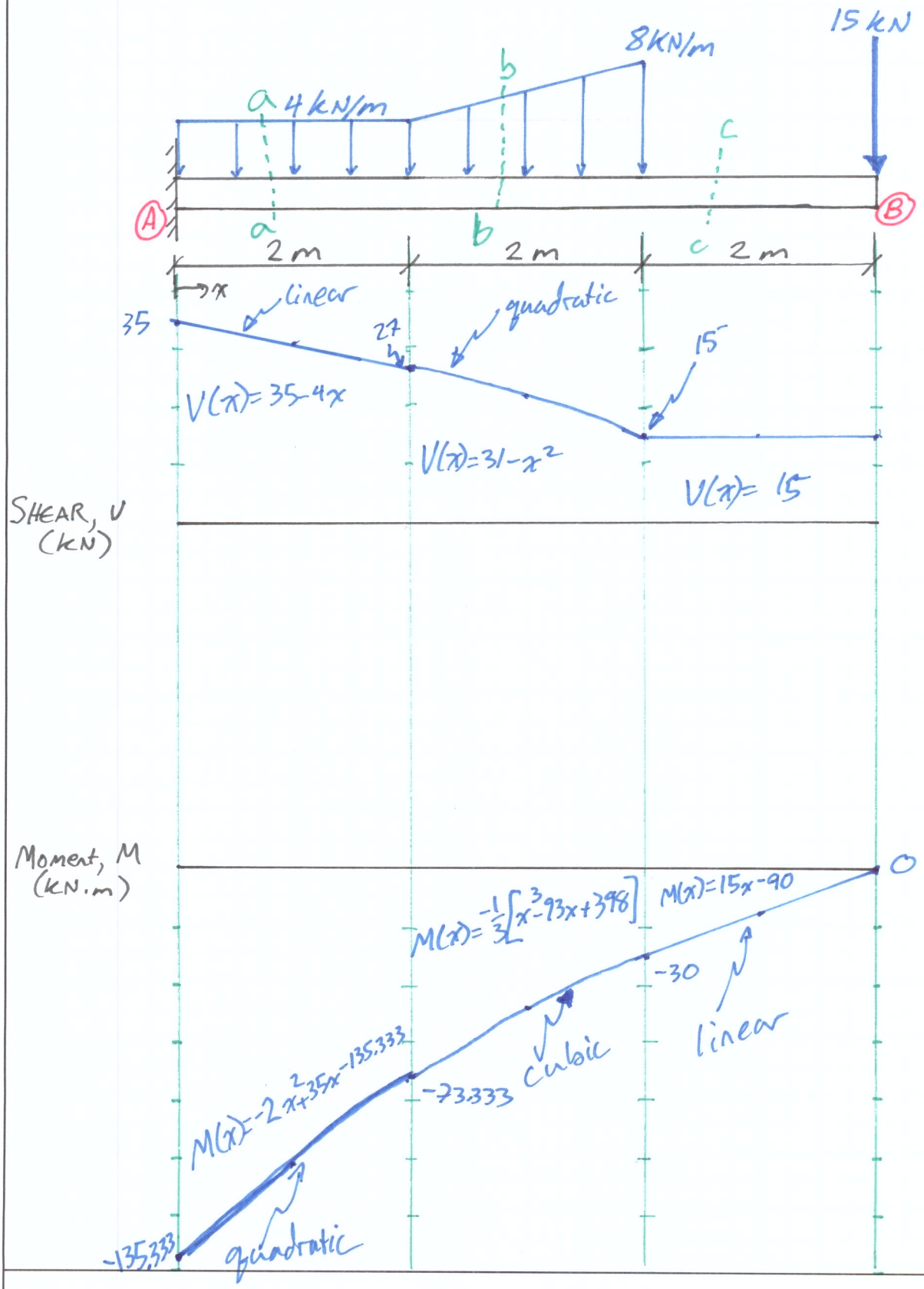
Find equations for load, shear, and moment. Draw diagrams for shear and moment.



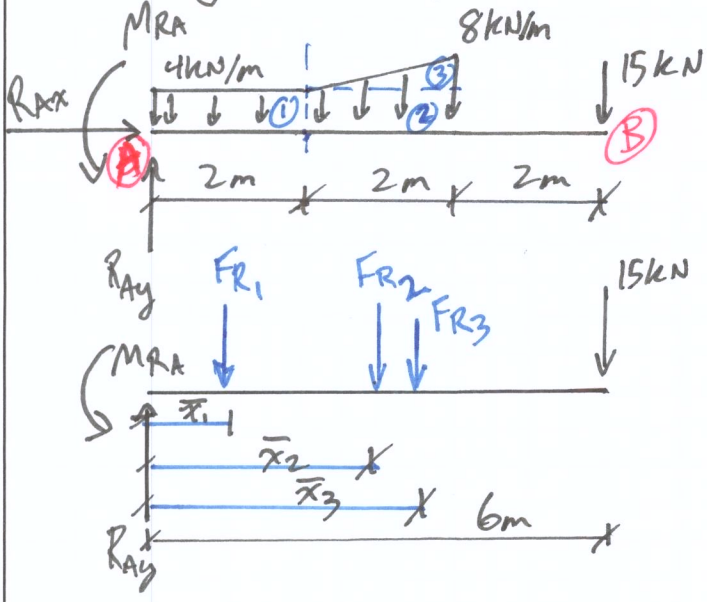
We see that there are discontinuities at

$x = 0\,m$	support
$x = 2\,m$	sudden change in distributed load
$x = 4m$	sudden change in distributed load
$x = 6m$	point load and end of beam

∴ we need 3 sets of $W(x), V(x), M(x)$ equations

$0 \le x < 2m$
$2m \le x < 4m$
$4m \le x \le 6m$

Use global equilibrium to find reactions



$\Sigma F_x = 0 \rightarrow R_{Ax} = 0$

Find Resultants

$F_{R_1} = (4kN/m)(2m) = 8kN$

$\bar{x}_1 = 2m/2 = 1m$

$F_{R_2} = (4kN/m)(2m) = 8kN$

$\bar{x}_2 = 2m + 2m/2 = 3m$

$F_{R_3} = \frac{(8kN/m - 4kN/m) \times 2m}{2} = 4kN$

$\bar{x}_3 = 2m + \frac{2}{3}(2m) = 3.333m$

$\Sigma M_A = 0 \rightarrow +M_{RA} - F_{R_1}(\bar{x}_1) - F_{R_2}(\bar{x}_2) - F_{R_3}(\bar{x}_3) - 15(6) = 0$

$M_{RA} = (8)(1) + (8)(3) + (4)(3.333) + 15(6)$

$M_{RA} = +135.333\ kN.m$ ↺

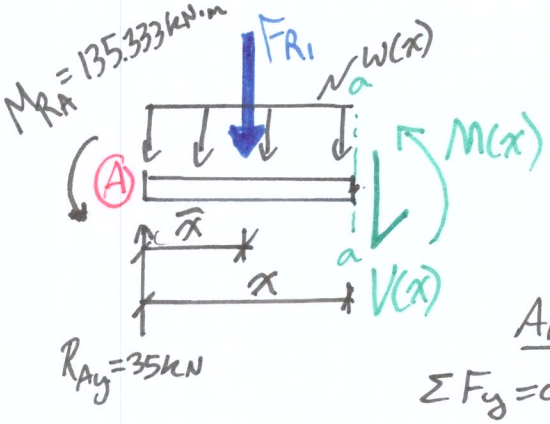
$\Sigma F_y = 0 \rightarrow R_{Ay} - F_{R_1} - F_{R_2} - F_{R_3} - 15 = 0$

$R_{Ay} = 8 + 8 + 4 + 15$

$R_{Ay} = +35\ kN\ \uparrow$

Cut through a-a

- a-a is in region $\boxed{0 \le x < 2m}$



$\boxed{w(x) = 4 kN/m}$ $\quad 0 \le x < 2m$

$F_{R_1} = x(4) = 4x$

$\bar{x} = x/2$

Apply equilibrium equations

$\Sigma F_y = 0 \rightarrow R_{Ay} - F_{R_1} - V(x) = 0$

$\boxed{V(x) = -4x + 35}$ $\quad 0 \le x < 2m$

$\Sigma M_{a-a} = 0 \rightarrow M_{RA} + M(x) + F_{R_1}(x - \bar{x}) - R_{Ay}(x) = 0$

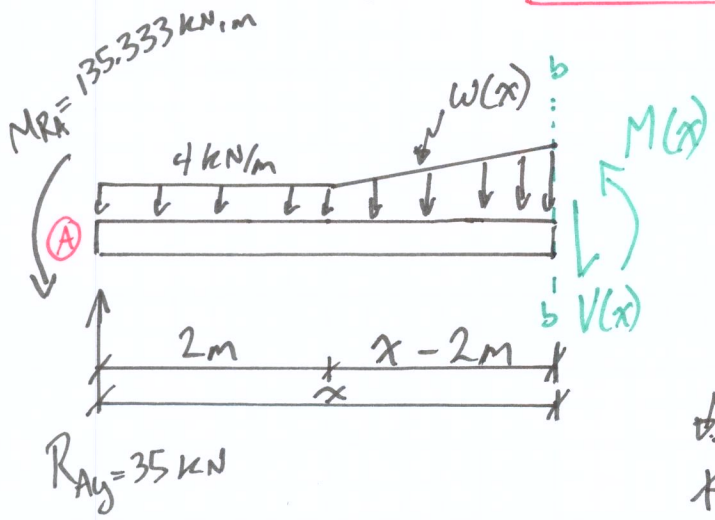
$M(x) = R_{Ay} x - F_{R_1}(x - \bar{x}) - M_{RA}$

$M(x) = (35)x - (4)(x)(x - x/2) - 135.333 kN.m$

$\boxed{M(x) = -2x^2 + 35x - 135.333 kN.m}$ $\quad 0 \le x < 2m$

Cut at b-b

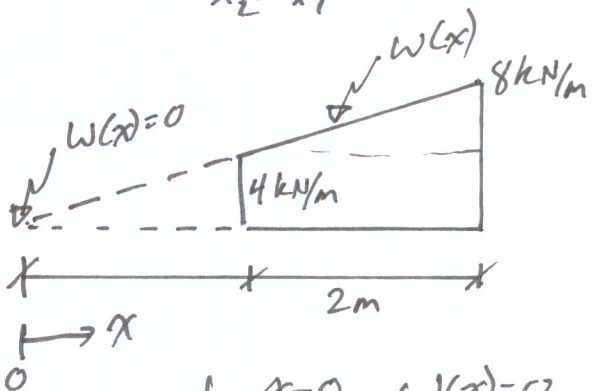
- b-b is in region $\boxed{2 \le x < 4m}$



Find $w(x)$

$w(x) = mx + b$

$m = \frac{w_2 - w_1}{x_2 - x_1} = \frac{8 - 4}{4 - 2} = 2 kN/m^2$

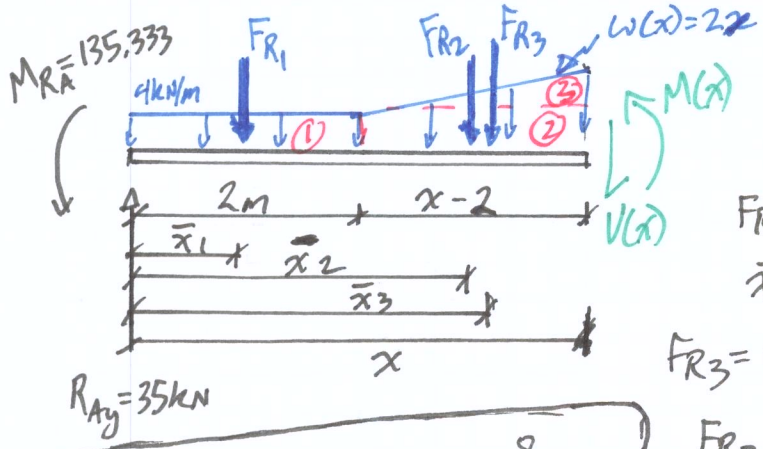


$\boxed{w(x) = 2x}$

$2 \le x < 4m$

at $x = 0$, $w(x) = 0$

$\therefore b = 0$



$F_{R_1} = (2m)(4kN/m) = 8kN = F_{R_1}$

$\bar{x}_1 = 2m/2 = 1m = \bar{x}_1$

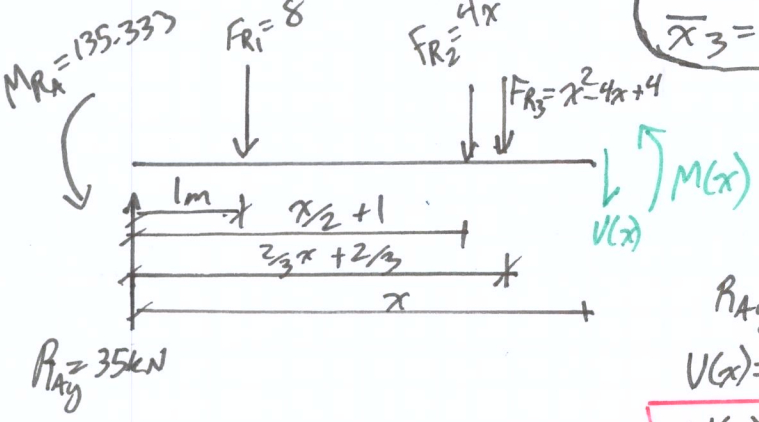
$F_{R_2} = (x-2)(4kN/m) = F_{R_2} = 4x-8$

$\bar{x}_2 = 2m + \left(\frac{x-2}{2}\right) = \frac{x}{2} + 1 = \bar{x}_2$

$F_{R_3} = \frac{(w(x)-4)(x-2)}{2} = \frac{(2x-4)(x-2)}{2}$

$F_{R_3} = x^2 - 4x + 4$

$\bar{x}_3 = 2m + (x-2)\frac{2}{3} = \bar{x}_3 = \frac{2x}{3} + \frac{2}{3}$



Apply Equilibrium

$\Sigma F_y = 0$

$R_{Ay} - F_{R_1} - F_{R_2} - F_{R_3} - V(x) = 0$

$V(x) = 35 - (8) - (4x-8) - (x^2-4x+4)$

$$\boxed{V(x) = 31 - x^2} \qquad 2 \le x < 4m$$

$\Sigma M_{b\text{-}b} = 0$ (⟲+)

$M(x) + M_{RA} + F_{R_1}(x-\bar{x}_1) + F_{R_2}(x-\bar{x}_2) + F_{R_3}(x-\bar{x}_3) - R_{Ay}(x) = 0$

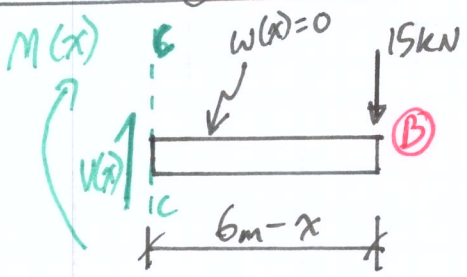
$M(x) + 135.333 + [8][x-1] + [4x-8][x-(\frac{x}{2}+1)] + [x^2-4x+4][x-(\frac{2x}{3}+\frac{2}{3})] - [35][x] = 0$

$M(x) + 135.333 + [8x-8] + [2x^2-8x+8] + [\frac{x^3}{3} - 6x^2/3 + 12x/3 - 8/3] - [35x] = 0$

$M(x) + x^3/3 - \frac{93x}{3} + 398/3 = 0$

$$\boxed{M(x) = -\frac{1}{3}\left[x^3 - 93x + 398\right]} \qquad 2 \le x < 4m$$

cut through c-c



$w(x) = 0$ $\quad 4 \le x \le 6\,m$

$\Sigma F_y = 0$

$V(x) - 15 = 0$

$V(x) = 15\,kN$ $\quad 4 \le x \le 6\,m$

$\Sigma M_{c-c} = 0 \rightarrow$ $\quad -M(x) - 15(6-x) = 0$

$-M(x) - 90 + 15x = 0$

$M(x) = 15x - 90$

$4 \le x \le 6\,m$

Summary

Region	$w(x)$	$V(x)$	$M(x)$
$0 \le x < 2$	4	$35 - 4x$	$-2x^2 + 35x - 135.333$
$2 \le x < 4$	$2x$	$31 - x^2$	$-\frac{1}{3}[x^3 - 93x + 398]$
$4 \le x \le 6$	0	15	$15x - 90$

x (m)	V (kN)	M (kN.m)
0	35	-135.333
1	31	-102.333
2 (L)	27	-73.333
2 (R)	27	-73.333
3	22	-48.667
4 (L)	15	-30
4 (R)	15	-30
5	15	-15
6	15	0