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UNIVERSITEIT VAN PRETORIA / UNIVERSITY OF PRETORIA
DEPARTMENT OF CIVIL ENGINEERING / DEPARTEMENT SIVIELE INGENIEURSWESE

MEGANIKA SWK122 / MECHANICS SWK122: KLASTOETS 2 / CLASS TEST 2

Initials and Surname ..... **Student Nr** .....
Voorletters en Van Memorandum **Studente No**

Studierigting ..... **Groep No** ..... **Datum** ..... **20** .....
Study discipline **Group Nr** **Date**

Met my handtekening verklaar ek dat ek alle EKSAMENREËLS sal gehoorsaam. / *With my signature I confirm that I will abide by all EXAMINATION RULES.*

SIGNATURE / HANDTEKENING .....

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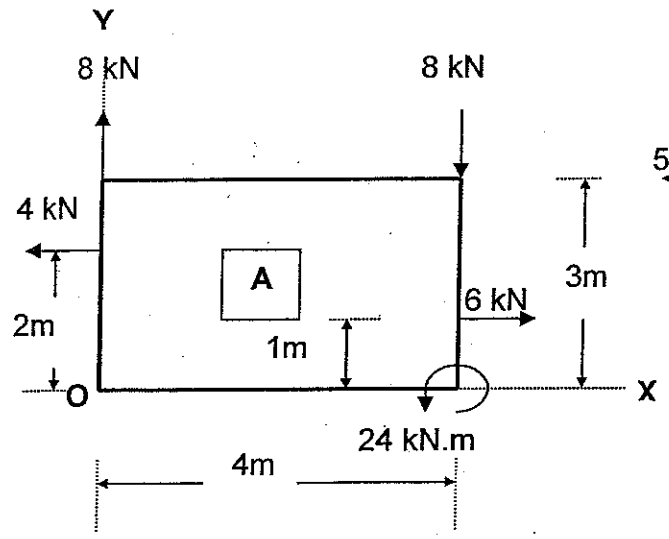
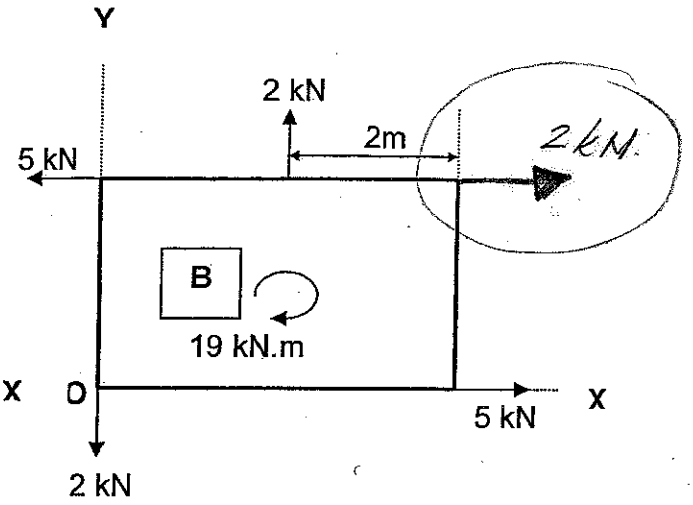
1. The figure shows two flat metal sheets [4m x 3m], A and B, with a system of forces and couple(s) acting on each sheet.
What force must be placed **where** on sheet B so that the system on sheet B is equavilant to the system on sheet A? Show all calculations.
Die figuur toon twee plat metaalplate [4m x 3m], A en B, met 'n stelsel van koppel(s) en kragte wat op elke plaat inwerk.
Watter *krag moet* ***waar*** *op plaat B geplaas word sodat die stelsel op plaat B ekwivalent aan die stelsel op plaat A is? Toon alle berekeninge.* **[10]**





(A)

$\overline{F_o} = (2;0;0)\ kN$

$\overline{M_o} = (0;0;-32-6+8+24)$

$= (0;0;-6)\ kN.m$ →

(B)

$\overline{F_o} = (0;0;0)$

$\overline{M_o} = (0;0;15+4-19) = (0;0;0)$

⇒ $F = (2;0;0)$

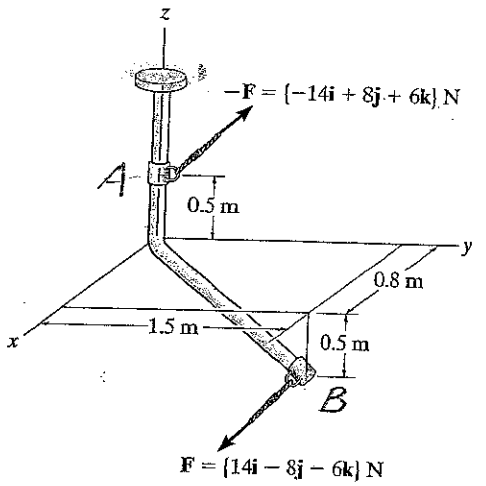
$M = (0;0;-6)$

⇒ $\therefore y = 3$ →

NB: CLEARLY SHOW YOUR ANSWER ON PLATE B.
LW: DUI U ANTWOORD DUIDELIK AAN OP PLAAT B.

2. Determine the couple moment in Cartesian format. Also give the magnitude of the couple. **[10]**

Bepaal die koppelmoment in Cartesiese formaat. Gee ook die grootte van die koppel.



⊙ $\overline{M_c} = \overline{AB} \times \overline{F}$

$A = (0; 0; 0.5)m \quad B = (0.8; 1.5; -0.5)m$

⊙ $\overline{AB} = (B)-(A) = (0.8; 1.5; -0.5)-(0\ 0\ 0.5)$

$= (0.8; 1.5; -1)\ m \rightarrow$

⊙ $\overline{M_c} = \begin{vmatrix} 0.8 & 1.5 & -1 \\ 14 & -8 & -6 \end{vmatrix}$

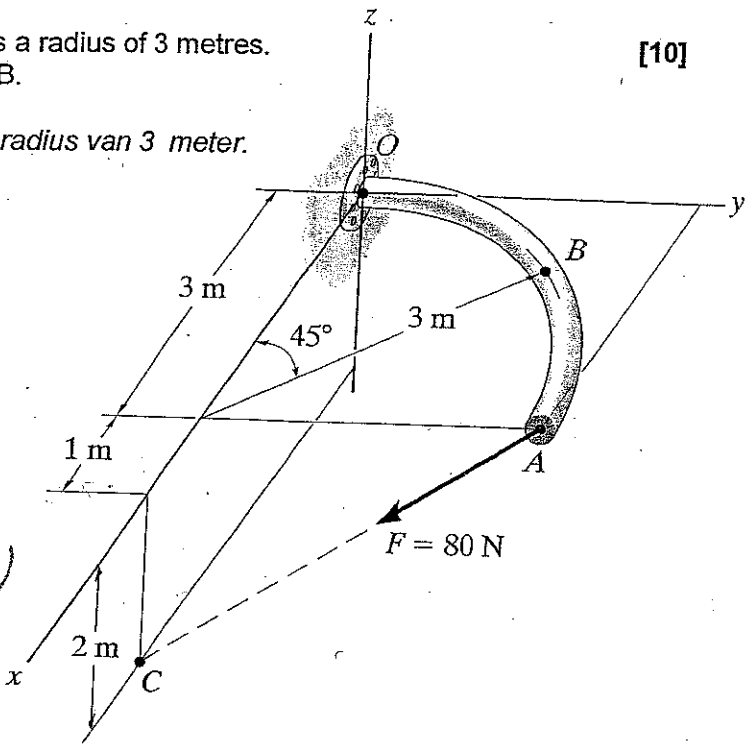
$= (-17; -9.2; -27.4)\ N.m \rightarrow$

⊙ $M_c = [(-17)^2 + (-9.2)^2 + (-27.4)^2]^{1/2}$

$= 33.5\ N.m \rightarrow$

2. The curved rod lies in the x-y plane and has a radius of 3 metres. Determine the moment of force **F** about point B. **[10]**

*Die gebuigde stang lê in die x-y vlak en het 'n radius van 3 meter. Bepaal die moment van krag **F** om punt B.*



$\odot\ \overline{M}_B = \overline{BA} \times \overline{F}$

$\odot\ \overline{BA} = (A) - (B)$

$= (3; 3; 0) - [3\cos 45°; 3\sin 45°; 0)$

$= (2.12; 0.879; 0) \rightarrow$

$\odot\ \overline{F}_{AC} = F * \overline{u}_{AC}$

$\overline{AC} = (C) - (A) = (4\ 0\ -2) - (3\ 3\ 0) = (1\ -3\ -2)\ m$

$= \sqrt{14}\ m$

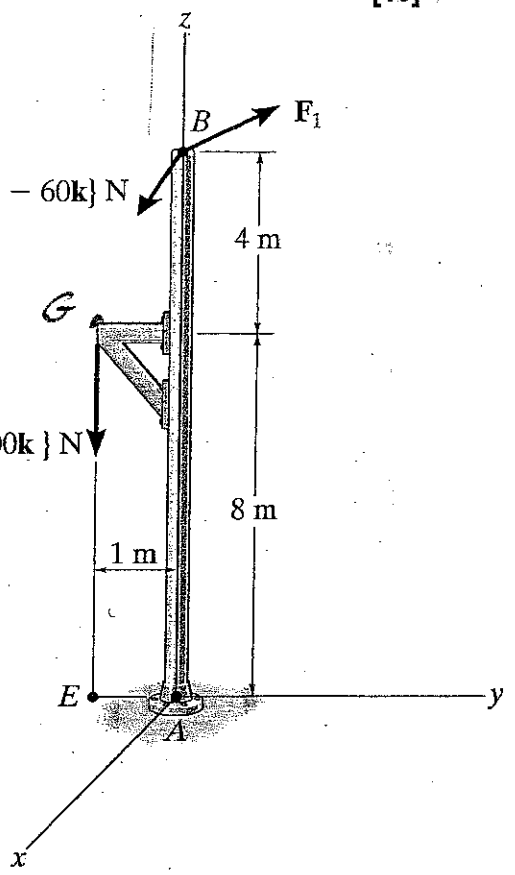
$\therefore \overline{F}_{AC} = \frac{80}{\sqrt{14}}(1\ -3\ -2) = (21.4; -64.1; -42.8)\ N$

$\odot\ \overline{M}_B = \begin{vmatrix} 2.12 & 0.879 & 0 \\ 21.4 & -64.1 & -42.8 \end{vmatrix}$

$= (-37.6; 90.7; -183)\ N.m \rightarrow$

2. Determine the rersultant moment of the given forces about point A. **[10]**
Give your answer in Cartesian format.
F_1 =(400 ; 300 ; 120) N.

Bepaal die resultantmoment van die gegewe kragte om punt A.
Gee u antwoord in Cartesiese formaat
F_1 =(400 ; 300 ; 120) N.



⊙ $\overline{F_R} = (100; -100; -60) + (400; 300; 120)$

$= (500; 200; 60)$ N →

⊙ $\overline{M_1} = \overline{AB} \times \overline{F_R}$

$= (0\ 0\ 12) \times (500\ 200\ 60)$

$= \begin{vmatrix} 0 & 0 & 12 \\ 500 & 200 & 60 \end{vmatrix}$

$= (-2400; 6000; 0)$ N.m →

⊙ $\overline{M_2} = \overline{AG} \times \overline{F_3}$ $\overline{AG} = (0\ -1\ 8) - (0\ 0\ 0) = (0\ -1\ 8)$

$= \begin{vmatrix} 0 & -1 & 8 \\ 0 & 0 & -500 \end{vmatrix}$

$= (500; 0; 0)$ N.m →

⊙ $\overline{M_R} = \overline{M_1} + \overline{M_2} = (-1900; 6000; 0)$ N.m →