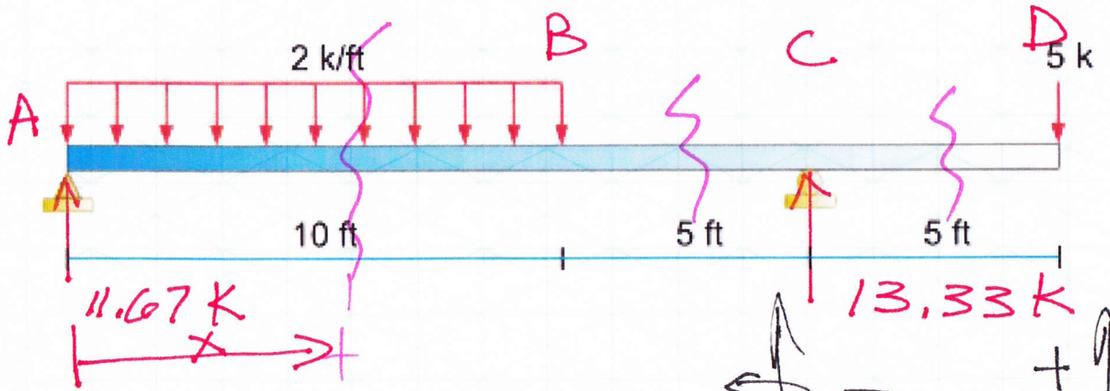
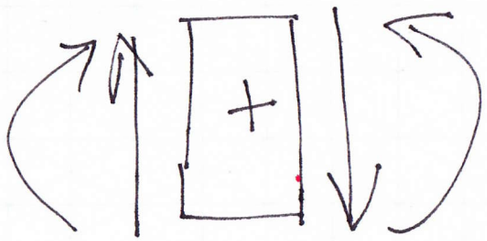
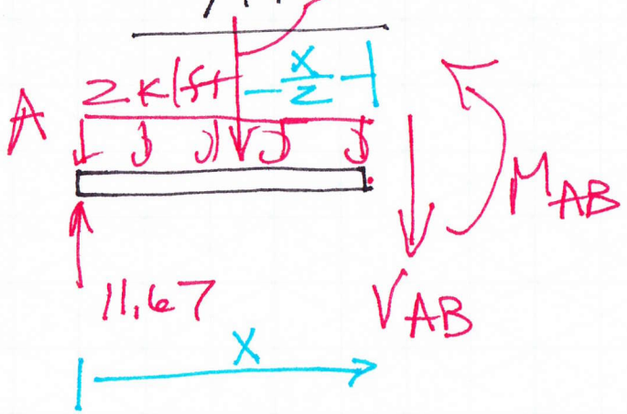




AB 2x



$+\uparrow \Sigma F_y = 0$

$11.67 - 2x - V_{AB} = 0$

$V_{AB} = 11.67 - 2x$ shear equation

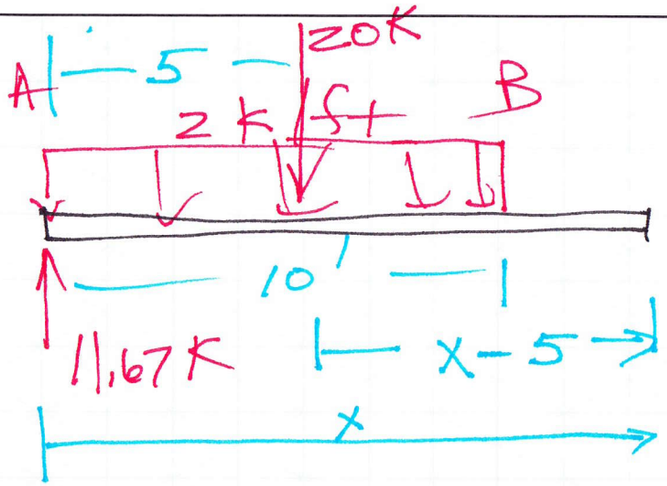
$+\circlearrowleft \Sigma M_{cut} = 0$

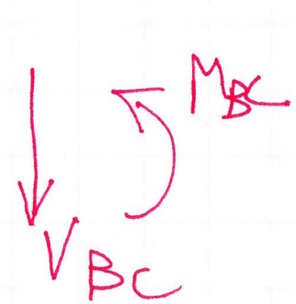
$M_{AB} + 2x\left(\frac{x}{2}\right) - 11.67x = 0$

$M_{AB} = 11.67x - x^2$ Moment equation

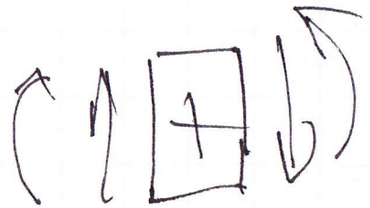
$0 < x < 10$

BC





Equilibrium Sign Convention



Shear and Moment Sign Convention

$+\uparrow \sum F_y = 0$

$11.67 - 20 - V_{BC} = 0$

$V_{BC} = -8.33$

$\circlearrowleft + \sum M_{cut} = 0$

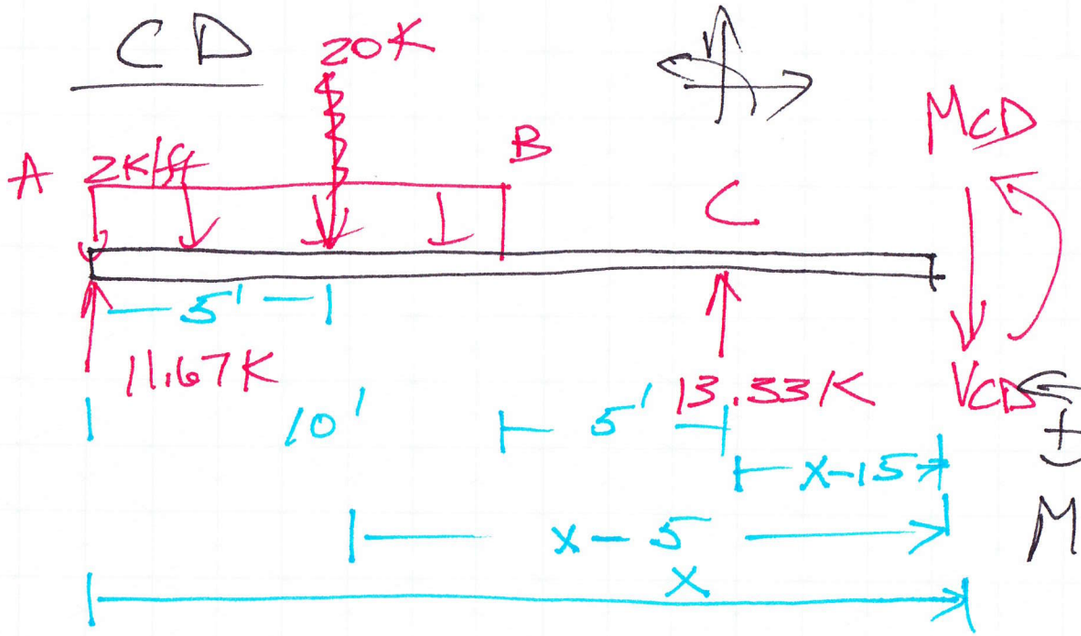
$M_{BC} + 20(x-5) - 11.67x = 0$

$M_{BC} = 11.67x - 20x + 100$

$M_{BC} = -8.33x + 100$

$10 < x < 15$

CD



$+\uparrow \Sigma F_y = 0$

$11.67 - 20 + 13.33 - V_{CD} = 0$

$V_{CD} = 5$

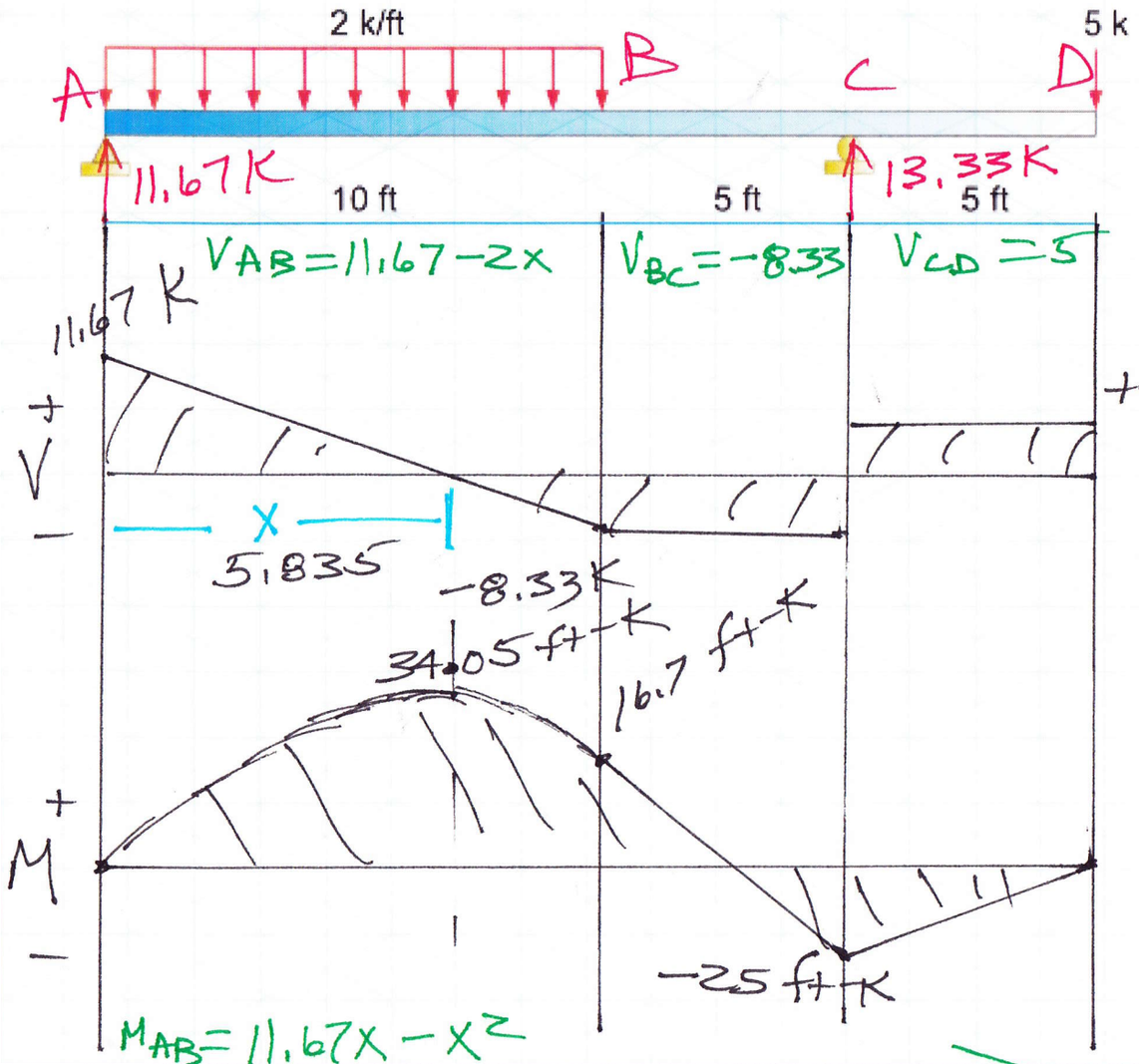
$+\circlearrowleft \Sigma M_{cut} = 0$

$M_{CD} + 20(x-5) - 11.67x - 13.33(x-15) = 0$

$M_{CD} = 5x - 100$

$15 < x < 20$

Shear and Bending Moment Diagrams



$V_{AB} = 11.67 - 2x$ (0)

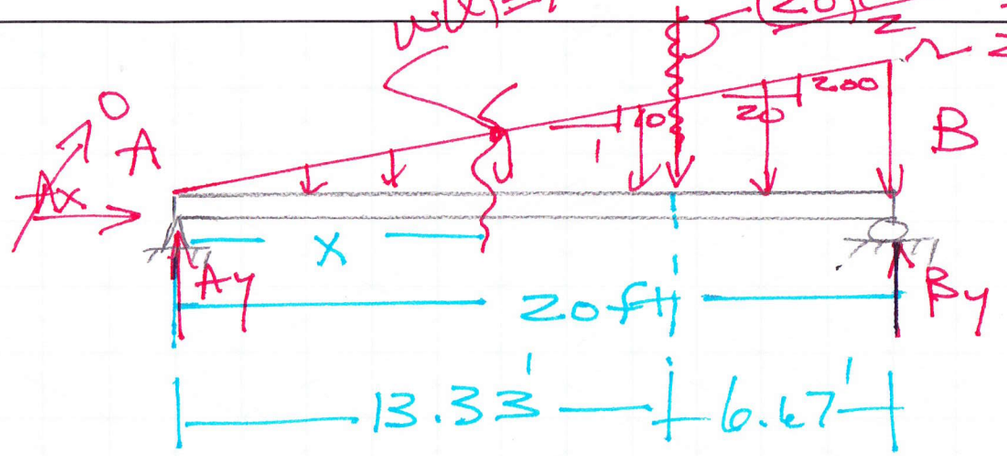
$X = 5.835$

$M_{AB} = 34.05$ at $X = 5.835$

$M_{AB} = 16.7$ at $X = 10$

$M_{BC} = -25$ at $X = 15$

$M_{CD} = 0$ at $X = 20$



$$\circlearrowleft + \sum M_A = 0$$

$$B_y(20) - 2000(13.33) = 0$$

$$B_y = 1333 \text{ lb} \uparrow$$

$$+\uparrow \sum F_y = 0$$

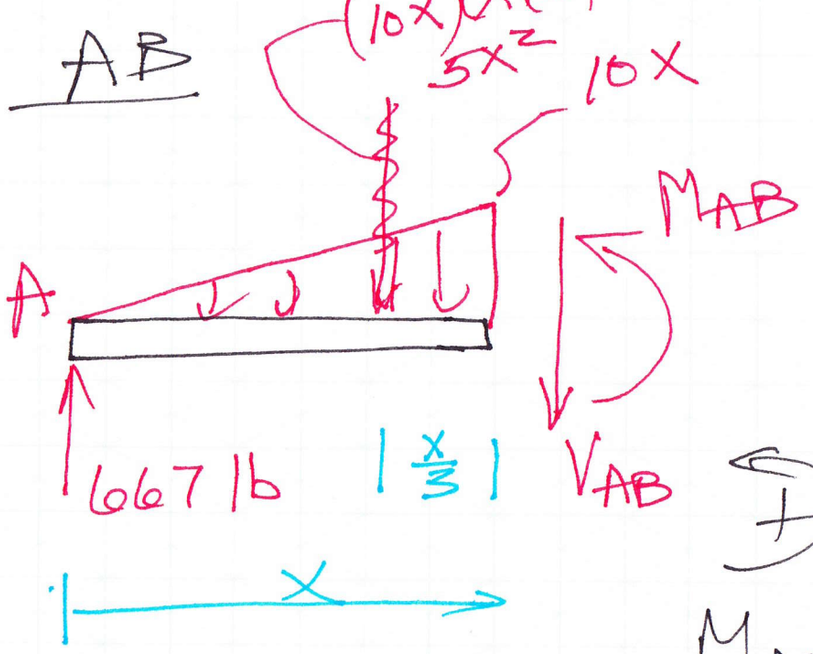
$$A_y - 2000 + 1333 = 0$$

$$A_y = 667 \text{ lb} \uparrow$$

$$+\rightarrow \sum F_x = 0$$

$$A_x = 0$$

AB



$$+\uparrow \sum F_y = 0$$

$$667 - 5x^2 - V_{AB} = 0$$

$$V_{AB} = 667 - 5x^2$$

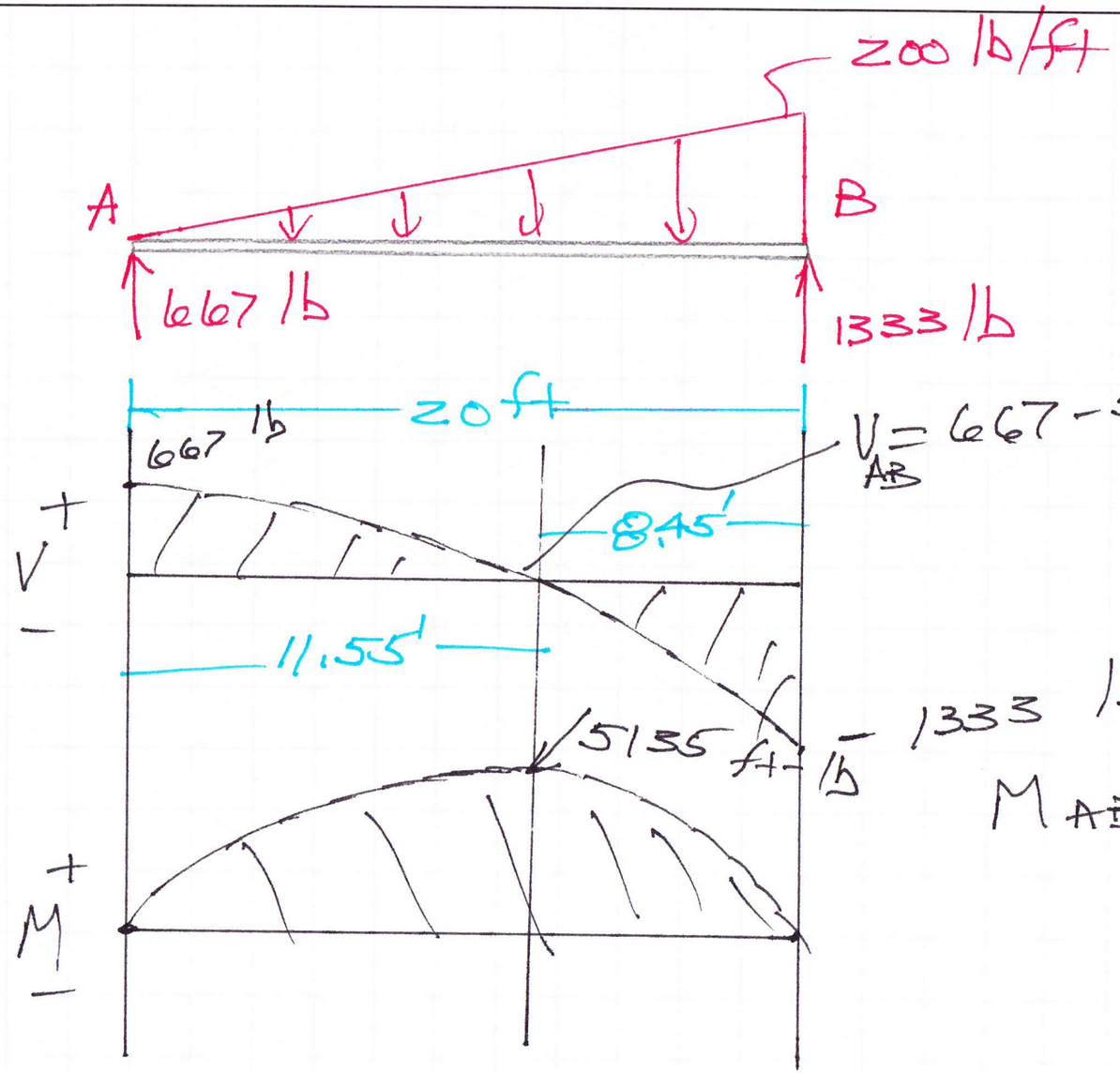
$$+\circlearrowleft \sum M_{cut} = 0$$

$$M_{AB} + 5x^2\left(\frac{x}{3}\right) - 667x = 0$$

$$M_{AB} = 667x - \frac{5}{3}x^3$$

$$M_{AB} = 667x - 1.667x^3$$

$$0 < x < 20$$



$V_{AB} = 667 - 5x^2$

$V_{AB} = 667 - 5x^2$

$0 = 667 - 5x^2$

$x = 11.55'$

$M_{AB} = 667x - 1.667x^3$