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ROll NO :- 16320

Section :- "B"

Dept :- Civil

Subject :- Engineering mechanics

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Question NO# "1"

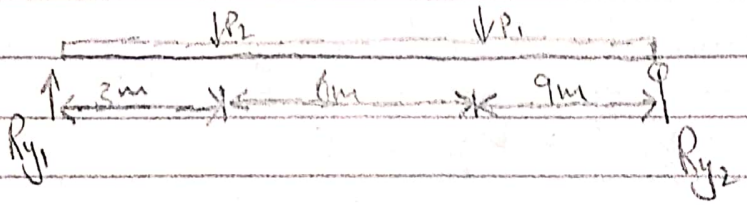
Solution:-

Given data.

$$P_1 = 200 + 16320$$
$$= 16520$$

$$P_2 = 500 + 16320$$
$$= 16820$$

$P_1 = 16520$ ↓ $P_2 = 16820$ ↓



$$R_x = 0 \quad \& \quad f_x = 0$$

$$R_{y_1} + R_{y_2} - 16520 - 16820\,N = 0$$

$$\boxed{R_{y_1} + R_{y_2} = 33,340\ N} \rightarrow eq\ (1)$$

Now:- $$R_{y_1} = \frac{[(16820 \times 9) + (16520 \times 15)]}{18}$$

$$R_{y_1} = \frac{(151380 + 247800)}{18}$$

$$\boxed{R_{y_1} = 22,176.66} \rightarrow eq\ (2)$$

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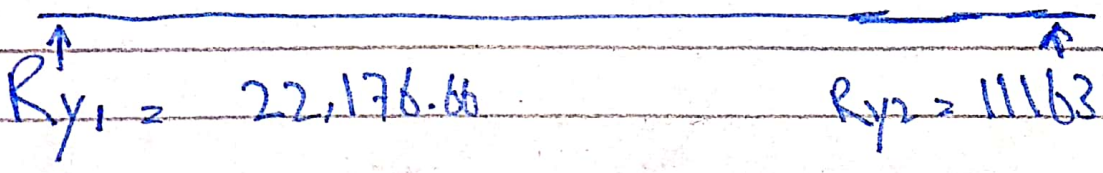
(2)

Put value of equation (2) in (1)

$22,176.66N + R_{y2} = 33,340\ N$

$R_{y2} = 33,340 - 22,176.66$

$\boxed{R_{y2} = 11163.34\ N}$



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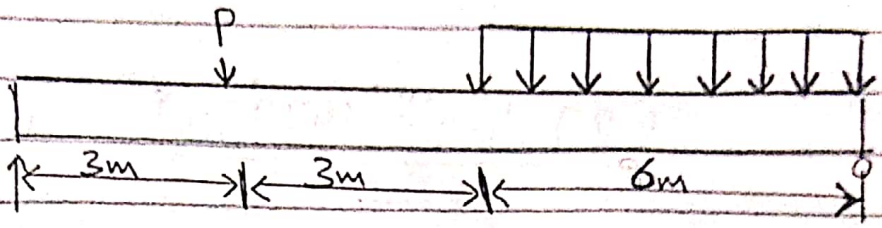
Question NO # "2":

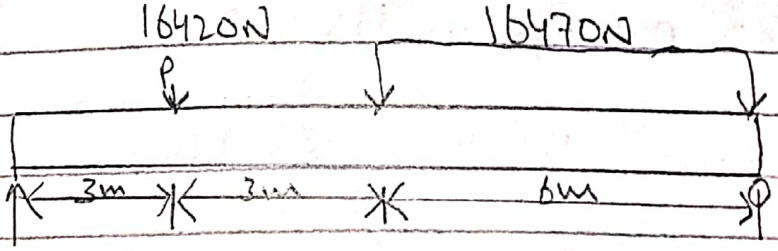
Solution:



Given data:

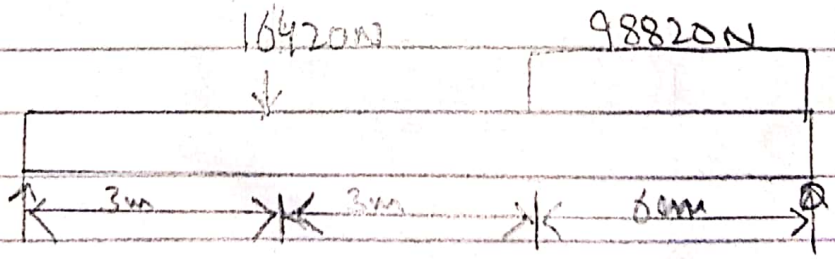
$P_1 = 100 + 16320 = 16420N$

$P_2 = 150 + 16320 = 16470N$



UDL Resultant = 16470×6

= 98820 will at centre of UDL



where $R_x \Rightarrow 0$

$R_{y_1} + R_{y_2} - 16420 - 98820 = 0$

$$\boxed{R_{y_1} + R_{y_2} = 115240\,N} \rightarrow \text{eq (1)}$$

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$$R_{y_1} = \frac{[(98820 \times 3) + (16420 \times 9)]}{12}$$

$$R_{y_1} = \frac{(296460 + 147780)}{12}$$

$$R_{y_1} = \frac{444240}{12}$$

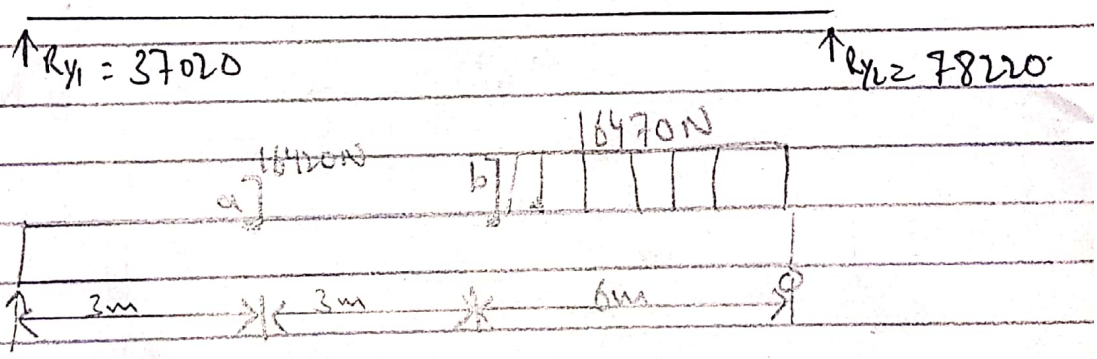
$$\boxed{R_{y_1} = 37020 \text{ N}}$$

Putting equation

$$37020 + R_{y_2} = 115240$$

$$R_{y_2} = 115240 - 37020$$

$$\boxed{R_{y_2} = 78220 \text{ N}}$$



$R_{y_1} = 37020$ N $\qquad R_{y_2} = 78220$

of section (a-a)

Now at $x = 0$m $\Rightarrow +$ 37020

where at $x = 3$m

$\Rightarrow$ 37020 N

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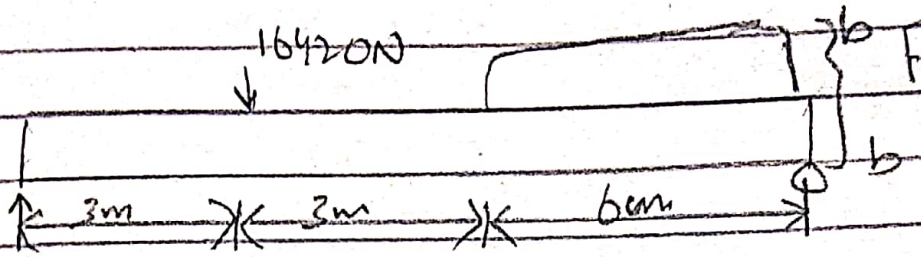
Now at Section (b-b)



at $x = 3m = 20600$

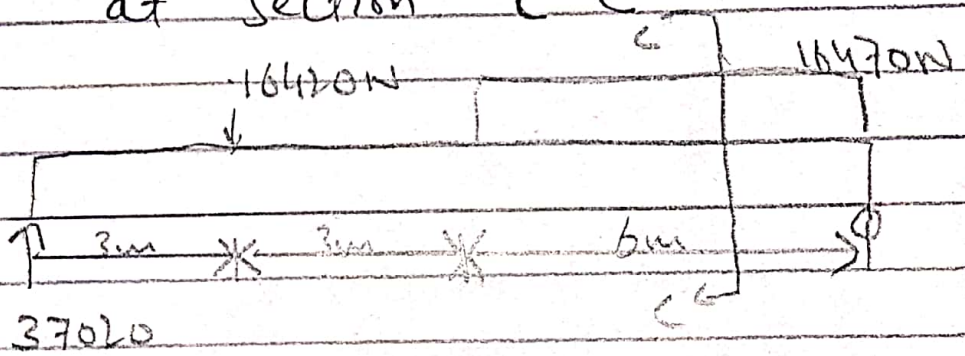
at $x = 6m = 20600$

$\Sigma F_y = 0$

$-F_{bb} - 16420 + 37020$

$F_{bb} = 20600.$

Now at Section C-C



at 6m = 20600

where at 12m

$-F_{cc} \rightarrow P_2 - P_1 + 37020$

$= -16420 - 98820 + 37020$

$= -115240 + 37020$

$= -78,220N$

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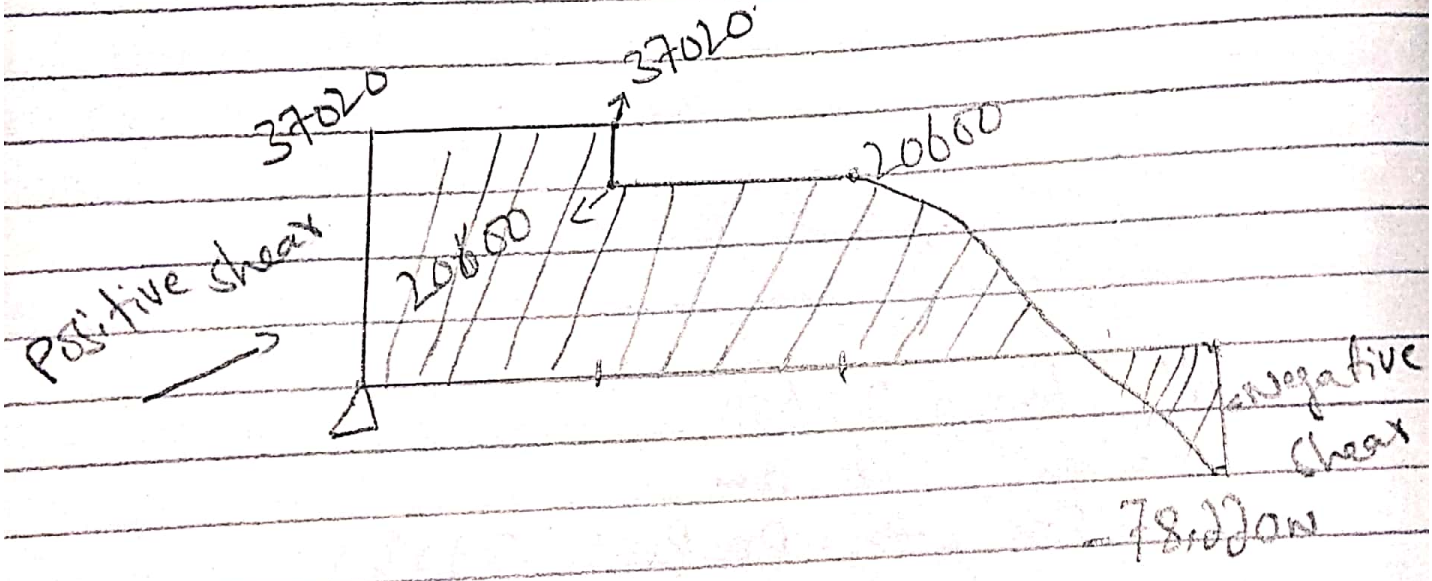
at

0m = +37020N
3m = 37020N
3m = 20600
6m = 20600
6m = 20600
12m = -78.22ON

Diagram:-



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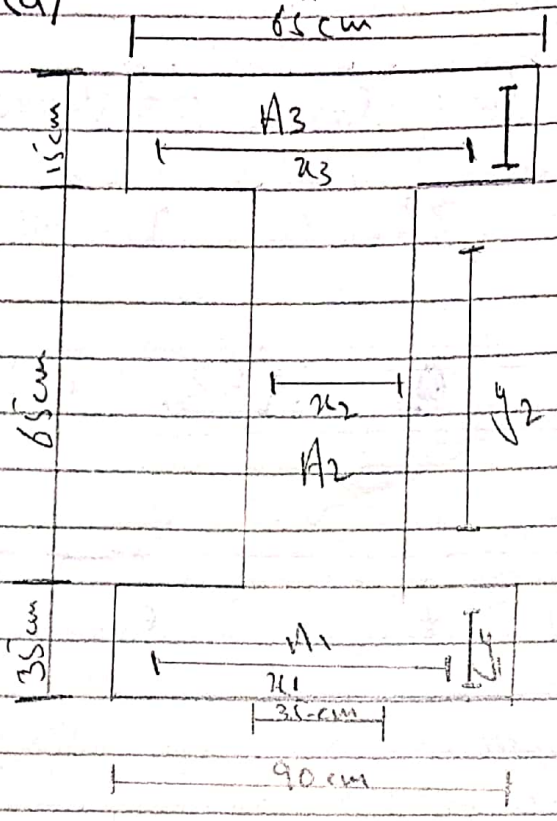
Question No # 4

Solution :- Part (a)



A_1	$3150\ cm^2$	x_1	45 cm	$y_1 = 17.5$
A_2	$2275\ cm^2$	x_2	45 cm	$y_2 = 80$
A_3	$975\ cm$	x_3	45 cm	$y_3 = 107.5$
ΣA				
$6400\ cm^2$				

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6400

(8)

$$x_c = \frac{A_1x_1 + A_2x_2 + A_3x_3}{A_1 + A_2 + A_3}$$

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

$$x_c = \frac{(3150)(45) + (2275)(45) + (975)(45)}{3150 + 2275 + 975}$$

$$\boxed{x_c = 45}$$

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

$$y_c = \frac{(3150)(17.5) + (2275)(50) + (975)(107.5)}{3150 + 2275 + 975}$$

$$\boxed{y_c = 42.76}$$

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Q NO:-"4" Part:-"B"

Solution :-

Given data

area = 65cm x 35cm

Required :?

(a) moment of inertia =?

(b) Radius of Gyration =?

(c) Section of moduli =?

Now

(a) For moment of inertia

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

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

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

$$I_y = \frac{1}{3} b^3 h$$

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

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

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

$$= \frac{1}{12}(65)(35)^3$$

$$= \boxed{6635.41\ mm^4}$$

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

$$\frac{1}{12}(65)^3(35) = \boxed{800989\ mm^4}$$

$$I_c = \frac{1}{12} bh(b^2 + h^2)$$

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

$$= \boxed{1033229.16\ mm^4}$$

Now

(b) Radius of gyration:

$$\gamma = (I/A)^{1/2}$$

$A = bxd$

$A = 65 \times 35$

$= 2275$

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

$$\boxed{\gamma = 21.31\ mm}$$

Now

(c) Section moduli:

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

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

$$\boxed{S = 13270.83\ mm^2}$$

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Question No# 5 (11)

Work:-

In physics, work is defined as a force causing the movement or displacement of an object.
In the case of a constant force, work is the scalar product of the force acting on an object and the displacement caused by that force.
Though both forces and displacement are vector quantities, work has no direction due to the nature of a scalar product (or dot product) in vector mathematics.
This definition is consistent with the proper definition because a constant force integrates to merely the product of the force and distance.

* Common symbol of work is "W".
* SI unit of work is "Joule (J)".

Mathematicaly:-

Mathematically work can be expressed by the following equation.

$$W = F \cdot d \cdot \cos\theta$$

where "F" is the force, "d" is the displacement and the angle (Theta) is defined as the angle between the force and the displacement vector.

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Examples of Work:-

These are many examples of work in daily life. Few of them are the following.

(1) A student lifting a backpack full of books upon her shoulder.

(2) A father pushing a grocery cart down the aisle of grocery store.

(3) A horse pulling a plow through the field.

(4) A weightlifter lifting a barbell above his head.

(5) An olympian launching the shot-put

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Energy:-

The capacity for doing work. It may exist in (potential, kinetic, thermal, electrical, chemical, nuclear e.t.c) or other forms. i.e., energy in the process of transfer from one body to another. After it has been transfered, energy is always designated according to its nature. Hence, heat transfered may be thermal energy, while work done may be mechanical energy. Energy can be neither created nor destroyed but only change from one form to another. This principle is called conversion of energy or the first law of Thermodynamics.

In the international system of units (SI) energy is measured in joules. One joule is equal to the work done by a one-newton force acting over one-meter distance.

Examples of energy:- ① Petroleum can be burned to release light and heat or changed into another form of chemical energy i.e gasoline.

② Any given body has kinetic energy if it is in motion.

③ A tensioned device such as bow or spring though at rest has the potential energy.

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Power :-

We can define power as the rate of doing work, it is the work done in unit time. The SI unit of power is "Watt" (w) which is joules per second (J/s). Sometimes the power of motor vehicles and other machines are given in terms of Horsepower which is approximately equal to 745.7 Watt.

Formula of power:- Power is a time based quantity, which is related to how fast a job is done. The formula for power is mentioned below.

$$\text{Power} = \text{Work} / \text{time}$$
$$P = W/t$$

Examples of power:-

① An example of power is the functioning of a gasoline driven saw & tool.

② An example of power is to start up an engine.

③ Producing & carrying electricity.

④ operated by electricity, a fuel engine.

⑤ Operated with mechanical & electrical energy in place of bodily exertion.

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(15)

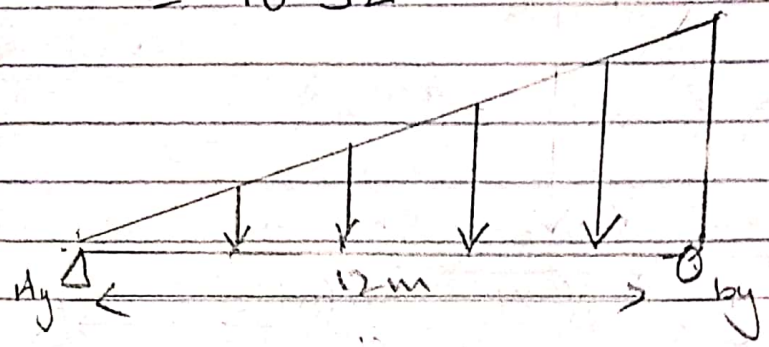
Question No # 3

Solution:-

Given data

UVL = 16320/1000

= 16.32

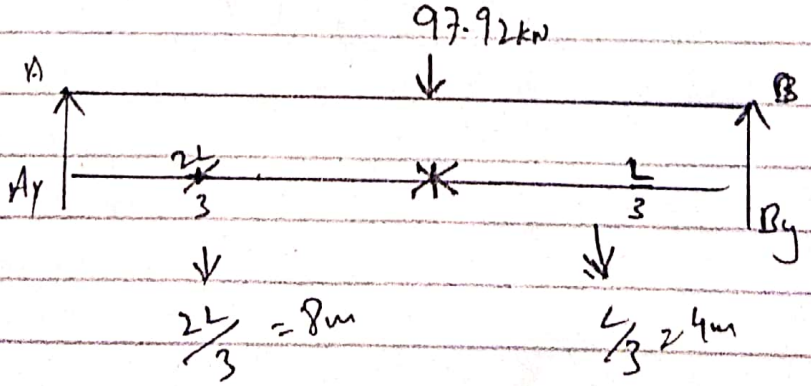


magnitude of point load = Area of UVL

$= \frac{1}{2} \times b \times h$

$= \frac{1}{2} \times 12 \times 16.32$

$= 97.92\ kN$



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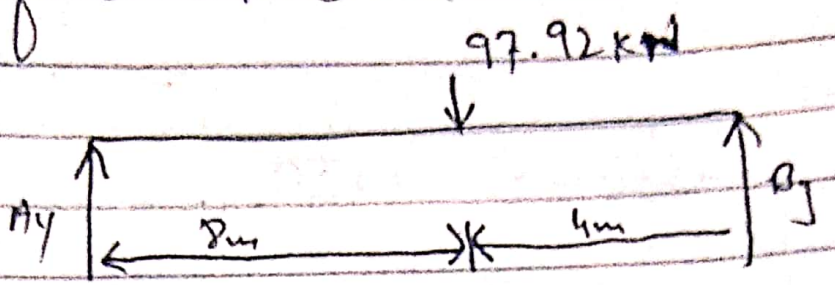
Now find reactions.



$\Sigma M_B = 0$

$A_y \times 12 - 97.92\,kN \times 4 = 0$

$A_y \times 12 = 391.68$

$$\boxed{A_y = 32.64\,kN}$$

$\Sigma F_y = 0$

$A_y - 97.92 + B_y = 0$

$= 32.64 - 97.92 + B_y = 0$

$= -65.28 + B_y = 0$

$B_y = 65.28\ kN.$

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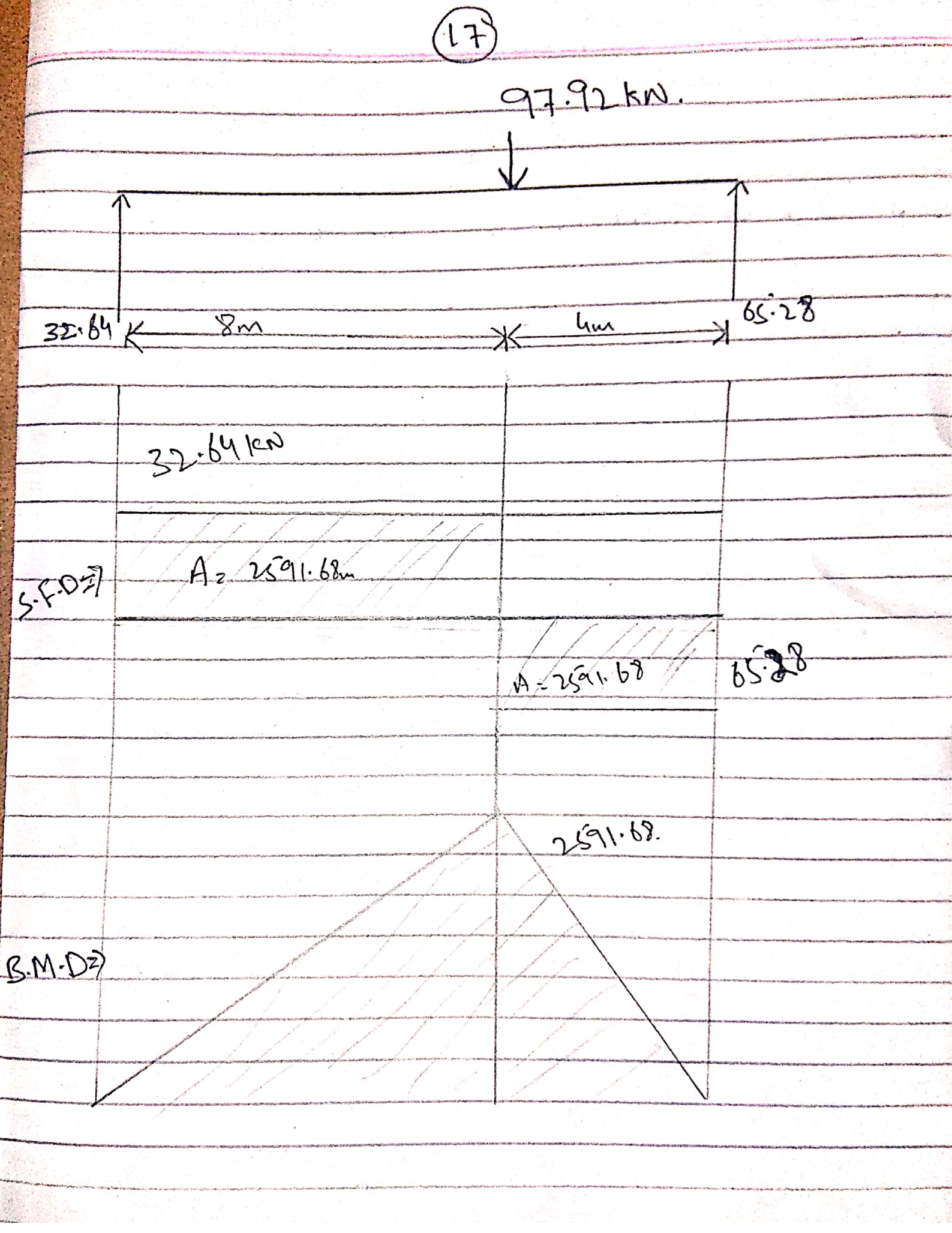

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