

Quiz 5

Problem 1:

a) $C(0, 1, 2)$, $D(4, 3, 0)$

$$\begin{aligned}\underline{\underline{CD}} &= (x_D - x_C)\underline{i} + (y_D - y_C)\underline{j} + (z_D - z_C)\underline{k} \\ &= (4 - 0)\underline{i} + (3 - 1)\underline{j} + (0 - 2)\underline{k} \\ &= 4\underline{i} + 2\underline{j} - 2\underline{k}\end{aligned}$$

$$\|\underline{\underline{CD}}\| = [(4)^2 + (2)^2 + (-2)^2]^{1/2} = \sqrt{24} = 2\sqrt{6}$$

$$\begin{aligned}\Rightarrow \underline{U}_{CD} &= \frac{\underline{\underline{CD}}}{\|\underline{\underline{CD}}\|} = \frac{4\underline{i}}{2\sqrt{6}} + \frac{2\underline{j}}{2\sqrt{6}} - \frac{2\underline{k}}{2\sqrt{6}} \\ &= \frac{1}{\sqrt{6}}(2\underline{i} + \underline{j} - \underline{k})\end{aligned}$$

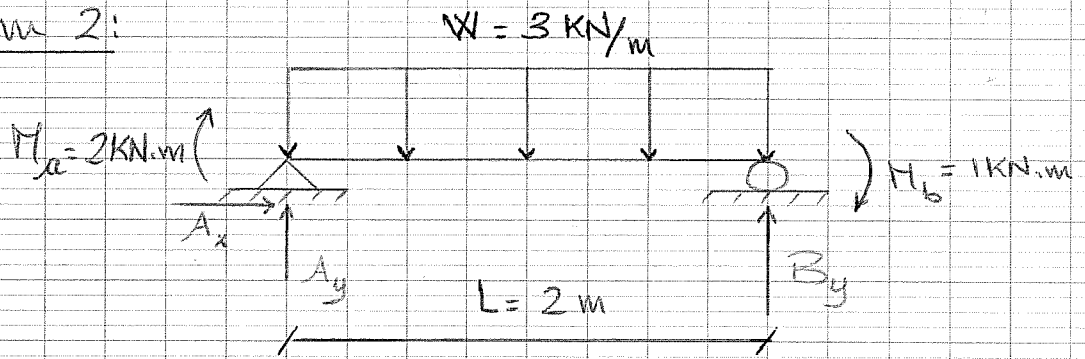
b) Force F acts at point C in the direction of $\underline{\underline{CD}}$

$$\begin{aligned}\Rightarrow \underline{F} &= \|F\| \underline{U}_{CD} \\ &= 10 \text{ KN} \cdot \frac{1}{\sqrt{6}}(2\underline{i} + \underline{j} - \underline{k}) \\ &= \frac{1}{\sqrt{6}}(20\underline{i} + 10\underline{j} - 10\underline{k}) \text{ KN}\end{aligned}$$

$$\begin{aligned}\text{c) } \underline{M}_A &= \underline{AC} \times \underline{F} = \begin{vmatrix} \underline{i} & \underline{j} & \underline{k} \\ 0 & 1 & 2 \\ \frac{20}{\sqrt{6}} & \frac{10}{\sqrt{6}} & -\frac{10}{\sqrt{6}} \end{vmatrix} \\ &= \left(\frac{-10}{\sqrt{6}} - \frac{20}{\sqrt{6}} \right) \underline{i} - \left(\frac{-40}{\sqrt{6}} \right) \underline{j} + \left(\frac{-20}{\sqrt{6}} \right) \underline{k} \\ &= \frac{-30}{\sqrt{6}} \underline{i} + \frac{40}{\sqrt{6}} \underline{j} - \frac{20}{\sqrt{6}} \underline{k}\end{aligned}$$

$$\Rightarrow \|\underline{M}_A\| = \left[\left(\frac{-30}{\sqrt{6}} \right)^2 + \left(\frac{40}{\sqrt{6}} \right)^2 + \left(\frac{-20}{\sqrt{6}} \right)^2 \right]^{1/2} = 21.985 \text{ KN.m}$$

Problem 2:



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

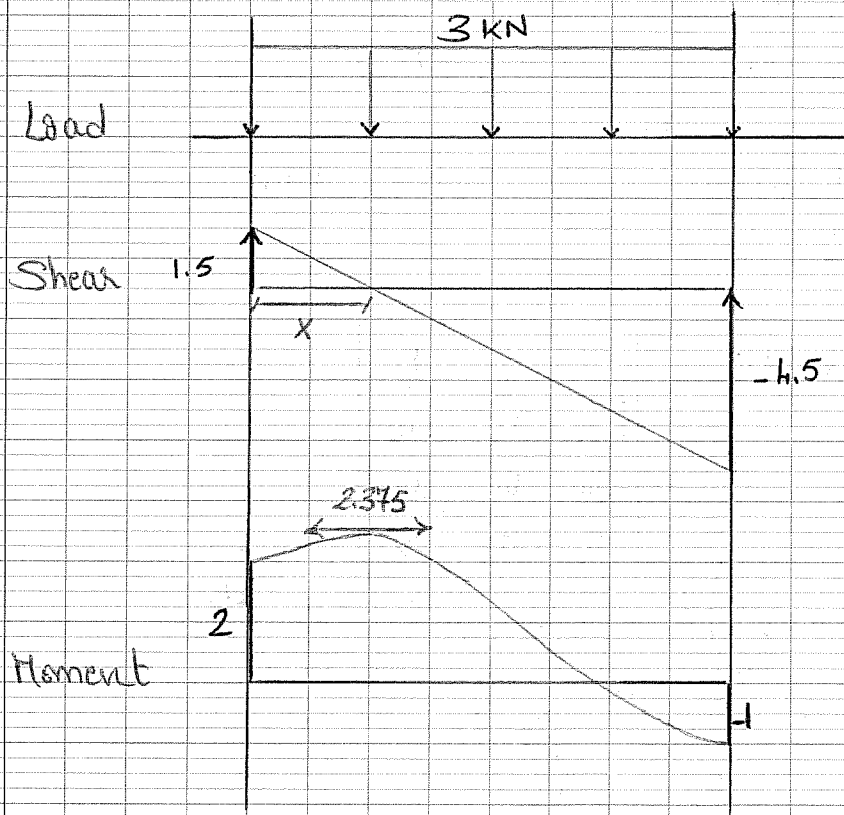
$$+\uparrow \sum F_y = 0 \Rightarrow A_y - 3 \times 2 + B_y = 0 \quad (1)$$

$$+\uparrow \sum M_A = 0 \Rightarrow 2 + (3 \times 2) \times 1 - (B_y \times 2) + 1 = 0$$

$$\Rightarrow 2 B_y = 9$$

$$\Rightarrow B_y = 4.5 \text{ kN}$$

$$(1) \Rightarrow A_y = 6 - 4.5 = 1.5 \text{ kN}$$



$$\text{slope} = \frac{1.5}{x} = 3$$

$$\Rightarrow x = 0.5 \text{ m}$$