Unknown Cases

Friday, February 9, 2024 10:40 PM

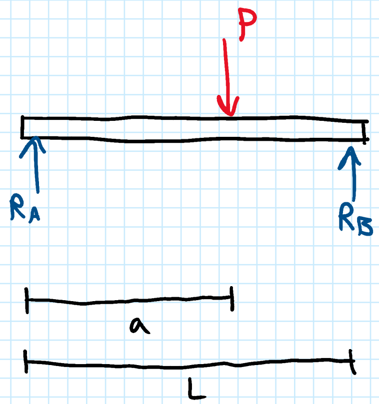
## Case 1:

$R_A = 41.9 + 4.6 = 46.5N$

$R_B = 184.4N$

$v_{max} = 0.7366$ mm

$P = 224.4N$




$$\Sigma M_A = R_B L - Pa = 0$$

$$a = \frac{R_B L}{P} = \frac{(184.4)(4)}{222.4}$$

$$\boxed{a = 3.31 \text{ m}}$$

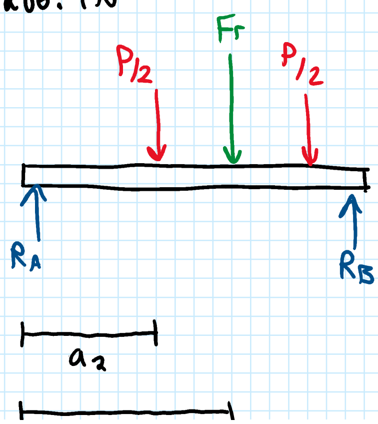
## Case 2

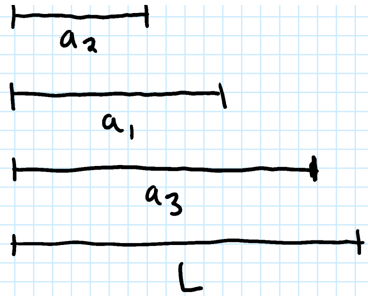
$R_A = 63.5 + 77.7 = 141.2N$

$R_B = 135.9N$

$v_{max} = 1.55$ mm

$P = 266.9N$






For resultant force:

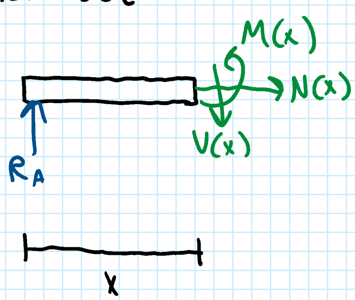
$$\Sigma M_A = R_B L - F_R a_1 = 0$$

$$a_1 = \frac{R_B L}{F_R} = \frac{(135.9)(4)}{266.9}$$

$$a_1 = 2.03 \text{ m}$$

so 1 load of $P/2$ must be on either side of 2.03m

For left side:




$$\Sigma M_x = M(x) - R_A x$$

$$M(x) = R_A x$$

$$\theta(x) = \frac{1}{EI}\int M(x)\,dx$$

$$= \frac{1}{EI}\left[\frac{R_A}{2}x^2 + C_1\right]$$

$$v(x) = \frac{1}{EI}\int \theta(x)\,dx$$

$$= \frac{1}{EI}\left[\frac{R_A}{6}x^3 + C_1 x + C_2\right]$$

$$\theta(a_2) = \frac{1}{EI}\left[\frac{R_A}{2}a_2^2 + C_1\right] = 0$$

$$\theta(a_2) = \frac{1}{EI}\left[\frac{R_A}{2}a_2^2 + C_1\right] = 0$$

$$C_1 = -\frac{R_A}{2}a^2$$

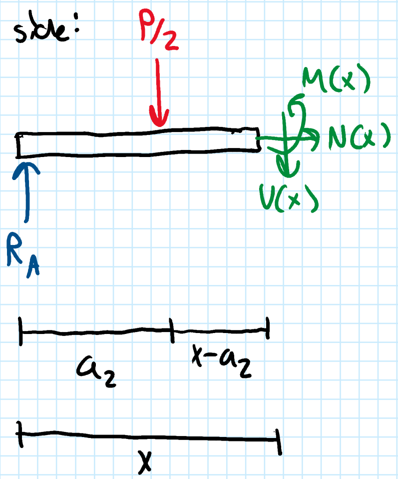
$$v(0) = \frac{1}{EI}C_2 = 0$$

$$C_2 = 0$$

$$v(x)_{left} = \frac{1}{EI}\left[\frac{R_A}{6}x^3 - \frac{R_A}{2}a^2 x\right]$$

where $0 < a_2 < 2.03$

For right side:




$$\Sigma M(x) = M(x) + \frac{P}{2}(x-a_2) - R_A x = 0$$

$$M(x) = R_A x - \frac{P}{2}(x-a_2)$$

$$\theta(x) = \frac{1}{EI}\int M(x)dx$$

$$= \frac{1}{EI}\left[\frac{R_A}{2}x^2 - \frac{P}{4}x^2 + \frac{P}{2}a_2 x + C_1\right]$$

$$v(x) = \frac{1}{EI}\int \theta(x)dx$$

$$= \frac{1}{EI}\left[\frac{R_A}{6}x^3 - \frac{P}{12}x^3 + \frac{P}{4}a_2 x^2 + C_1 x + C_2\right]$$

$$\theta(a_3) = \frac{1}{EI}\left[\frac{R_A}{2}a_3^2 - \frac{P}{4}a_3^2 + \frac{P}{2}a_2 a_3 + C_1\right] = 0$$

$$\theta(a_3) = \frac{1}{EI}\left[\frac{R_A}{2}a_3^2 - \frac{P}{4}a_3^2 + \frac{P}{2}a_2a_3 + C_1\right] = 0$$

$$C_1 = \frac{P}{4}a_3^2 - \frac{P}{2}a_2a_3 - \frac{R_A}{2}a_3^2$$

$$v(0) = \frac{1}{EI}C_2 = 0$$

$$C_2 = 0$$

$$v(x)_{right} = \frac{1}{EI}\left[\frac{R_A}{6}x^3 - \frac{P}{12}x^3 + \frac{P}{4}a_2x^2 + \left(\frac{P}{4}a_3^2 - \frac{P}{2}a_2a_3 - \frac{R_A}{2}a_3^2\right)x\right]$$

where $2.03 < a_3 < 4$