

بسم الله الرحمن الرحيم
الدرجة الأولى: 30% - مدة 30 دقيقة
2024-2025

السؤال الأول: 35%

1- $P_1(3, 4, 5)$ $P_2(2, 5, 0)$ $A_1(1, 0, 2)$ $A_2(0, -1, 3)$

$\vec{R} = \vec{P}_1 + \vec{P}_2 = 5\vec{i} + 9\vec{j} + 5\vec{k}$ (2)

$\vec{M}_O = \vec{OA}_1 \wedge \vec{P}_1 + \vec{OA}_2 \wedge \vec{P}_2 + \vec{M}$ $\vec{OA}_1 = 1\vec{i} + 0\vec{j} + 2\vec{k}$ (1)

$\vec{OA}_2 = 0\vec{i} - 1\vec{j} + 3\vec{k}$ (1)

$$= \begin{vmatrix} \vec{i} & \vec{j} & \vec{k} \\ 1 & 0 & 2 \\ 3 & 4 & 5 \end{vmatrix} + \begin{vmatrix} \vec{i} & \vec{j} & \vec{k} \\ 0 & -1 & 3 \\ 2 & 5 & 0 \end{vmatrix} + \begin{vmatrix} \vec{i} & \vec{j} & \vec{k} \\ 0 & 1 & 2 \\ 0 & -1 & 3 \end{vmatrix}$$

$(-8\vec{i} + \vec{j} + 4\vec{k}) + (-15\vec{i} + 10\vec{j} + 2\vec{k}) + (2\vec{i} - 20\vec{j} + 15\vec{k})$ (3)

$\vec{M}_O = -23\vec{i} + 27\vec{j} - 21\vec{k}$ (3)

$\vec{M}_D = \vec{M}_O + \vec{DO} \wedge \vec{R}$ (2)

$(-23\vec{i} + 27\vec{j} - 21\vec{k}) + \begin{vmatrix} \vec{i} & \vec{j} & \vec{k} \\ 0 & -3 & -4 \\ 5 & 9 & 5 \end{vmatrix}$ $\vec{DO} = 0\vec{i} - 3\vec{j} - 4\vec{k}$ (1)

$\vec{M}_D = (-23\vec{i} + 27\vec{j} - 21\vec{k}) + (21\vec{i} - 20\vec{j} + 15\vec{k}) = -2\vec{i} + 7\vec{j} + 36\vec{k}$ (3)

$\vec{M}_D = \vec{M}_D \cdot \vec{e}_{OD}$ (2)

$\vec{e}_{OD} = \frac{\vec{OD}}{|\vec{OD}|} = \frac{0\vec{i} + 3\vec{j} + 4\vec{k}}{\sqrt{0+6}} = 0\vec{i} + \frac{3}{\sqrt{6}}\vec{j} + \frac{4}{\sqrt{6}}\vec{k} = 0.6\vec{j} + 0.8\vec{k}$ (3)

$\vec{M}_{OD} = \vec{M}_D \cdot \vec{e}_{OD} = (-2\vec{i} + 7\vec{j} + 36\vec{k}) \cdot (0.6\vec{j} + 0.8\vec{k}) = 0 + 4.2 + 28.8$

$\vec{M}_{OD} = 33$ (2)

$\vec{M}_{OD} = \vec{M}_{OD} \cdot \vec{e}_{OD} = 33(0.6\vec{j} + 0.8\vec{k}) = 19.8\vec{j} + 26.4\vec{k}$ (2)

النتيجة

السؤال الثاني 20 درجة
1- دريستم القدر

$$m = 2n - 3$$

$$17 = 2(10) - 3 = 17 \text{ OK (3) لا زفر}$$

2- دريستم القدر

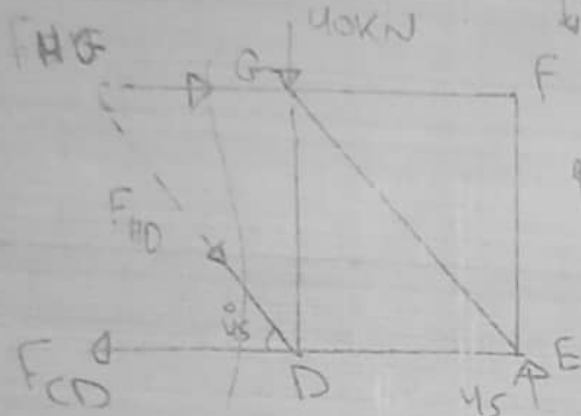
$$\sum M_A = 0 \Rightarrow (20 \cdot 4) - (20 \cdot 2) - (40 \cdot 12) + (V_E \cdot 16) = 0 \Rightarrow V_E = 45 \text{ KN (4)}$$

$$\sum V = 0 \Rightarrow 45 - 40 - 20 - 20 - 30 + V_A = 0 \Rightarrow V_A = 65 \text{ KN (3)}$$

$$\sum H = 0 \Rightarrow H_A = 0 \text{ KN (1)}$$

$$\sum M_H = 0 \Rightarrow (45 \cdot 8) - (40 \cdot 4) - F_{CD} \cdot 4 = 0$$

$$F_{CD} = 50 \text{ KN (3)}$$



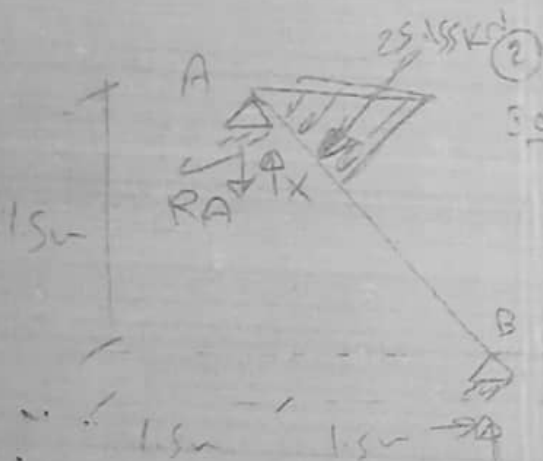
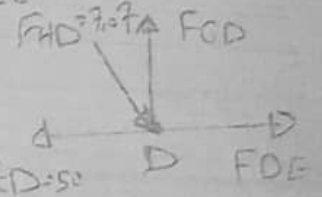
$$\sum V = 0 \Rightarrow 45 - 40 - F_{HD} \sin 45 = 0$$

$$F_{HD} = 7.07 \text{ (3)}$$

نفر لبقه D

$$\sum V = 0 \Rightarrow F_{CD} - 7.07 \sin 45 = 0$$

$$F_{CD} = 5 \text{ KN (3)}$$



$$\frac{50 \cdot 1.677}{2} = 25.155 \text{ KN}$$

السؤال الثالث 15 درجة

1- دريستم القدر

$$AB = 3.354 \text{ m (2)}$$

$$AB = 1.677 \text{ (2)}$$

$$\tan \alpha = \frac{1.5}{3} \Rightarrow \alpha = 26.56^\circ (1)$$

$$\sin \alpha = 0.447$$

$$\cos \alpha = 0.894$$

$$\sum M_B = 0 \Rightarrow -40 \cdot 2 + 25.155(1.677 + \frac{1}{3} \cdot 1.677) - 3 \cdot R_A = 0 \Rightarrow R_A = -7.92 \text{ KN (4)}$$

$$\sum V = 0 \Rightarrow -7.92 - 40 + V_B - 25.155 \cos \alpha = 0 \Rightarrow V_B = 70.4 \text{ KN (4)}$$

$$\sum H = 0 \Rightarrow H_B - 25.155 \sin \alpha = 0 \Rightarrow H_B = 11.82 \text{ KN (2)}$$

السؤال الرابع 10 درجة
1- دريستم القدر

[2]