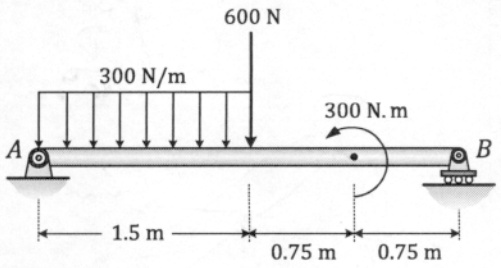
Question 2: (2 Marks)

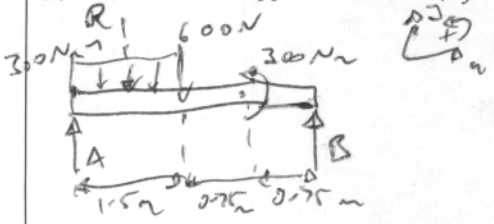
A simply supported beam AB is subjected to the loads and moment as shown. Determine the following:

(Proceed according to the steps provided in solution boxes)



Solution:

(a) Determine the support reactions (A_y and B_y)



$R = 300 \times 1.5 = 450\ N$

$\Sigma M_A = 0$

$-450\left(\frac{1.5}{2}\right) - 600(1.5) + 300 + B(3) = 0$

$\therefore B = 312.5\ N \uparrow$

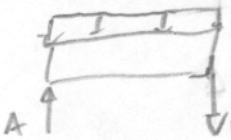
$\Sigma F_y = 0$

$A - R - 600 + B = 0$

$A = 450 + 600 - 312.5 = 737.5\ N \uparrow$

*(b) Draw the free body diagram, shear force diagram and bending moment diagram, on the axis provided. (Use this space for relevant working **if needed** else you are free to draw the SFD and BMD by inspection)*

$0 < x < 1.5$



$\Sigma F_y = 0$

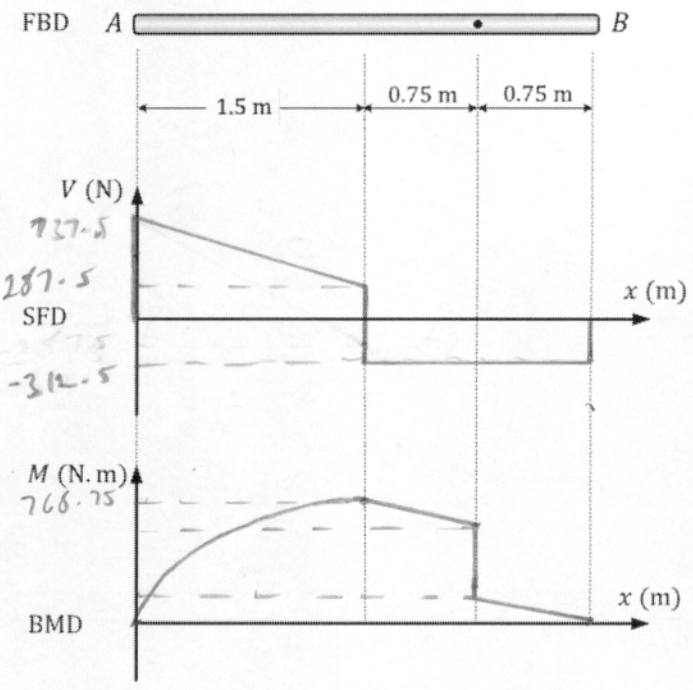
$A - R + V = 0$

$V = 737.5 - 450 = 287.5\ N \uparrow$

$\Sigma M = 0$

$-A(1.5) + R\left(\frac{1.5}{2}\right) + M = 0$

$M = 768.75\ N\text{m}$ ↻



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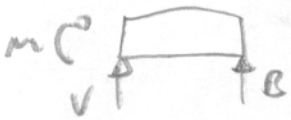
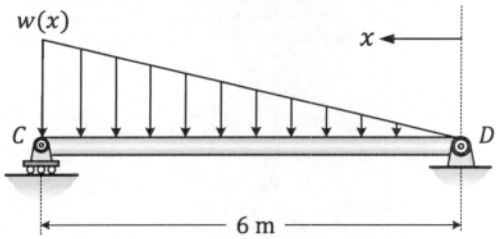
Continue your working for part (b) here:

$2.25 < n < 3$



The bending moment function for the loaded beam shown is given as:

$$M(x) = 6x - \frac{x^3}{6} \quad \text{(kN.m)}$$



Knowing that $\frac{d^2M(x)}{dx^2} = -w(x)$, *determine the loading function w(x) and then calculate the support reactions* C_y *and* D_y *at C and D respectively.*

$\frac{dM(x)}{dx} = 6 - \frac{x^2}{2}$

$\frac{d^2M(x)}{dx^2} = -x$

$\therefore w(x) = x$

$R = w(6) = 6$ kN ↓

$\Sigma M_O = 0$

$-C_y(6) + R(\frac{2}{3} \times 6) = 0$

$\therefore C_y = 4$ kN ↑

$\Sigma F_y = 0$ 2.1

$C_y + D_y - R = 0$

$\therefore D_y = 2$ kN ↑

Using the bending moment function given above, determine the location x_{max} *and the magnitude* M_{max} *of the maximum bending moment.*

For M_{max}: $\frac{dM(x)}{dx} = 0$

$\therefore 6 - \frac{x^2}{2} = 0$

$\therefore x = 2\sqrt{3}$ m

$\therefore M_{max} = 6 \times (2\sqrt{3}) - \frac{(2\sqrt{3})^3}{6}$

$= 13.9$ kNm

Answers:	$C_y =$ 4 kN ↑	$D_y =$ 2 kN ↑	$x_{max} = 2\sqrt{3}$ m	$M_{max} = 13.9$ kNm	RJBV2OEM 4

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