

Name = Asalan Ihsan

II) = 16196

Section = B

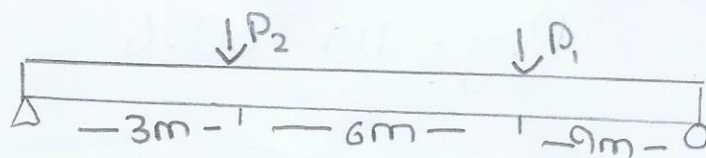
Department = Civil Engineering

Paper = Mechanics Final

Subject = "Mechanics"

Q.1) Solution:

①



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

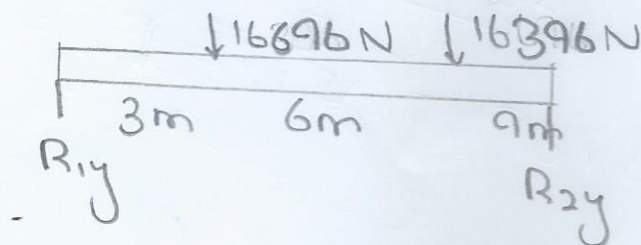
$$P_1 = 200 + 16196$$

$$P_1 = 16396 \text{ N}$$

$$P_2 = 500 + \text{Student II}$$

$$P_2 = 500 + 16196$$

$$P_2 = 16696 \text{ N}$$



$$R_{1x} = 0$$

$$R_{1y} + R_{2y} = 16396 + 16696 = 0 \quad \text{--- (i)}$$

$$(R_{2y} \times 18) - (16396 \times 9) - (16696 \times 3) = 0$$

$$18R_{2y} - 147564 - 50088 = 0$$

$$18R_{2y} - 197652 = 0$$

$$18R_{2y} = 197652$$

$$R_{2y} = \frac{197652}{18}$$

(2)

$$R_{2y} = 10980.6$$

Put the value of R_{2y} in equation (i)

$$R_{1y} + R_{2y} - 16396 - 16696 = 0$$

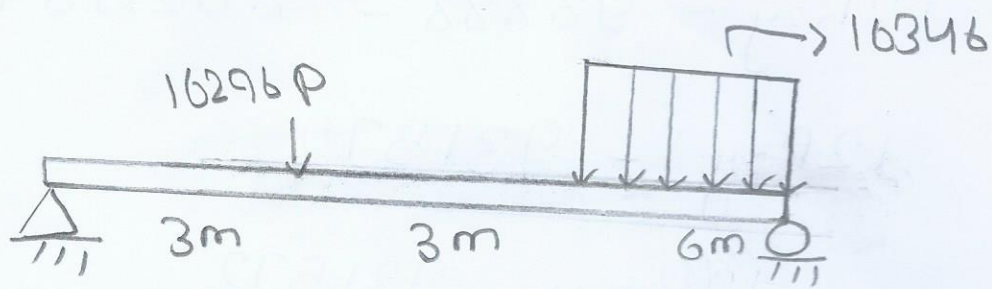
$$R_{1y} + 10980.6 - 33092 = 0$$

$$R_{1y} - 22111.4 = 0$$

$$R_{1y} = 22111.4 \text{ N}$$

Q.2) Solution:

3



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

$$P = 100 + 16196$$

$$P = 16296 \text{ N}$$

$$U(L) = 150 + \text{student ID}$$

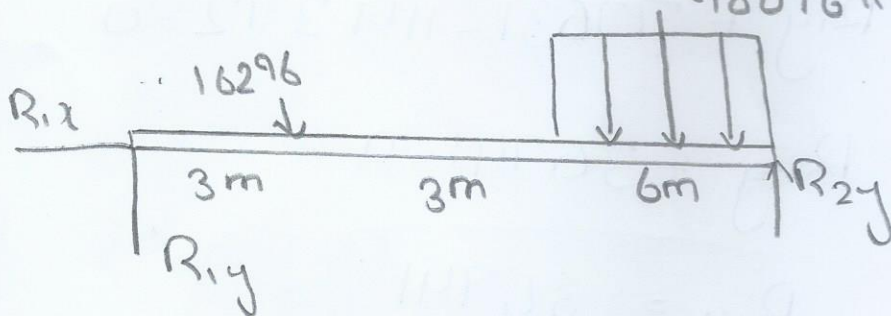
$$= 150 + 16196$$

$$= 16346 \text{ N}$$

$$\text{Resultant of } U(L) = 16346 \times 6$$

$$= 98076 \text{ kN}$$

$$98076 \text{ kN}$$



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

$$R_{1y} + R_{2y} - 16296 - 98076 = 0 \quad \text{--- (i)}$$

(4)

$$(R_{2y} \times 12) - (16296 \times 3) - (98076 \times 9) = 0$$

$$12R_{2y} - 48888 - 882684 = 0$$

$$12R_{2y} - 931572$$

$$\frac{12R_{2y}}{12} = \frac{931572}{12}$$

$$R_{2y} = \frac{931572}{12}$$

$$R_{2y} = 77631$$

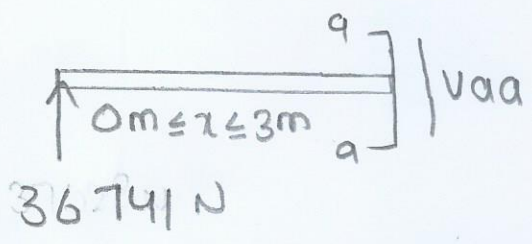
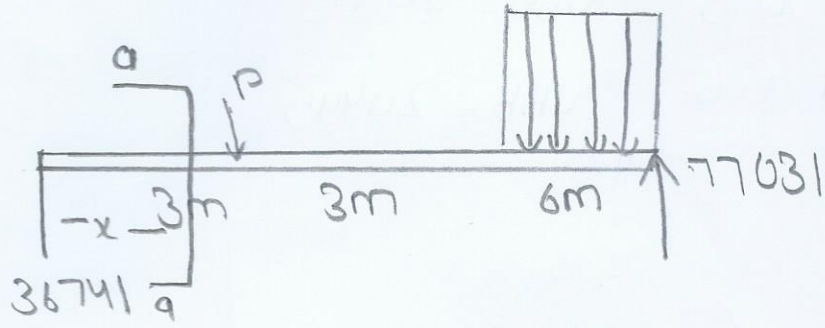
Put the value of R_{2y} in equation (i)

$$R_{1y} + R_{2y} - 16296 - 98076 = 0$$

$$R_{1y} + 77631 - 114372 = 0$$

$$R_{1y} - 36741 = 0$$

$$R_{1y} = 36741$$

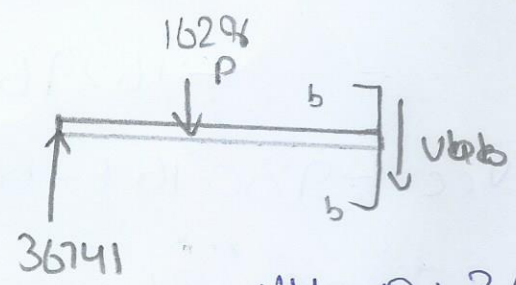
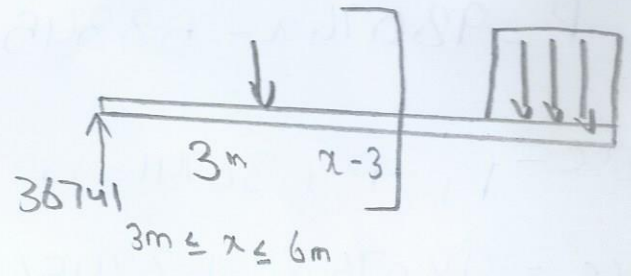


Sumation of $F_y = 0$

$$-V_{aa} + 36741 = 0$$

$$V_{aa} = \cancel{36741} 36741$$

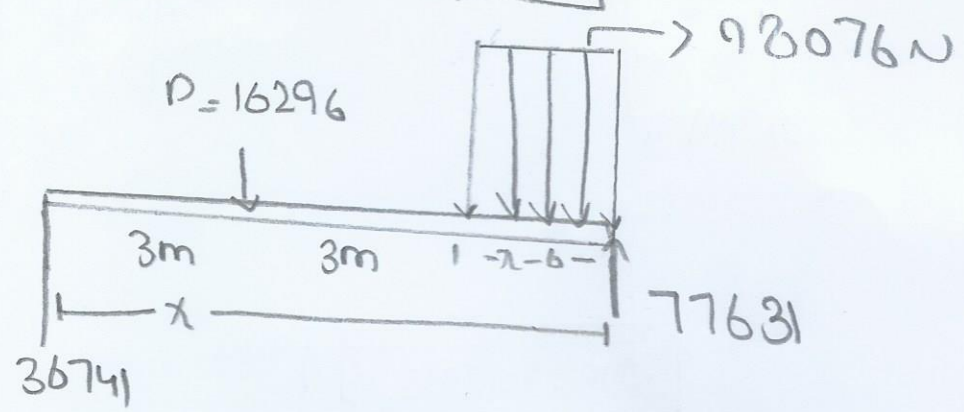
at $x=0$ $V_{aa} = 36741 \text{ N}$
 at $x=3$ $V_{aa} = 36741 \text{ N}$



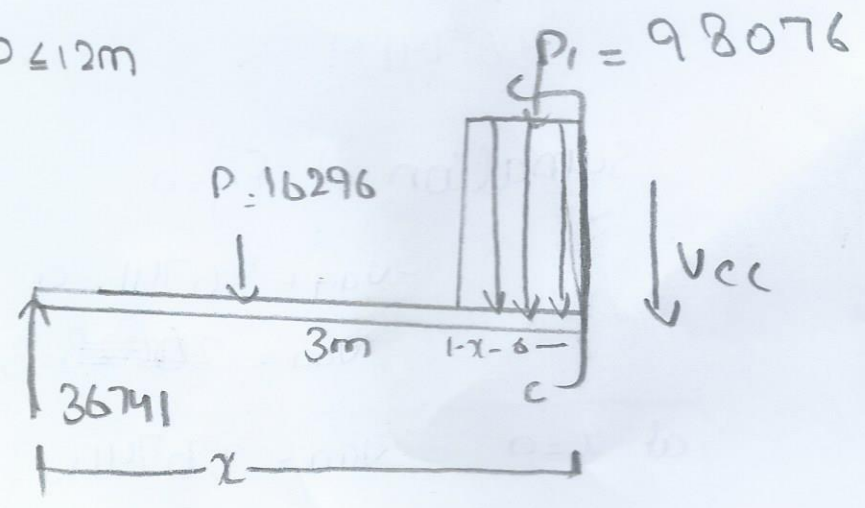
$$-V_{bb} - P + 36741 = 0$$

$$-V_{bb} - 16296 + 36741 = 0$$

at $x=3$ $V_{bb} = 20445$
 at $x=6$ $V_{bb} = 20445$



$6 \leq 0 \leq 12\text{m}$



$P_1 = 98076(x-6)$

$P = 98076x - 588456$

$-V_{cc} - P_1 - P + 36741 = 0$

$-V_{cc} - 98076x - 588456 + 36741$
 $-16296 = 0$

$-V_{cc} - 98076x - 551715 - 16296 = 0$

$-V_{cc} - 98076x - 568011$

$V_{cc} = -98076x - 568011$

at = 6

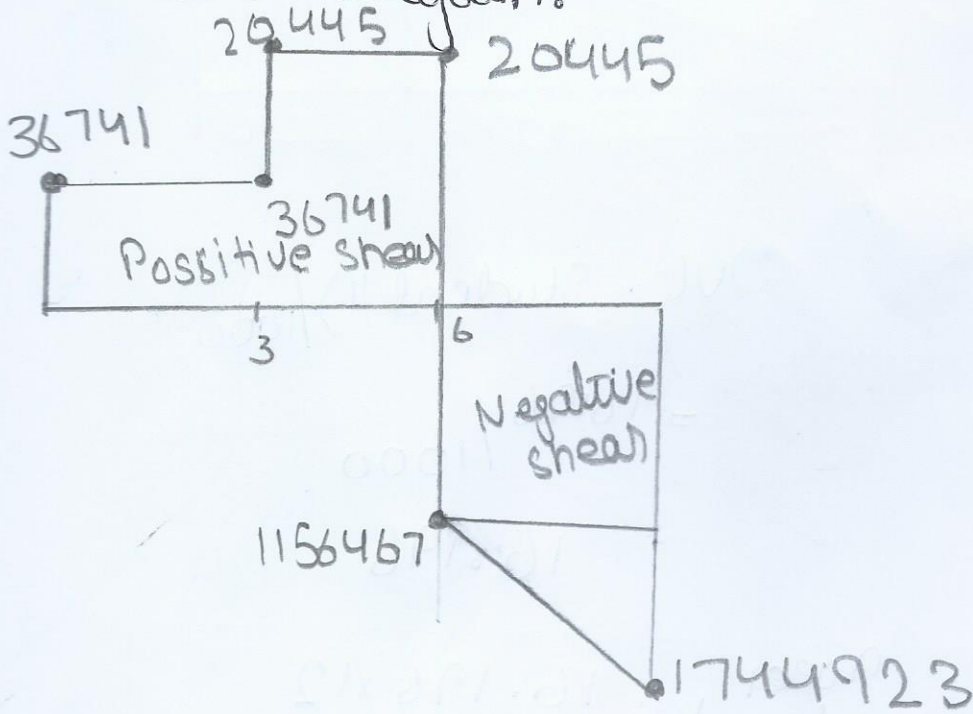
$V_{cc} = -1156467$

at = 12

$V_{cc} = -1744923$

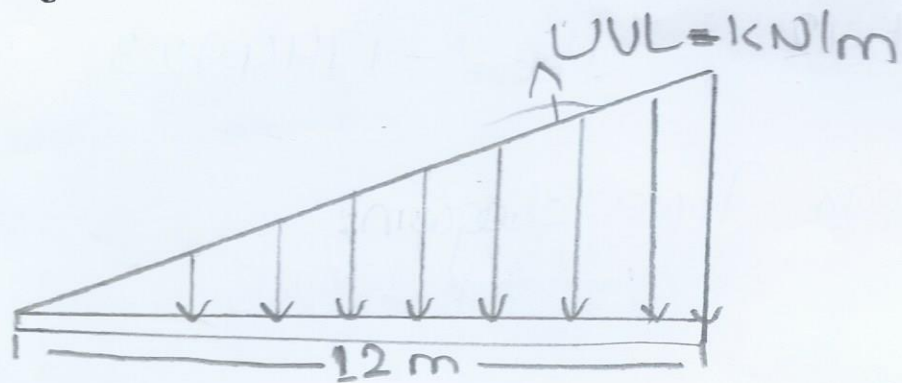
7

Shear Force diagram:



Q.3) Solution:

8



$$UUL = \text{Student ID} / 1000$$

$$= 16196 / 1000$$

$$= 16.196$$

$$\begin{aligned} \text{Area load} &= \frac{16.196 \times 12}{2} \\ &= \frac{194.352}{2} \\ &= 97.176 \end{aligned}$$

$$\begin{aligned} \text{Dist.} &= \frac{2(12)^3}{3} \\ &= 8m \end{aligned}$$

$$\sum MA = 0$$

$$= 97.176 \times 8$$

$$= 777.408$$

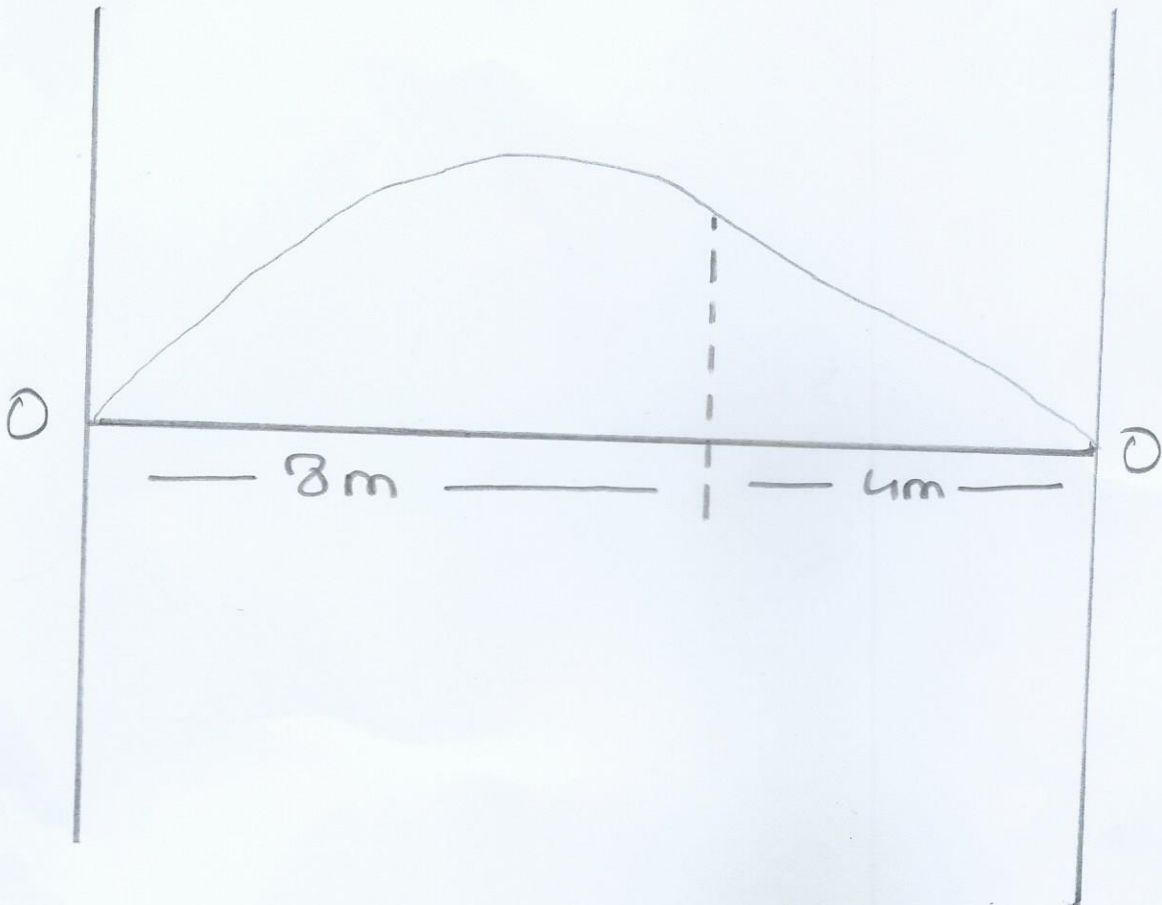
$$B_y \times 12 =$$

$$B_y = \frac{777.408}{12}$$

BMD:

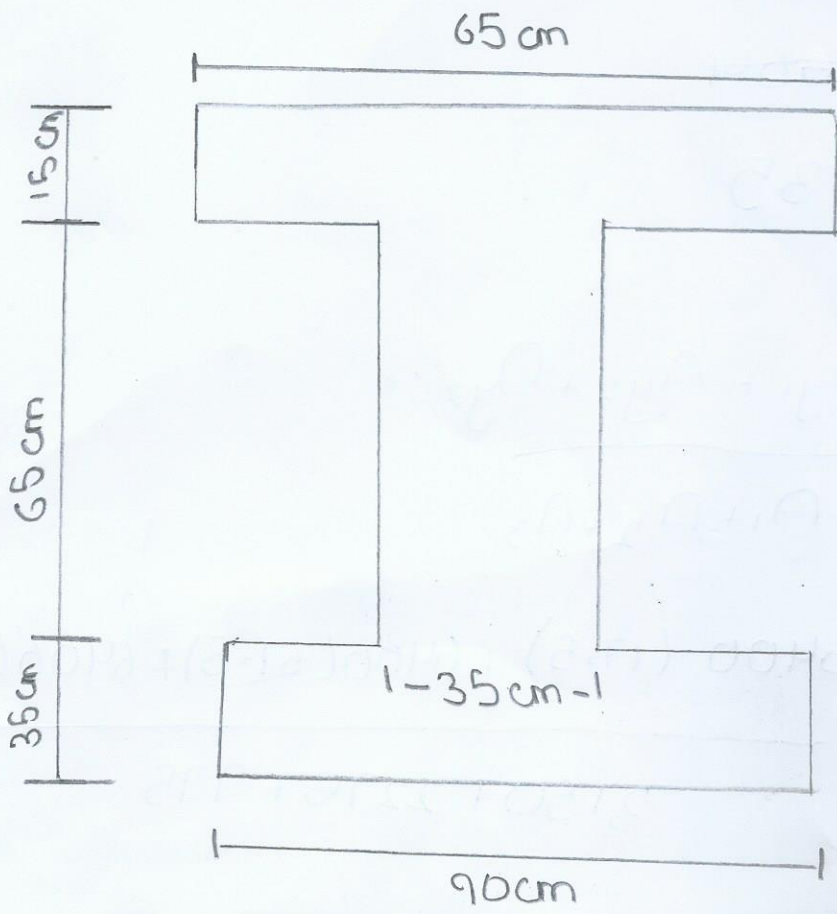
$$R_{By} = 64.784$$

(9)



Q.4) Solution:

a)



| | | | |
|-------|---------------------|------------|---------------|
| A_1 | 3150 cm^2 | $x_1 = 45$ | $y_1 = 17.5$ |
| A_2 | 2275 cm^2 | $x_2 = 45$ | $y_2 = 67.5$ |
| A_3 | 975 cm^2 | $x_3 = 45$ | $y_3 = 107.5$ |

$$\sum A = 6400 \text{ cm}^2$$

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

$$= \frac{6400(45) + 6400(45) + 6400(45)}{3150 + 2275 + 975}$$

$$= \frac{288000 + 288000 + 288000}{6400}$$

$$x_c = \cancel{566.4}$$

$$x_c = 135$$

$$y_c = \frac{Ay_1 + Ay_2 + Ay_3}{A_1 + A_2 + A_3}$$

$$= \frac{6400(17.5) + 6400(67.5) + 6400(107.5)}{3150 + 2275 + 975}$$

$$= \frac{112000 + 432000 + 688000}{6400}$$

$$y_c = \frac{1232000}{6400}$$

$$y_c = 192.5$$

Q.4b) Solution:

Area = 65 cm x 35 cm

Moment of Inertia = ?

Radius of Gyration = ?

Section of Moduli = ?

For moment of Inertia,

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

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

$$= \frac{1}{3} (65) (42875)$$

$$\bar{I}_x = 928958 \text{ mm}^4$$

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

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

$$= \frac{1}{3} (274625) (35)$$

$$\bar{I}_y = 3203958 \text{ mm}^4$$

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

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

$I_{\bar{y}} = 232239.5 \text{ mm}^4$

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

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

$$= \frac{1}{12} (274625) (35)$$

$I_{\bar{y}} = 800989.5 \text{ mm}^4$

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

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

$$J_c = \frac{1}{12} (2275) (5450)$$

$$J_c = \frac{12398750}{12}$$

$J_c = 1033229.16 \text{ mm}^4$

Radius of gyration:

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

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

$A = b \times d$
 $A = 65 \times 35$
 $A = 2275$

$$r = 21.311 \text{ mm}$$

Section moduli:

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

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

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

Q.5) Explain work, energy and power in 15 details along with practical examples from daily life.

Work:

The Product of force and displacement is called work.

A force is said to be positive work when the applied force has a component in the direction of the displacement of the point of application. And a force does negative work if the force component is opposite to the direction of displacement at this point of application of the force.

Example:

When a ball is held above the ground and then dropped, the work

done by the gravitational force on the ball as it falls. As equal to length of the ball (force) multiply by the distance to the ground (displacement) when the force (F) is constant on the angle b/w the force and displacement (S) is the work done is given by

$$W = F s \cos \theta$$

SI unit is Joule (J)

Energy:

The ability to do work. it may exist. it may exist in various form of energy. There are more over heat and work ~~is~~ energy is the process of transfer from one form is another form and from one body to another body energy is always, designed according to it nature.

Example:

light energy, heat energy, mechanical energy, gravitational energy, chemical energy.

We divide our energy use among four economic sectors, Residential, commercial, Transportation and industrial. Heating and cooling our home lighting office, building, driving and manufacturing the products that we really use in our daily lives are functions that require energy.

SI unit = joule

Power:

The rate of doing work, it is the work done in unit time. The SI unit of Power is watt (W). which is

motor vehicle and other machine ⁽¹⁸⁾ are given in term of Horsepower (hp). which is approximately equal to 745.7 watts.

Example:

1) power is the Authority a local government has to collect taxes.

2) Power is the strength needed to run five miles.

BMD:

$$B_y = 64.784$$

(9)

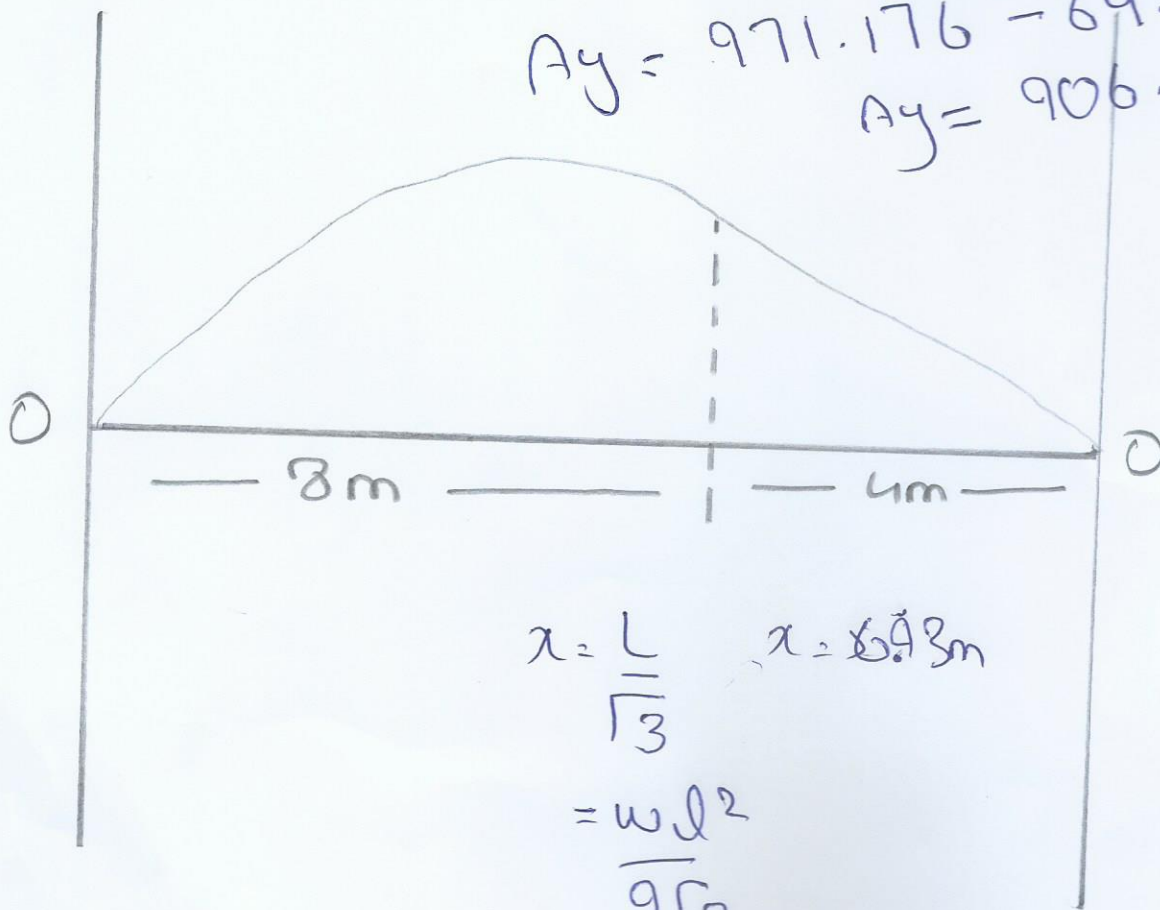
Putting B_y value in eq (i)

$$A_y + B_y = 97.176$$

$$A_y + 64.784 = 97.176$$

$$A_y = 97.176 - 64.784$$

$$A_y = 32.392$$



$$x = \frac{L}{\sqrt{3}} \quad x = 6.93m$$

$$= \frac{wL^2}{9\sqrt{3}}$$

$$= 150.665 \text{ kNm.}$$