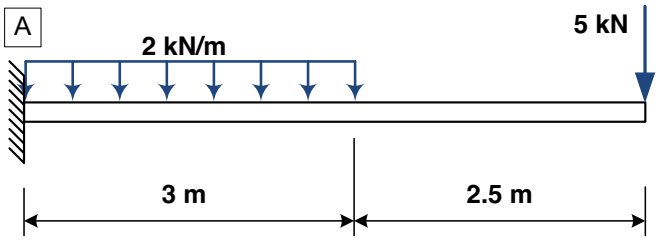
CVG2140 – Assignment No. 1 (External Reactions)

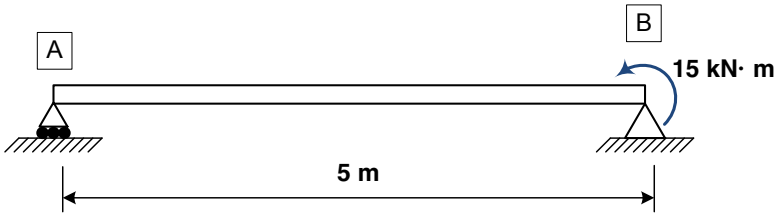
(Due Date: Friday, January 19th, 2018 by 4:59 PM)

Compute the external reactions for the following problems:

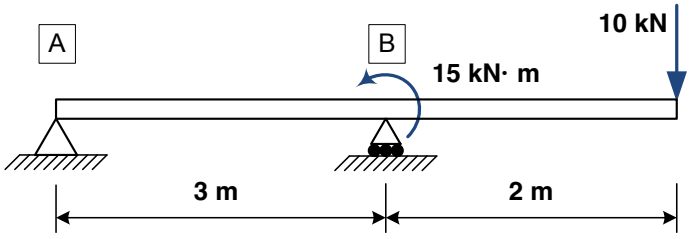
1.



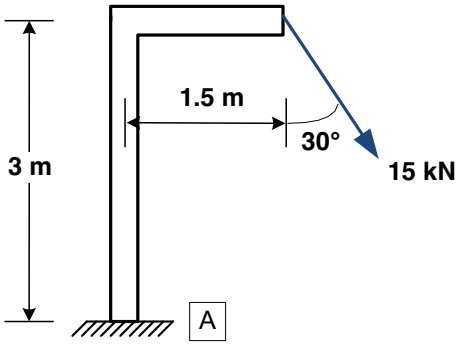
2.



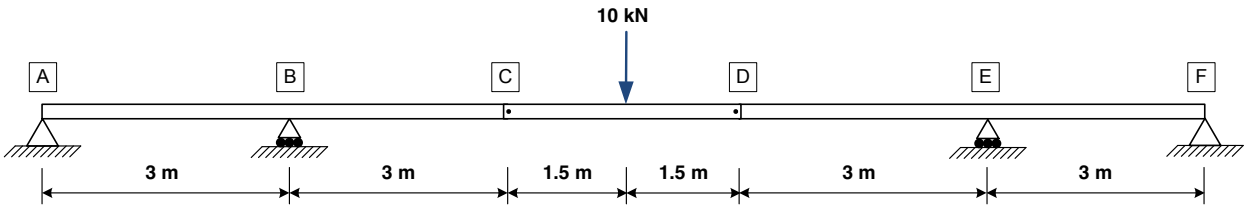
3.



4.



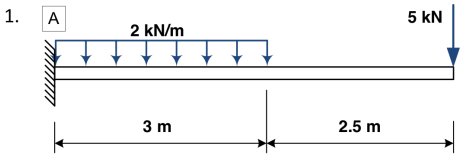
5.

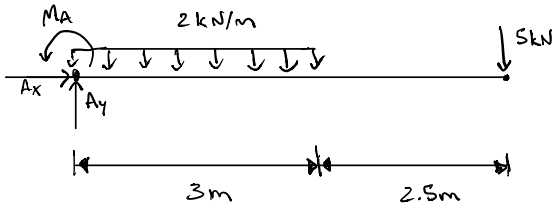


Note: C and D are internal pins.

CVG 2140 ASSIGNMENT #1 [redacted]

1.





$\overset{+}{\rightarrow} \Sigma F_x = 0$ $\quad +\uparrow \Sigma F_y = 0$

$0 = A_x$ $\quad 0 = A_y - 2(3) - 5$

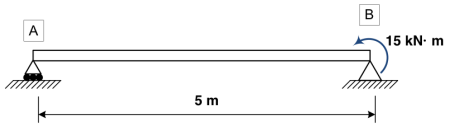
$\therefore \boxed{A_x = 0 \text{ kN}}$ $\quad \boxed{A_y = 11 \text{ kN}}$

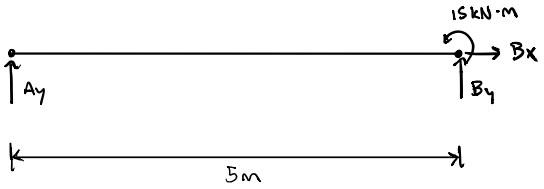
$\circlearrowleft \Sigma M_A = 0$

$0 = M_A - 6(1.5) - 5(5.5)$

$\boxed{M_A = 36.5 \text{ kN}\cdot\text{m}}$

2.





$\overset{+}{\rightarrow} \Sigma F_x = 0$ $\quad +\uparrow \Sigma F_y = 0$

$0 = B_x$ $\quad [1] \quad 0 = A_y + B_y$

$\therefore \boxed{B_x = 0 \text{ kN}}$

$\circlearrowleft \Sigma M_B = 0$

$0 = 15 - A_y(5)$

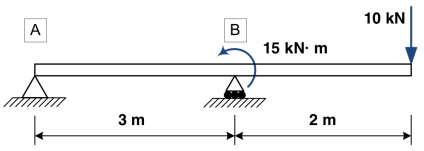
$\boxed{A_y = 3 \text{ kN}}$

$\therefore [1] \quad 0 = 3 + B_y$

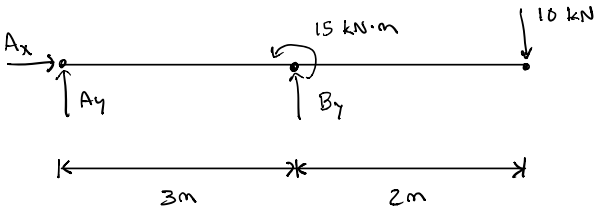
$B_y = -3 \text{ kN}$

$\boxed{B_y = 3 \text{ kN} \downarrow}$

3.



NKT PA



$\stackrel{+}{\rightarrow} \Sigma F_x = 0$

$0 = A_x$

$\therefore \boxed{A_x = 0\ kN}$

$+\uparrow \Sigma F_y = 0$ [1] $0 = A_y + B_y - 10$

$\circlearrowleft \Sigma M_B = 0$

$0 = 15 - A_y(3) - 10(2)$

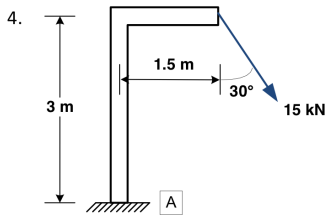
$A_y = \frac{-5}{3}\ kN$

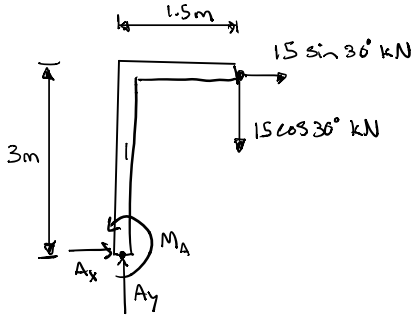
$\boxed{A_y \doteq 1.67\ kN \downarrow}$

$\therefore$ [1] $0 = -\frac{5}{3} + B_y - 10$

$\boxed{B_y \doteq 11.67\ kN}$

4.





$\stackrel{+}{\rightarrow} \Sigma F_x = 0$

$0 = A_x + 15\sin 30°$

$A_x = -15\sin 30$

$\therefore \boxed{A_x = -7.5\ kN}$ $\therefore A_y \leftarrow$

$+\uparrow \Sigma F_y = 0$

$0 = A_y - 15\cos 30$

$A_y = 15\cos 30°$

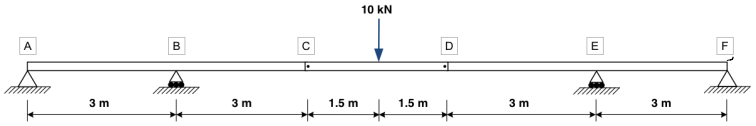
$\therefore \boxed{A_y \doteq 13.0\ kN}$

$\circlearrowleft \Sigma M_A = 0$

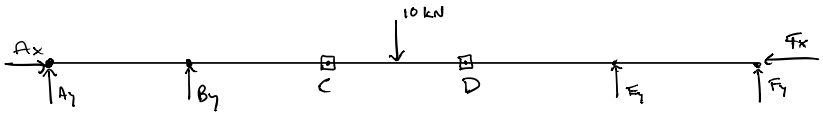
$0 = M_A - (15\cos 30°(1.5)) - (15\sin 30°)(3)$

$\therefore \boxed{M_A \doteq 41.99\ kN\cdot m}$

5.



Note: C and D are internal pins.



$\pm \Sigma F_x = 0$

$0 = A_x - F_x$

∵ There are No external Forces, the rxn forces A_x, F_y equal 0

$\therefore A_x = F_y = 0$ kN

$+\uparrow \Sigma F_y = 0$

$0 = A_y + B_y - 10 + E_y + F_y$

∵ Problem is symmetric

$0 = A_y + B_y - 10 + A_y + B_y$

$0 = 2A_y + 2B_y - 10$ [1]

$0 = A_y + B_y - 5$

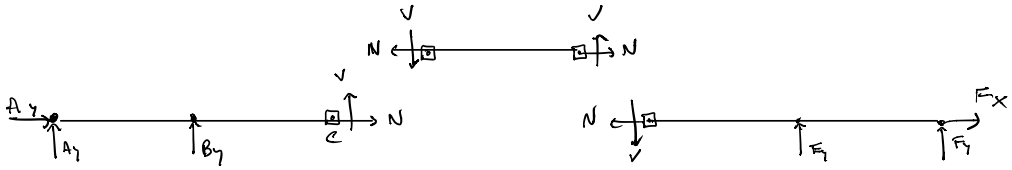
$\circlearrowright \Sigma M_A = 0$

$0 = B_y(3) - 10(7.5) + B_y(12) + A_y(15)$

Checking values:

$0 = 10(3) - 10(7.5) + 10(12) + (-5)(15)$

$0 = 0$



$\pm \Sigma F_x = 0$

$0 = B_y + N$

$+\uparrow \Sigma F_y = 0$

$0 = A_y + B_y + V$

sub into [1] → $0 = -V - 5$

$V = -5$ kN

$\circlearrowright \Sigma M_A = 0$

$0 = B_y(3) + V(6)$

$V = -\frac{B_y}{2} \Rightarrow -5 = -\frac{B_y}{2}$

$\therefore B_y = 10$ kN $= E_y$

$\therefore 0 = A_y + B_y - \frac{B_y}{2} \Rightarrow 0 = A_y + 10 - \frac{10}{2}$

$A_y = -5$ kN $= F_y$

Direction assumption was incorrect

$\therefore A_y \downarrow$ and $F_y \downarrow$