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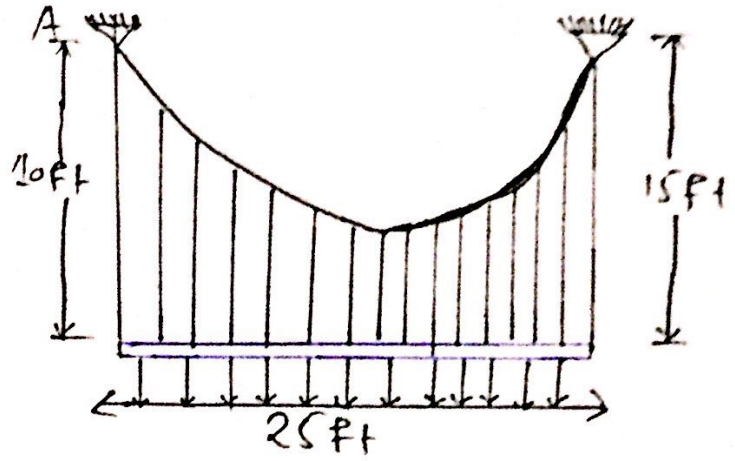
Subject Structural Analysis-I

ID/sec 7875/B

Teacher Engr Saqib khan

Final Term Exam

Ans; 02: Cable



- Cable supports uniform load = 875 lb/ft

Determine the tension in the cable at; Support A = ?

Support B = ?

Sol;

$$y = \frac{W_o}{2F_H} x^2$$

By putting values;

$$15 = \frac{875}{2F_H} x^2 \quad \text{——— (1)}$$

$$10 = \frac{875}{2F_H} (25-x)^2 \quad \text{— (2)}$$

By Solving Both Equations

$$FH = \frac{875}{2(15)} x^2, \quad FH = \frac{875}{2(10)} (25-x)^2$$

Now

$$FH = FH$$

$$\frac{875}{2(15)} x^2 = \frac{875}{2(10)} (25-x)^2$$

$$29.08x^2 = 43.8(625 - 50x + x^2)$$

$$x^2 = \frac{43.80}{29.08} (625 - 50x + x^2)$$

$$x^2 = 1.50 (625 - 50x + x^2)$$

$$0.5x^2 - 75x + 937.50 = 0 \quad \text{— 1)}$$

Now choose root < 25 ft

By solving Eq (1)

$$\boxed{x = 13.76 \text{ ft}}$$

Now

$$25 - 13.76 = \boxed{11.25 \text{ ft}}$$

As;

$$FH = \frac{875}{2(15)} x^2 = \frac{875}{2(15)} (13.76)^2 = 3788 lb - A$$

$$FH = \frac{875}{2(10)} (25-x)^2 = \frac{875}{20} (11.25)^2 = 5518.12 lb - B$$

Suppor B

$$y = \frac{w_o}{2FH} x^2 = \frac{875}{2(5504.41)} (x^2)$$

$$\frac{dy}{dx} = \tan\theta B = 0.0792 (x^2) = 0.0792 (13.76)$$

$$= \boxed{1.089}$$

We have;

$$\tan\theta B = 1.089$$

$$\theta B = \tan^{-1}(1.089)$$

$$\theta B = 47.439^\circ$$

Tension at B;

$$T_B = \frac{FH}{\cos\theta B} = \frac{5504.41}{\cos(47.439)} = 8138.1 lb = \boxed{8.138 kip}$$

Support A

$$y = \frac{w l_0 x^2}{2FH} = \frac{875}{2(5504.41)}(22-x)^2 = \frac{875}{2(5504.41)}(11.25)^2$$

$$\boxed{y = 10.024}$$

$$\frac{dy}{dx} = \tan\theta_A = 10.024$$

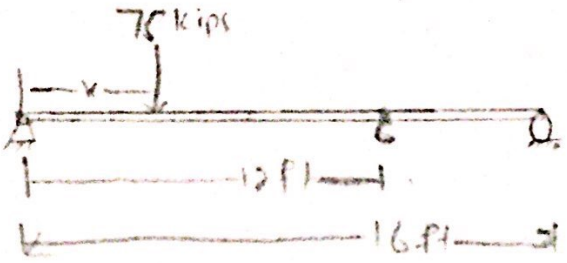
$$\theta_A = \tan^{-1}(10.024) = \boxed{\theta_A = 84.302^\circ}$$

Tension at A;

$$T_A = \frac{FH}{\cos\theta_A} = \frac{5504.41}{\cos(84.302)} = 55,440 \text{ lb} = \boxed{55.440 \text{ kip}}$$

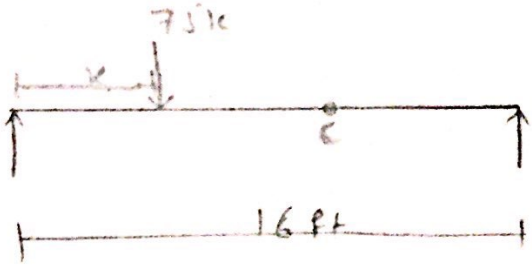
Q3

P= last two digits of registeration number



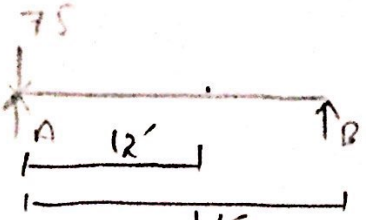
Solution

Shear force influence line for Beam



x=0 VC=?

∵ shear force changes with every different position

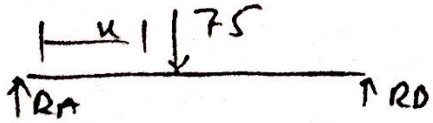


$\Sigma M_B = 0$

$$-RA(16) + 75(16) = 0$$

$$\boxed{RA = 75}$$

Now to find influence line for RA



$\Sigma M_b = 0$

$-RA(16) + 75(16)$

$RA = 75$

=> x=0 RA=?

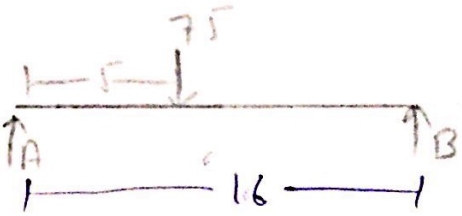
NOW

$75 - 75 - V_c = 0$

$V_c = 0$

NOW

$x = 5$

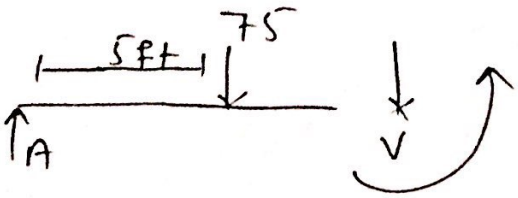


$\circlearrowleft^{+} \quad \Sigma M_B = 0$

$-R_A(16) + 75(11) = 0$

$R_A = 46.62\ k$

NOW

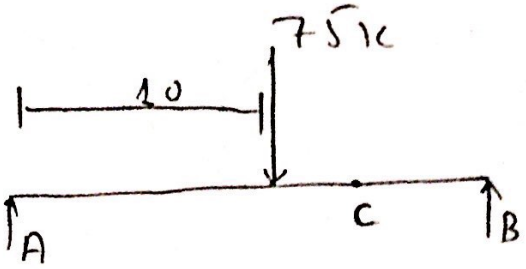


$46.62 - 75 - V_c = 0$

$\boxed{V_c = -28.38}$

Now

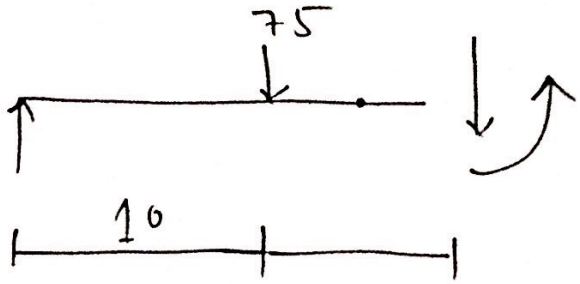
$x = 10$



$\circlearrowleft^{+} \Sigma M_b = 0$

$-RA(16) + 75(6) = 0$

$RA = 28.12\ k$

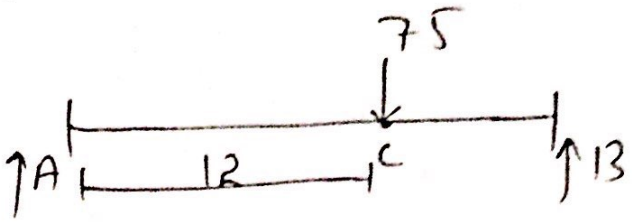


$28.12 - 75 - Vc = 0$

$Vc = -46.88$

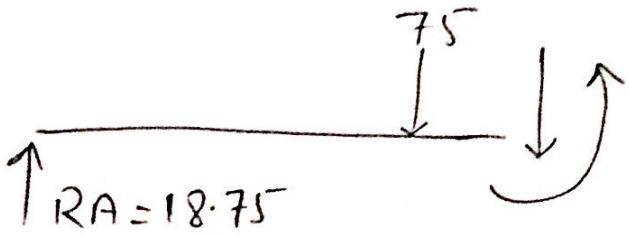
Now

$x = 12^-$



$$75(4) - RA(16) = 0$$

$$\boxed{RA = 18.75}$$

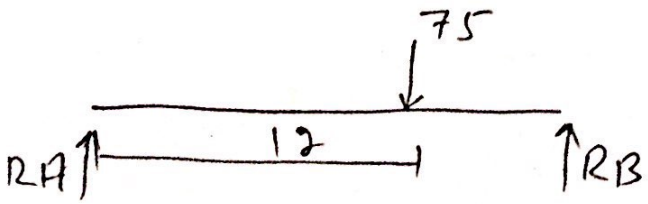


$$18.75 - 75 - V_C = 0$$

$$V_C = -56.25$$

Now

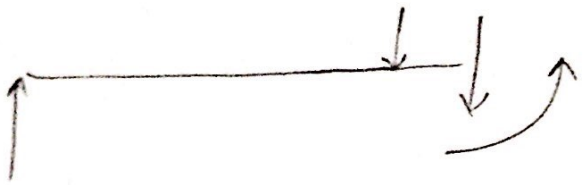
$x = 12^+$



$$-RA(16) + 75(4) = 0$$

$$RA = 18.75$$

Now

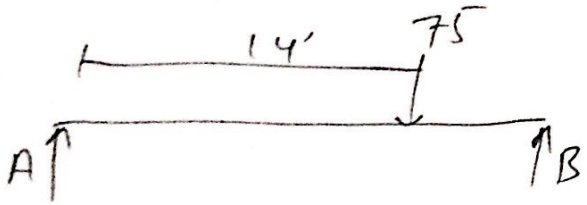


$$18.75 - V_C = 0$$

$$V_C = 18.75$$

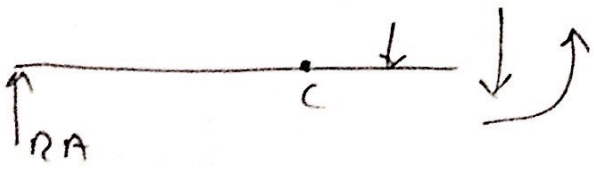
Now

$x = 14$



$$-R_A(16) + 75(9) = 0$$

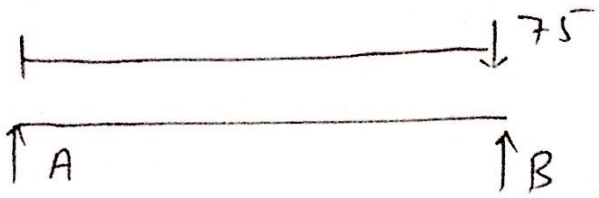
$$R_A = 9.375$$



$$9.375 - V_C = 0$$

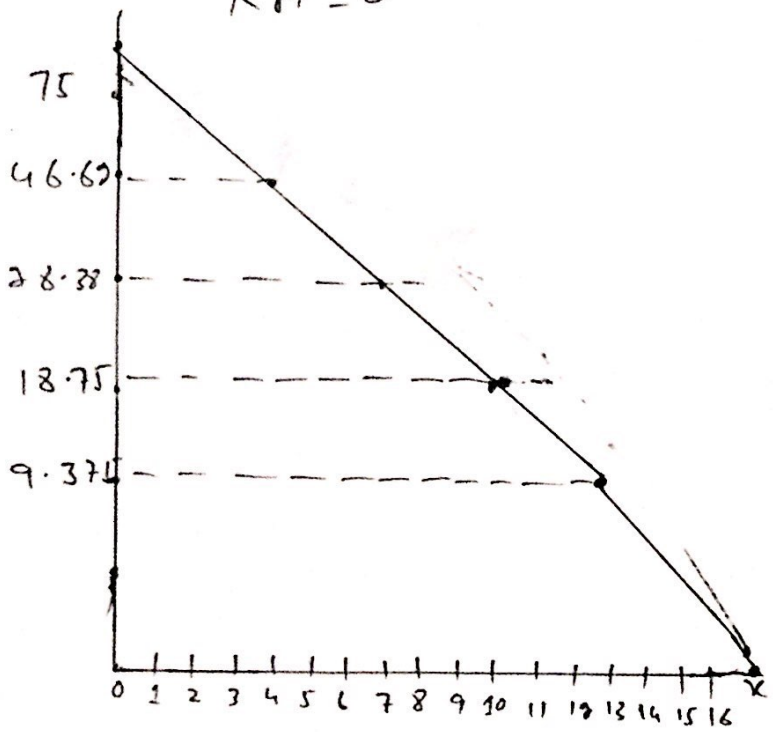
$$V_C = 9.375$$

$x = 16$



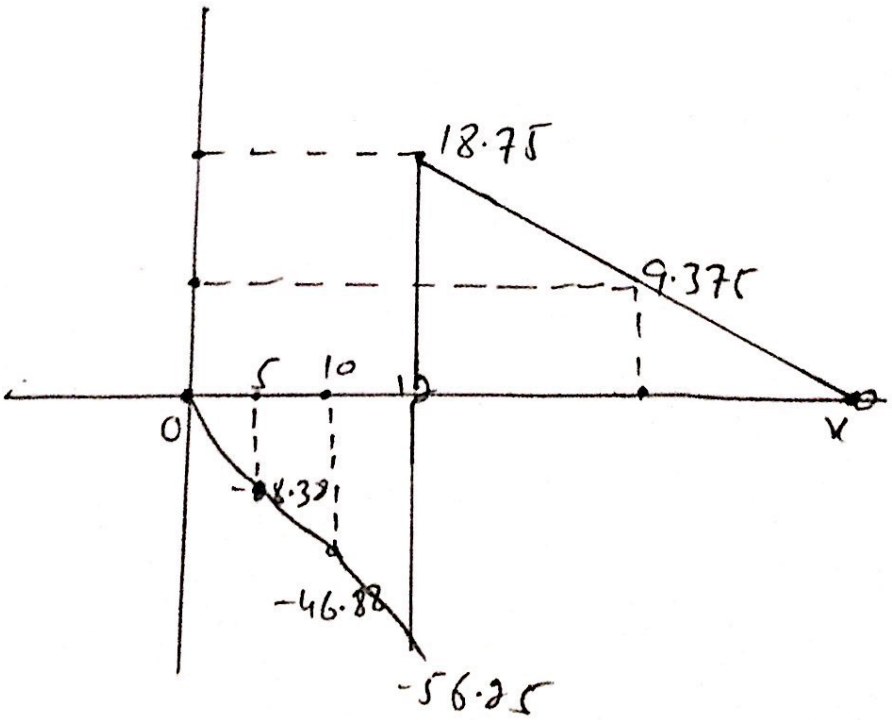
$-RA(16) + 75(0) = 0$

$RA = 0$

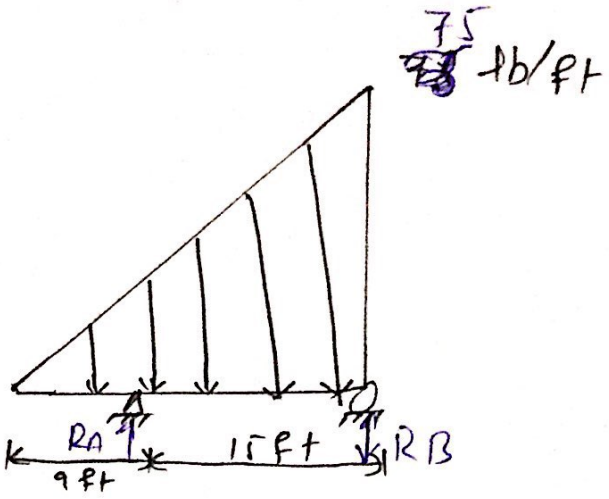


Influence line of RA

K	Vc
0	0
5	-28.38
10	-46.88
12⁻	-56.25
12⁺	18.75
14	9.375
16	0



Q NO:-1



Solution:-

To find shear force & Bending moment diagram

$\Sigma M_B = C \quad \circlearrowleft +$

$\Rightarrow \frac{1}{2} \times 75 \times 24 \times \frac{1}{3} \times 24 = R_A \times 15$

$\Rightarrow \boxed{R_A = 620.8 \text{ lb}}$

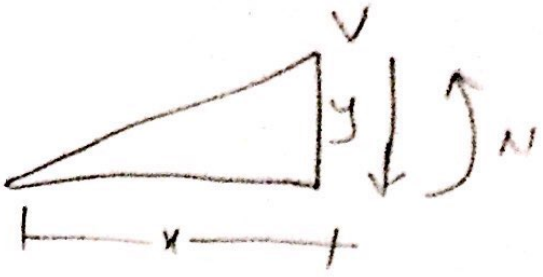
$\Sigma F_y = 0 \quad \uparrow$

$R_A + R_B = \frac{1}{2} \times 75 \times 24$

$\Rightarrow R_B = 1164 - 620.8$

$R_B = 543.2 \text{ lb}.$

Now Section 1)—1)



for y

$$\frac{y}{x} = \left(\frac{75}{24}\right)x$$

So $\Sigma y = 0 \quad \uparrow +$

$$\Rightarrow -\frac{1}{2} \times x \times \left(\frac{75}{24}\right)x - V_c = 0$$

$$\Rightarrow V_c = -\frac{75}{48}x^2$$

at $x = 0$

$$V_c = 0$$

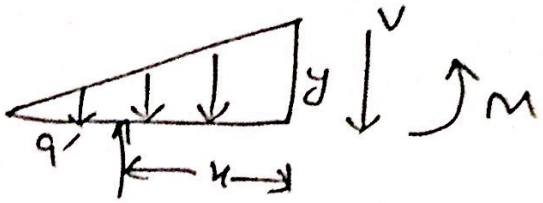
& at $x = 9$

at $x = 9$

$$\boxed{M = -491.0625 \text{ kip.ft}}$$

Now for Section (2 — 2)

for y



$$y = \frac{75}{24}(x+9)$$

So

$$\Sigma F_y = 0 \uparrow$$

$$620.8 - \frac{1}{2} \times (x+9)\left(\frac{75}{24}(x+9)\right) - V_c = 0$$

$$V_c = 620.8 - \frac{75 \times (x+9)^2}{48}$$

at $x = 0$

$$\boxed{V_c = 457.1125 \text{ kip}}$$

at $x = 15$

$$V_C = -543.2\ k$$

$$M + \frac{1}{2} x (x+9)\left(\frac{75}{24}(x+9)\right) - \frac{1}{3}(x+9) - 620.8x = 0$$

$$M = 620.8x - \frac{975(x+9)^3}{144}$$

at $x = 0$

$$M = -491.0625\ k\text{-}ft$$

at $x = 15$

$$M = 0$$