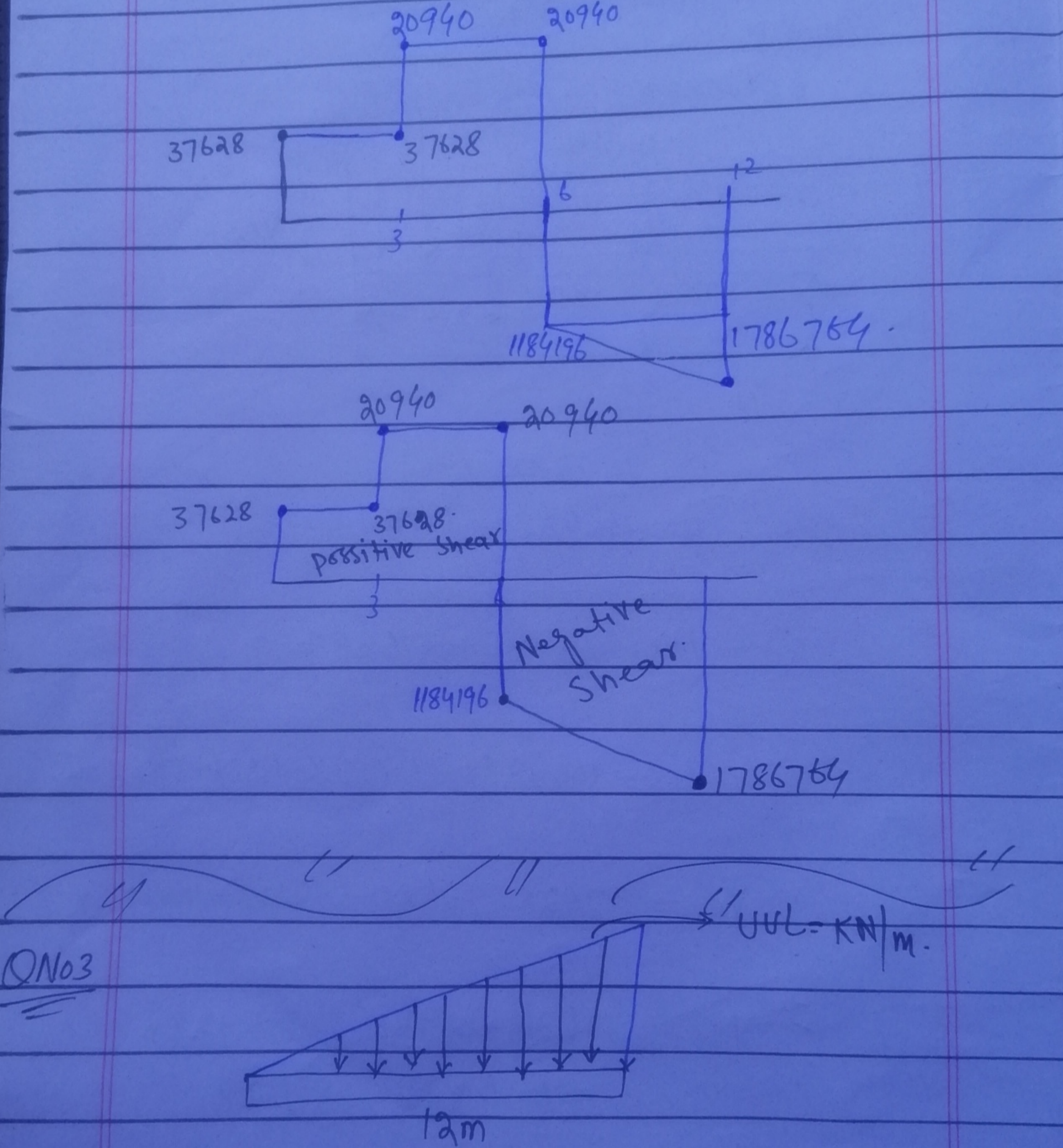
Shear force diagrams:→



QNo3

UVL= Student ID/1000

UUL= 16588/1000

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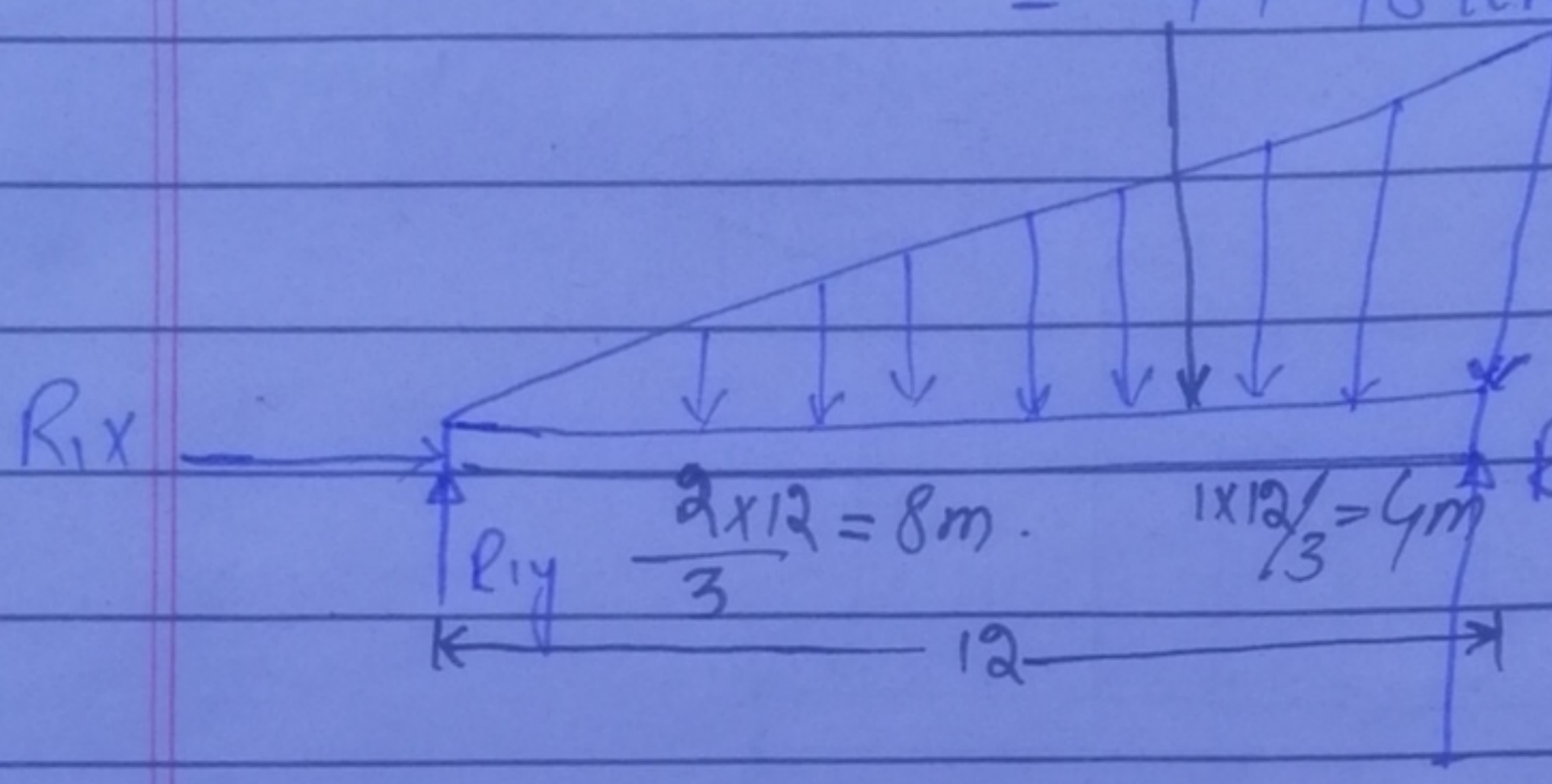
UVL = 16.58-KN/m.

P= Resultant of UVL = $\frac{16.58 \times 12}{2}$

= 99.48 KN/m.



$R_{1x} = 0$

$R_{1y} + R_{2y} - 99.48 = 0$ —(i)

$\sum M = 0$

$(R_{2y} \times 12) - (99.48 \times 8) = 0$

$12\, R_{2y} = 795.84$

$R_{2y} = \frac{795.84}{12}$

$\boxed{R_{2y} = 66.32\text{-N}}$ put the value of R_{2y} in eq(i) we get.

$R_{1y} + R_{2y} - 99.48 = 0$

$R_{1y} + 66.32 - 99.48 = 0$

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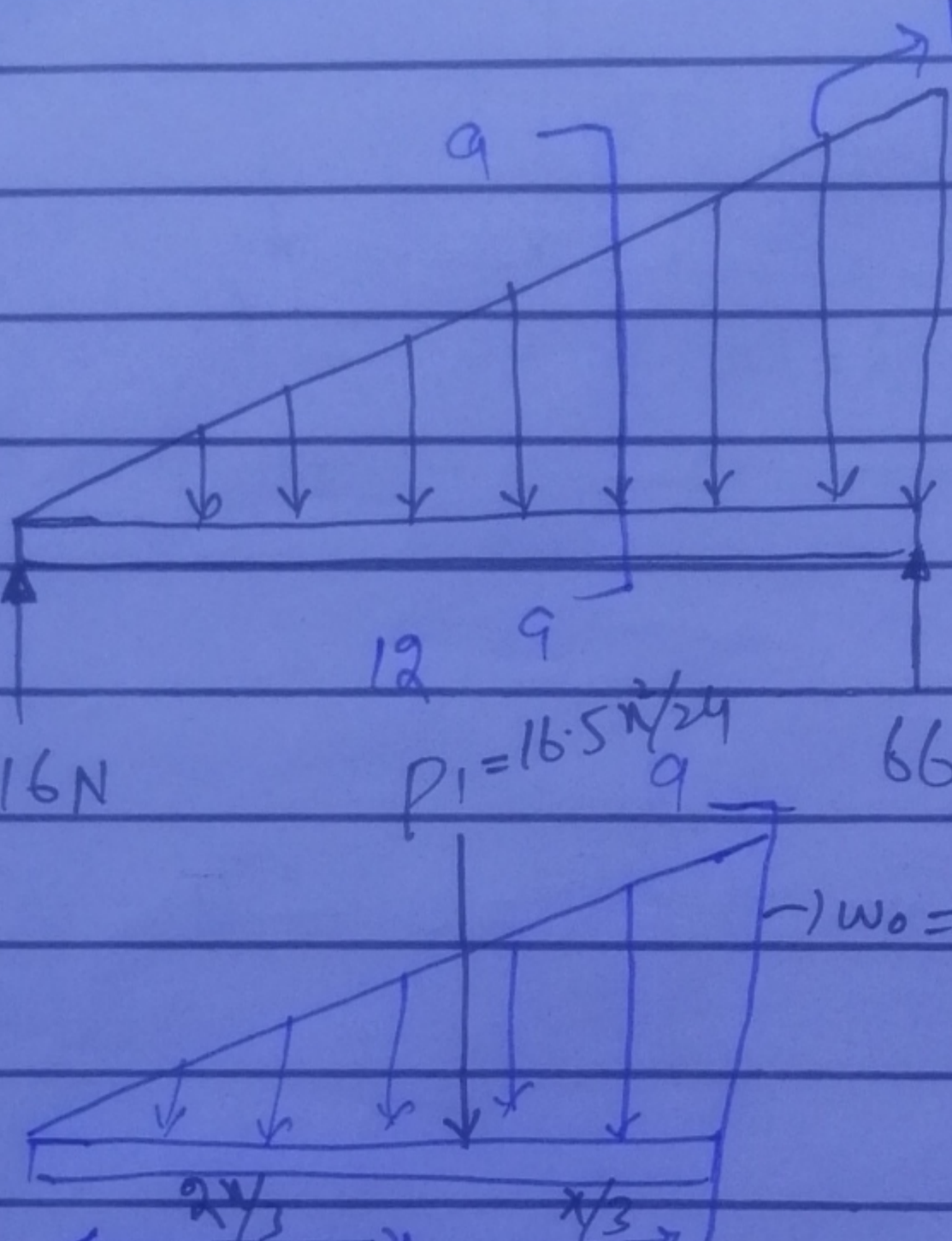
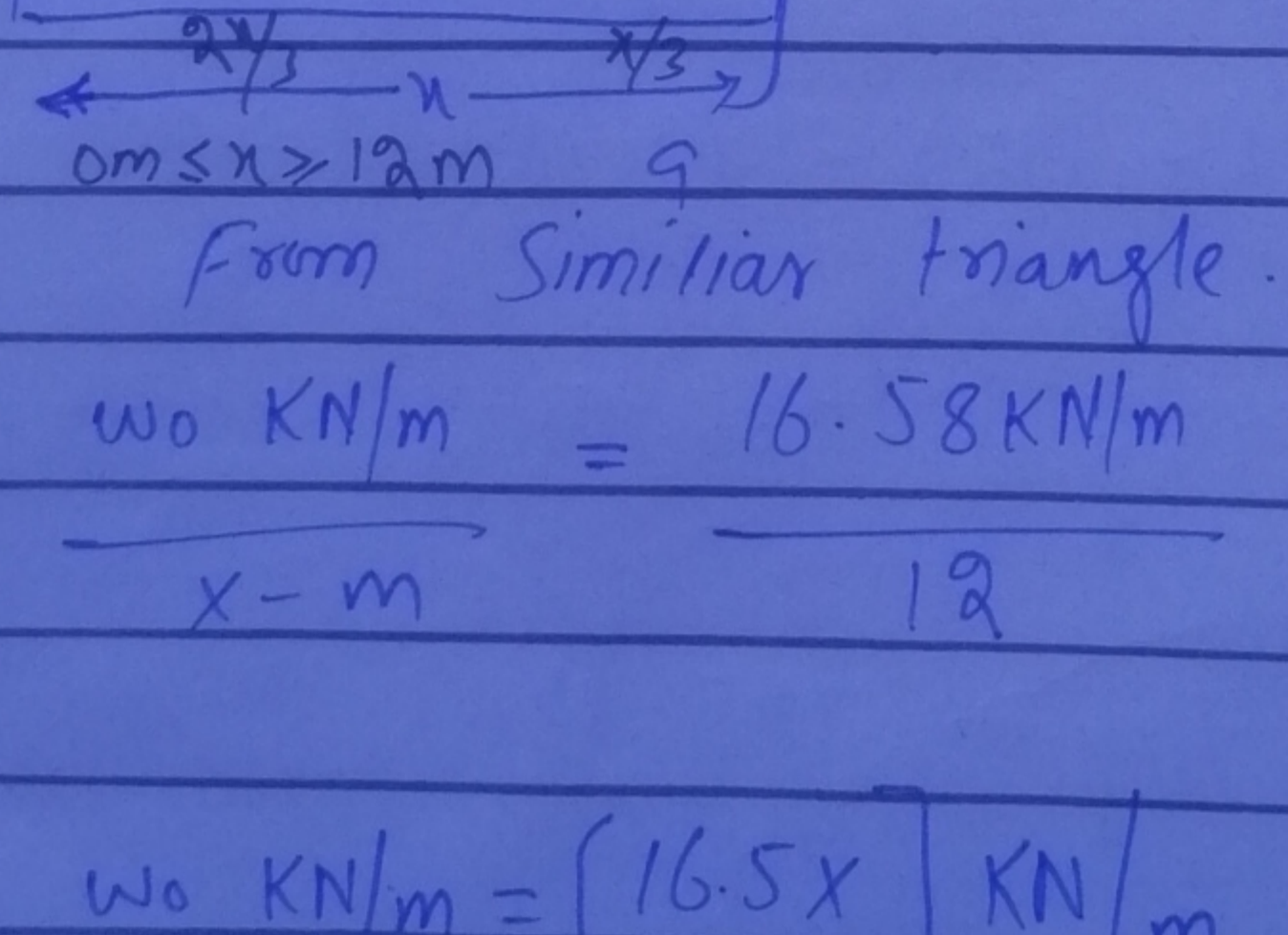
$$R_1y - 33.16 = 0$$

$$\boxed{R_1y = 33.16 - N}$$

Now force shear force.





$$W_0 = \frac{16.5x}{12}$$

From Similiar triangle.

$$\frac{w_0\ KN/m}{x - m} = \frac{16.58\ KN/m}{12}$$

$$w_0\ KN/m = \left[\frac{16.5x}{12}\right] KN/m.$$

$$P_1 = w_0 \times x/2$$

$$P_1 = \left[\frac{16.5x \times x}{12}\right] \div 2$$

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$$P_1 = \frac{16.5x^2}{24} - KN$$

Sumation $Fy = 0$

$$-V_{aa} - p + 33.16 = 0$$

$$-V_{aa} - \frac{16.5x^2}{24} + 33.16 = 0$$

$$V_{aa} = -\frac{16.5x^2}{24} + 33.16$$

at $x = 0$ $\quad V_{aa} = 33.16 - N$

at $x = 12$ $\quad V_{aa} = -65.84 - N$

Now for Bending moment :→

$R_1x = 0$ $\quad R_2y = 66.32 - N$ $\quad R_1y = 33.16N$

we find p in Shear force

thus p = 99.48 K-N/m.

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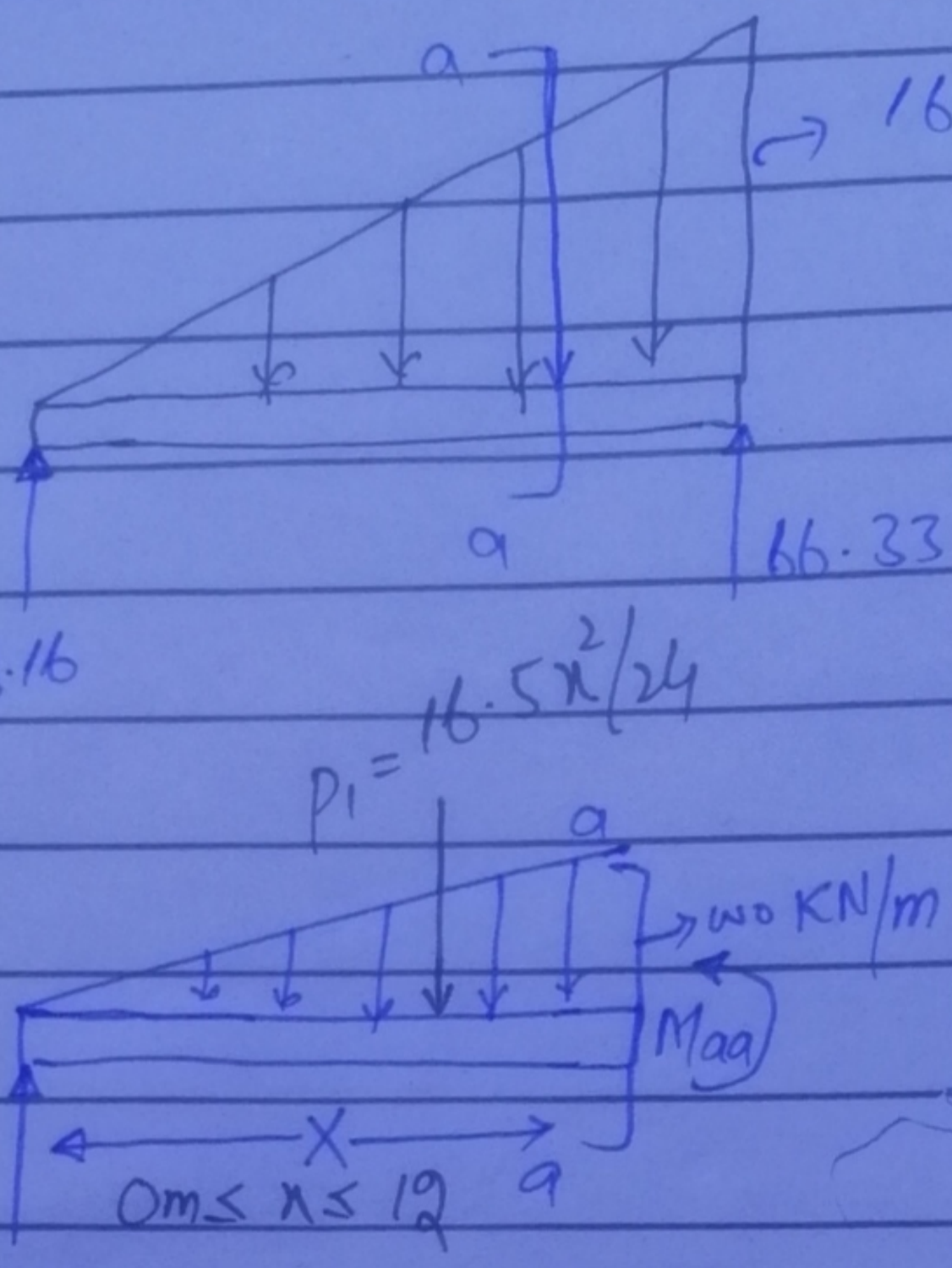

$P_1 = 16.5x^2/24$

From Similar triangle.

$$\frac{wo\ KN/m}{x-m} = \frac{16.58\ KN/m}{12}$$

$$wo\text{-}KN/m = \frac{16.58x\ K\text{-}N/m}{12}.$$

$$P_1 = wo \cdot x/2$$

$$P_1 = \frac{16.58x \cdot x}{12 \times 2}$$

$$\boxed{P_1 = \frac{16.58x^2 \cdot KN/m}{24}}$$

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Sumation $M = 0$

$$Maa - P_1(x/3) - 33.16x = 0$$

$$Maa + \left(\frac{16.58x^2}{24} \times x/3\right) - 33.16x = 0$$

$$Maa + \frac{16.58x^3}{72} - 33.16x = 0$$

$$Maa = 33.16x - \frac{16.58x^3}{72}$$

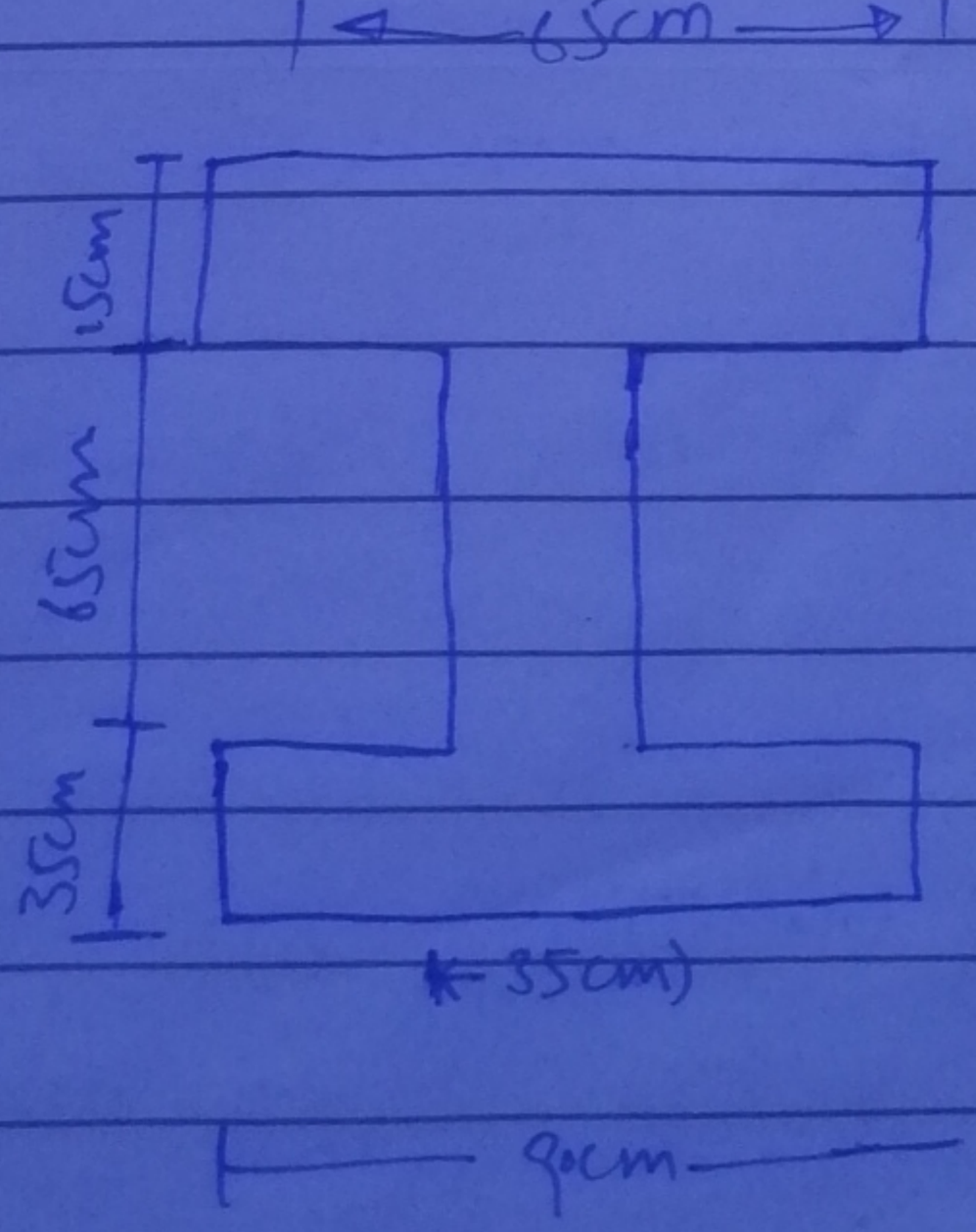
at $x = 0$ $\quad Maa = 0$ - KNm

at $x = 12$ $\quad Maa = 0$ - KN-m

11 C1

Q No 4 (a)

Sol



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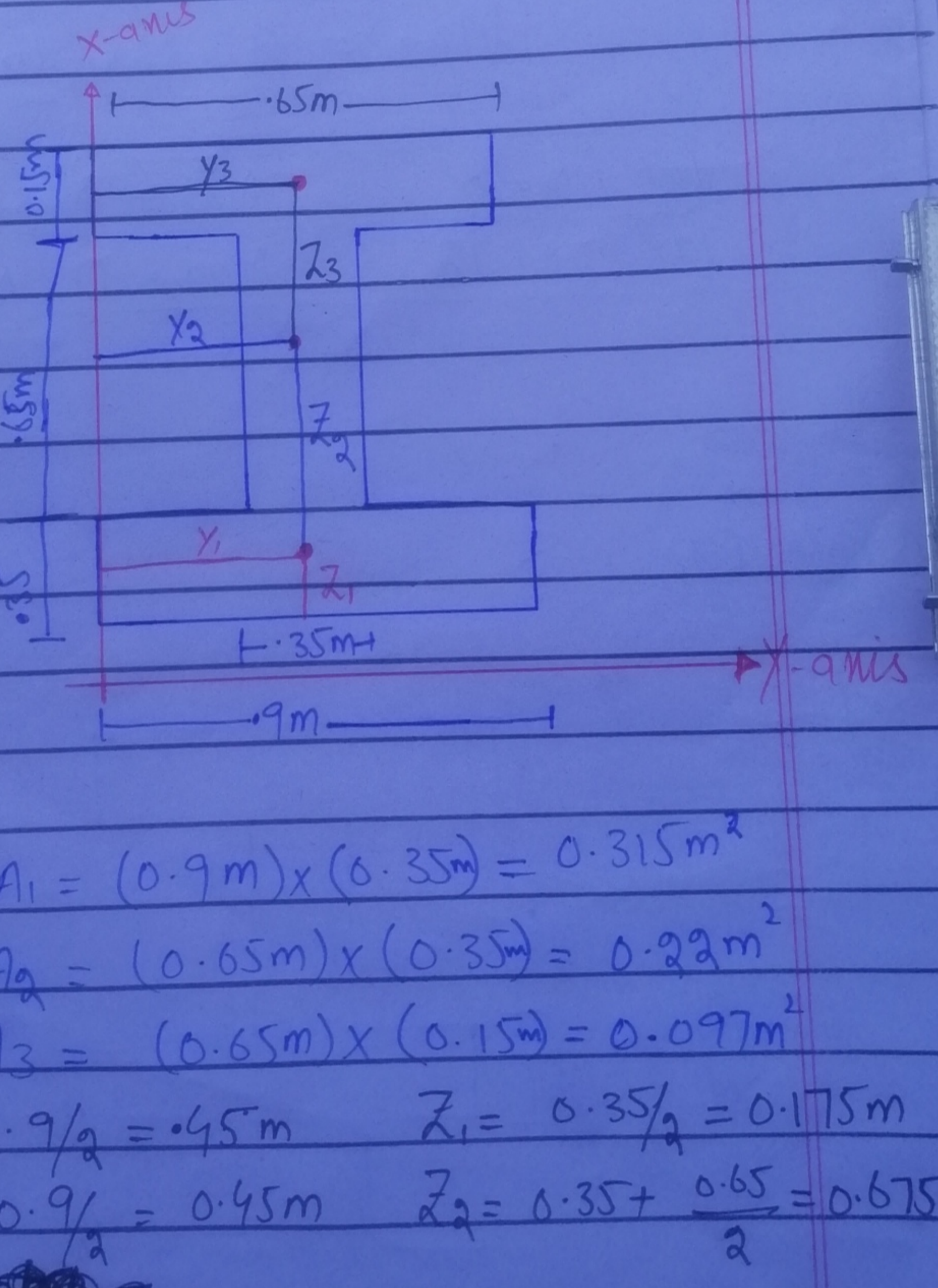
Change Cm into meter.

90cm = .9m

35 cm = .35m

65cm = .65m

15 cm = 0.15m.



$A_1 = (0.9m) \times (0.35m) = 0.315m^2$

$A_2 = (0.65m) \times (0.35m) = 0.22m$

$A_3 = (0.65m) \times (0.15m) = 0.097m^2$

$y_1 = 0.9/2 = .45m$ $\quad z_1 = 0.35/2 = 0.175m$

$y_2 = 0.9/2 = 0.45m$ $\quad z_2 = 0.35 + \frac{0.65}{2} = 0.675m$

$y_3 = 0.65/2 = 0.325m$, $\quad z_3 = 0.35 + 0.65 + 0.15/2 = 1m$

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$y_1 = 0.45m$, $y_2 = 0.45m$, $y_3 = 0.325m$

$Z_1 = 0.175m$, $Z_2 = 0.675m$, $Z_3 = 1m$.

$$y_c = \frac{A_1y_1 + A_2y_2 + A_3y_3}{A_1 + A_2 + A_3}$$

$$= \frac{(0.315)(0.45) + (0.22)(0.45) + (0.097)(0.325)}{0.315 + 0.22 + 0.097}$$

$$= \frac{0.141 + 0.099 + 0.0315}{0.632}$$

$$= \frac{0.2715}{0.632}$$

$$\boxed{y_c = 0.429m}$$

$$Z_c = \frac{A_1Z_1 + A_2Z_2 + A_3Z_3}{A_1 + A_2 + A_3}$$

$$= \frac{(0.315)(0.175) + (0.22)(0.675) + (0.097)(1)}{0.315 + 0.22 + 0.097}$$

$$= \frac{0.055 + 0.148 + 0.097}{0.632} = \frac{0.3}{0.632}$$

$$\boxed{Z_c = 0.4m}$$

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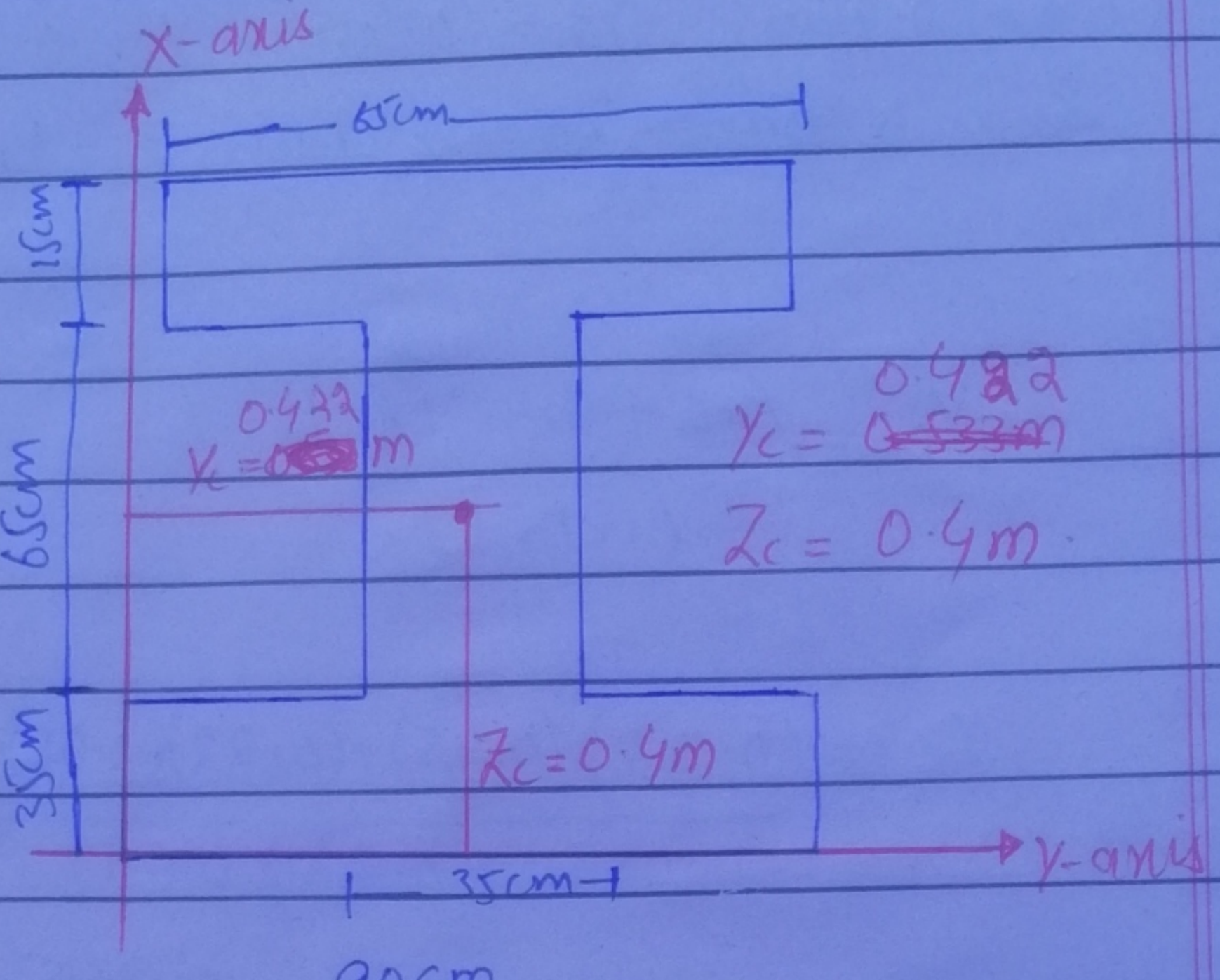

Q No5

Ans WORK:→

Work is Said to be done to be done when a body or object moves with application of external force. We can define work as an activity involving a movement & force in the direction of the force. For Example, a force of 30 newtons pushing an object 3 meter in the Same direction of the force will

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will do 90 joules (j) of work.

$W = F \cdot d$

$W = Fd\cos\theta$.

there are Several good Example of work in real life that Can be observed in everyday life. A horse pulling a plow through the field, a father pushing a grocery Cart down the aisle of a grocery Store. A freshman lifting a backpack full of books upon her shoulder, A weightlifter lifting a barbell above his head .e.t.c

Energy:→

Energy is the ability to do work. energy Can neither be created nor destroyed. it Can only be transformed from one object to another.

Examples:→

An object possessing mechanical energy has both both Kinetic & potential energy.

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Although the energy of one of the forms may be equal to Zero.
A moving Car has Kinetic energy. If you move the Car up a mountain, it has Kinetic & potential energy.
A ~~block~~ Book Sitting on a Table has potential energy.

Power:→

power Can be defined as the work done per unit time. power is a physical Concept that has several different meanings, depending on the Context & the Information that is available. We Can define power is the rate of doing work. it is the amount of energy Consumed per unit time.

$$P = W/t$$

The unit of power is joule per Second.

Example of powers→ A garage hoist lifts a truck

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truck up a meters above the ground in 15 second. Find the power dilivered to the truck?

Sol

$$F = mg = 1000 \times 9.81 = 9810\,N$$

$$W = F \cdot d = 9810\,N \times 2m = 19620\,Nm$$

$$W = 19620\,j$$

$$P = W/t = 19620\,j/15s$$

$$\boxed{P = 1308\,j/s}$$

Q No4 (b)

Sol

Given data

Area = 65cm x 35cm.

Required = ?

moment of Inertia = ?

Radius of Gyration = ?

Section of moduli = ?

For moment of Gyration:→

$$I_x = \frac{1}{3}bh^3$$

$$= \frac{1}{3}(65)(35)^3$$

$$\boxed{I_x = 928958\,mm^4}$$

$$I_y = \frac{1}{3}b^3h = \frac{1}{3}(65)^3(35)$$

$$\boxed{I_y = 3203958\,mm^4}$$

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$$\bar{I}_{x'} = \frac{1}{12} bh^3$$

$$\bar{I}_{x'} = \frac{1}{12} (65)(35)^3$$

$$\boxed{\bar{I}_{x'} = 232239.5\ mm^4}$$

$$\bar{I}_{y'} = \frac{1}{12} b^3 h$$

$$\bar{I}_{y'} = \frac{1}{12} (65)^3 (35)$$

$$\boxed{\bar{I}_{y'} = 800989.5\ mm^4}$$

$$\bar{I}_z = \frac{1}{12} bh\left(b^2 + h^2\right)$$

$$= \frac{1}{12} (65)(35)\left((65)^2 + (35)^2\right)$$

$$= \frac{1}{12} (65)(35)(5450)$$

$$\boxed{I_z = 1033229\ mm^4}$$

Radius of gyration:→

$$r_y = \left(\frac{I_y}{A}\right)^{1/2} \qquad A = b \times d$$

$$r_y = \left(\frac{3923958}{2275}\right)^{1/2} \qquad A = 65 \times 35$$

$$= 2275$$

$$r_y = \sqrt{1408.3}$$

$$\boxed{r_y = 37.52\ mm}$$

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$$Y_Z = \left(\frac{I_Z}{A}\right)^{1/2}$$

$$= \left(\frac{1033229.16}{2275}\right)^{1/2}$$

$$Y_Z = \sqrt{454}$$

$$\boxed{Y_Z = 21.3 \text{ mm}}$$

Section moduli :→

$$S = \frac{1}{6} bh^2$$

$$S = \frac{(65)(35)^2}{6}$$

$$S = \frac{79625}{6}$$

$$\boxed{S = 13270 \text{ mm}^2}$$

" " "

the end -