NAME * YASIR ZAMAN KHAN

ID * 16158

Department * BE (civil)

Semestr * 2nd

Section * B

Subject * (Eng) Mechanics

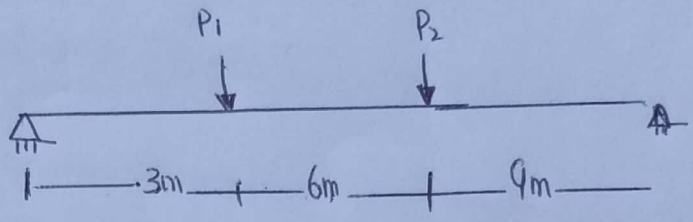
Submitted TO * Sir M. Majid Naem

Date of submission * 27/6/2020

Exam * final

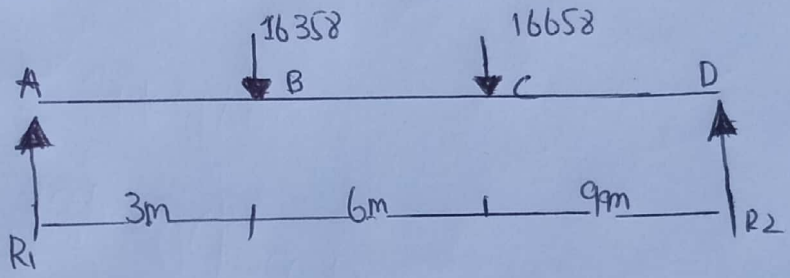
Q1 Find the support reactions, show all your calculations.

(P_1 = 200 + student ID NO) (P_2 = 500 + student ID NO).



$P_1 = 200 + 16158 = 16358$ kN

$P_2 = 500 + 16158 = 16658$ kN



$\sum M_A = 0$ (+ ↻ − ↺)

$-R_2 \times 18 + 16658 \times 9 + 16358 \times 3 = 0$

$\Rightarrow 18R_2 = 198996$ unit

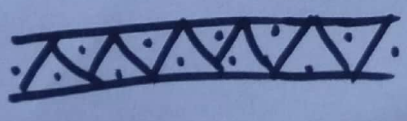
$R_2 = 11055.33$ kN

$\sum M_B = 0$ (+ ↺ − ↻)

$R_1 \times 18 - 16358 \times 15 - 16658 \times 9 = 0$

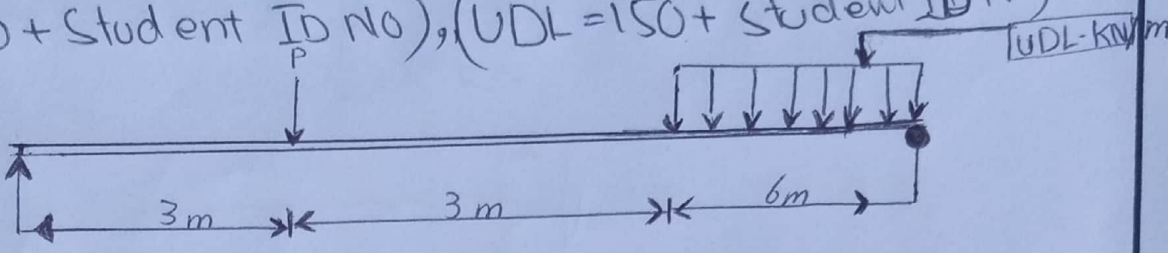
$18R_1 = 395292$

$R_1 = 21960.67$ kN



Q2 Draw the neat shear force diagram, show all your calculations.

(P= 100 + Student ID NO), (UDL = 150 + student ID NO).



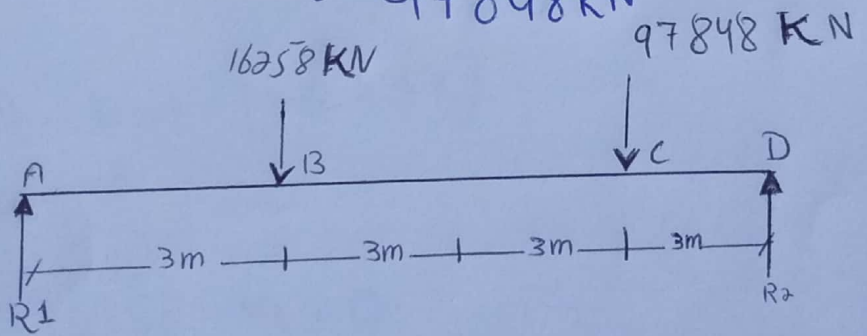
Solu

- P = 100 + 16158 = 16258 KN

UDL = 150 + 16158 = 16308 KN/m

= 16308 x 6

= 97848 kN



$\Sigma M_A = 0$ (+ ↻ − ↺)

$-R_2 \times 12 + 97848 \times 9 + 16258 \times 3 = 0$

$12 R_2 = 929406$

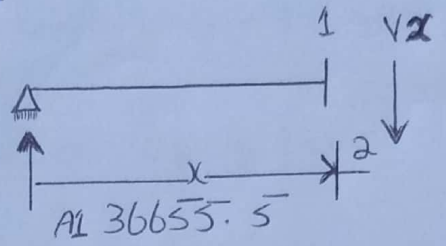
$= 77450.5$ KN

$\Sigma M_B = 0$ (+ ↺ − ↻)

$R_1 \times 12 - 16258 \times 9 - 97848 \times 3 = 0$

$$\frac{12R_1}{12} = \frac{439866}{12}$$

$R_1 = 36655.5\,kN$



Origin A limit $[0 \le x \le B]$

$\Sigma F_y = 0 \uparrow + \downarrow -$

$R_1 - V_x = 0$

$V_x = 36655.5\,kN$

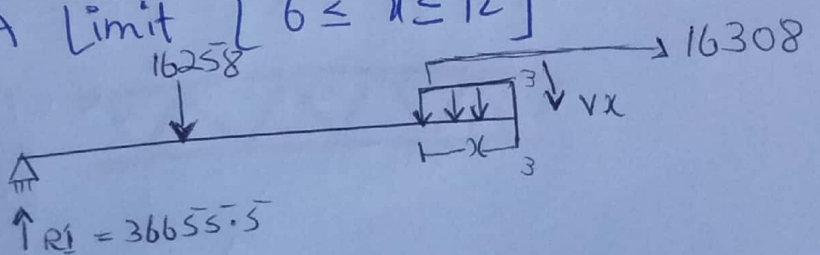
Origin A limit $[3 \le x \le 6]$

$\Sigma F_y \uparrow + \downarrow -$

$36655.5 - 16258 - V_x = 0$

$V_x = 20397.5\,kN$

Origin A Limit $[6 \le x \le 12]$

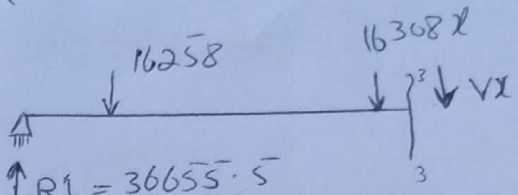


$\Sigma F_y = \uparrow + \downarrow -$

$36655.5 - 16258 - 16308x - V_x = 0$

$V_x = 20397.5 - 16308x$

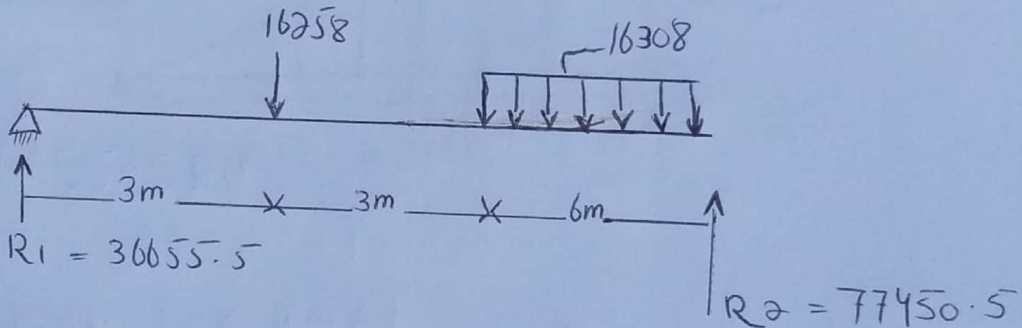
$V_x = 20397.5 - 16308x$

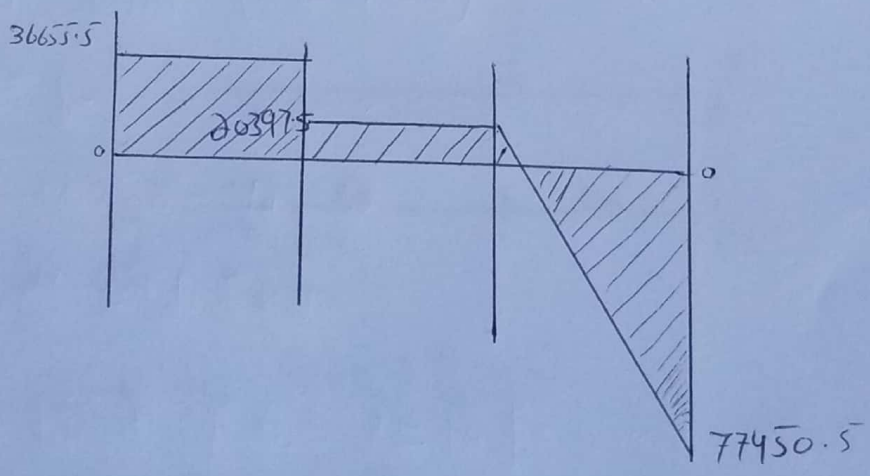


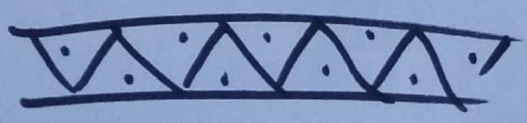
[Put value of x]

for 0 = 20397.5

for 3 = -28526.5

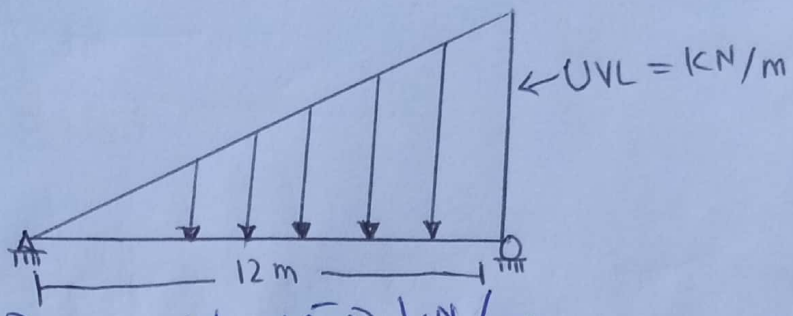




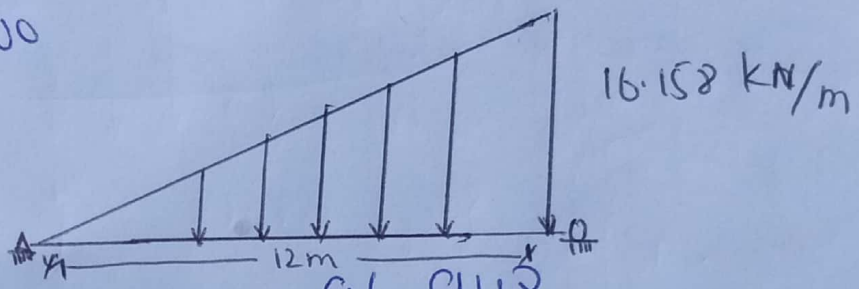


Q3 Draw the neat Shear and bending moment diagrams. Show all your calculations (UVL = Student ID NO/1000).

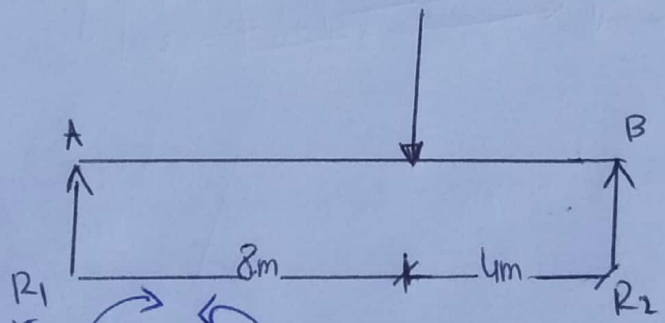
Solution



$$UVL = \frac{16158}{1000} = 16.158\ kN/m$$



$$w_o = \frac{16.158 \times 12}{12} = 96.948$$



$\Sigma M_A = 0$ (+ ↻ , − ↺)

$$-R_2 \times 12 + 96.948 \times 9 = 0$$

$$\frac{12R_2}{12} = \frac{775.584}{12}$$

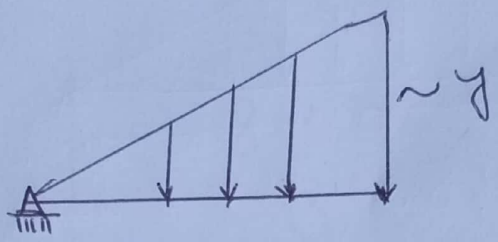
$$R_2 = 64.632\ kN$$

$\Sigma M_B = 0$ (+ ↺ −)

$R_1 \times 12 - 96.948 \times 4 = 0$

$\frac{12 R_1}{12} = \frac{387.792}{12}$

$R_1 = 32.316\ KN$

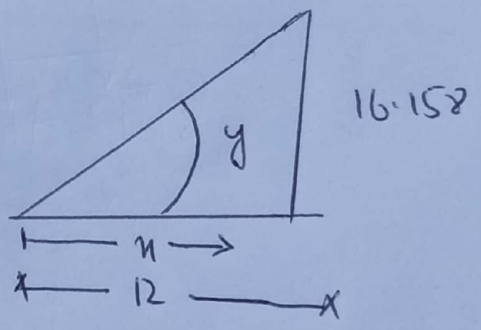


To find "y" by angle of similarity

$\frac{x}{y} = \frac{12}{16.158}$

$\frac{16.158x}{12} = y$

$y = 1.3465x$



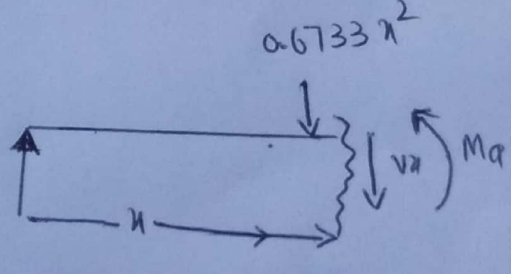
$\omega_0 = \frac{1}{2}(y)(x)$

$= \frac{1}{2}(1.3465x)x$

$\omega_0 = 0.6733x^2$

Origin A

limit $[0 \le x \le 12]$



$\Sigma F_y = 0$ ↑+ ↓−

$32.316 - 0.6733x^2 - V_x = 0$

$V_x = 32.316 - 0.6733x^2$

$\Sigma M_{1-1} = 0$ ↻ (+) ↺ (−)

$$32.316x - 0.6733x^2 \times \frac{x}{3} - M_x = 0$$

$$M_x = 32.316x - 0.2244x^3$$

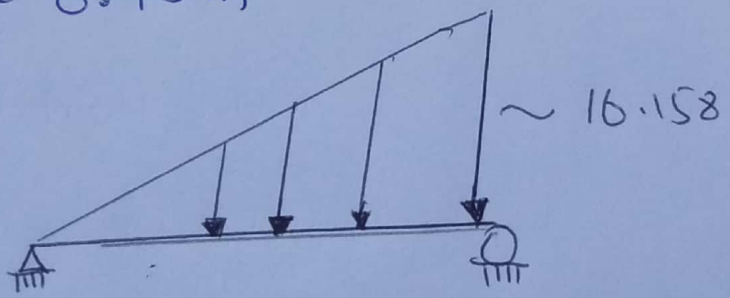
x - length	Vx [kN]	M (kN-m)
0	32.316	0
6	8.0772	399.32
6.93	0	149.267
12	64.632	0

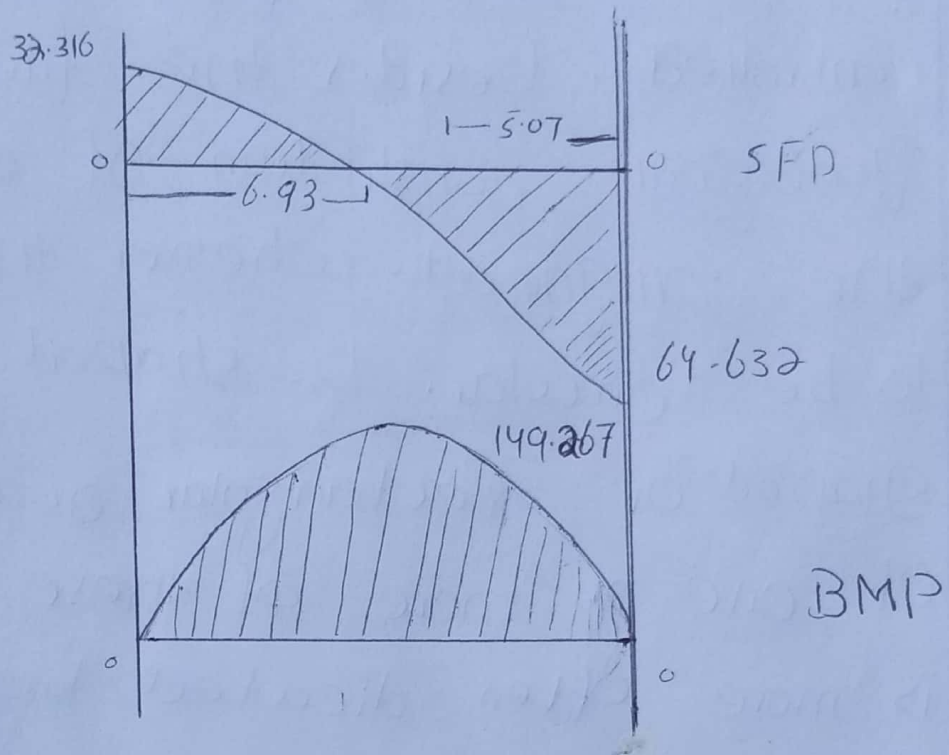
$$32.316 - 0.6733x^2 = 0$$

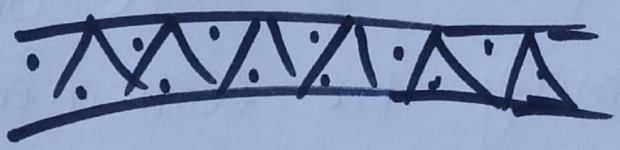
$$\frac{32.316}{0.6733} = \frac{0.6733x^2}{0.6733}$$

$$\sqrt{x^2} = 48$$

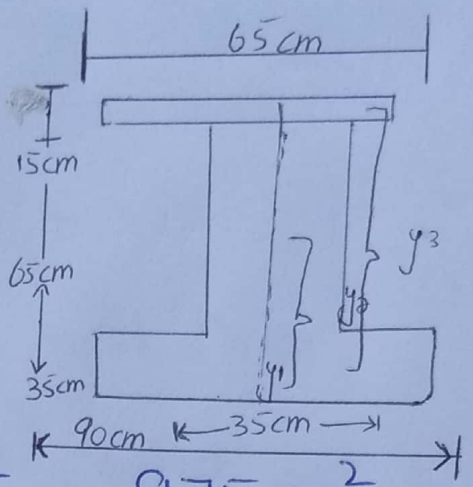
$$= 6.93\ m$$







Q4 (a) find the Centroid of the Given Shape. Show all your calculations.



Sol

$a_1 = 65 \times 15 = 975\ cm^2$

$a_2 = 16 \times 35 = 2275\ cm^2$

$a_3 = 90 \times 15 = 1350$

$y_1 = 15/2 = 7.5cm$

$y_2 = 15 + 65/2 = 47.5cm$

$y_3 = 80 + 15/2 = 87.5cm$

$$\bar{y} = \frac{\Sigma ay}{\Sigma a}$$

$$= \frac{a_1y_1 + a_2y_2 + a_3y_3}{a_1 + a_2 + a_3}$$

$$= \frac{(975)(7.5) + (2275)(47.5) + (1350)(87.5)}{975 + 2275 + 1350}$$

$\bar{y} = 50.76\,cm$

As this Shape is Symmetrical axis about x-axis

So $\bar{x} = 45\,cm$

(B) Inertia of mid Area

$$I_{xx} = \frac{bh^3}{12} + Ad^2$$

$$= \frac{35(65)^3}{12} + 2275(50.76-47.5)^2$$

$$I_{xx} = 825167.37\,cm^4$$

$$I_{yy} = \frac{b^3h}{12} + Ar^2 \quad (\because r = 0)$$

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

$$I_{yy} = 232239.6\,cm^3$$

Radius of gyration

$$k_y = \sqrt{\frac{I_{yy}}{A}}$$

$$k_y = \sqrt{\frac{232239.6}{2275}}$$

$$k = 10.104\,cm$$

$$k_n = \sqrt{\frac{I_{nn}}{A}}$$

$$= \sqrt{\frac{825167.37}{2275}}$$

$$\Rightarrow k_n = 19.04\text{cm}.$$

Section moduli

for rectangular Section

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

$$Z = 24645.83\text{cm}^3$$

Q5 Explain work, energy and power in detail along with Practical examples from daily life.

Ans:-

WORK

work is defined as the force causing movement or displacement of an object. In the case of constant force work is the product of the force acting on an object and the displacement caused by that force. Though both force and displacement are vector quantities. work has no direction due to nature of a scalar product in vector.

* Example Of Work *

work has many examples in our everyday life. Some of them are:

A Person Pulling a door, a student lifting a bag, an athlete kicking a ball, a boy pushing a cart etc.

In general for work to occur, a force has to be exerted.

Causing Something to move. So a frustrated Person Pushing against a wall does not do any work because the wall does not move.

Mathematical form :-

$$W = f \cdot d$$

UNIT :-

The unit of work is Joule.

2) * ENERGY *

The ability to do work is called energy. There are various forms of energy. Morever heat and work i-e energy is the process of transfer from one form to another body.

Energy is always designed according to its nature. Hence heat transfer may become thermal energy. while work done may manifest itself in the form of mechanical energy.

Examples of Energy *

All forms of energy are associated with motion. for example any given

body has kinetic energy. if it is in motion. A tensioned device such as bow or spring though at rest, has a potential for creating motion. It contains potential energy because of its configuration similarly, Nuclear energy is Potential energy be because its result from the configuration of subatomic particles in the nucleus of an atom.

3 ★ POWER ★

Power can be defined as the rate of doing work. it is the work done in unit time. The SI unit for power is watt (w), which is Joule per second (J/sec).

Sometimes the power of motor vehicles and other machines are given in terms of horsepower (hp) which is approximately equal to 745.7 watts. Power is always dependent on work done. So if a person does work at different rates, his power also differs at different times.

Mathematical form

$$P = \frac{w}{t}$$

$$\text{Power} = \frac{\text{work}}{\text{time}}$$

UNIT

The SI unit of Power is Watt. (w).

Example

If a person A takes 10 mins to climb a tree and person B takes 5 min to climbs the same tree. we say that person B is more powerful.