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Paper : Engineering Mechanics.

Section (B)

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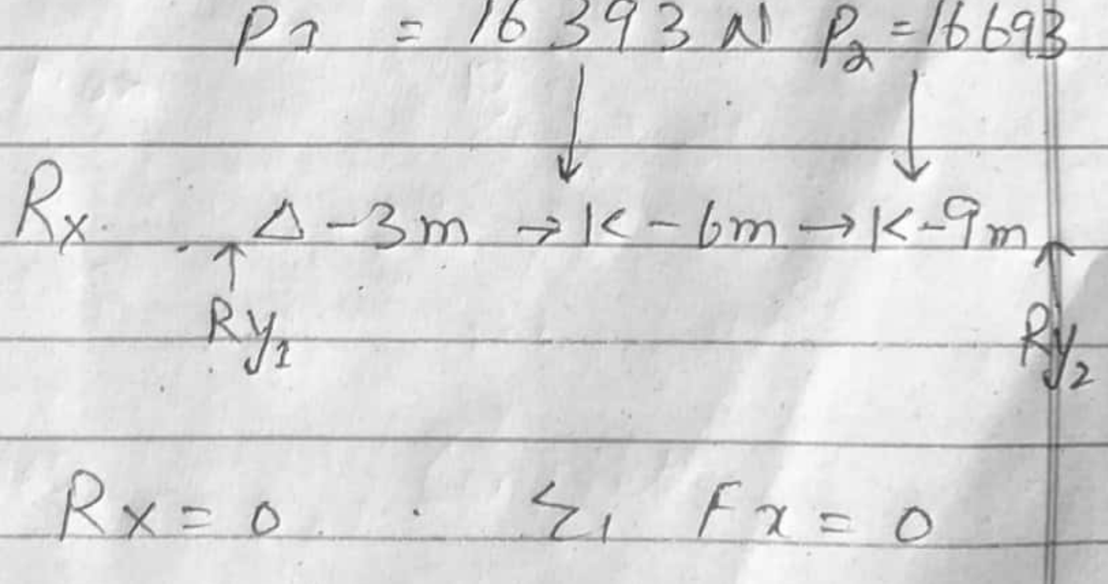
Q_1 :

Given Data :

$P_1 = 200 + 16193$
$= 16,393\ N.$

$P_2 = 500 + 16193$
$16,693\ N$

solve .



$Rx = 0 \quad \Sigma_1\ Fx = 0$

$Ry_1 + Ry_2 - 16393 + 16693N$

$Ry_1 + Ry_2 = 33086\ N$ — eq(1)

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Now

$$Ry_1 = \frac{[(16693 \times 9) + (16393 \times 15)]}{18}$$

$$Ry_1 = \frac{(150237 + 245895)}{18}$$

$$\boxed{Ry_1 = 396132} \quad \text{— eq - 2}$$

Put values of equation 2 in equation (i)

$$396132 + Ry_2 = 33086$$

$$Ry_2 = 33086 - 396132$$

$$\boxed{Ry_2 = -363,046}$$

$$\boxed{Ry_1 = 396132\ N} \quad \boxed{Ry_2 = -363,046}$$

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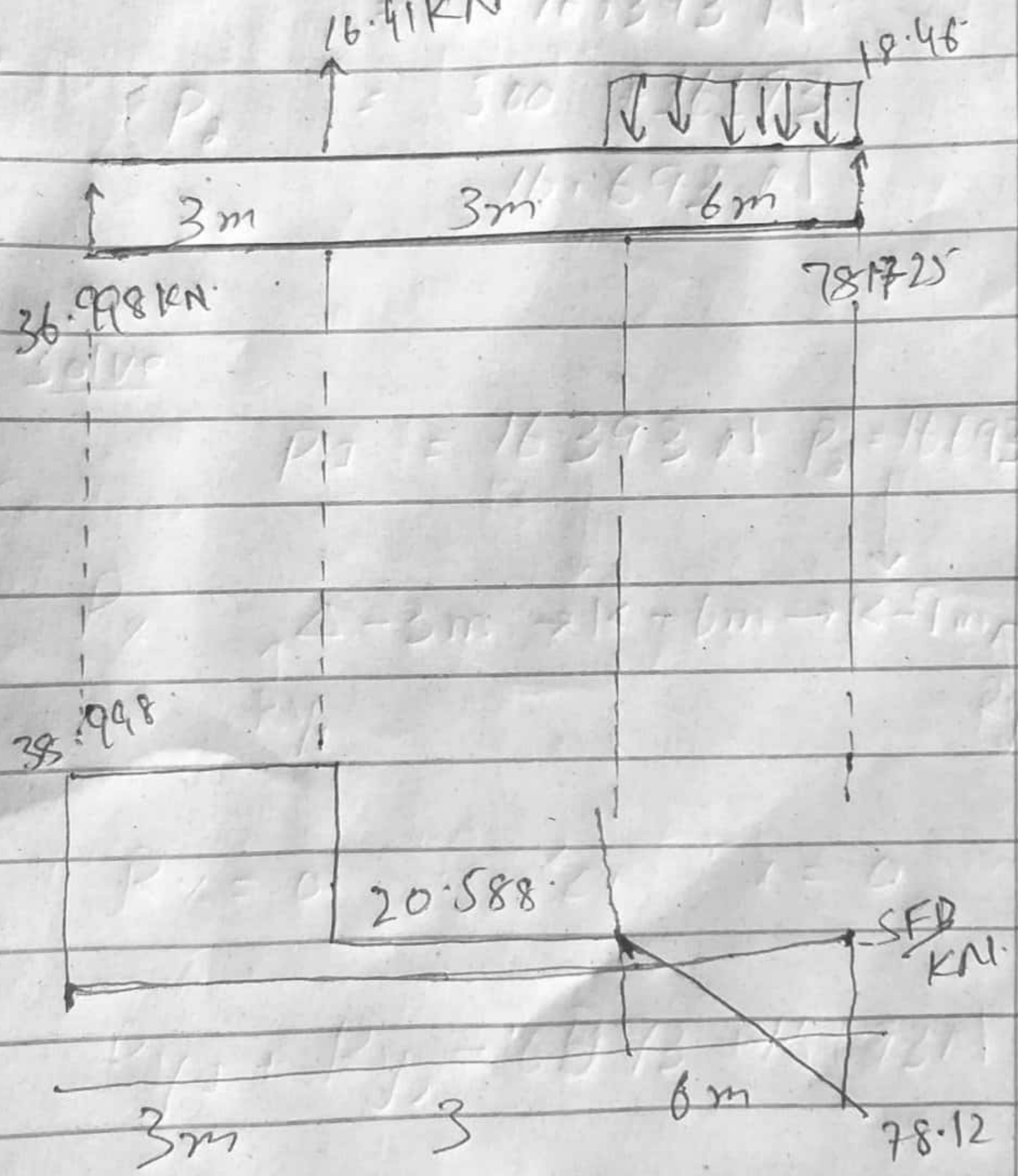
Q2

Now shear force diagram.



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Calculation:

$P = 100 + 16193 = 16193 = 16.19\,KN$

$UDL = 150 + 16193 = 16343 = 16.34\,KN/m$

Solution:

$\uparrow \sum F_y = 0$

$A_y + B_y = P - 98.76 = 0$

$A_y + B_y = 115.17\,KN.$

Now.

$\sum M_B = 0$

$A_y \times 12 + P \times 9 + 98.76 - 3 = 0$

$-12A_y + (16.19 \times 9) + (98.76 - 3) = 0$

$-12A_y = 244.44$

$$A_y = \frac{244.44}{12}$$

$A_y = 153.9375\,KN$

putting in eq (i)

$B_y = 78.1725\,KN.$

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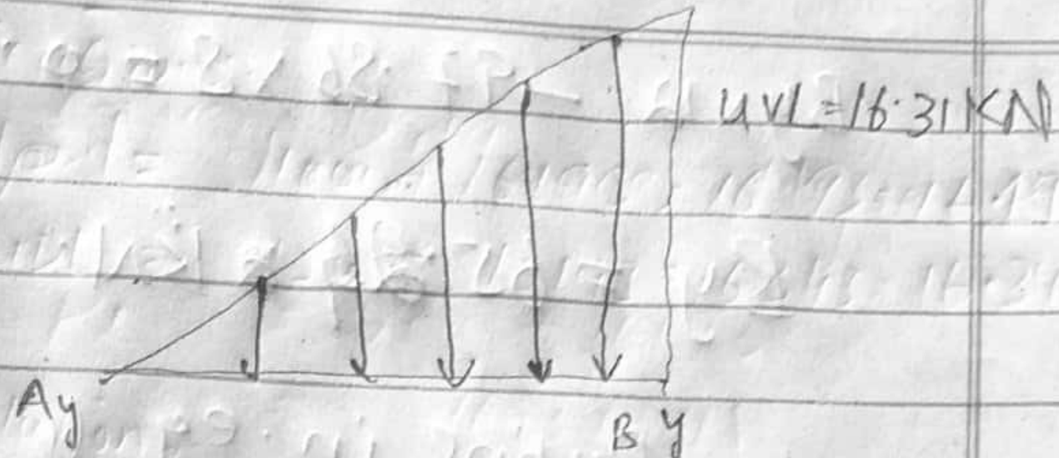
Q)



total load = area of triangle

total load = $\frac{1}{2} \times L \times UVL$.

total load = $\frac{1}{2} \times 12 \times 16.31$

total load = 97.86 KN.

Now:

$\Sigma F_y = 0$:

$A_y + B_y = 97.86\ KN$ — (1)

$\Sigma M_A = 0$:

$B_y \times 12 - 97.86 \times \frac{2}{3} L = 0$.

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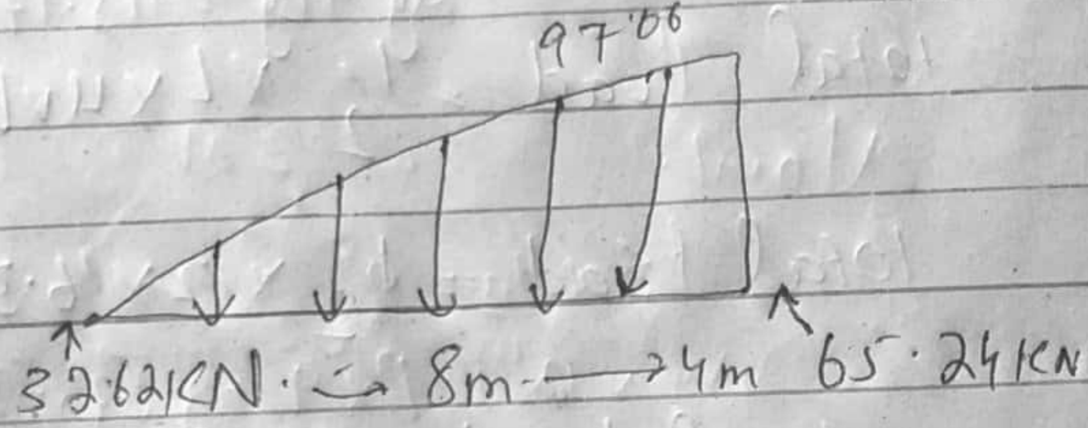
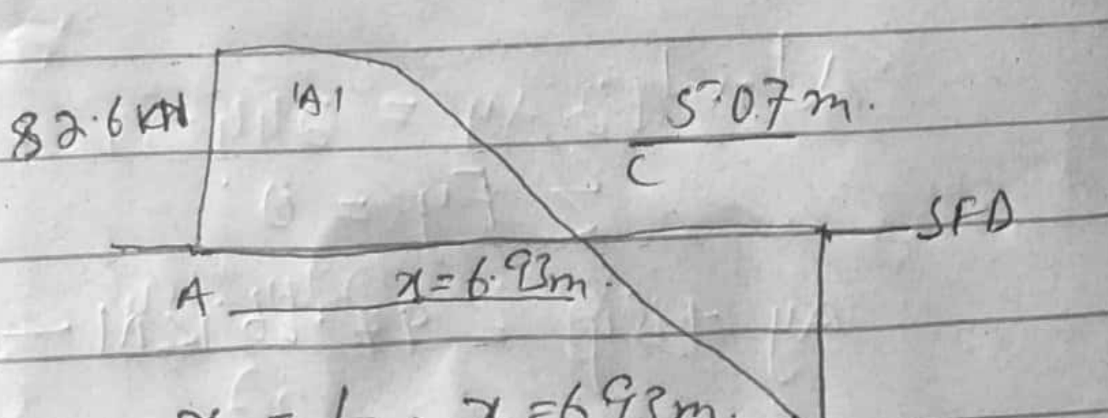
$By \times 12 - 97.86 \times 8 = 0$

$By = 65.24 \text{ KN}$

Putting in eq (i)

(i) ⇒ $Ay = 32.62 \text{ KN}$





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

Mass. BM at C. $= \frac{wl^2}{9\sqrt{3}} = 150.665 \text{ KNm}$

Work:-

The product of force and displacement is called work.

$$W = \vec{F} \cdot \vec{S}$$

$$W = FS\cos\theta$$

Its unit is joul.

If $\theta = 0$

Then $W = FS$ $\cos 0^\circ = 1$

If $\theta = 90$

Then $W = 0$ $\cos 90^\circ = 0$

Work is a scalar quantity.

Examples

pushing a car horizontally
waiking up stairs

Energy:-

The ability of a body to do work is called energy.

In any system the total energy is constant and

$$P = VI$$

Also

$$V = IR$$

So

$$P = IR \times I$$

$$P = I^2 R$$

power can also be written as

$$P = \frac{V^2}{R}$$

⇒ Its unit is watt.

⇒ It is a scalaler quantity

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is equal to

$$E_T = K.E + P.E$$

$$K.E = \frac{1}{2} mv^2$$

$$P.E = mgh$$

⇒ Its unit is joul

⇒ Like work it is also a scalar quantity.

Examples :-

Kinetic energy
potential energy
electrical "
Solar " etc.

Power :-

The rate of doing work is called power.

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

As $W = Vq$

so

$$P = V\frac{q}{t}$$

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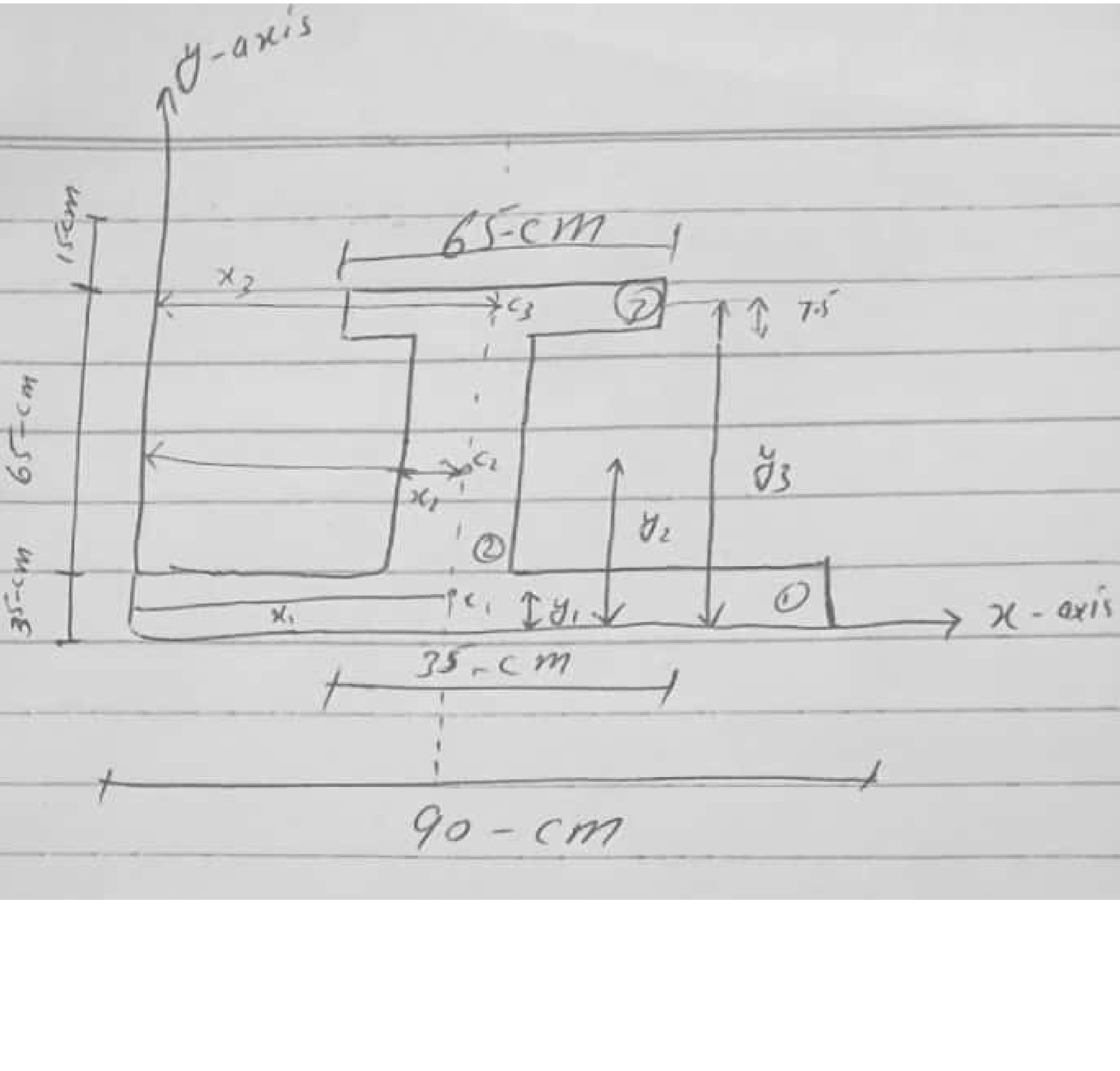
y-axis
65-cm
15cm
x3
c3
3
7.5
65-cm
c2
x2
y3
y2
2
35-cm
c1
x1
y1
1
x - axis
35-cm
90-cm

	cm				cm	
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

$\Sigma A = 6400 cm^2$

$$x_c = \frac{Ax_1 + Ax_2 + Ax_3}{A_1 + A_2 + A_3} = \frac{6400(45) + 6400(45) + 6400(45)}{3150 + 2275 + 975}$$

Given Data

area = 65 cm x 35 cm

Required = ?

moment of Inertia = ?
Radius of Gyration = ?
Section of moduli = ?

For moment of Inertia

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

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

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

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

$\frac{1}{3} (65)^3 (35) = 3203958 \text{ mm}^4$

(2)

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

$= \frac{1}{12} (65)(35)^3 = 6635.41 \text{ mm}^4$

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

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

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

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

$= 1033229.16 \text{ mm}^4$

(b) Radius of gyration

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

$$A = 65 \times 35$$

$$= 2275$$

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

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

(c) section moduli

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

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

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

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

$$x_c = 56004.4 \text{ cm}$$

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

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

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

$$y_c = 544107.5$$

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