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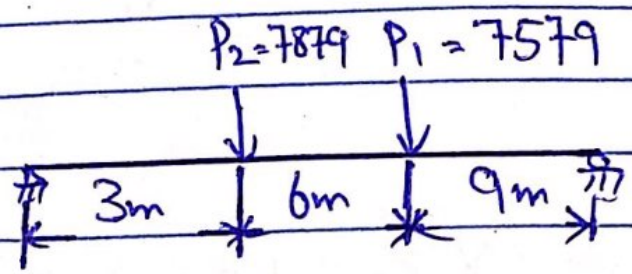
ID:- 7379
Subject:- Engineering Mechanics
Final Term
Sir Engr. Majid Naeem

Q1:- Find the support reactions, Show all your calculations



$P_1 = 200 + 7379 = 7579$
$P_2 = 500 + 7379 = 7879$

Sol:-

$+\circlearrowleft \Sigma R_2 = 0$

$18R_1 - (7579 \times 15) - (7879 \times 9) = 0$

$18R_1 - 113685 - 70911 = 0$

$R_1 = \frac{184596}{18}$

$R_1 = 10255.33$

$+\circlearrowleft \Sigma R_1 = 0$

$(7579 \times 3) + (7879 \times 9) - 18R_2 = 0$

$22737 + 70911 - 18R_2 = 0$

$R_2 = \frac{93648}{18}$

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$R_2 = 5202.66$

Hence

$R_1 = 10255.33$

$R_2 = 5202.66$

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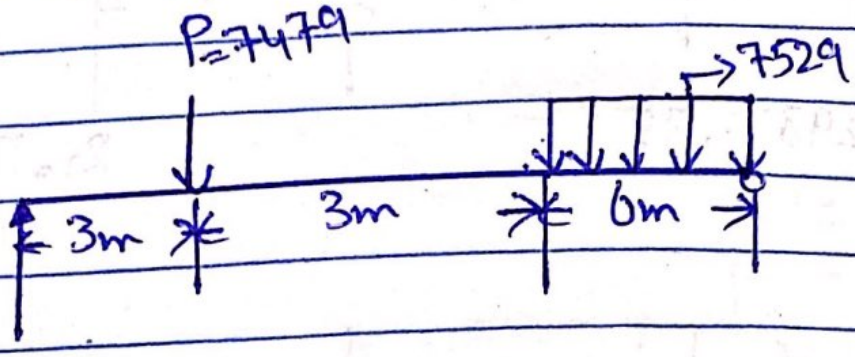
Q2:- Draw the neat shear force diagram Show all your calculations.



P = 100 + 7379 = 7479 kN

UDL = 150 + 7379 = 7529 kN/m

Soln:-

$\circlearrowleft \Sigma R_1 = 0$

$(7479 \times 3) + (7529)(6)(6/2) - 12R_2 = 0$

$22437 + 135522 - 12R_2 = 0$

$$R_2 = \frac{157959}{12}$$

$R_2 = 13163.25$ kN

$\uparrow \Sigma R_2 = 0$

$R_1 + R_2 = 7479 + 135522$

$R_1 + 13162.25 = 143001$

$R_1 = 143001 - 13163.25$

$R_1 = 129837.75$ kN

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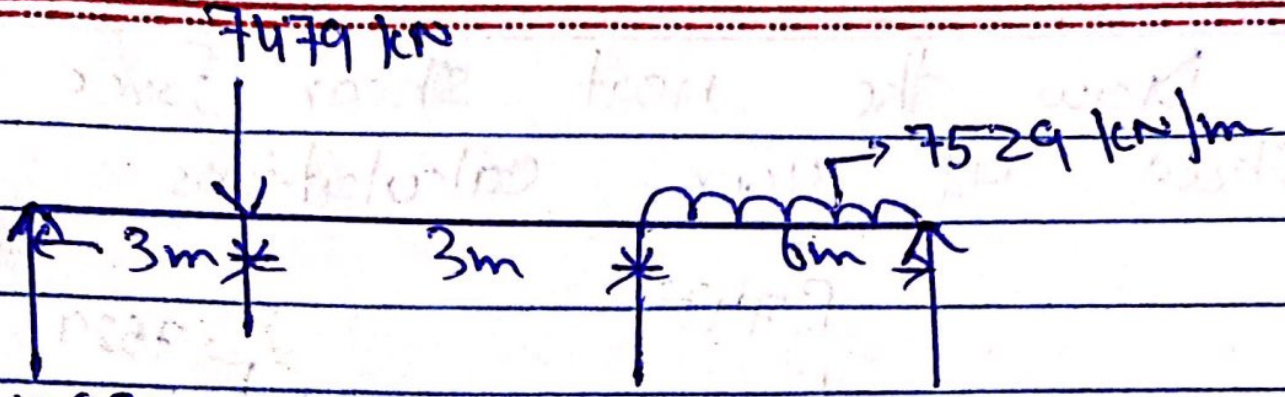
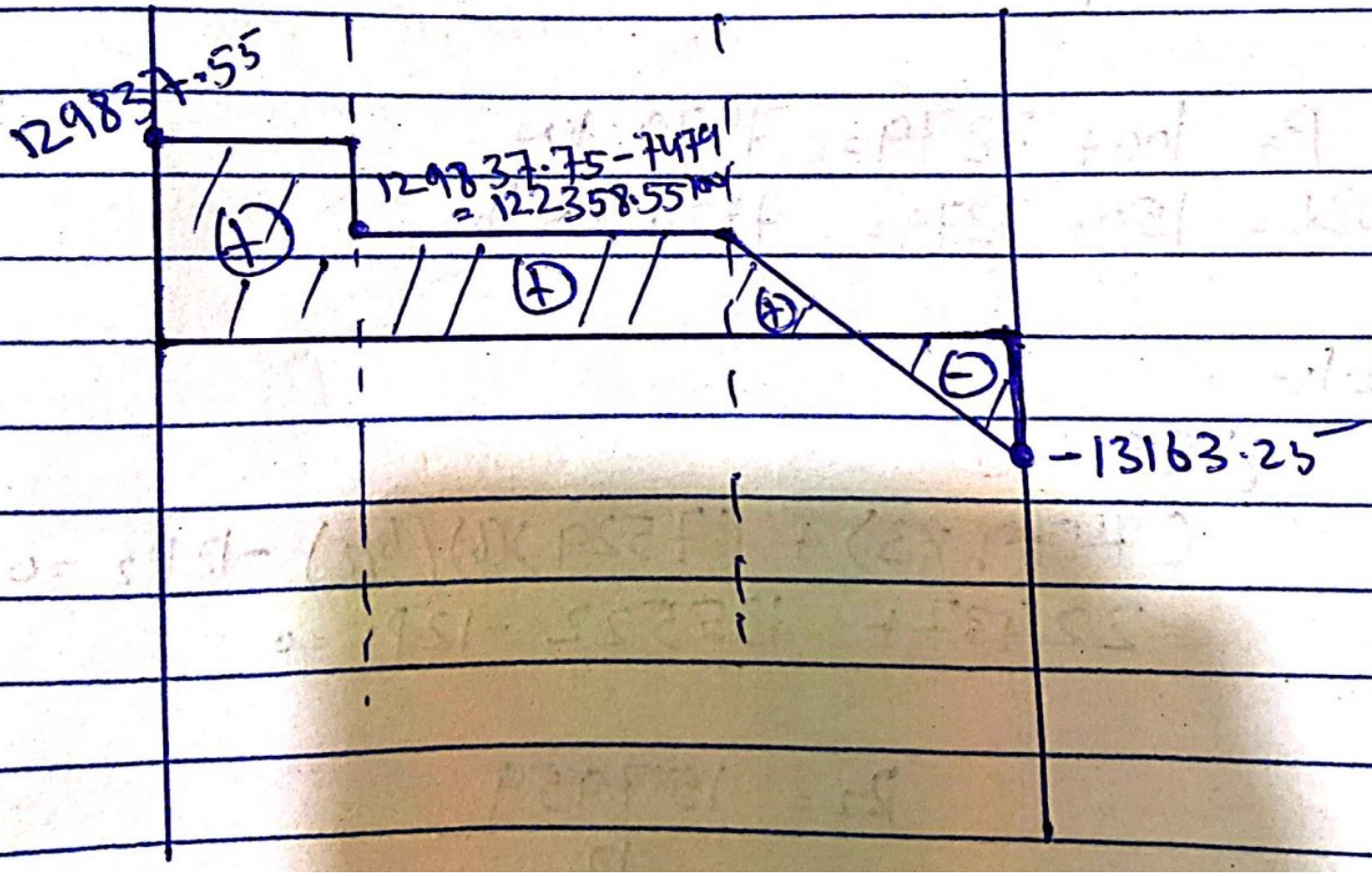
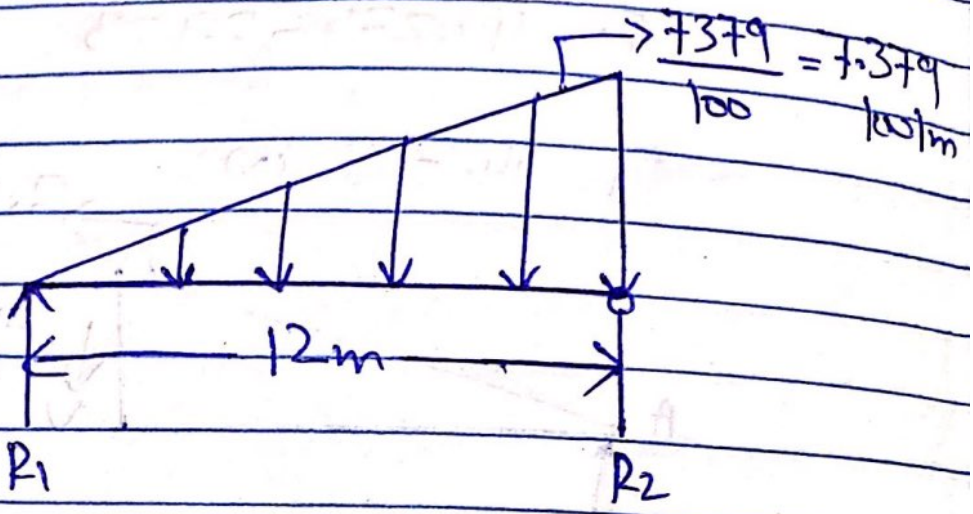

7479 kN
7529 kN/m
3m
3m
6m
$R_1 = 129837.75$
$R_2 = 13163.25$


129837.55
129837.75 - 7479
= 122358.55
-13163.25

Data: / /

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



Sol:-

$$\uparrow \Sigma F_y = 0$$

$$R_1 + R_2 = \frac{7.379 \times 12}{2}$$

$$R_1 + R_2 = 44.274$$

Now

$$\circlearrowleft \Sigma M_A = 0$$

$$\left(\frac{7.379 \times 12}{2}\right) \times \left(12 \times \frac{2}{3}\right) - 12R_2 = 0$$

$$44.274 \times 8 - 12R_2 = 0$$

$$354.192 - 12R_2 = 0$$

$$R_2 = \frac{354.192}{12}$$

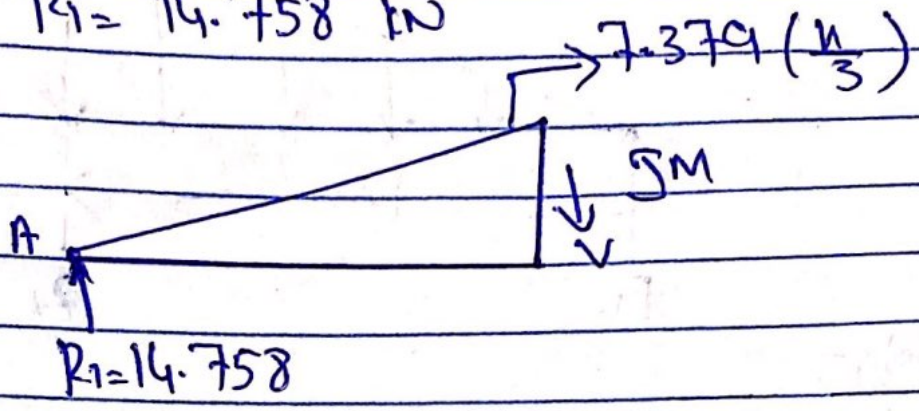
$R_2 = 29.516$ kN

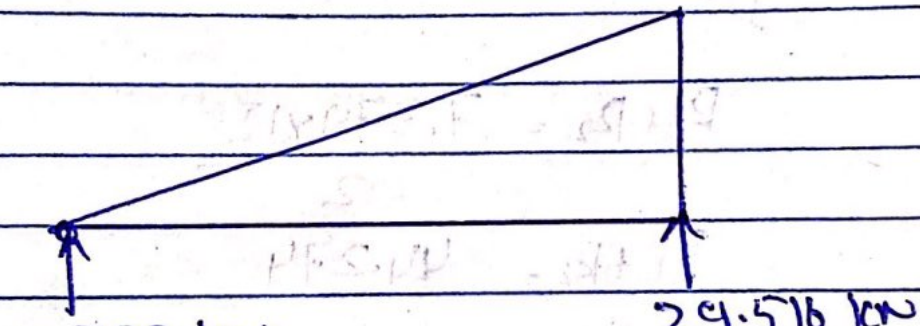
Put in eqn (A)

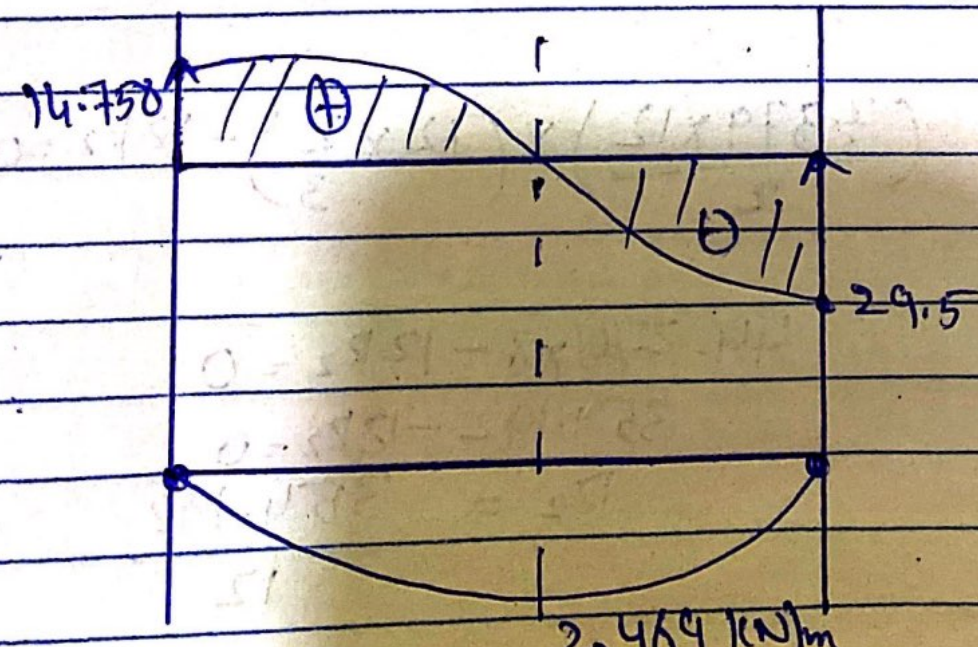
$R_1 + 29.516 = 44.274$

$R_1 = 44.274 - 29.516$

$R_1 = 14.758$ kN



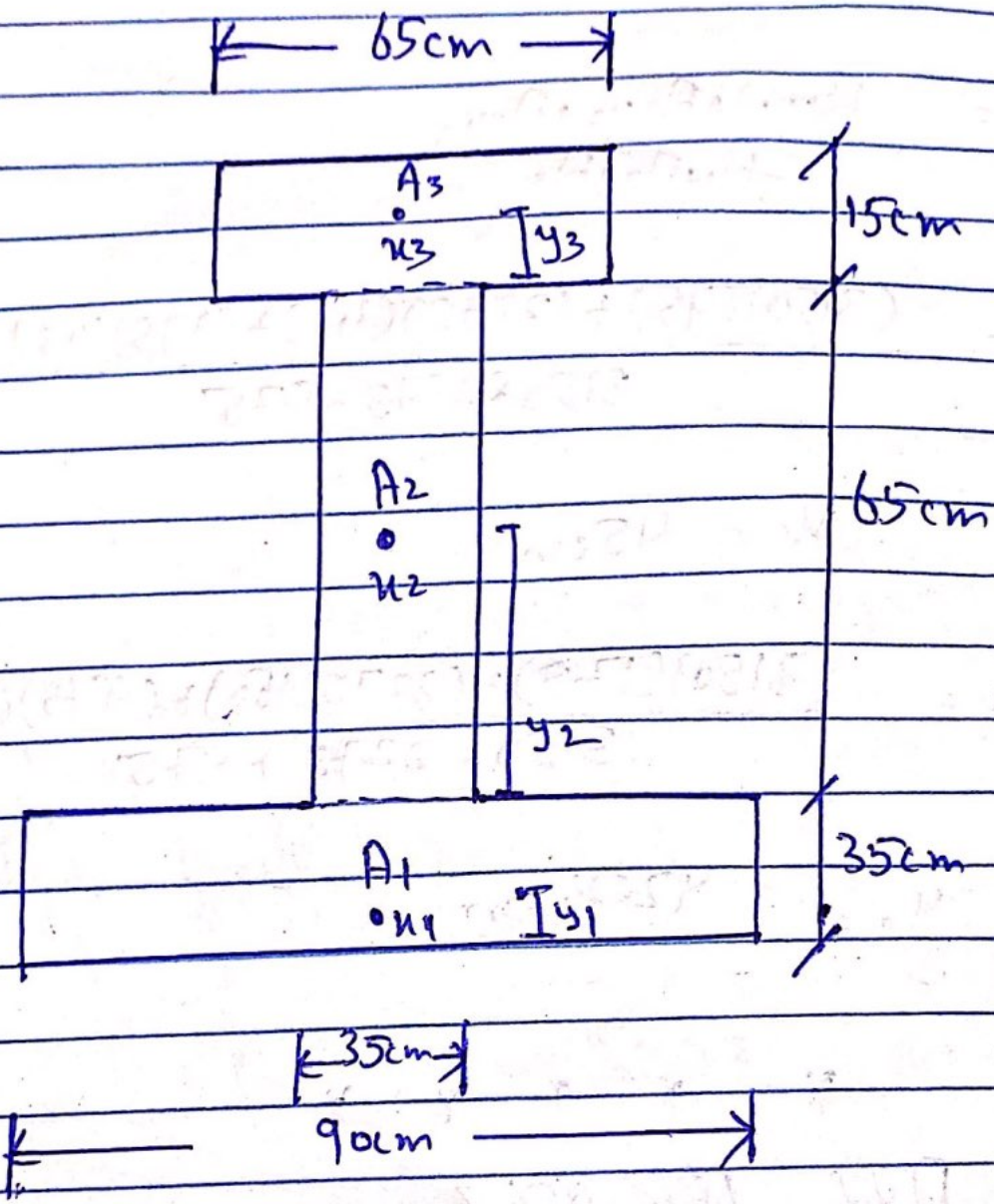




Reber Register

Q4 (a)

Find the centroid of the give Shape. Show all your calculations.



A_1	$3150\,cm^2$	x_1	45cm	$y_1=17.5$
A_2	$2275\,cm^2$	x_2	45cm	$y_2=50$
A_3	$975\,cm^2$	x_3	45cm	$y_3=107.5$
ΣA	$6400\,cm^2$			

$$x_c = \frac{A_{x_1} + A_{2x_2} + A_{3x_3}}{A_1 + A_2 + A_3}$$

$$y_c = \frac{A_{y_1} + A_{2y_2} + A_{3y_3}}{A_1 + A_2 + A_3}$$

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

$$x_c = 45\,cm$$

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

$$y_c = 42.76\,cm$$

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b for mid area (65cm x 35cm) only find the moment of inertia, Radius of Gyration & section moduli

A Moment of Inertia :-

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

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

$$= \frac{1}{3} (65)(35)^3 = 928958 \text{ cm}^4$$

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

$$= \frac{1}{3} (65)^3 (35) = 3203558 \text{ cm}^4$$

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

$$= \frac{1}{12} (65)(35)^3 = 0635.41 \text{ cm}$$

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

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

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

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

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

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

$$= 1033\,29.16 \text{ cm}^4$$

3 Radius of Gyration:-

$$r = \left(\frac{I}{A}\right)^{1/2}$$

$$A = b \times d$$

$$A = 65 \times 35$$

$$\frac{I}{2} = 2275$$

$$r = \left(\frac{1033229.16}{2275}\right)$$

$$r = 21.31 \text{ cm}$$

c Section Modulus:-

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

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

$$S = 13270.83 \text{ cm}^2$$

Q5 Explain work, energy and Power in details along with practical examples from daily life.

WORK:-

The application of a force through certain distance is know as work

$$W = f \cdot d$$

EXAMPLE:-

① A horse pulling the cart.
② A bullock pulling the shaft of lavez system.

ENERGY:-

It is the measure of the ability of an object or a system to perform work. It is unit is Joule and is denoted by J.

TYPES:-

1) Kinetic Energy
2) Elastic Energy

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3 Nuclear Energy
4 Gravitational Energy / P.E
5 Chemical Energy

Joule (J) is the MKS unit of energy, equal to the force of one Newton acting through one meter.

* K.E :-
Energy of an object due to its speed.

* P.E :-
Energy of an object due to position in a gravational feild.

* Elastic Potential Energy :-
Energy stored when an object is streched or compressed.

* Chemical Energy :-
Energy stored in chemical bond.

* EXAMPLE:-

→ Starting of generator in which convertation of energy take place.

→ Shooting a robber band.

* POWER:-

It is the rate at which work is done

$$\text{Power} = w/t$$

Where

- Power is measured in watt (w)
- Work done or energy transfered is measured in joules (J)
- time is measured in seconds (s)

Motive Power:-

The power outputted by a power object, such as an engine or muscles is called motive power.

$$\text{Power} = fv$$

EXAMPLE:-

→ Gasoline-driven saw

→ Startup of engine of car