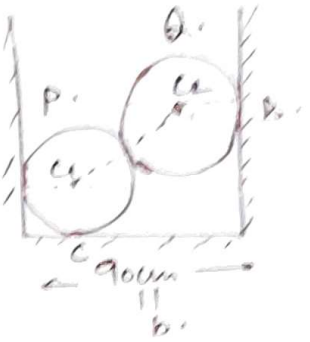
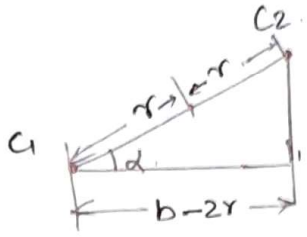
2) Two smooth spheres P, Q, each of radius 25 cm and weight 500 N, rest in a horizontal channel having vertical walls. If the distance between the walls is 90 cm, make calculations for the pressure exerted on the walls and floor at point of contact A, B & C.

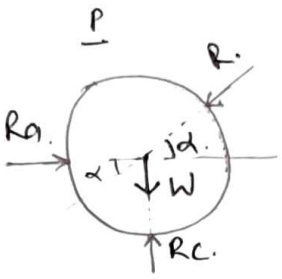


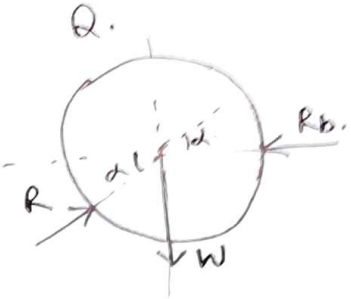
Soln



$$\cos\alpha = \frac{b-2r}{2r} = \frac{90-50}{50} = \frac{40}{50} = \frac{4}{5}$$

$$\alpha = 36.87^\circ$$





Consider the eqn of sphere Q., $\Sigma F_x = 0$ & $\Sigma F_y = 0$

$R\cos\alpha - R_b = 0$ — (i), & $R\sin\alpha - 500 = 0$ — (ii)

$R\sin\alpha = 500 \Rightarrow R = \frac{500}{\sin\alpha} = \frac{500}{\sin 36.87^\circ} =$ **833.33 N = R.**

from eqn (i)

$R_b = R\cos\alpha \Rightarrow 833.33 \times \cos 36.87 =$ **666.66 N = Rb.**

Consider the eqn of sphere P., $\Sigma F_x = 0$, & $\Sigma F_y = 0$

$R_a - R\cos\alpha = 0$ — (iii), $R_C - W - R\sin\alpha = 0$ — (iv)

$R_a = 833.33 \times \cos 36.87$,

$R_a = 666.67$ N.

$R_C = W + R\sin\alpha$

$= 500 + 833.33 \times \sin 36.87^\circ$

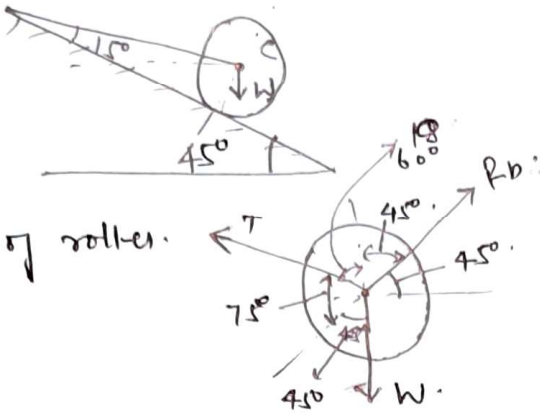
$\Rightarrow$ **1000 N = Rc**

Answer → (x)

$R_a = 666.67$ N. $R_b = 666.66$ N.

$R_C = 1000$ N, $R = 833.33$ N.

Q3) A roller of weight 500N rests on a smooth inclined plane and is kept from rolling down by a string as shown in fig. work out tension in the string and reaction at the point of contact B.



Sol^{n}. F.B.D. of roller.

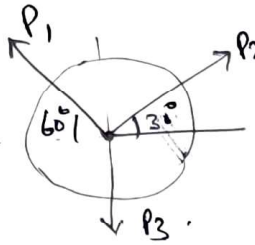
$180° - 75 - 45° = 60°$

$$\frac{W}{\sin(60+45^\circ)} = \frac{R_b}{\sin(75+45^\circ)} = \frac{T}{\sin(90^\circ+45^\circ)}$$

$$R_b = \frac{W \sin 120^\circ}{\sin 105^\circ} = 500 \times \frac{.866}{.966} = 448.24\,N$$

$$T = \frac{W \sin 135^\circ}{\sin 105^\circ} = 500 \times \frac{.707}{.966} = 365.94\,N.$$

Q4) A body acted upon by three forces P_1, P_2 & P_3 as shown in fig. is in equilibrium, if $P_2 = 300N$, make calculation for the forces P_1 & P_3.



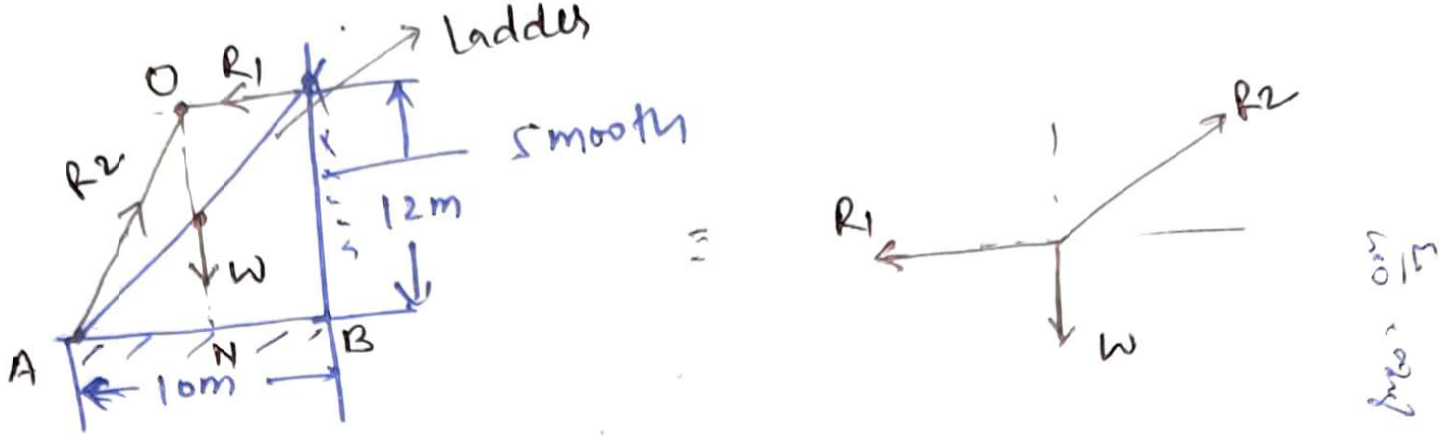
Sol^{n} Apply: Lami's Theorem

$$\frac{P_1}{\sin(120^\circ)} = \frac{P_2}{\sin 150^\circ} = \frac{P_3}{\sin 90^\circ}$$

$$P_1 = 300 \times \frac{\sin 120^\circ}{\sin 150^\circ} = 300 \times \frac{.866}{.5} = 519.6\,N$$

$$P_3 = 300 \times \frac{\sin 90^\circ}{\sin 150^\circ} = 300 \times \frac{1}{.5} = 600\,N.$$

Q. - A uniform ladder weighing 80N rests against a smooth vertical wall at a height of 12m above the ground, the foot of ladder being 10m from the wall. Determine the pressure due to wall.



Δ AGN, $\frac{R_1}{AN} = \frac{R_2}{OA} = \frac{W}{ON}$

$AN = 5m.$

$OA = \sqrt{5^2 + 12^2} = 13m.$

$\frac{R_1}{\sin 157.38} = \frac{R_2}{\sin 90} = \frac{W}{\sin 112.62}$

$R_1 = \frac{W \sin 157.38^\circ}{\sin 112.62^\circ} = 33.33N.$