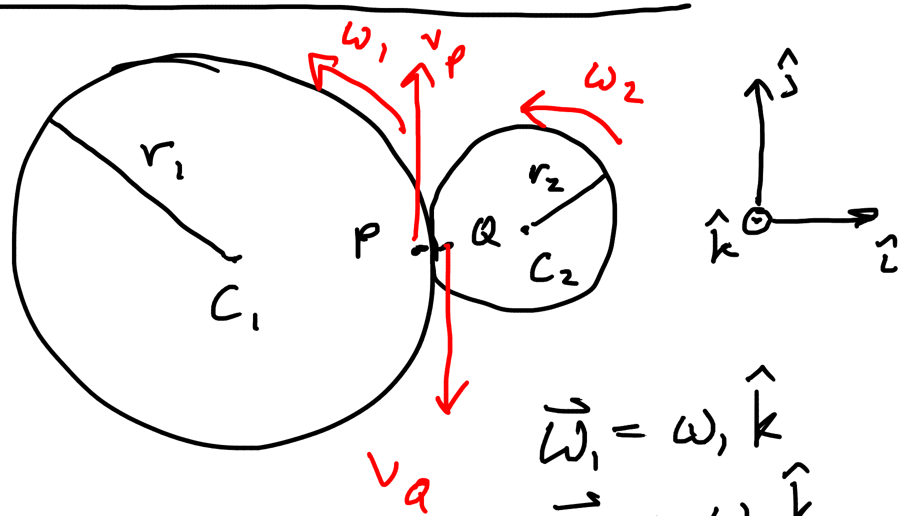
Notes: exam instructions posted on Piazza

Review

standard sign convention



$\vec{\omega}_1 = \omega_1 \hat{k}$

$\vec{\omega}_2 = \omega_2 \hat{k}$

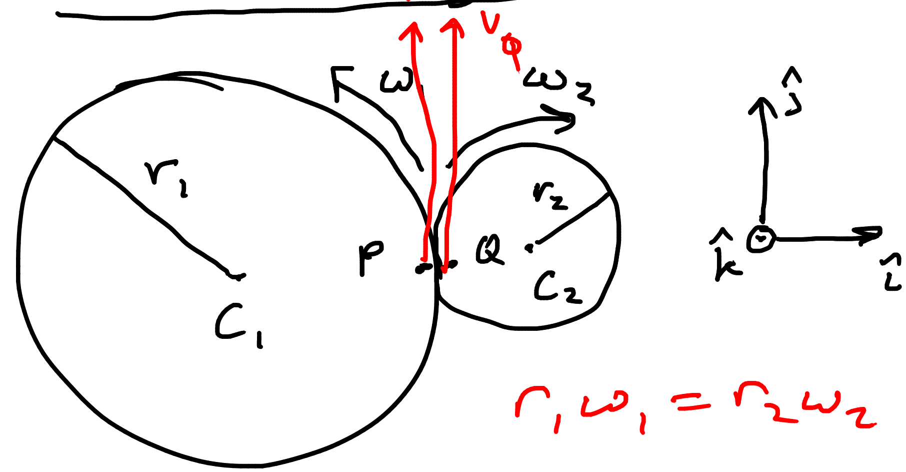
	$\vec{V}_P$ =	$\vec{V}_Q$
A.	$r_1\omega_1\hat{j}$ ✗	$r_2\omega_2\hat{j}$
B.	$-r_1\omega_1\hat{j}$	$r_2\omega_2\hat{j}$
C.	$r_1\omega_1\hat{j}$ ↗	$-r_2\omega_2\hat{j}$ ←
D.	$-r_1\omega_1\hat{j}$	$-r_2\omega_2\hat{j}$

$r_1\omega_1 = -r_2\omega_2$

$1.3 = -1.\omega_2$

$\omega_2 = -3$

Consistent v_P v_Q sign convention



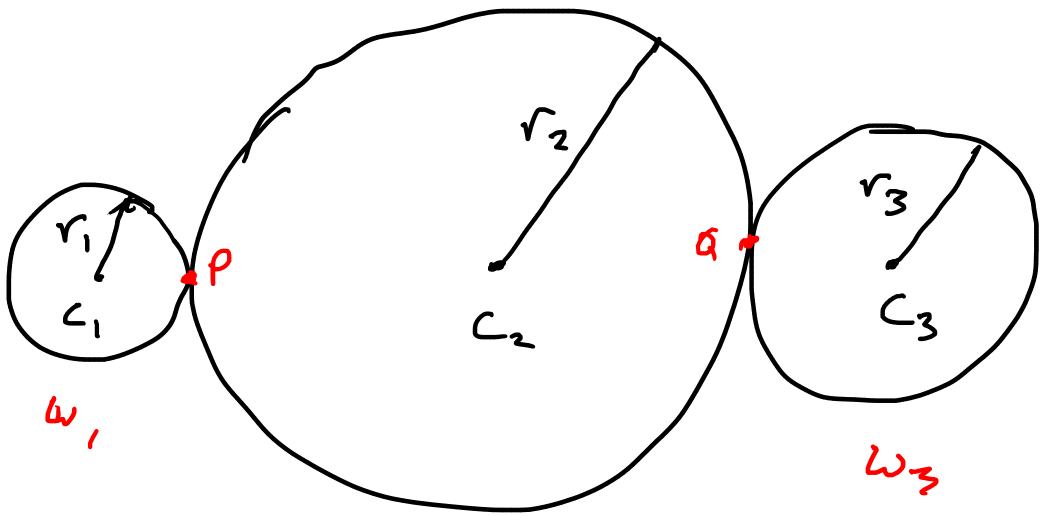
$r_1\omega_1 = r_2\omega_2$

	$\vec{V}_P$ =	$\vec{V}_Q$
A.	$r_1\omega_1\hat{j}$	$r_2\omega_2\hat{j}$ ←
B.	$-r_1\omega_1\hat{j}$	$r_2\omega_2\hat{j}$
C.	$r_1\omega_1\hat{j}$	$-r_2\omega_2\hat{j}$
D.	$-r_1\omega_1\hat{j}$	$-r_2\omega_2\hat{j}$

A +
B −

$\vec{\omega}_1 = \underline{+\omega_1}\,\hat{k}$ $\quad$ $\vec{\omega}_2 = \underline{-\omega_2}\,\hat{k}$

Ex



$$\left|\frac{\omega_3}{\omega_1}\right| =$$

A. $\frac{r_1}{r_3}$

B. $\frac{r_3}{r_1}$

C. $\frac{r_1 r_3}{r_2}$

D. $\frac{r_2}{r_1 r_3}$

stand. :

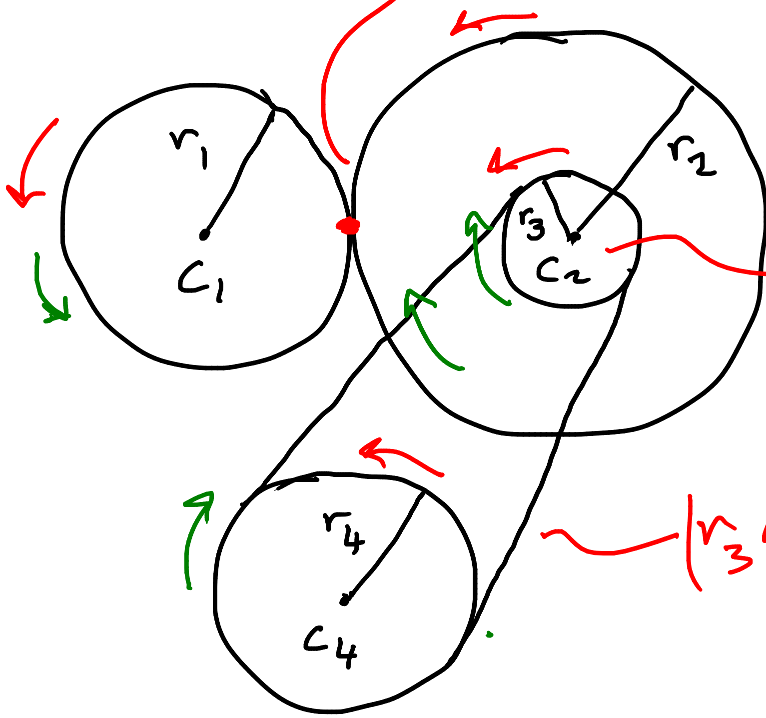
consist :

$$\frac{\omega_3}{\omega_1} = \square \, \frac{r_1}{r_3}$$

	standard	consistent
A.	+	+
B.	+	−
C.	−	+
D.	−	−

Ex

$|r_1 \omega_1| = |r_2 \omega_2|$



$|\omega_2| = |\omega_3|$

$|r_3 \omega_3| = |r_4 \omega_4|$

$$\left|\frac{\omega_4}{\omega_1}\right| =$$

A. $\frac{r_1 r_2}{r_3 r_4}$

B. $\frac{r_2 r_4}{r_1 r_3}$

C. $\frac{r_2 r_3}{r_1 r_4}$

D. $\frac{r_1 r_3}{r_2 r_4}$

standard

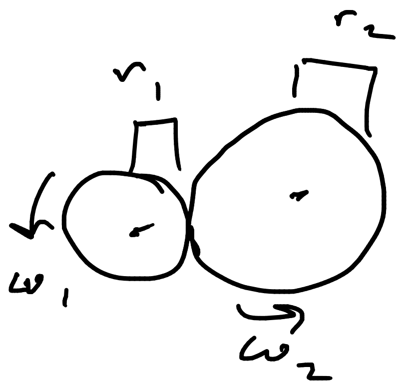
consistent

$$\frac{\omega_4}{\omega_1} = \boxed{}\ \frac{r_1 r_3}{r_2 r_4}$$

	standard	consistent
A.	+	+
B.	+	−
C.	−	+
D.	−	−

Accelerations in contact (no slip)

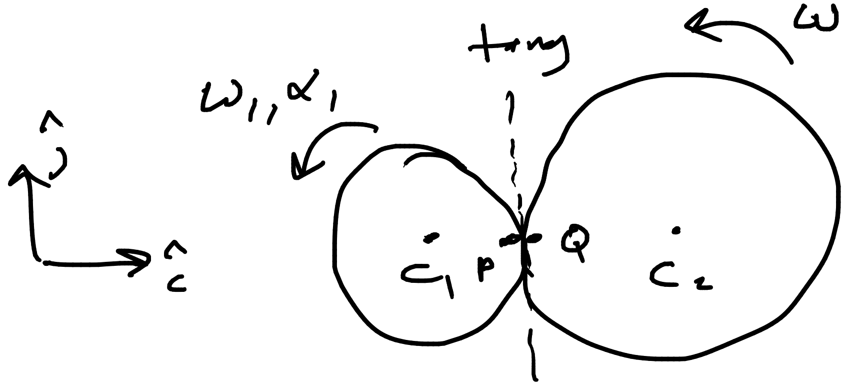
① differentiate velocity expression



$$\frac{\omega_2}{\omega_1} = -\frac{r_1}{r_2} \qquad r_1\omega_1 = -r_2\omega_2$$

$$\frac{d}{dt} \Rightarrow \underline{r_1\alpha_1 = -r_2\alpha_2}$$

② contacting points have equal tangential accelerations



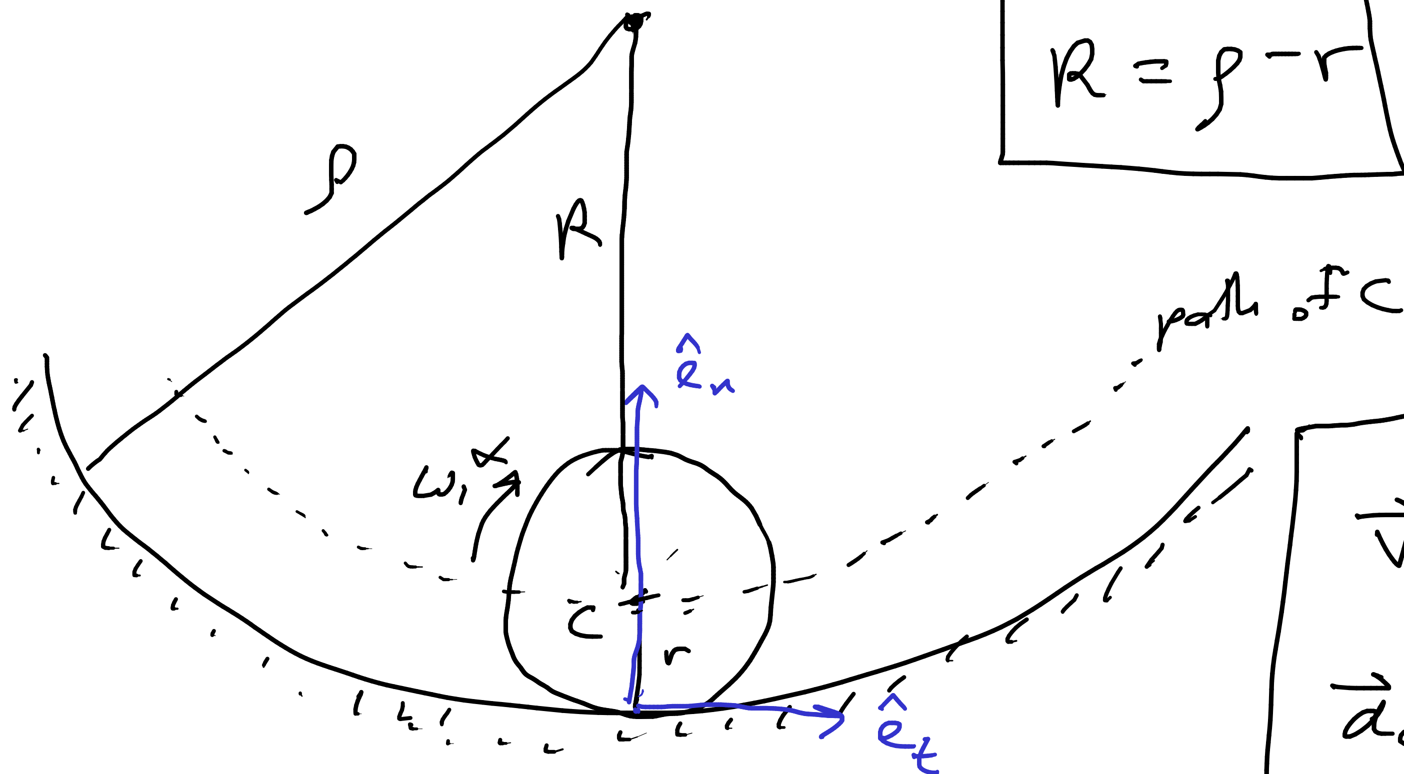
not equal   equal

$$\vec{a}_P = -r_1\omega_1^2\,\hat{i} + r_1\alpha_1\,\hat{j}$$

$$\vec{a}_Q = r_2\omega_2^2\,\hat{i} - r_2\alpha_2\,\hat{j}$$

tang: $\hat{j}$ $r_1\alpha_1 = -r_2\alpha_2$

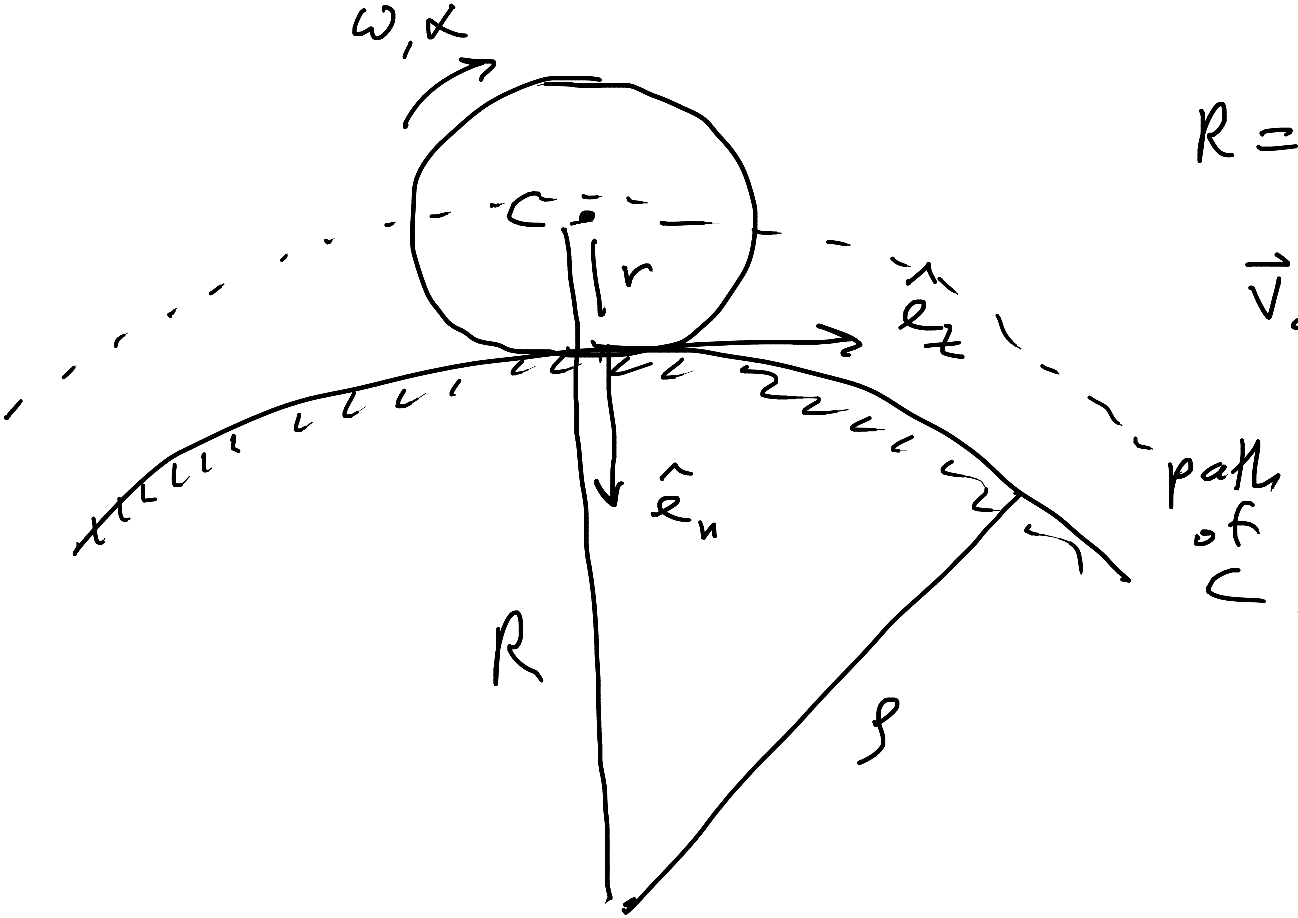
Rolling on curved surfaces (no slip)



$$\boxed{R = \rho - r}$$

$$\vec{v}_c = r\omega \hat{e}_t$$

$$\vec{a}_c = r\alpha \hat{e}_t + \frac{v_c^2}{R} \hat{e}_n$$



$R = \rho + r$

$\vec{V}_c$, $\vec{a}_c$ same.