Quiz No 1

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Q 1

a) Rectangular Component

$$\vec{A} = \vec{A}_x + \vec{A}_y + \vec{A}_z$$

b) Cartesian form

$$\vec{A} = A_x \hat{i} + A_y \hat{j} + A_z \hat{k}$$

c) $$\vec{A} + \vec{B} = (A_x + B_x)\hat{i} + (A_y + B_y)\hat{j} + (A_z + B_z)\hat{k}$$

d) Cartesian Notation

$$F_1 = F_{1x}\hat{i} + F_{1y}\hat{j}$$

$$F_2 = F_{2x}(-\hat{i}) + F_{2y}\hat{j}$$

$$F_3 = F_{3x}(\hat{i}) + F_{3y}(-\hat{j})$$

$$\boxed{F_R} = (F_{1x} - F_{2x} + F_{3x})\hat{i} + (F_{1y} + F_{2y} - F_{3y})\hat{j}$$

e) A(1, 0, -3)

B(-2, 2, 3)

$$\boxed{r_{AB}} = -3\hat{i} + 2\hat{j} + 6\hat{k}$$

f) Define

i. Rigid Body : In which there is no deformation.

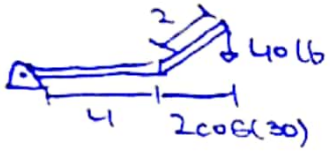
ii. Free Body Diag. : Forces on a system isolated from any external factor

iii Moment of Force : The measure of tendency of a body to rotate

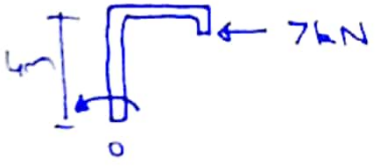
$M = r F \sin\theta \, \hat{n}$

iv Moment of Couple : Special case of moment without any translation.

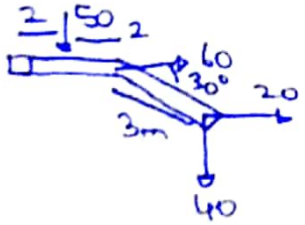
g) $M_o = ?$



$\Rightarrow C + M_o = 40(2\cos 30) = \underline{69.28 \text{ N.m}}$



$\circlearrowleft M_o + = 7k(3) = \underline{21000 \text{ N.m}}$



$\Rightarrow C + M_o = 50(2) + 40(3\cos(30)+4) - 20(3\sin 30)$

$= \underline{334 \text{ N.m}}$

h) $\vec{a} \times (\vec{b} + \vec{c}) = \vec{a} \times \vec{b} + \vec{a} \times \vec{c}$

i) $(A_y B_z - A_z B_y)\hat{i} - (A_x B_z - A_z B_x)\hat{j} + (A_x B_y - A_y B_x)\hat{k}$

j) M_o

Scalar F_r

Vector $r \times F$

k) $M_o = Fd = (F_x)y_1 - (F_y)x$

l) $M_o = ?$

$d = 3(\sin 75) = 2.89\ m$

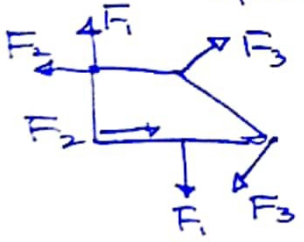
$M_o = Fd = (5k)(2.89) = 14450\ Nm$ ↻

m) Specified Axis

$M_a = u_a \cdot (r \times F)$

$= u_{a_x}(r_y F_z - r_z F_y) - u_{a_y}(r_x F_z - r_z F_x) + u_a(r_x F_y - r_y F_x)$

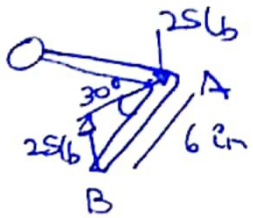
n) Couple



$C_o + M_R = -F_1 d_1 + F_2 d_2 - F_3 d_3$

$= -(200)(4) + (450)(3) - (300)(5)$

$= -950\ lb.ft$



$r_A = 8\hat{j}$

$r_B = 5.12\hat{i} + 8\hat{j} - 3\hat{k}$

$M = r_A \times (-25k) + r_B \times (25k)$

$= -200\,i - 128.\,j + 200\,i$

$= -130\hat{j}\ lb.in$