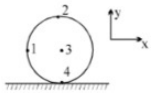
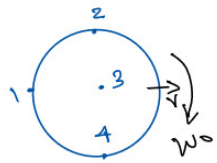
QUES 02:- A rigid cylinder is kept on a smooth horizontal surface as shown. If **Column-I** indicates velocities of various points (3-centre of cylinder, 2- top point, 4-bottom point, 1- on the level of 3 at the rim) on it shown, choose correct state of motion from **Column-II**.



Column-I		Column-II	
(A)	$\vec{v}_1 = \hat{i}+\hat{j}, \vec{v}_2 = 2\hat{i}$	(P)	Pure rotation about centre
(B)	$\vec{v}_1 = \hat{i}+\hat{j}, \vec{v}_3 = -\hat{i}$	(Q)	Rolling without slipping to left
(C)	$\vec{v}_2 = \hat{i}, \vec{v}_3 = 0$	(R)	Rolling without slipping to right
(D)	$\vec{v}_4 = 0, \vec{v}_1 = -\hat{i}-\hat{j}$	(S)	Not possible

Soln): A;



$v_1 = \hat{i}+\hat{j}$

$v_2 = 2\hat{i}$

let $\rightarrow v_{com} = v$

$\omega = \omega_0$

(1) at 2 :→ $(v+\omega_0 r)\hat{i} = 2\hat{i}$

at 1 :→ $v\hat{i} + \omega_0 r\hat{j} = \hat{i}+\hat{j}$

$\omega_0 r(\hat{i}-\hat{j}) = \hat{i}-\hat{j}$

$\therefore \boxed{\omega_0 r = 1}$

$\boxed{v = 1}$

Check rolling point ; $v = \omega_0 r$; $1 = 1$ With out slipping at Contact

Similarly do others ;

Answer :→ A → R
B → S
C → P
D → Q