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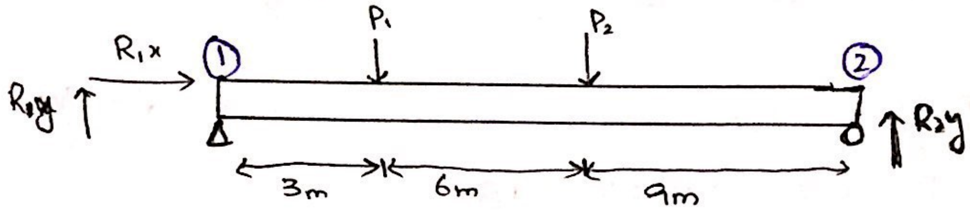
Section: A

Q1 Find the support reactions, show all your ~~values~~. calculations.



$P_1 = 200 + \text{Student I.D}$, $P_2 = 500 + \text{Student I.D}$

$= 200 + 16096$ $\quad = 500 + 16096$

$= 16296$ $\quad = 16596$

Solution

$R_1x = 0$ $\quad \Sigma F_x = 0$

Now

$R_{1y} + R_{2y} - P_1 - P_2 = 0$ $\quad \Sigma F_y = 0$

$R_1y + R_2y - 16296 - 16596 = 0$

$R_1y + R_2y - 32896 = 0$

$\boxed{R_1y + R_2y = 32896} \rightarrow eq①$

$R_1y = [(16596 \times 9) + (16296 \times 15)]/18$ $\quad \Sigma M_2 = 0$ at Point ②

$R_1y = (149,364 + 244,396)/18$

$\boxed{R_1y = 21,875} \rightarrow$ Put in eq ①

$R_1y + R_2y =$ ~~32~~ 32896

$R_{2}y = -R_{1}y + 32896$

$R_{2}y = 32896 - 21,875.5$

$R_{2}y = 11,020.5$

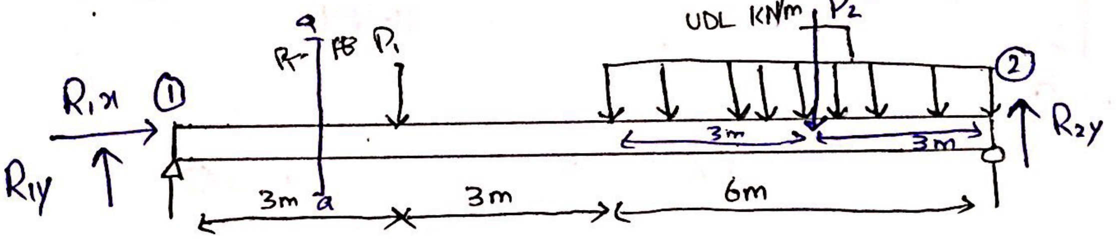
$\boxed{R_{1}x = 0}$, $\boxed{R_{1}y = 21,875.5}$, $\boxed{R_{2}y = 11020.5}$

(i) 2 Draw the neat shear force diagram, show all your calculations.

$P_1 = 100 +$ Student I.D , UDL $= 150 +$ Student I.D

$= 100 + 16096$, UDL $= 150 + 16096$

$= 16196$ $= 16246.$



Solution

UDL Resultant $= P_2 = 16249 \times 6 = 97,496$

$R_1x = 0$ $\Sigma F_x = 0.$

$R_1y + R_2y - P_1 - P_2 = 0$ $\Sigma Fy = 0$

$R_1y + R_2y - 16196 - 97496 = 0$

$\boxed{R_1y + R_2y = 113692}$ → eq ①

Now

$R_1y = [(97496 \times \cancel{6}\,3) + (16196 \times 9)]/12$ $\Sigma M_2 = 0$ at point ②

$= (~~584,976~~$ 292,407 $+ 145,764)/12$

~~$R_1y = 60,895$~~ $\boxed{R_1y = 36,514.25}$.

Put in eqv (1)

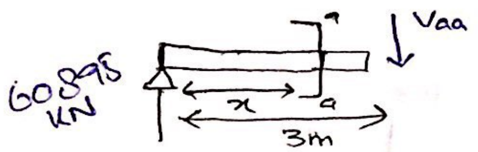
$R_{1y} + R_{2y} = 113692$

$R_{2y} = 113692 - R_{1y}$

$R_{2y} = 113692 -$ ~~60,895~~ 36,514.25

$R_{2y} =$ ~~52,796~~ 77,177.75 KN

$R_{1x} = 0$ | $R_{1y} = 60,895$ | $R_{2y} =$ ~~52,796~~ 77,177.75 KN



$0 \le x \le 3$

$\Sigma F_y = 0$

$-V_{aa} + 60,895 \text{ KN} = 0$

$V_{aa} = 60,895 \text{ KN} = 0$

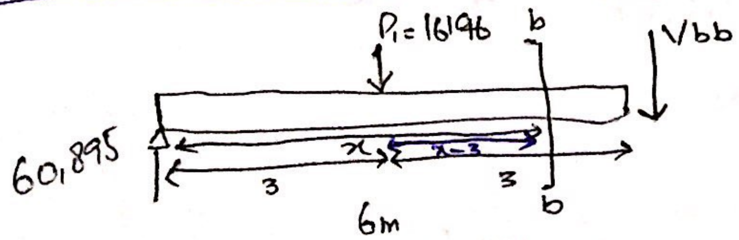
Now putting limit

$x = 0$

$V_{aa} = 60,895 \text{ KN}$

$x = 3$

$V_{aa} = 60895 \text{ KN}$



$3m \le x \le 6m$

$\Sigma F_y = 0$

$-V_{bb} - 16196 + 60895 = 0$

$V_{bb} = 44,699$

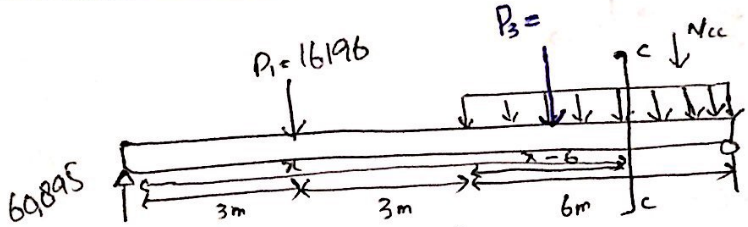
Putting Limit

$x = 3m$

$V_{bb} = 44,699$

$x = 6m$

$V_{bb} = 44,699$



$6m \le x \le 12m$

UDL Resultant $= P_3 = 16246(x-6) = 16246x - 97,476$
(This load will act at centre of UDL).

$\Sigma F_y = 0$

$-V_{cc} - P_1 - P_3 + 60895 = 0$

$-V_{cc} - 16196 - (16246x - 97,476) + 60895 = 0$

$V_{cc} = 44,699 - 16246x + 97476$

$V_{cc} \quad 142,175 - 16246x$

Putting Limits

@ $x = 6m$

$V_{cc} = 142175 - 16246(6)$

$= 142175 - 97476$

$V_{cc} = 44,699$

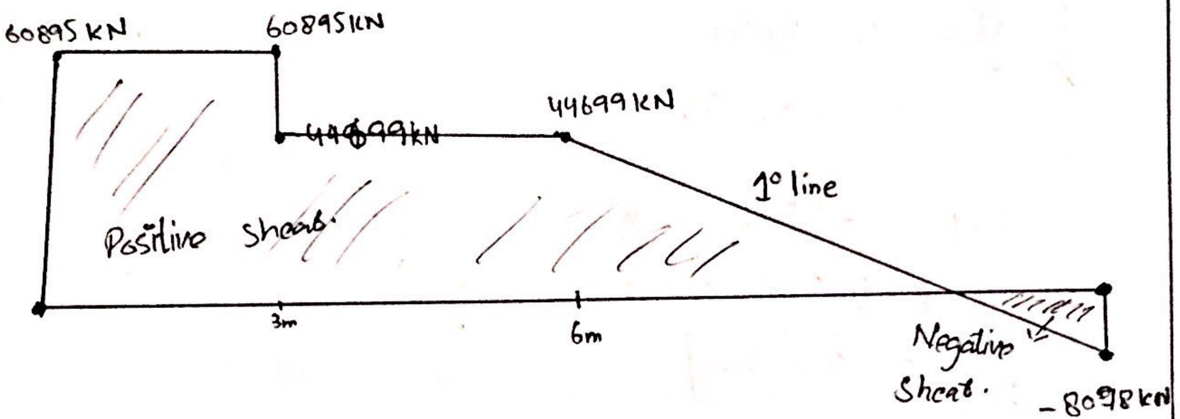
$x = 12m$

$V_{cc} = 142175 - 16246(12)$

$V_{cc} = 142175 - 150,253$

$V_{cc} = -8078$

Shear force digram.

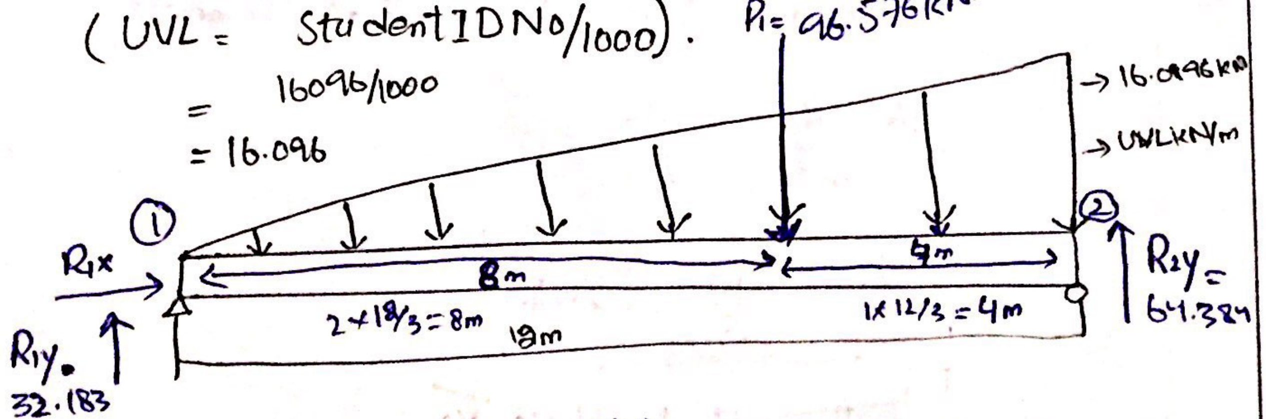


Q3 Draw the neat shear force and bending moment diagrams, Show all your calculations

(UVL = StudentIDNo/1000).

= 16096/1000

= 16.096



Resultant = P = (16.096×12m)/2 = 96.576 kN

This load will act at 1/3 of lenght from the maximum side.

$R_{1x} = 0$ $\quad \Sigma F_x = 0$

$R_{1y} + R_{2y} - 96.567 = 0$ → eq (1) $\quad \Sigma F_y = 0$

$12 \times R_{2y} - 96.567 \times (8m) = 0$ eq (3) $\quad \Sigma M_z = 0$ at point (1)

$R_{2y} = \frac{772.608}{12}$

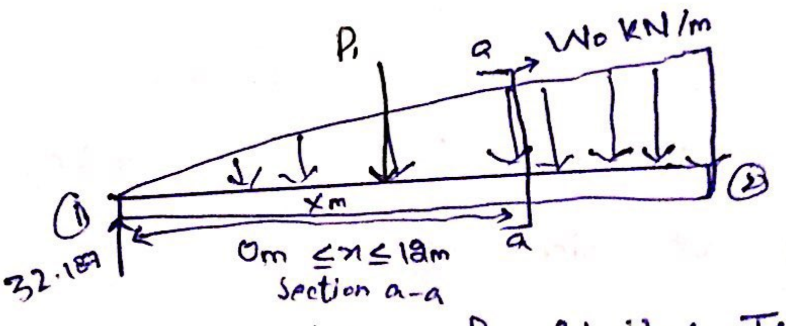
$R_{2y} = 64.384$

Put in eq (1)

$R_{1y} = 96.567 - R_{2y}$

$R_{1y} = 96.567 - 64.384$

$R_{1y} = 32.183$

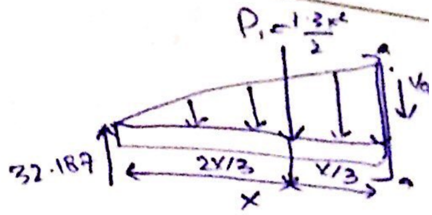


From law of Similar Triangle.

$\frac{16.096}{12m} = \frac{W_o}{X\text{-}m}$

$W_o = \frac{16.096x}{12m}$ KN/m

Finding Resultant P_1 at section a-a



Resultant $= P_1 = [W^o x]/2$

$P_1 = ~~16~~ (~~1.3x \cdot x~~)/2$

$P_1 = \frac{~~1.3x^2~~}{2} = \frac{16.096x}{12} \times \frac{x}{2}$

$= \frac{16.096x^2}{24}$

(The load will act at x/3 of lenght from the maximum side.)

$\Sigma F_y = 0$

$-V_{aa} - P_1 + 32.187 = 0$

$V_{aa} = 32.187 - \frac{~~1.3x^2~~}{~~2~~} \left(\frac{16.096x^2}{24}\right) \rightarrow$ eq (1)

Putting Limits

$x = 0$

$V_{aa} = 32.187 - \frac{16.096(0)^2}{24}$

$V_{aa} = 32.187$

$x = 12$

$V_{aa} = 32.187 - \frac{~~1.3(12)^2~~}{~~2~~} \frac{16.096(12)^2}{24}$

$V_{aa} = 32.187 - 96.5$

$\boxed{V_{aa} = -58.365}$

In the section the value of shear changes from positive to negative which means at some point the shear will be zero.

To find the point of zero shear put eq (1) equal to zero.

bending moment.

$$0 = 32.187 - \frac{16.096x^2}{24}$$

$$32.187 = \frac{16.096x^2}{24}$$

$$16.096x^2 = 32.187 \times 24$$

$$x^2 = \frac{32.187 \times 24}{16.096}$$

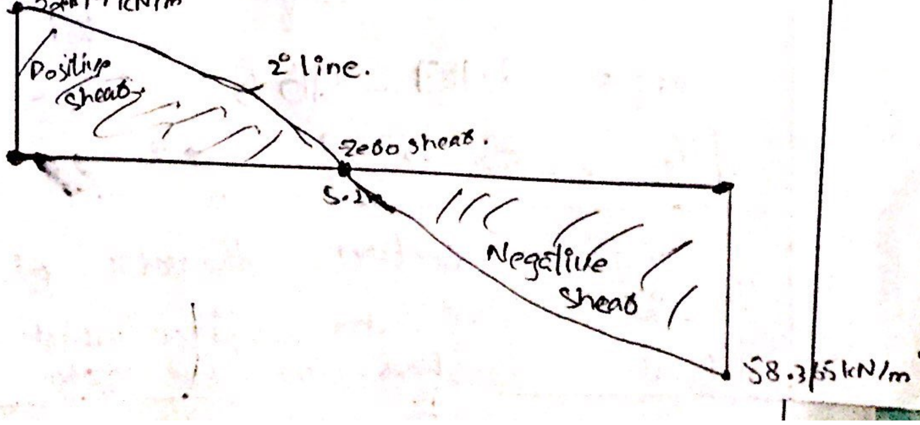
$$x^2 = 47.99$$

$$x = \sqrt{47.99}$$

$$\boxed{x = 6.927}$$

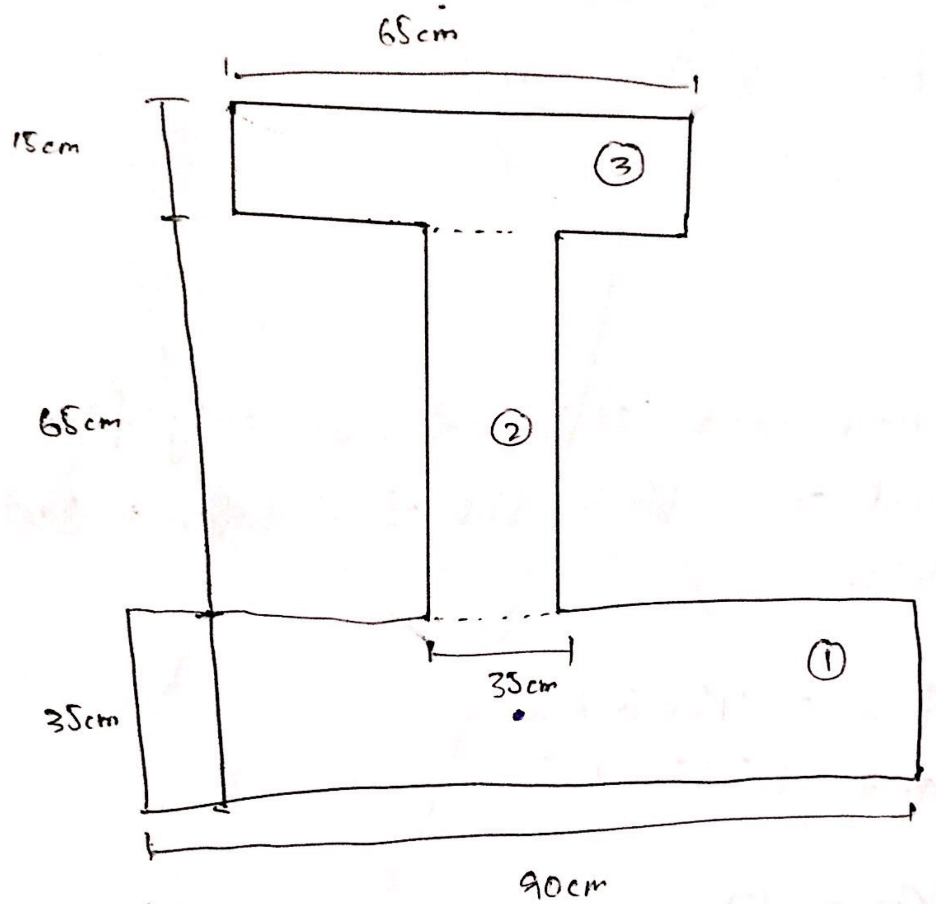
at $x = 6.9m$ eq (1) $= V_{aa} = 0$ kN/m

Shear diagram.



(a)

Find the centroid of the given shape, show all your Calculations.



$A_1 =$ ~~0.65 x 0.15~~ $= 0.9m \times 0.35m =$ ~~0.315 m²~~ 3150 cm²

$A_2 = 0.65 \times 0.35m =$ ~~0.2275 m²~~ 2275 cm²

$A_3 = 0.65 \times 0.15 =$ ~~0.0975 m²~~ 975 cm²

~~$X_1 = 45$ cm~~

~~$X_2 = 45$cm~~

~~$X_3 = 45$cm~~

~~$Y_1 = 17.5$ cm~~

~~$Y_2 = 42.5$ cm~~

$Y_3 = 52.5$cm

Centroid of portions

$C_1 = 107.5$ cm

(35 + 65 + 7.5)

$C_2 = 35 + ~~32.5~~ 65/2$

$C_2 = 35 + 32.5$

$C_2 = 67.5$ cm

$C_3 = 35/2 = 17.5$ cm

Moment of area

$M_1 = 975 \times 107.5$

$M_1 = 104812.5$

$M_2 = 2275 \times 67.5 = 1535.625$ cm

$M_3 = 17.5 \times 3150 = 55,125$

Summation of moment of areas.

$M_1 + M_2 + M_3$

$= 313,500$

$\bar{Y} = \frac{\Sigma A'Y'}{\Sigma A'} = \frac{313500}{6400} = \boxed{48.98}$ is the centroid for x-axis.

(b) For mid area (65x 35) only find the moment of inertia, Radius of Gyration & Section moduli.

Moment of Inertia = $\frac{bh^3}{12}$ & $I_{yy} = \frac{hb^3}{12}$

Radius of gyration:- $R_y = \sqrt{\frac{I_y}{A}}$

Section Moduli = $\frac{I}{C} = \frac{bh^3}{12} / h/2$

Moment of inertia = $\frac{65(35)^3}{12}$ = 232239.5 cm⁴

I_y = $\frac{35(65)^3}{12}$ = 800989.5 cm⁴

Radius of gyration = $K_y = \sqrt{\frac{800984.5}{65 \times 32}}$

$K_y = 352.08$

Section moduli = $\frac{I}{C} = \frac{232239.5}{35/2}$

= 13270.8

Q5 Explain work, energy and power in details along with practical examples for daily life.

Ans

Work

In physics, work is the product of force and displacement. A force is said to be positive work if (when applied) the force has a component in the direction of displacement of the point of application. A force does negative work if the force has a component opposite to the direction of displacement at the point of application of the force.

The work is also known as the ability to do work. If you use more of your energy you will be able to do more of work.

Its symbol is 'W', its S·I unit is joule (J) other units are Foot - Pound, Erg.

Its S·I base units are $1 kg m^2 s^{-2}$. Its derivation is

$$W = F \cdot s$$

$$W = \tau \theta$$

Its dimensions are ML^2T^{-2}.

Daily life examples:

→ When the ball is held above the ground and then dropped, the work done by the gravitational force on the ball as it falls is equal to the weight of ball (a force) multiplied by the distance to the ground (a displacement)

~~When the force F is constant~~

→ Pushing a car horizontally from rest,

→ Shooting a bullet

→ Walking upstairs.

→ Sawing a log.

Energy.

Is the quantitative property that must be transferred to an object in order to perform work on, or to heat, the object. Energy is a conserved quantity, the law of conservation of energy states that energy can be converted in form but not created or destroyed.

Its S.I unit is Joule. Other units are kW-h, BTU, calorie, eV, erg, foot-pound.

In S.I base units are $kg\,m^2 s^{-2}$ and its Dimensions are ML^2T^{-2}.

Daily life example:

- Watching T.V
- Washing clothes
- heating home
- lighting home
- ~~the tom~~ taking shower
- Working from home on your laptop or computer.
- Even i am writing know is energy and when sir will read this paper its also energy that he will be able to read.

Power: The amount of energy transferred or converted per unit time. In the international systems of Units, the unit of power is the watt, equal to one Joule per second. In older works, power is some times called activity. Power is a scaler quality.

Its S.I unit is Watt and in the SI base unit $kg \cdot m^2 \cdot s^{-2}$ derivation

$$\text{Power} = \frac{\text{Work}}{\text{Time}} = \frac{F \cdot S}{t} = F \cdot \frac{S}{t} = \boxed{F \cdot V}$$

Daily life example.

Power is a fundamental part of human relations, little is known about Power in daily life. We studied the every day experience of power by surveying individuals multiple times over 3 d regarding their subjective feelings of power and positional power. Power dynamics were common, though not constant, experiences. People's feeling of power did not always onto the positions they held.