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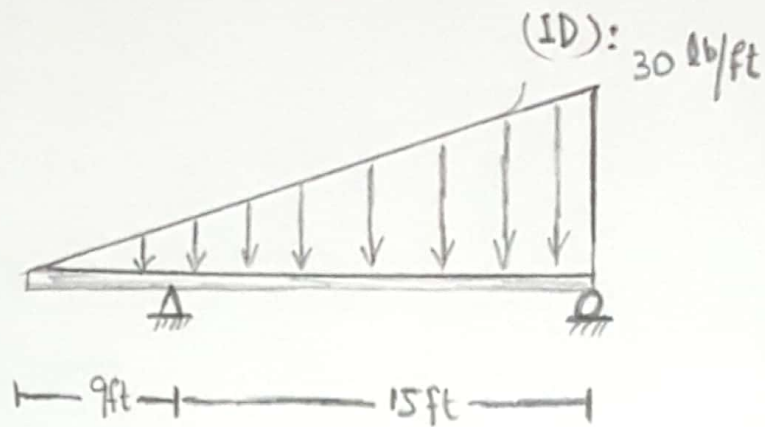
Paper : Structural I

Section : "B"

Date : 26 Sep - 2020

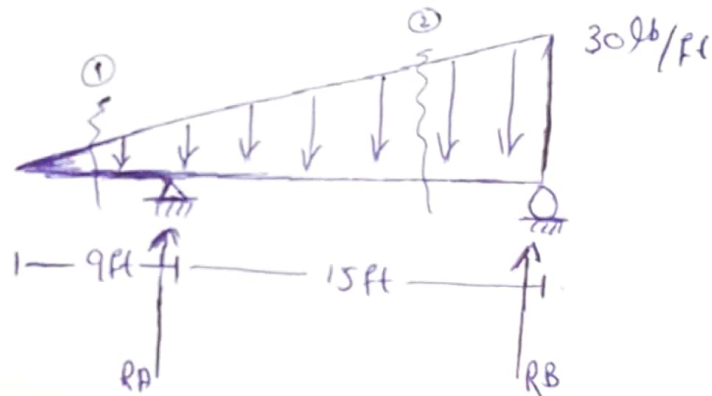
INU - Official : 

Q No # 1



Solution:

We know that:



Now:

$$\sum M_B = 0 \quad \curvearrowright$$

$$\Rightarrow \frac{1}{2} \times 30 \times 24 \times \frac{1}{3} \times 24 = R_A \times 15$$

$$\Rightarrow \boxed{R_A = 192 \text{ lb}}$$

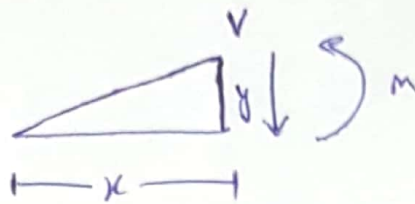
$$\Rightarrow \sum F_y = 0 \quad \uparrow$$

$$\Rightarrow R_A + R_B = \frac{1}{2} \times 30 \times 24$$

$$= R_B = 300 - 192$$

$$\boxed{R_B = 108 \text{ lb}}$$

Now section (i) - (i)



For dy:

$$y/x = 30/24$$

$$y = (30/24)x$$

$$\text{So; } \sum R_y = 0 \uparrow +$$

Now:

$$\Rightarrow \frac{1}{2} \times x \times (30/24)x - V_c = 0$$

$$= \boxed{V_c = \frac{-30x^2}{48}}$$

$$\Rightarrow \text{at } \boxed{x=0}$$

$$\boxed{V_c = 0}$$

∴

$$\text{at } x = 9$$

$$\boxed{V_c = -50.625 \text{ lb}}$$

NOW:

$$\Rightarrow M = \frac{1}{2} x x \times \left(\frac{30x}{24} \right) \times \frac{1}{3} x$$

$$\Rightarrow M = -\frac{30}{144} x^3$$

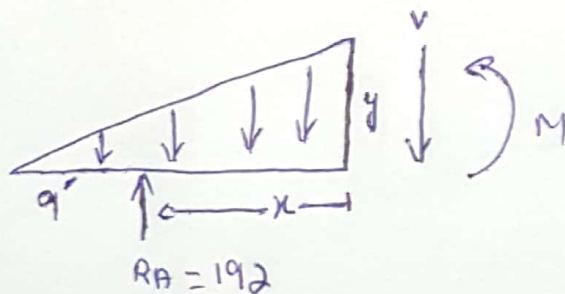
at # $x = 0$

$$M = 0$$

at # $x = 9$

$$M = -491.0625 \text{ lb/ft}$$

\Rightarrow NOW OR Section ②-②



For y :

$$\Rightarrow \frac{y}{x+9} = \frac{30}{24}$$

$$\Rightarrow y = \frac{30}{24} (x+9)$$

\Rightarrow SO:

$$\Rightarrow \sum F_y = 0 \uparrow$$

$$\Rightarrow 192 - \frac{1}{2} x (x+9) \left(\frac{30}{24} \right) (x+9) - V_c = 0$$

$$\Rightarrow V_c = 192 - \frac{(30)(x+9)^2}{48}$$

at #

$$\boxed{x = 0}$$

$$\boxed{V_c = 141.375}$$

at #

$$\boxed{x = 15}$$

$$\boxed{V_c = -168 \text{ k}}$$

$$\Rightarrow M + \frac{1}{2} x (x+9) \left(\frac{30}{24} \right) (x+9) \times \frac{1}{3} x (x+9)$$

$$\Rightarrow \boxed{-192 = 0}$$

$$M = 192x - \frac{30(x+9)^3}{144}$$

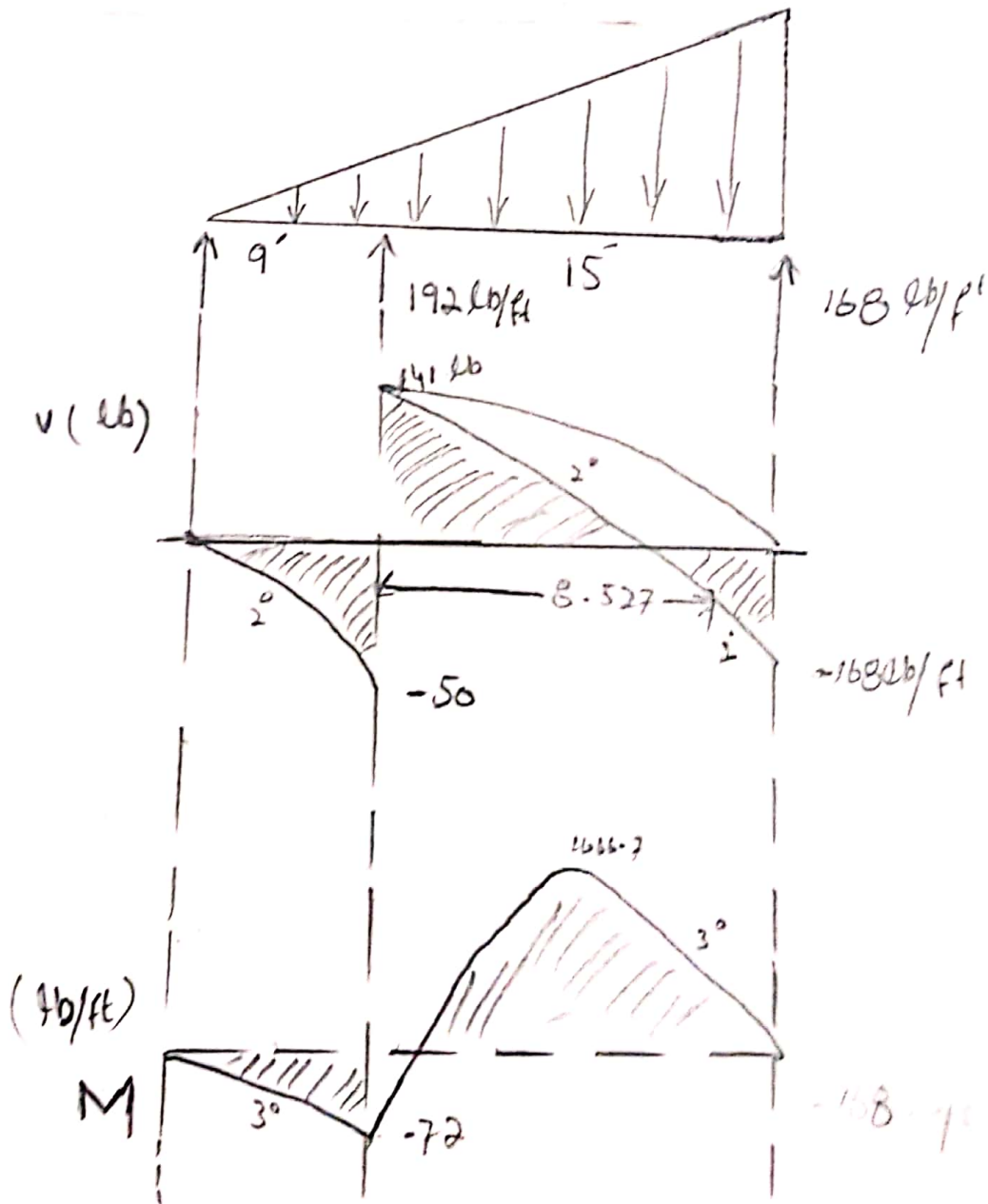
$$\Rightarrow \text{at \# } \boxed{x = 0}$$

$$\Rightarrow \boxed{M = 40.125 \text{ lb/ft}}$$

at $x = 15$

$M = 72$

Now Draw diagram :

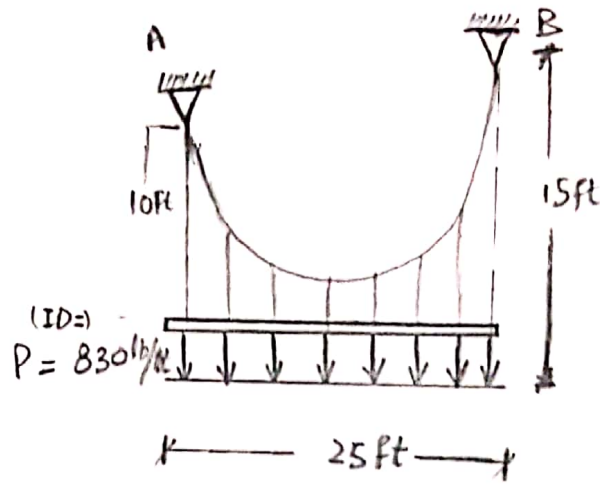


(1)

(6)

2830

Q No # 2



Solution:

The cable supports the Uniform load $w = 830 \text{ lb/ft}$ (UD).

→ Determine the tension in cable at cable support A & B?

We know that:

So:

$$y = \frac{w_0}{2F_H} \cdot x^2$$

where:

Put the value:

$$y = 15 \Rightarrow 15 = \frac{830 (10)}{2F_H} \cdot x^2$$

$$\Rightarrow 10 = \frac{830}{2F_H} \cdot (25 - x^2)$$

$$\Rightarrow \frac{830}{2(15)} \cdot x^3 = \frac{830}{2(10)} (25 - x^2)^2$$

→ ~~30~~ = calculate each other.

P.T.O

$$\Rightarrow \frac{830}{2(5)} (x)^2 = \frac{830}{2(10)} (25-x)^2$$

$$\Rightarrow \frac{x^2}{30} = \frac{1}{20} (25-x)^2$$

open formula:

$$\Rightarrow \frac{x^2}{30} = \frac{1}{20} \left[(25)^2 + (x)^2 - 2(25)(x) \right]$$

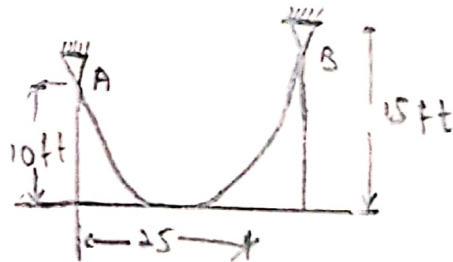
$$\Rightarrow \frac{x^2}{30} = \frac{1}{20} \left[625 + x^2 - 50x \right]$$

$$= x^2 = \frac{30}{20} \left(625 + x^2 - 50x \right) \quad \text{Rearrange:}$$

$$= x^2 = 1.5 (625 - 50x + x^2)$$

By using calculator:

$$\Rightarrow 0.5x^2 - 75x + 937.50 = 0$$



⇒ Choose root < 25 ft.

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

(8)

7830

3

Now :

$$F_H = \frac{w_0}{2y} (x^2) = \frac{830}{2(15)} (x^2)$$

$$= \frac{w_0}{2y} (x^2) = \frac{830}{2(15)} (13.76)^2 = \boxed{5238 \text{ lb}}$$

Now At Point "B" :

$$\Rightarrow y = \frac{w_0}{2F_H} x^2 = \frac{830}{2(5238)} (x^2)$$

$$= \frac{dy}{dx} = \cancel{x} \cdot \frac{830}{2(5238)} \cdot \cancel{2} = \frac{830}{5238} x$$

$$= \frac{830}{5238} (13.76)$$

$$\frac{dy}{dx} = \tan \theta = 0.079 \Big|_{x=13.76} = 2.180$$

$$= \boxed{\theta_B = 65.30^\circ}$$

Now,

$$\bar{T}_B = \frac{F_H}{\cos \theta_B}$$

$$= \frac{5238}{\cos 65.30} \text{ lb/ft}$$

$$\bar{T}_B = 125.108 \approx \boxed{13.0 \text{ kip}}$$

P.T.O

At Point A:

we know that:

$$y = \frac{w_0}{2ft} x^2 \quad \text{Formula:}$$

$$= \frac{830}{2(5238)} x^2$$

$$= \tan \theta_A = 0.158x \quad \left| \begin{array}{l} x = 25 - 13.7 \\ = 11.3 \end{array} \right. = 1.780$$

$$= \theta_A = 60.67^\circ$$

where:

$$\Rightarrow T_A = \frac{5230}{\cos 60.67}$$

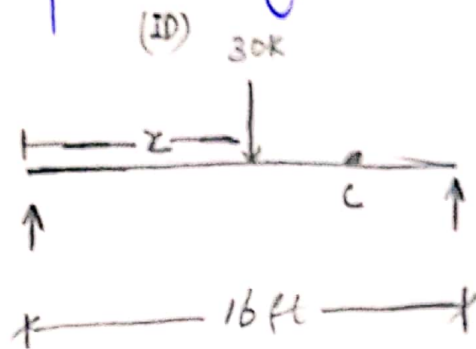
$$\Rightarrow T_A = 106.296 \approx \boxed{11.0 \text{ kip}}$$

$$\boxed{T_A = 11.0 \text{ kip}}$$

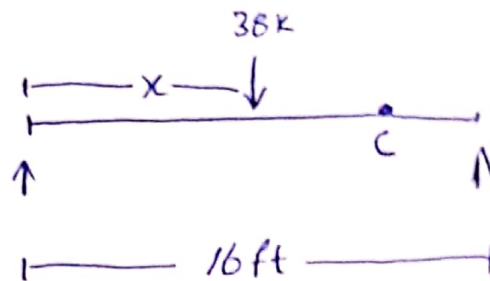
Answer.

Q NO# 3 :

Shear force influence line for the beam:



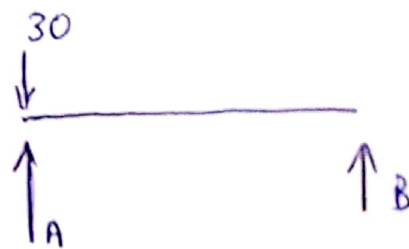
Solution :



Where:

$$x = 0, \quad V_C = ?$$

So:



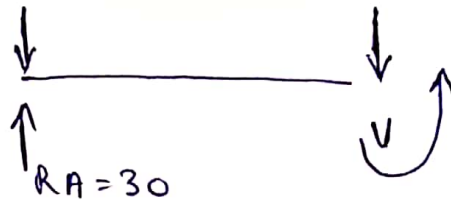
Now:

$$\sum M_B = 0$$

$$\Rightarrow -R_A (16) + 30(16) = 0$$

$$\Rightarrow \boxed{R_A = 30}$$

NOW:



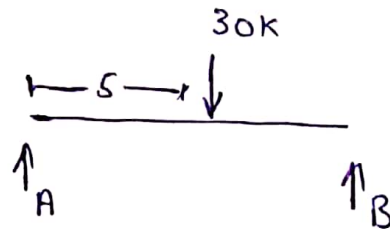
$$\Rightarrow 30 - 30 - V_C = 0$$

where:

$$V_C = 0$$

Σ

$$x = 5$$



$$\Rightarrow \sum M_B = 0$$

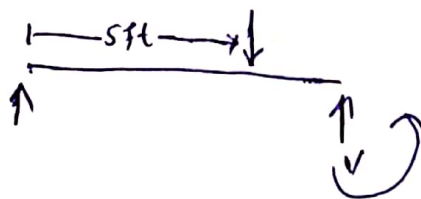
$$\Rightarrow +R_A(16) + 30(11) = 0$$

$$= -R_A(16) + 330 = 0$$

$$\Rightarrow R_A = \frac{330}{16}$$

$$\Rightarrow R_A = 20.625 \text{ k}$$

NOW:

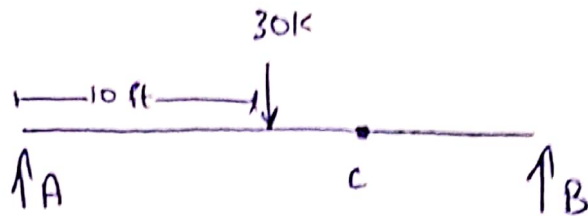


$$\Rightarrow 20.625 - 30 - V_C = 0$$

$$V_C = -9.375$$

Now:

$$x = 10$$



$$\Rightarrow \sum M_b = 0 \quad \curvearrowright$$

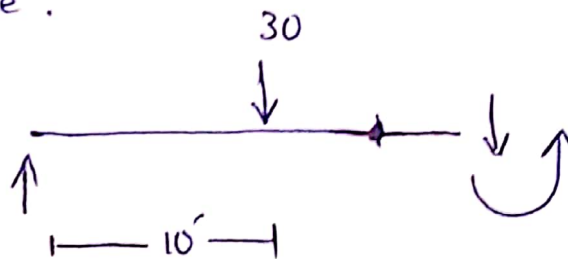
$$V_c = ?$$

$$\Rightarrow -R_A(16) + 30(6) = 0$$

$$\Rightarrow R_A = \frac{180}{16}$$

$$\Rightarrow R_A = 11.25 \text{ k}$$

Where:

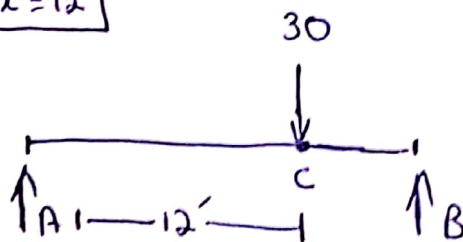


$$\Rightarrow 11.25 - 30 - V_c = 0$$

$$= V_c = -18.75$$

Now for

$$x = 12$$

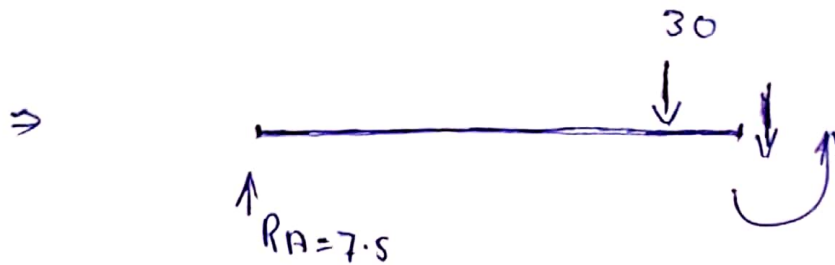


P.T.O

$$\Rightarrow 30(4) - RA(16) = 0$$

$$\Rightarrow RA = \frac{120}{16}$$

$$\Rightarrow \boxed{RA = 7.5}$$

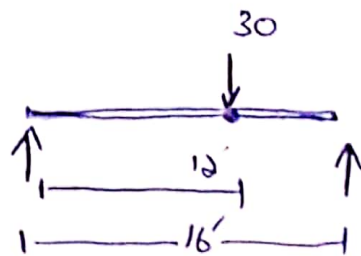


Now:

$$\Rightarrow 7.5 - 30 - VC = 0$$

$$\Rightarrow \boxed{VC = -22.5}$$

$$\boxed{x = 12'}$$



$$\Rightarrow -RA(16) + 30(4) = 0$$

$$\Rightarrow \boxed{RA = 7.5}$$



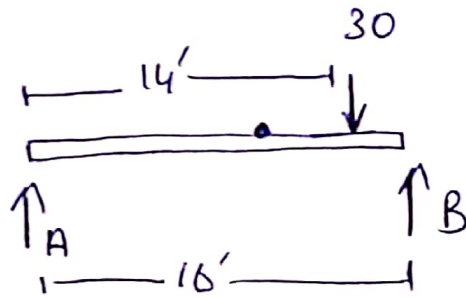
$$\Rightarrow 7.5 - VC = 0$$

$$\boxed{VC = 7.5}$$

Now Der

$$x = 14$$

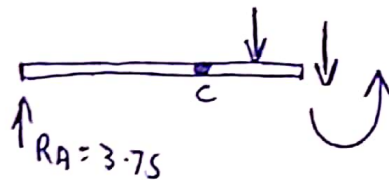
Where !



$$\Rightarrow -R_A(16) + 30(2) = 0$$

$$\Rightarrow R_A = 3.75$$

Then !

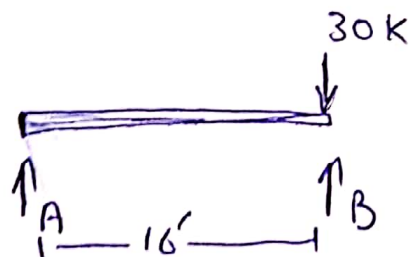


$$\Rightarrow 3.75 - V_c =$$

$$= V_c = 3.75$$

Now Der

$$x = 16$$

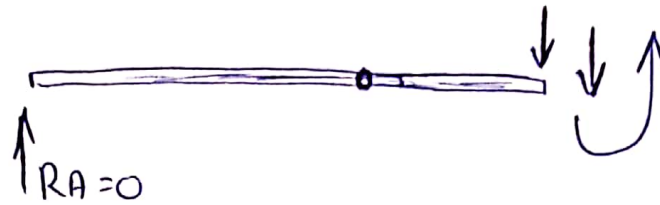


$$\Rightarrow -R_A(16) + 30(0) = 0$$

$$\Rightarrow R_A = 0$$

P.T.O

NOW!



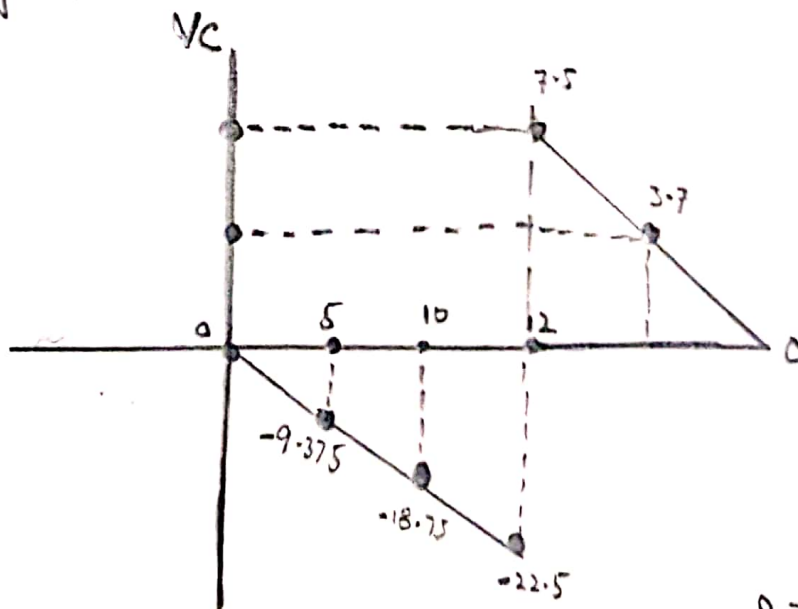
$$\Rightarrow 0 - V_c = 0$$

$$\Rightarrow \boxed{V_c = 0}$$

where:

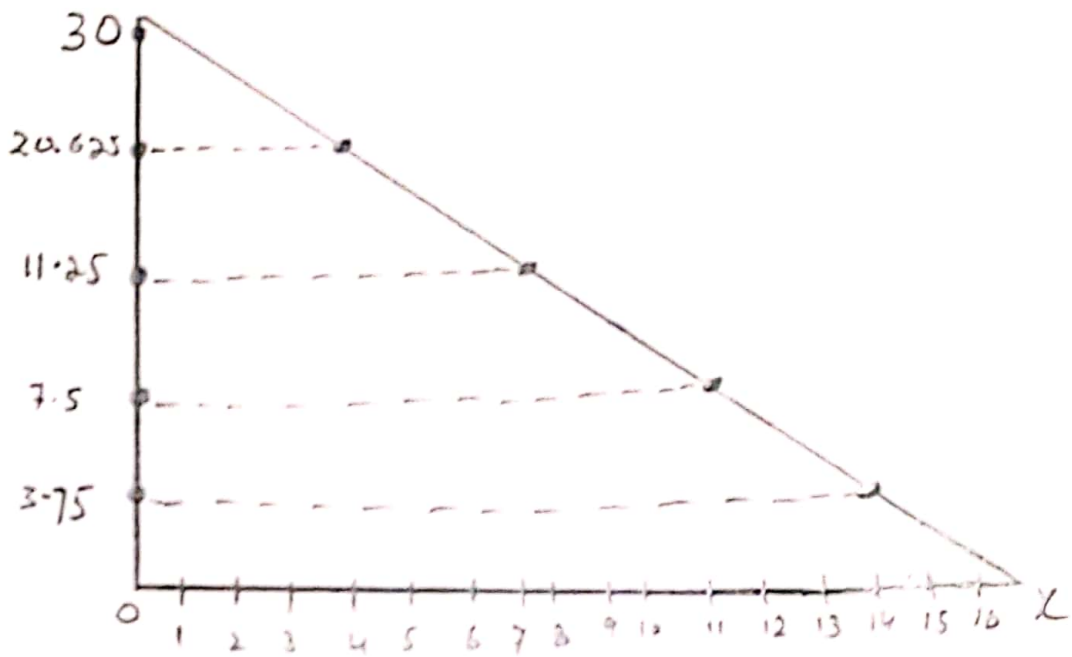
x	V_c
0	0
5	-9.375
10	-18.75
12 ⁻	-22.5
12 ⁺	7.5
14	3.75
16	0

diagram:



P.T.O

⇒ Influence line of D RA diagram:



The End.

