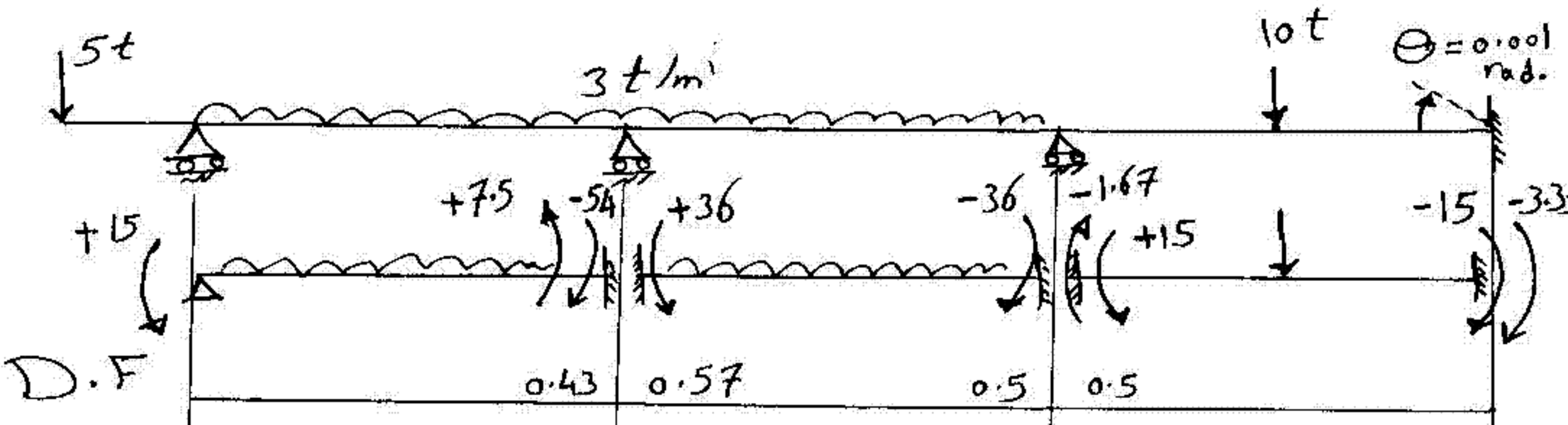
Model Answer

Structural Analysis and Mechanics

3rd year civil

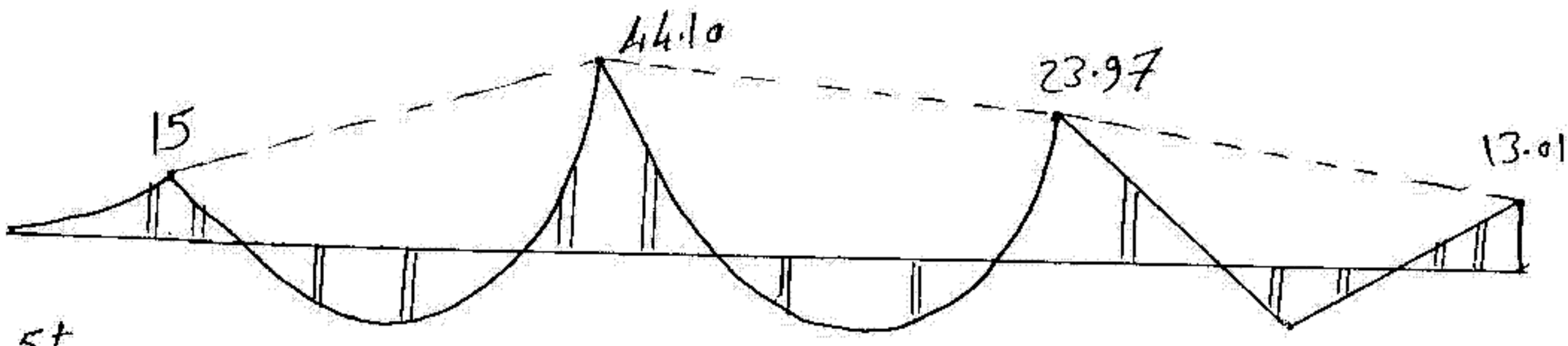
1st term exam 2009 - 2010

Question (1)

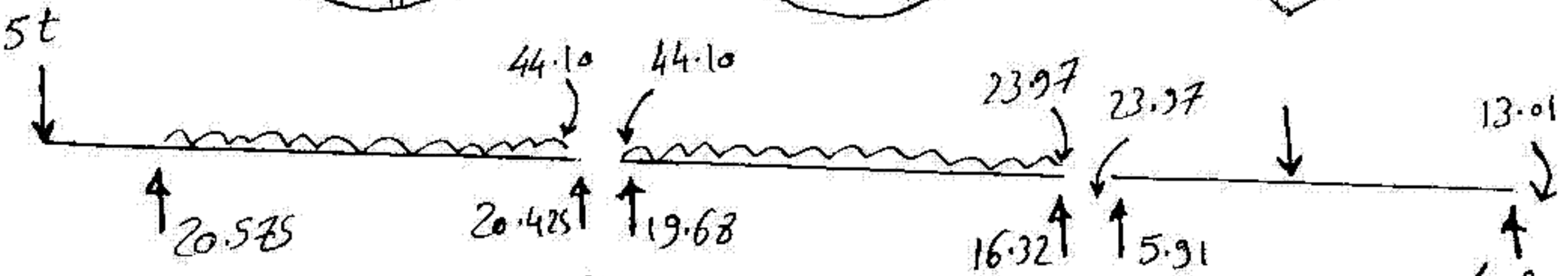


F.E.M	+15	-46.5	+36	-36	+13.33	-18.33
B.M	0	4.515	5.985	11.33	11.33	0.0
C.o.M	0.0	0.0	5.665	2.99	0.0	5.665
B.M	0.0	-2.44	-3.23	-1.495	-1.495	0
C.o.M	0.0	0.0	-0.7475	-1.615	0.0	-0.7475
B.M	0.0	0.321	0.426	0.8075	0.8075	0.0
						0.404
	+15	-44.10	44.10	-23.97	23.97	-13.01

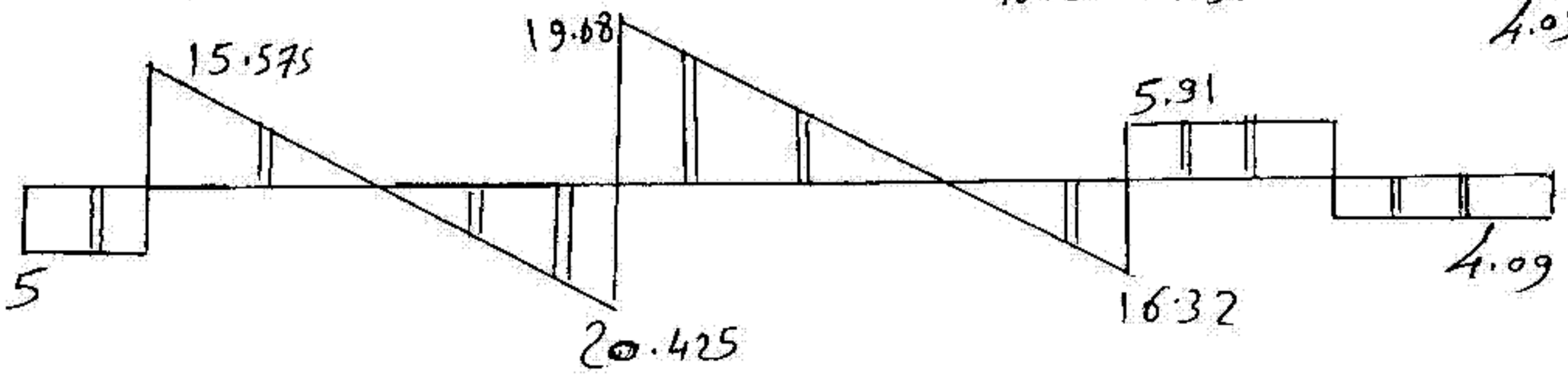
Final moment



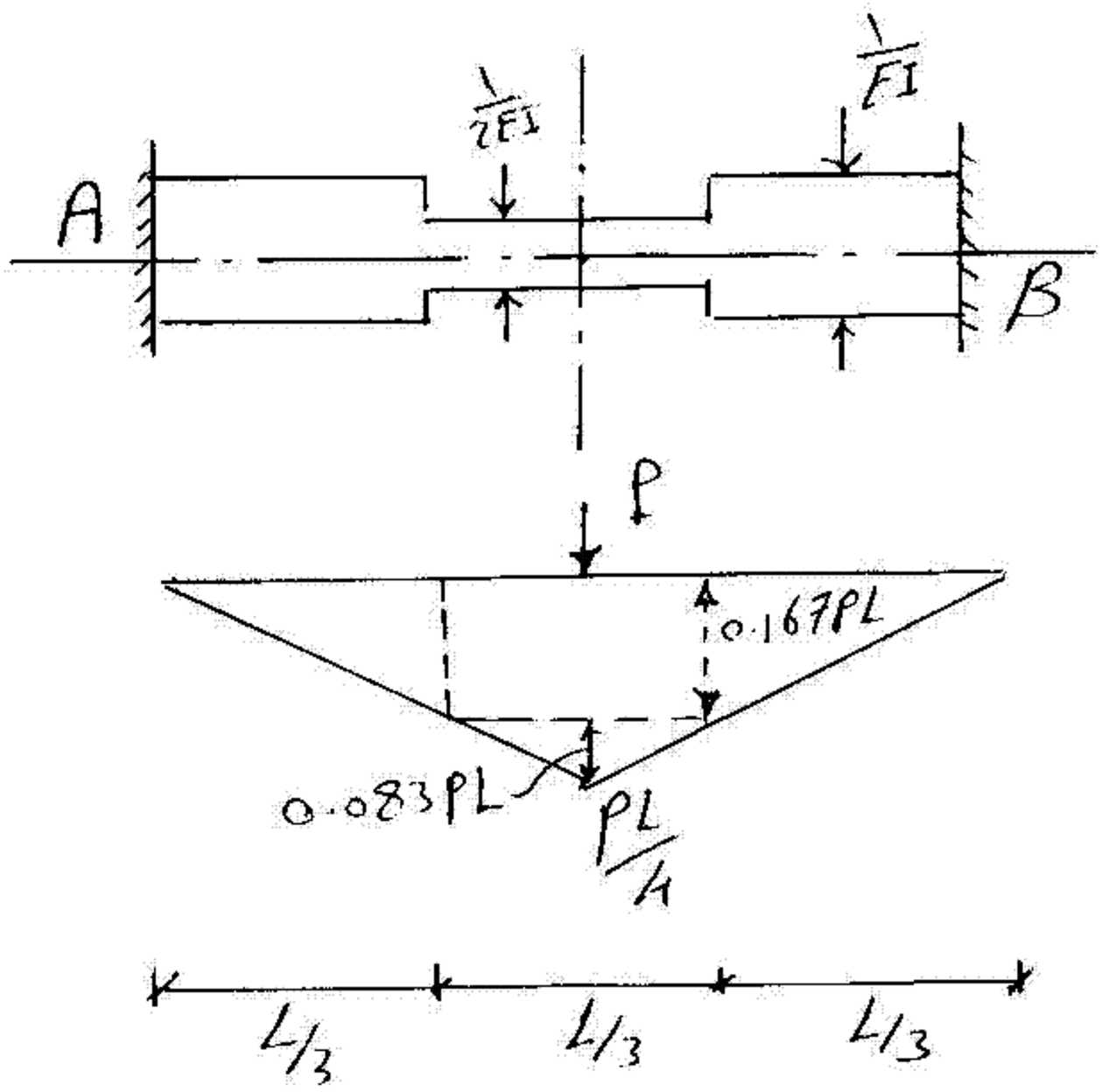
Reactions



S.F.D



Question (2)



$$A = \frac{L}{3}\left(\frac{1}{EI}\right)*2 + \frac{L}{3}\left(\frac{1}{2EI}\right) = \frac{5L}{6EI}$$

$$I_y = 0.08179\frac{L^3}{EI}$$

$$N = -0.09025\frac{PL^2}{EI}$$

* M_A = fixed end moment at A $= \frac{N}{A}$

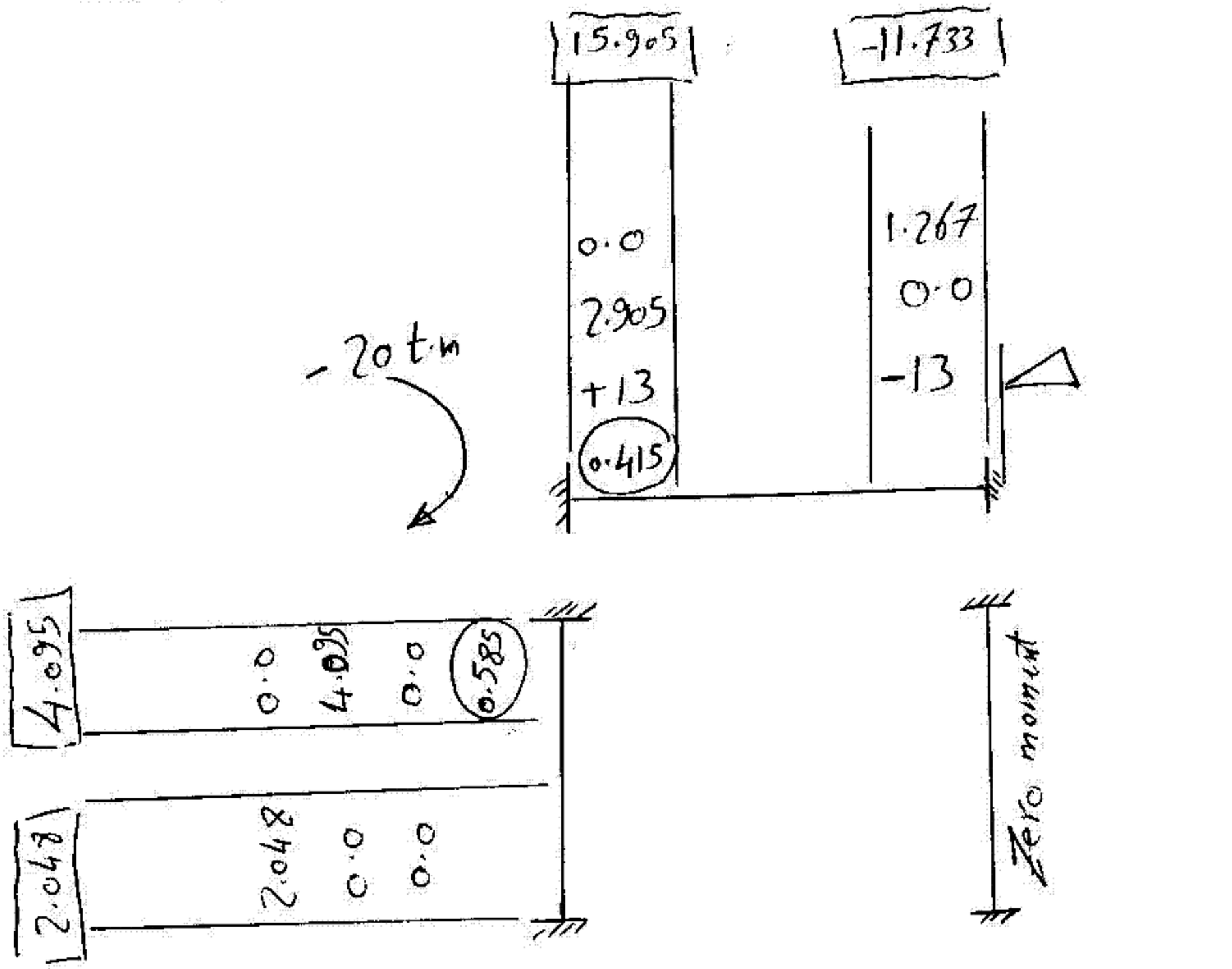
$= -0.108PL$

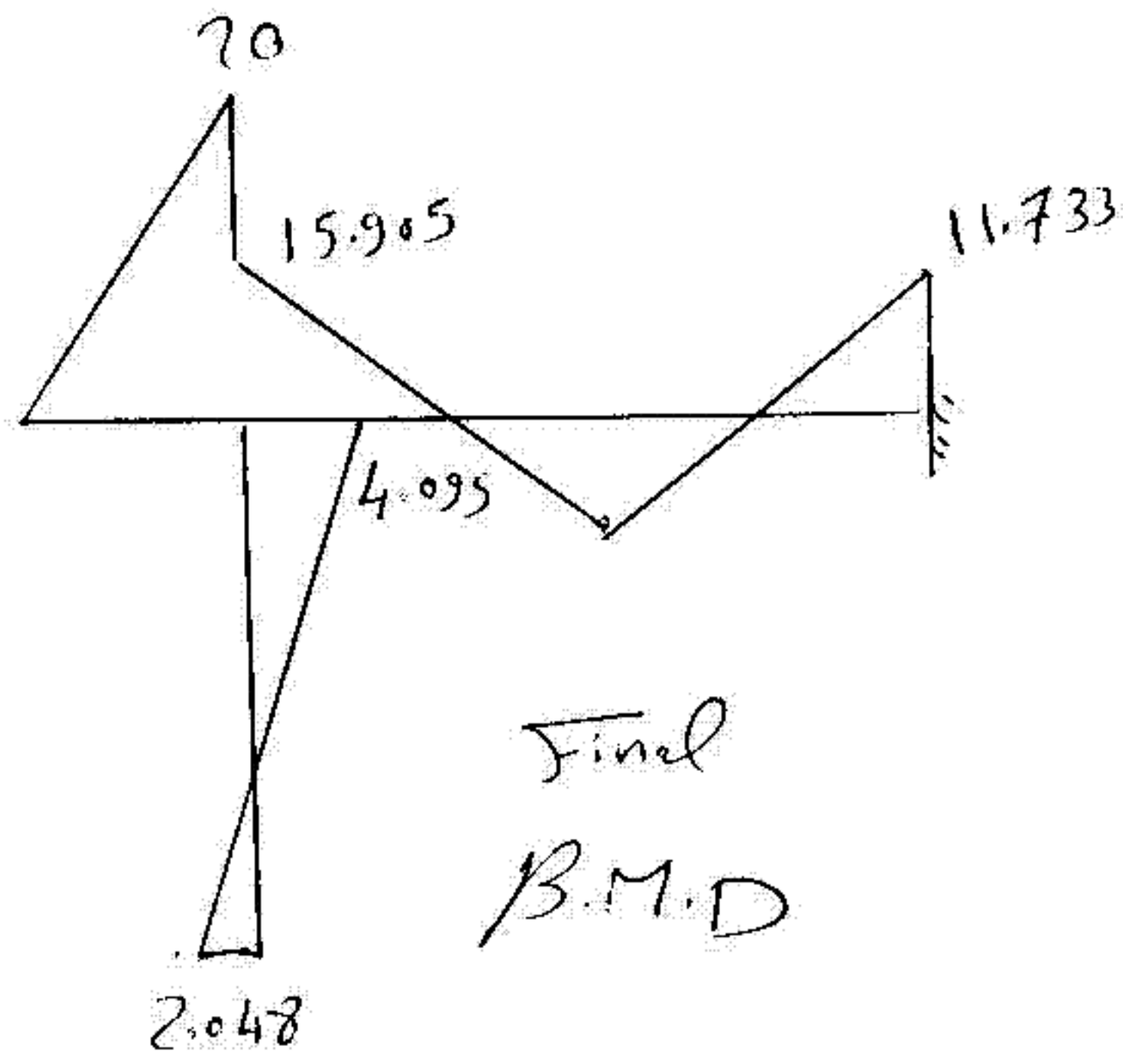
* Stiffness at A: Unit load at A

M_A = stiffness $= 4.26\frac{EI}{L}$

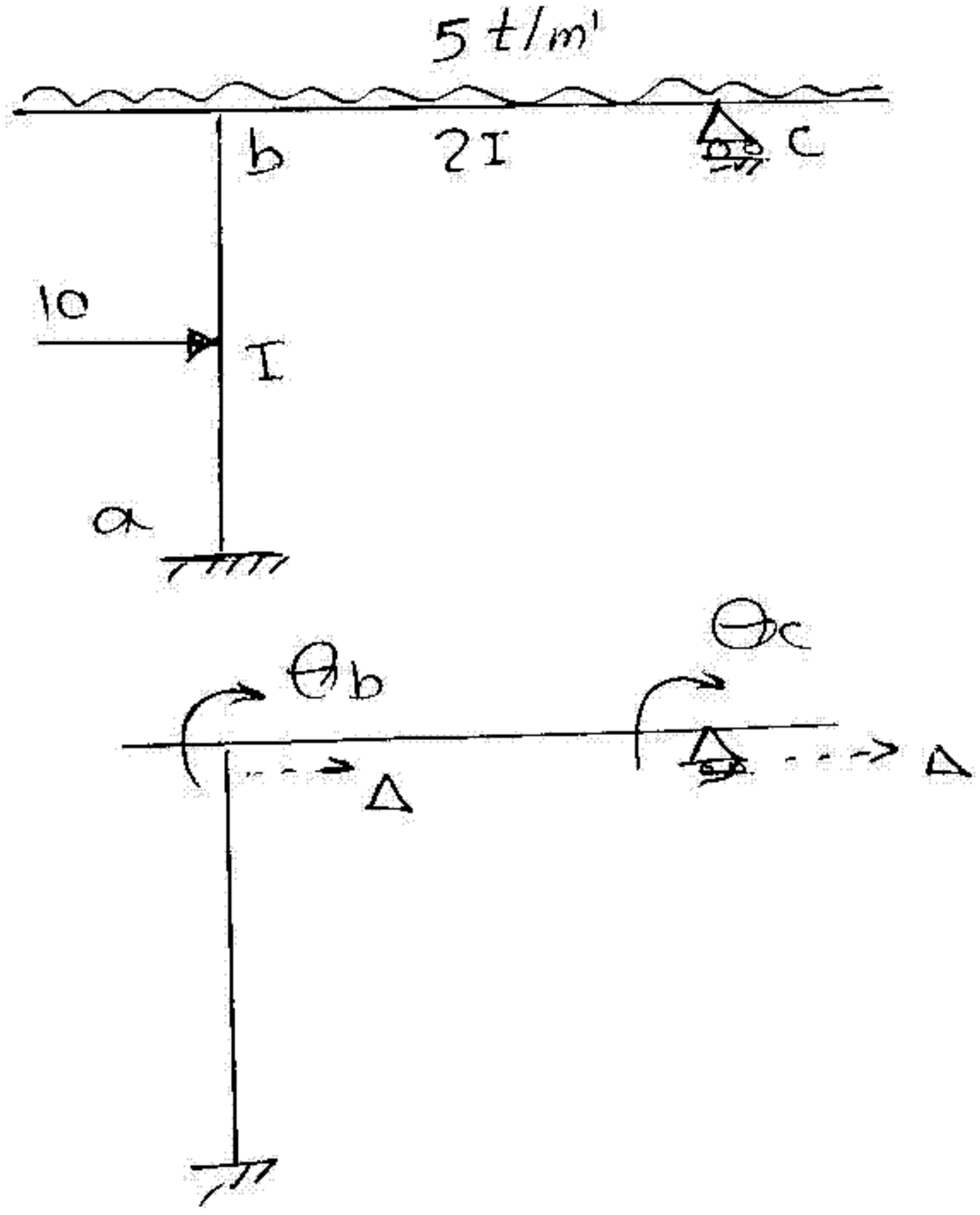
* Carry over factor $= \frac{M_B}{M_A} = 0.436$

Question (3)


15.905
-11.733
0.0
2.905
+13
0.415
1.267
0.0
-13
-20 t.m
4.095
0.0
4.095
0.0
0.585
2.048
2.048
0.0
0.0
Zero moment


20
15.905
11.733
4.095
2.048
Final
B.M.D

Question (4)



$$M_{ab} = \frac{2EI}{6}\left[0 + \theta_b - \frac{3\Delta}{6}\right] - 7.50$$

$$M_{ba} = \frac{2EI}{6}\left[2\theta_b - \frac{3\Delta}{6}\right] + 7.50$$

$$M_{bc} = \frac{2E(2I)}{6}\left[2\theta_b + \theta_c\right] - 15$$

$$M_{cb} = \frac{2E(2I)}{6}\left[2\theta_c + \theta_b\right] + 15$$

* Equilibrium equations

$$M_{bc} + M_{ba} + 10 = 0.0$$

$$M_{cb} - 10 = 0.0$$

$$\frac{M_{ba} + M_{ab}}{6} + 5 = 0.0$$

* $$\Delta = \frac{128.57}{EI}$$

$$\theta_b = \frac{12.857}{EI}$$

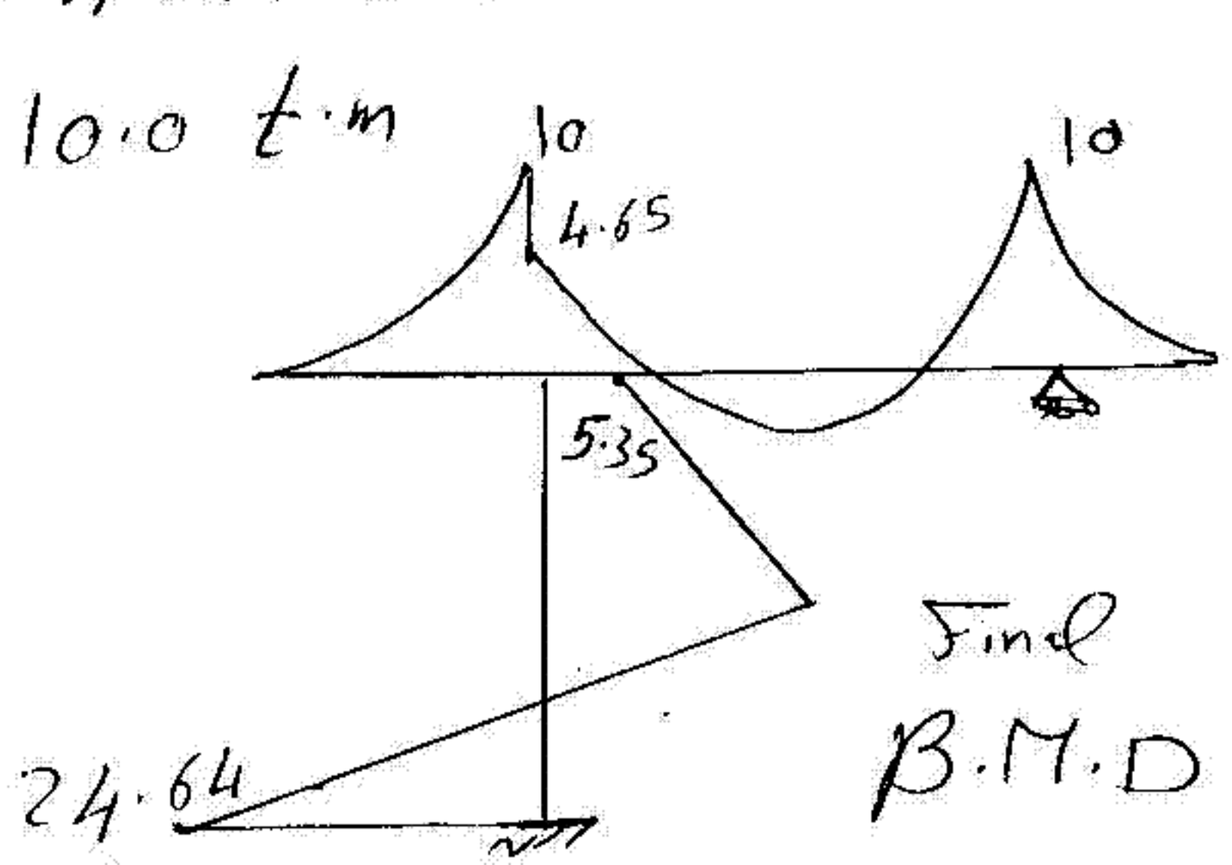
$$\theta_c = \frac{-10.18}{EI}$$

*
$$M_{ab} = -24.64 \ t.m$$

$$M_{ba} = -5.357 \ t.m$$

$$M_{bc} = -4.644 \ t.m$$

$$M_{cb} = 10.0 \ t.m$$



Final B.M.D