model ans. [redacted]

Mansoura University	**Mid. Term Exam**	**Course: Mechanics (1)**
Faculty of Engineering	**19 / 11 / 2016**	**Course code: Math 002**
Special Programs: B. C. E., M. T. E., C. I. E. and B. M. E.		**Time: 1 hour**

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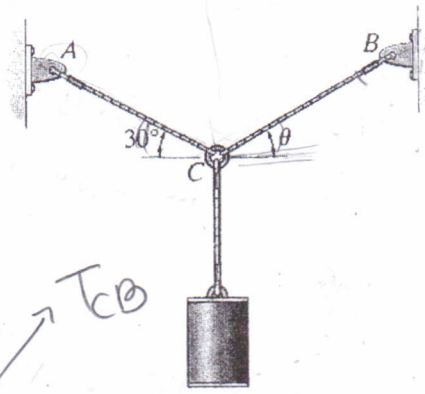
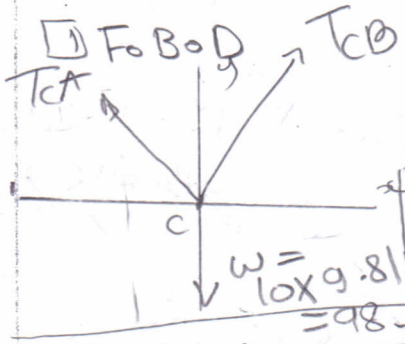
1- If cable *CB* is subjected to a tension that is twice that of cable *CA* ($T_{CB} = 2\ T_{CA}$), determine: (a) the angle θ for equilibrium of the 10-kg cylinder. Also, (b) what are the tensions in wires *CA* and *CB* (T_{CB} and T_{CA})? (7 Marks)



1 FoBoD



(a) The angle $\theta = 64°$

2 vectors:

$W = 10 \times 9.81 = -98.1 J$

$T_{CA} = -T_{CA} \cos 30\, i + T_{CA} \sin 30\, J$

$T_{CB} = -T_{CB} \cos \theta\, i + T_{CB} \sin \theta\, J$

3 Equations:

$\rightarrow \Sigma F_x = 0$

(1) $-T_{CA} \cos 30 + T_{CB} \cos 64 = 0$

$\rightarrow \Sigma F_y = 0$

$T_{CA} \sin 30 + T_{CB} \sin \theta - 98.1 = 0$

(2) $T_{CA} \sin 30 + T_{CB} \sin 64 = 98.1$

$\therefore -T_{CA} \cos 30 + T_{CB} \cos 64 = 0$

$T_{CA} \sin 30 + T_{CB} \sin 64 = 98.1$

(b) $T_{CA} = 43.10 N$

$T_{CB} = 85.16 N$

(a) Angle $\theta = 64°$

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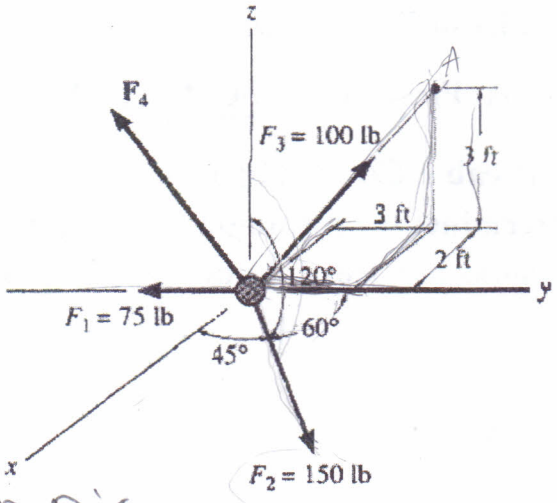
Lecturers: Hamed Nour, Ayman Ashour, Waleed El-Beshbeshy, and Amro El-Sonbaty

2- Determine the magnitude of the force F_4 required to keep equilibrium. (10 Marks)



[4] Equations :-

$\Sigma F_x = 0$

$0 + 106.6 - 42.64 + F_4 i = 0$

$106.6 + 42.64 + F_4 i = 0$

$F_4 i = -63.96 i$

$\Sigma F_y = 0$

$-75 + 75 + (-63.96) + F_4 J = 0$

$\rightarrow F_4 J = -63.96 J$

$\Sigma F_z = 0$

$0 - 75 - 6.39 + F_4 k = 0$

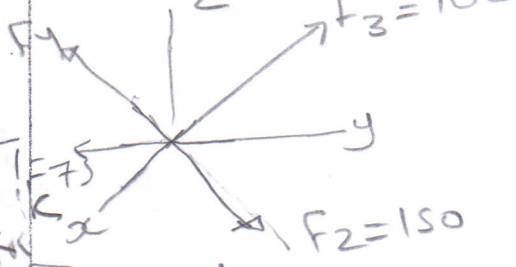
$F_4 z = 11.04 k$

$F_4 = -63.96 i - 63.96 J + 11.04 k$

$F_4 = \sqrt{(63.96)^2 + (63.69)^2 + (11.04)^2}$

$\boxed{F_4 = 91.04 \text{ lb}}$

[1] F.B.D :-



[2] Points

$O(0,0,0)$ $A(-2, 3, 3)$

[3] vectors :-

$F_1 = -75 J$

$F_2 = 150 (\cos 45 i + \cos 60 J + \cos 120 k)$

$F_2 = 106.6 i + 75 J - 75 k$

$F_3 = 100 \frac{OA}{|OA|} = 100 \frac{-2i + 3J + 3k}{4.69}$

$100 \frac{-2i + 3J + 3k}{4.69} = -42.64 i + 63.96 J + 63.96 k$

$F_4 = F_x i + F_y J + F_z k$

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[3] Vectors :-

$F_1 = -20i + 10J + 30k$

$F_2 = -10i - 30J + 50k$

$\rightarrow \cos\theta_{F_1 F_2} = \frac{F_1 \cdot F_2}{|F_1||F_2|}$

$= \frac{(-20 \times -10) + (10 \times -30) + (30 \times 50)}{37.41 \times 59.16}$

$\cos\theta = 0.6325$

$\boxed{\cos\theta = 50.765^\circ}$

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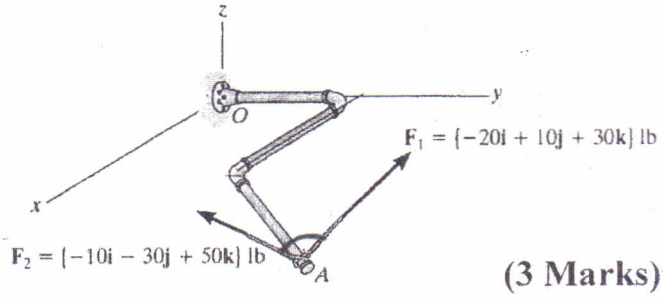

(3 Marks)

3- Determine the angle between F_1 = -20 i + 10 j + 30 k and F_2= -10 i –30 j + 50 k.