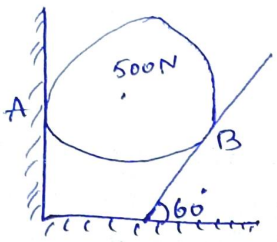
Problems on Sphere:

① Find the reaction at the point of contact A & B for the sphere of weight 500N shown below.

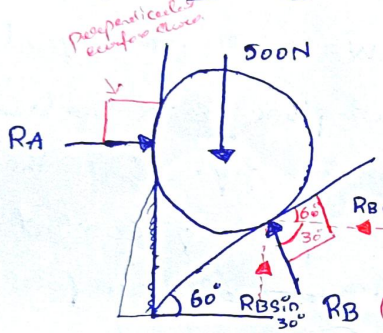


Extend apply forced Load is applied on body, the support apply reactive force/ moment (reaction)

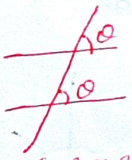
Solu: FBD of Sphere:

① Body weight → Centre → Vertical → ↓

② Support / surface / contact reaction



③ Resolve inclined



$\uparrow + \sum f_y = 0$

$R_B \sin 30^\circ - 500 = 0$

$R_B \sin 30 = 500$

$R_B = \frac{500}{\sin 30^\circ}$

$R_B = 1000N$

$\rightarrow + \sum f_x = 0$

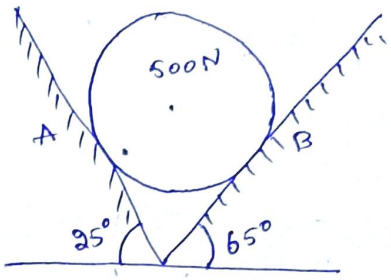
$R_A - R_B \cos 30^\circ = 0$

$R_A - 1000 \cos 30^\circ = 0$

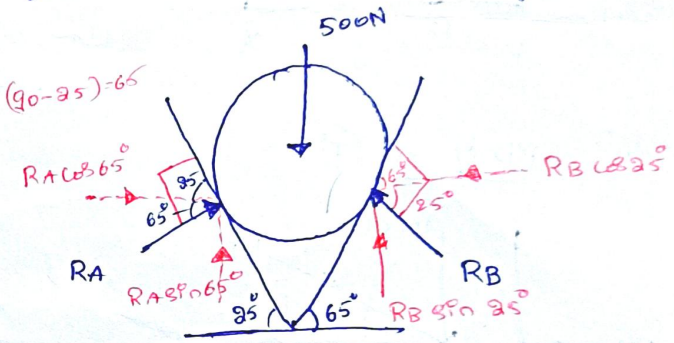
$R_A - 866.025 = 0$

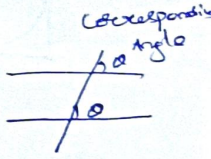
$R_A = 866.025N$

② Find the reaction at the point of contact A & B for the sphere of weight 500N shown below.



Solu:





$\rightarrow + \sum f_x = 0$

$R_A \cos 65^\circ - R_B \cos 25^\circ = 0 \rightarrow ①$

$\uparrow + \sum f_y = 0$

$R_A \sin 65^\circ + R_B \sin 25^\circ - 500 = 0$

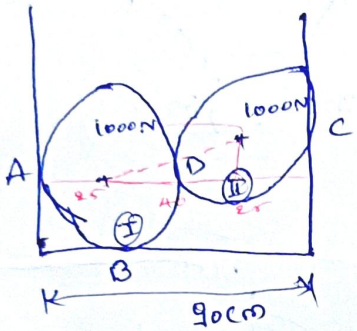
$R_A \sin 65^\circ + R_B \sin 25^\circ = 500 \rightarrow ②$

from Eqn ① & ②

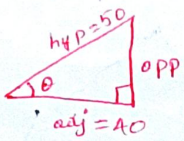
$R_A = 453.158N$

$R_B = 211.309N$

③ Two spheres each of weight 1000N & of radius 25cm rest in a Hgl channel of width 90cm as shown in fig. Find the reaction at the point of contact A, B & C.



Identical

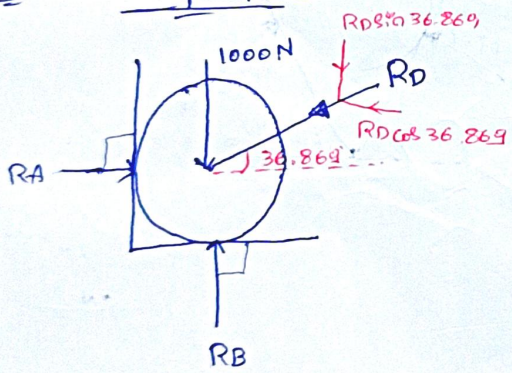


$\cos\theta = \frac{adj}{hyp} = \frac{AO}{50}$

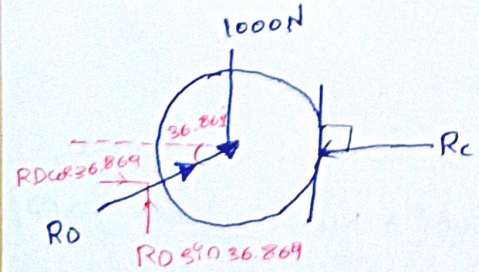
$\theta = \cos^{-1}()$

$\theta = 36.869$

Solu': FBD of sph. (I)



FBD of sph. (II)



$+\uparrow \Sigma f_y = 0$

$R_D \sin 36.869 - 1000 = 0$

$R_D \sin 36.869 = 1000$

$R_D = 1666.701\ N$

$\Sigma f_x = 0$

$R_D \cos 36.869 - R_C = 0$

$R_C = 1333.376\ N$

From the FBD of sph (I)

$+\rightarrow$

$\Sigma f_x = 0$

$R_A - R_D \cos 36.869 = 0$

$R_A - 1666.701 \cos 36.869 = 0$

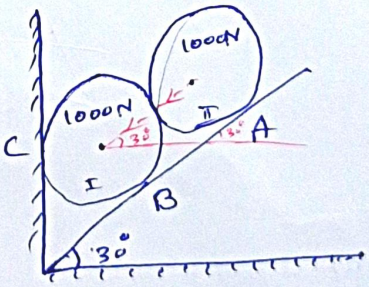
$R_A = 1333.376\ N$

$\uparrow \Sigma f_y = 0$

$R_B - 1000 - 1666.701 \sin 36.869$

$R_B = 2000\ N$

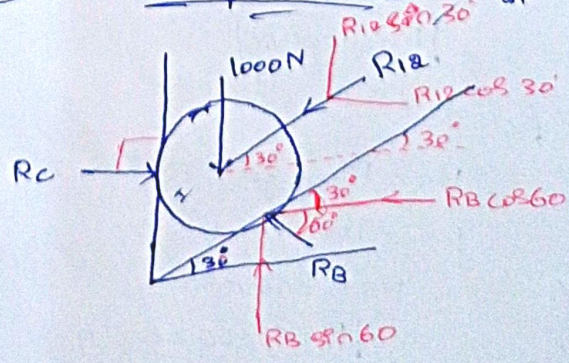
④ Two identical rollers each of weight W = 1000N are supported by an inclined plane & a vertical wall as shown in fig. find the reaction at the point of contact A, B, & C. Assume all surfaces to be smooth.



Solu':

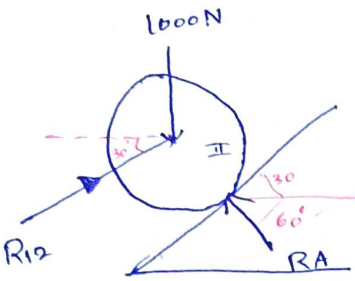
FBD of Roller (I)

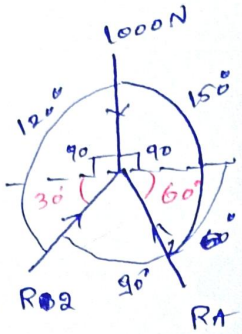
Reaction @ spn I & II



contd...

FBD of Roller (II)





By Lami's theorem,

$$\frac{RA}{\sin 120} = \frac{1000}{\sin 90} = \frac{R_{12}}{\sin 150}$$

$RA = 866.025N$ $R_{12} = 500N$

from the FBD of Roller (I)

$+\uparrow \Sigma f_y = 0$

$R_B \sin 60 - 500 \sin 30 - 1000 = 0$

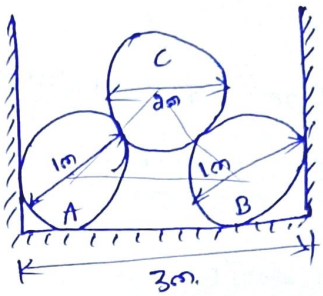
$R_B = 1443.375N$

$\rightarrow \Sigma f_x = 0$

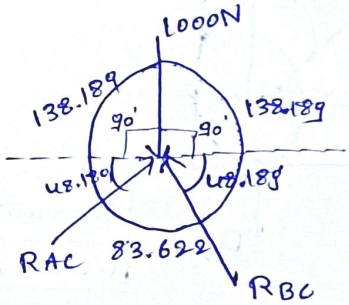
$R_C - 500\cos 30 - 1443.375\cos 60 = 0$

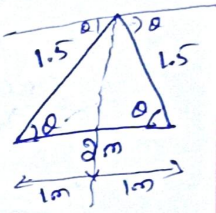
$R_C = 1154.7N$

(5) Cylinders A & B weighs 500N each & cylinder C weighs 1000N. Compute all contact surfaces.



Sol'n: FBD of cylinder C:





hyp = 1.5m
adj = 1m
$\theta = \cos^{-1}\left(\frac{1}{1.5}\right)$
$\theta = 48.189°$

By Lami's theo,

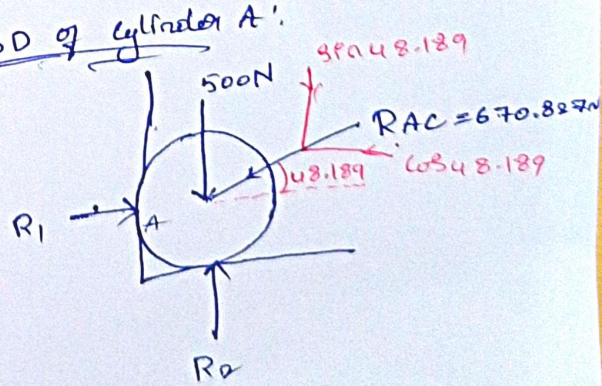
$$\frac{RAC}{\sin 138.189} = \frac{1000}{\sin 83.622} = \frac{RBC}{\sin 138.189}$$

Select,

$RAC = 670.887N$

$RBC = 670.887N$

FBD of cylinder A:



$\xrightarrow{+}$ $\Sigma f_x = 0$

$R_1 - 670.827 \cos 48.189 = 0$

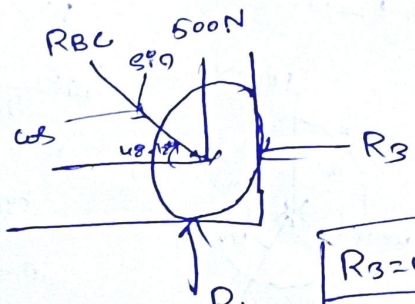
$\therefore \boxed{R_1 = 447.223 N}$

$\uparrow^{+}$ $\Sigma f_y = 0$

$R_2 - 500 - 670.827 \sin 48.189 = 0$

$\therefore \boxed{R_2 = 1000 N}$

FBD of cylinder (B) (Same of A)



$\boxed{R_3 = 447.223 N}$

$\boxed{R_4 = 1000 N}$