Beams

* Draw to suitable scale The
  - Normal Forces Diagram (N.F.D)
  - shear Forces Diagram (S.F.D)
  - Bending Moments Diagram (B.M.D)

Illustrate the values at supports, points of loading and point of load changing

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steps

① Draw the body
② put external forces
③ Replace supports by reactions
④ use equilibrium equations $\Sigma F_x = 0$, $\Sigma F_y = 0$, $\Sigma M = 0$
⑤ Draw (N.F.D) under the body start from right. → ↑
⑥ Draw (S.F.D) under (N.F.D) start from left. ↑ ↑
⑦ Draw (B.M.D) under (S.F.D). After calculating moment at each moment just from left.

No ① sheet ⑤

$\pm\Sigma F_x = 0$ $\quad X_A + 100 - 300 = 0$ $\quad \therefore X_A = 200\,KN$

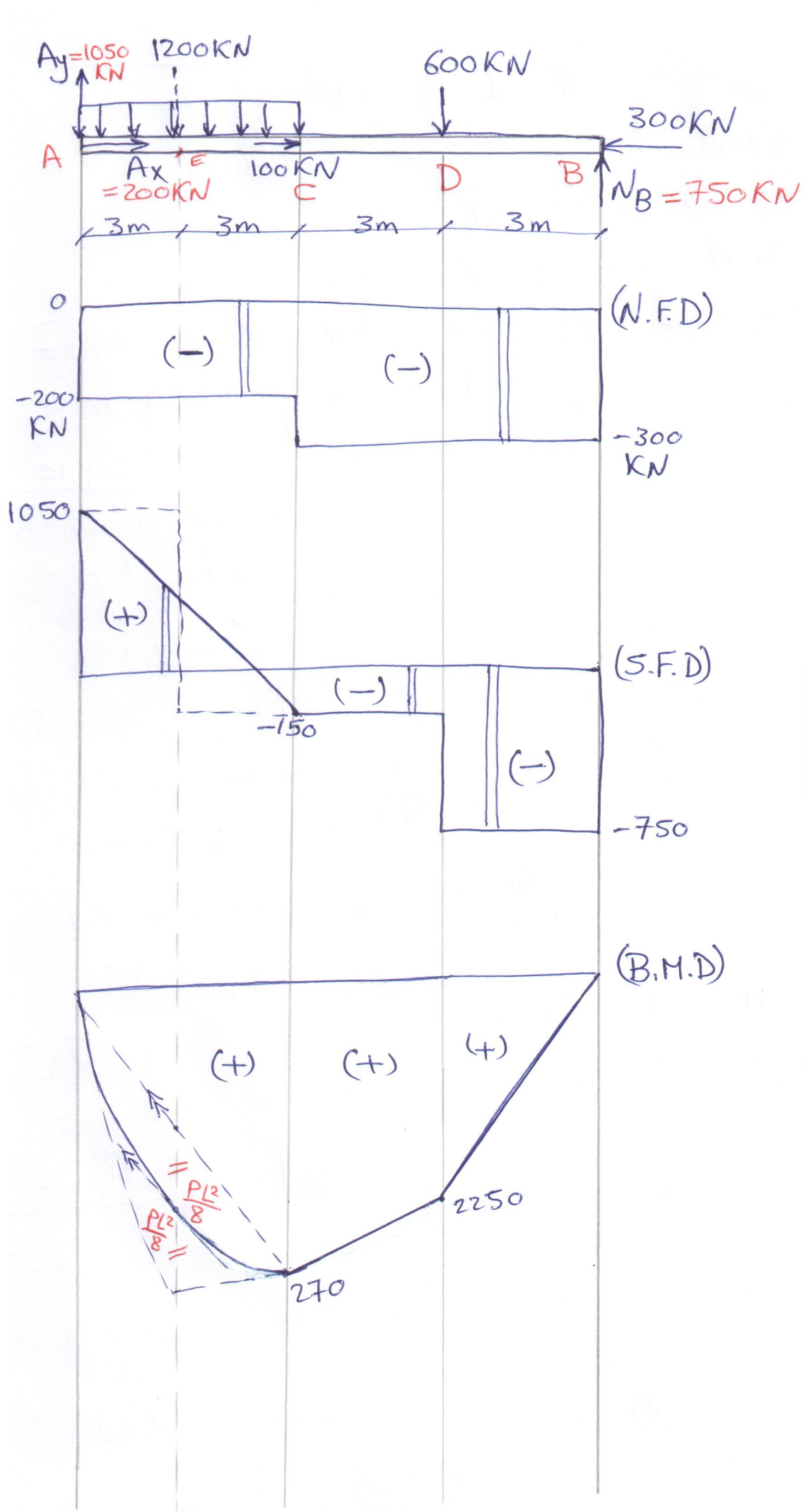
$+\uparrow \Sigma F_y = 0$ $\quad Y_A + N_B - 1200 - 600 = 0$

$Y_A + N_B = 1800 \longrightarrow ①$

$\circlearrowleft \Sigma M_A = 0$ $\quad 1200 * 3 + 600 * 9 - N_B * 12 = 0$

$\therefore N_B = 750\,KN$

sub. in ① $\quad Y_A = 1050\,KN$



moment at each point

$\circlearrowleft \Sigma M_A = 0$

$\circlearrowleft \Sigma M_C =$

$1050 * 6 - 1200 * 3$

$= 2700$ KN.m

$\circlearrowleft \Sigma M_D =$

$1050 * 9 - 1200 * 6$

$= 2250$ KN.m

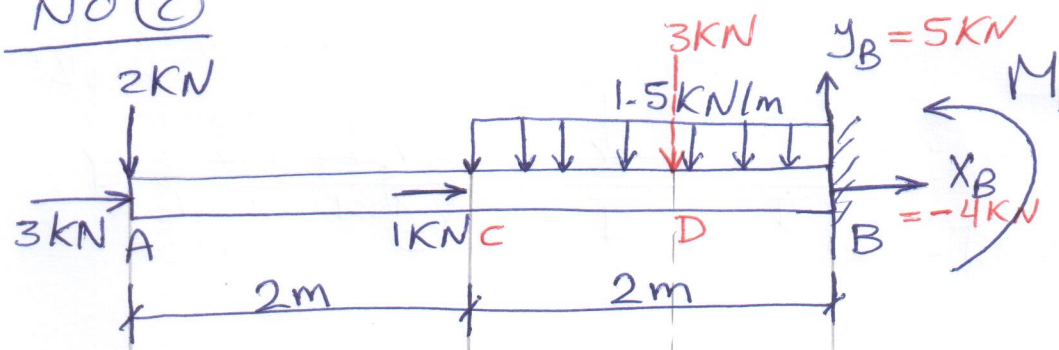
$\Sigma M_B = 0$

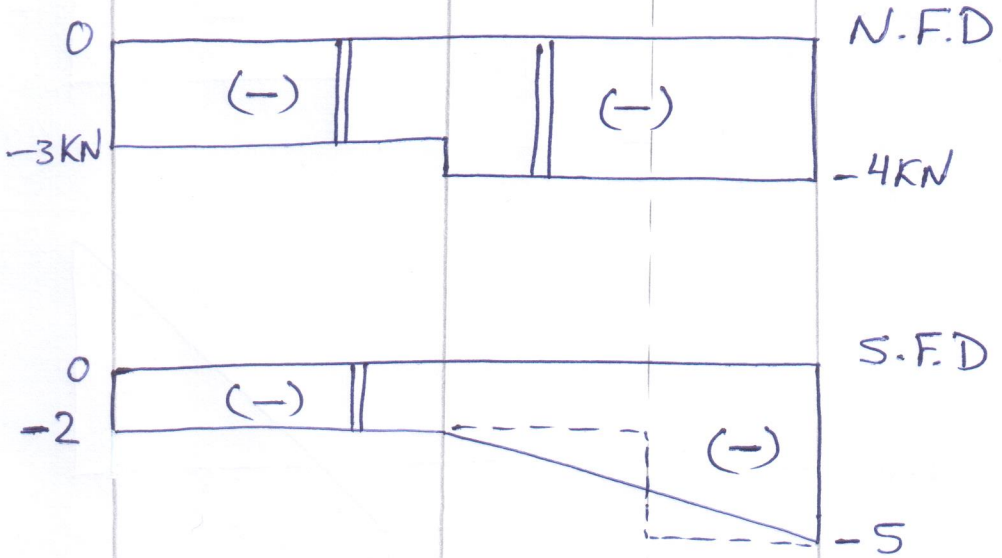
$\Sigma M_E =$

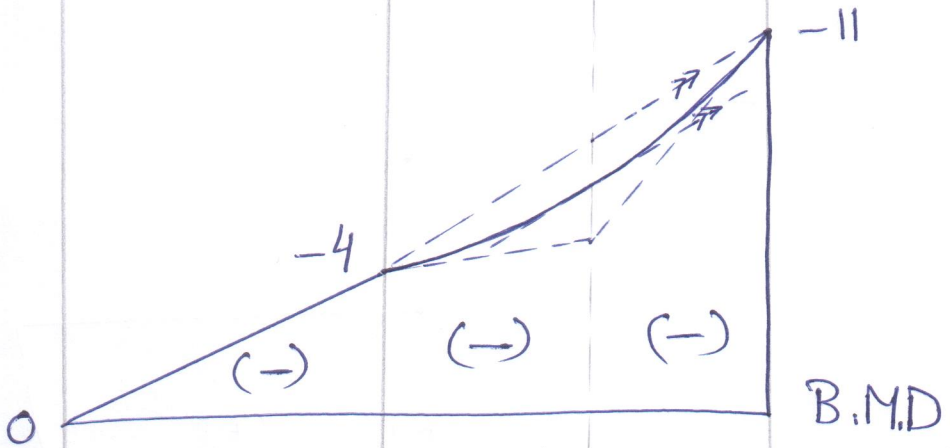
$1050 * 3 - 600 * 1.5$

$= 2250$ KN.m

NO (2)







$\xrightarrow{+} \Sigma F_x = 0$

$3 + 1 + X_B = 0$

$X_B = -4KN$

$+\uparrow \Sigma F_y = 0$

$-2 - 3 + y_B = 0$

$y_B = 5\,KN$

$(+) \Sigma M_B = 0$

$0 = -2 * 4 - 3 * 1 - M_B$

$M_B = -11\,KN.m$

$\Sigma M_A = 0$ (+)

(+) $\Sigma M_C =$

$-2 * 2 = -4$

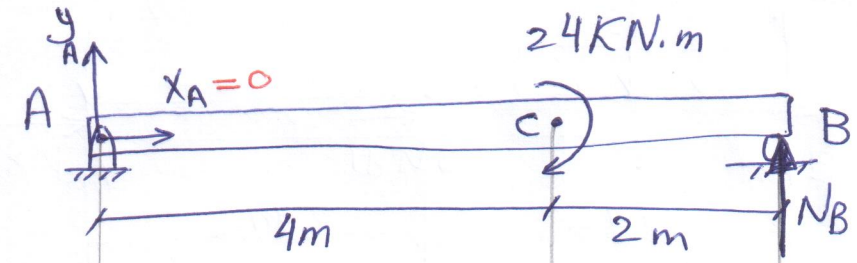
$\Sigma M_B = 0$

(+) $\Sigma M_D = 0$

$-2 * 3 - 1.5 * 0.5$

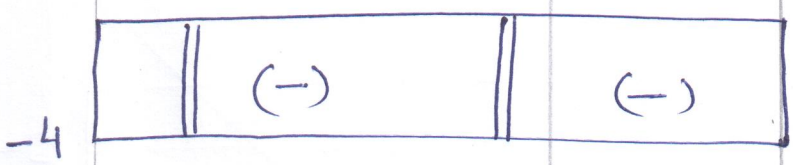
$= -6.75\,KN.m$

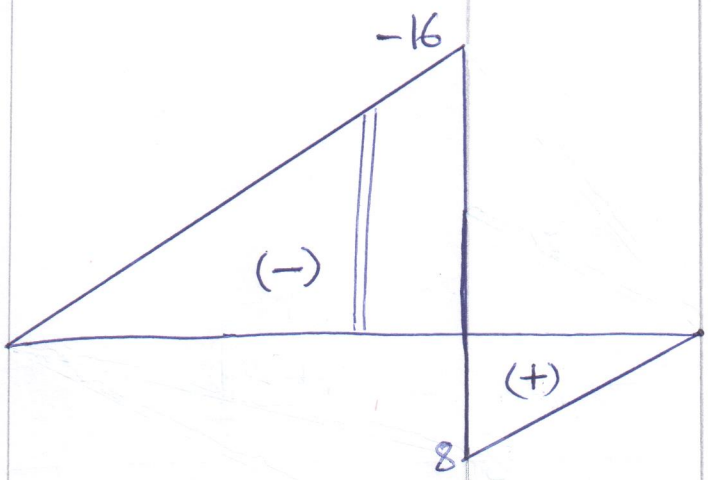
No (5)



N.F.D

S.F.D





B.M.D

$\xrightarrow{+} \Sigma F_x = 0$

$x_A = 0$

$+\uparrow \Sigma F_y = 0$

$y_A + N_B = 0$ ——→ (1)

$\circlearrowleft + \Sigma M_A = 0$

$24 - N_B * 6 = 0$

$N_B = 4\ KN$

sub. in (1)

$y_A = -4\ KN$

$\circlearrowleft + \Sigma M_{C'} =$

$-4 * 4 = -16$

عزم اليسار KN.m

C' . C . C''

$\circlearrowleft + \Sigma M_{C''} =$

$4 * 2 = 8$

عزم اليمين KN.m