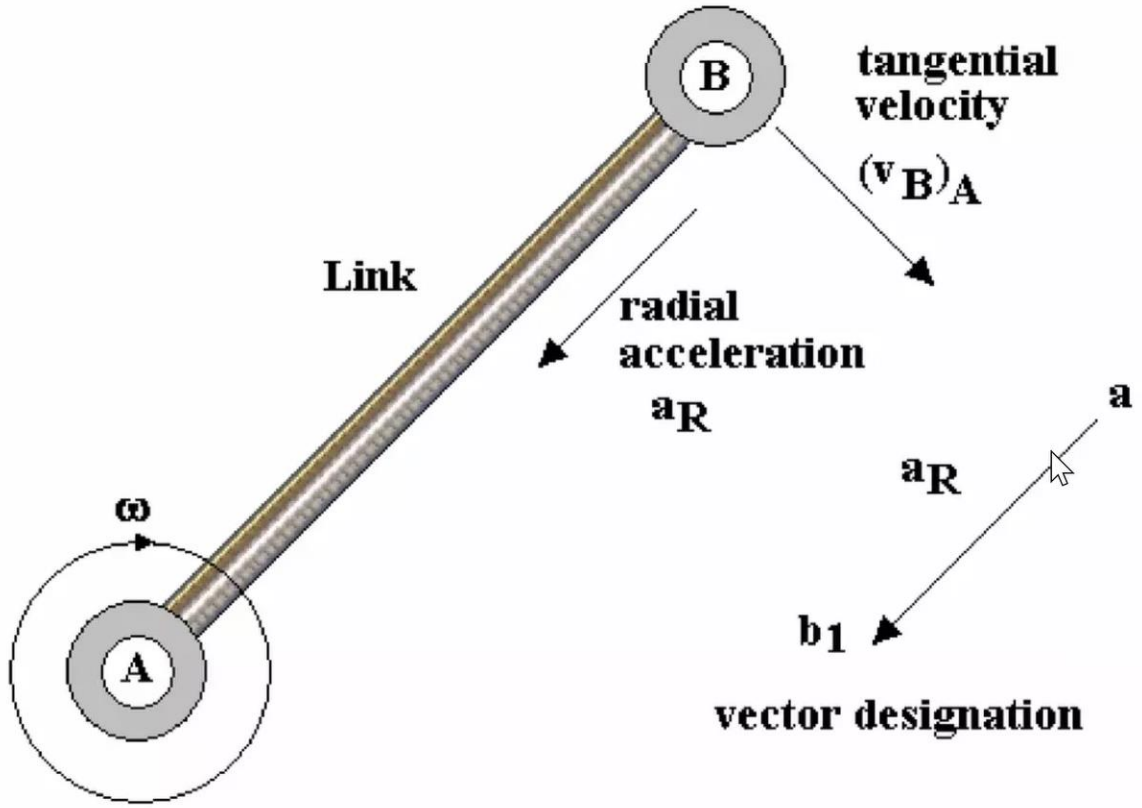
Acceleration vector diagram

Radial acceleration

A point rotating about a center at a radius R has a tangential velocity v and angular velocity ω and it continually accelerating towards the center. This is centripetal/radial acceleration and it is caused by the constant change in direction.

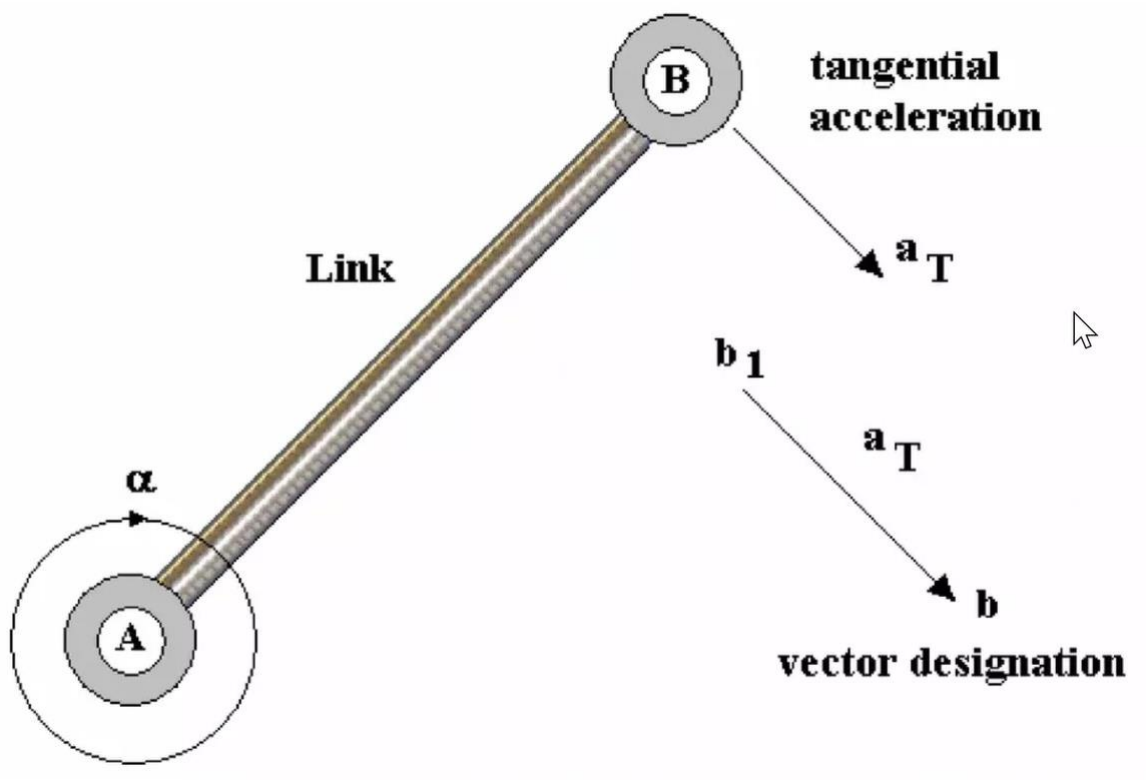
$$a_r = \omega^2 R \text{ or } a_r = \frac{v^2}{R}$$

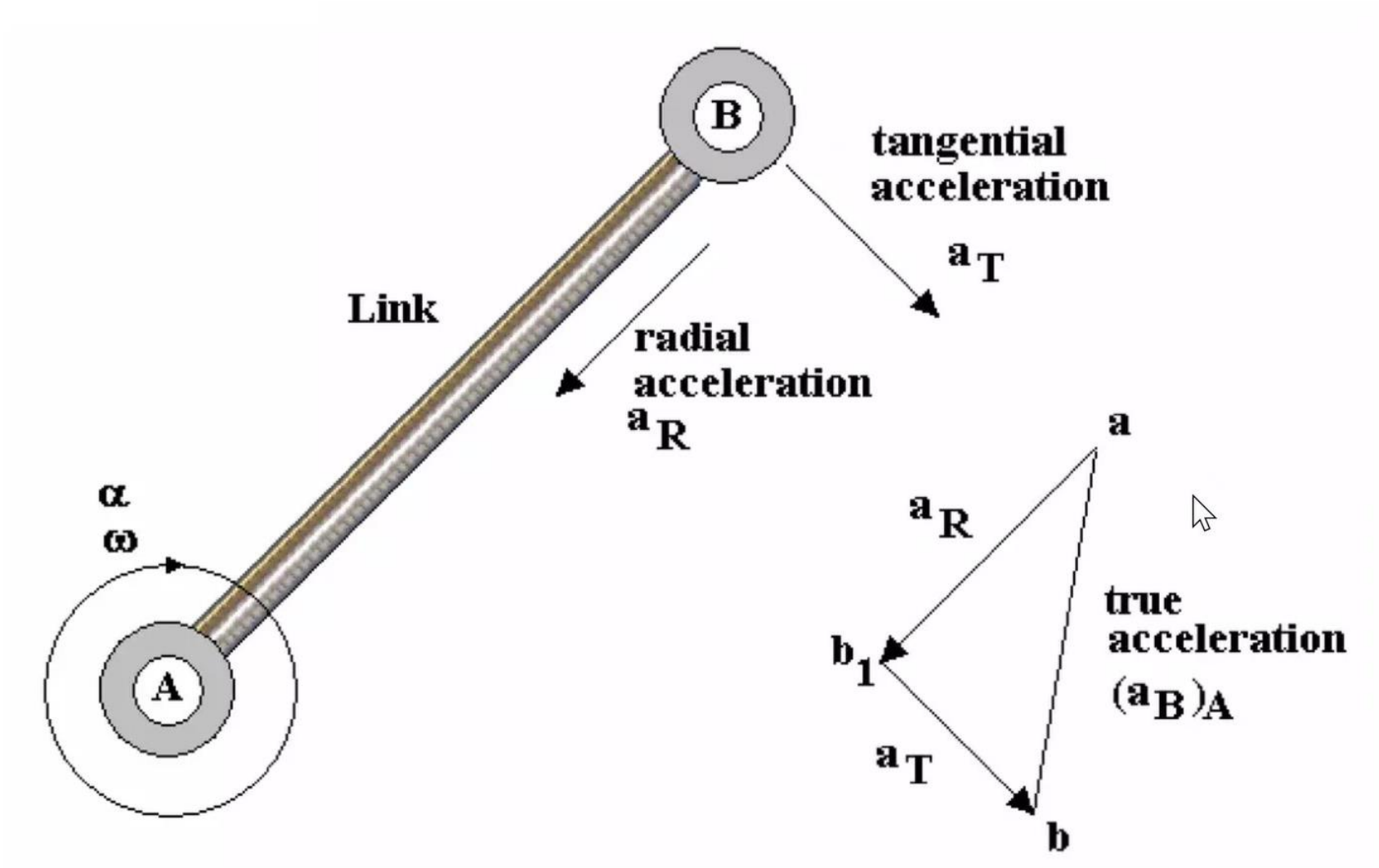


Tangential acceleration

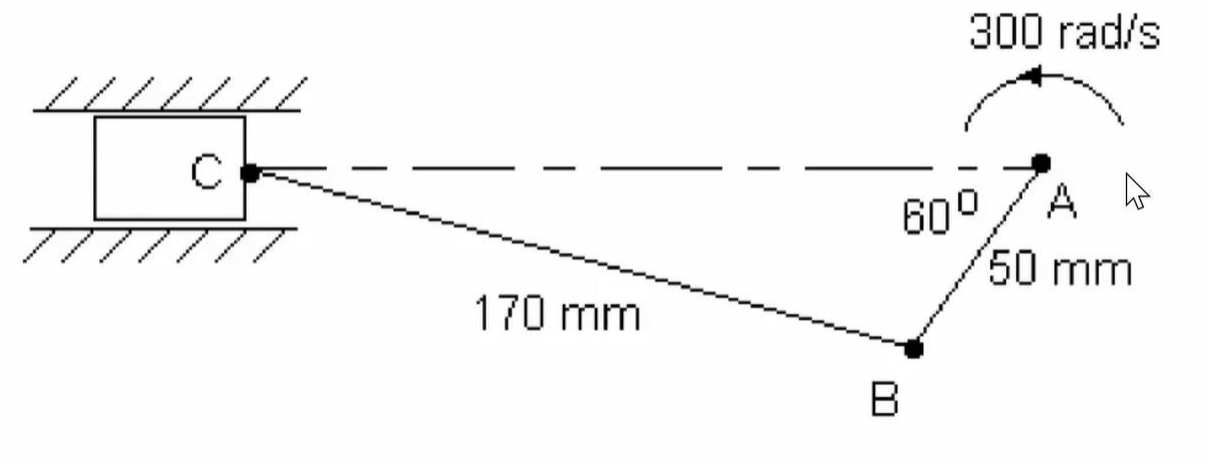
Tangential acceleration only occurs if the link has an angular acceleration α rad/s^2. Consider a link AB with an angular acceleration about A.

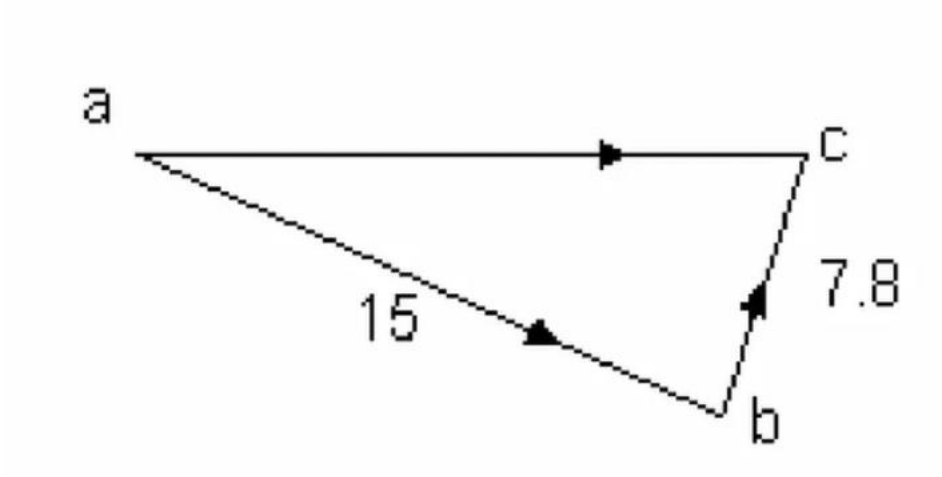
$$a_t = r\alpha$$




B
tangential
acceleration
a_T
Link
radial
acceleration
a_R
α
ω
A
a
a_R
b_1
true
acceleration
$(a_B)_A$
a_T
b

The crank rotates at a constant angular velocity of 300 rad/s. Find the acceleration of the piston and the angular acceleration of the link BC.





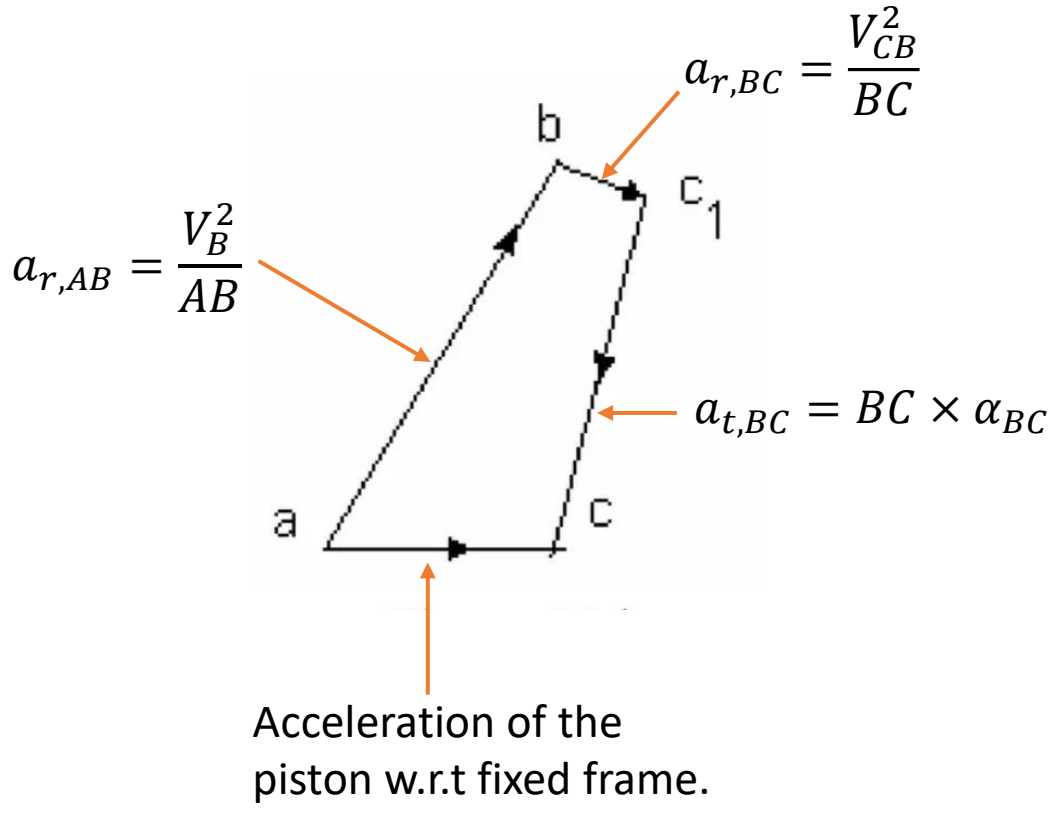
Acceleration of the piston = $\overrightarrow{ac}$

Angular acceleration of the link BC

$$a_{t,BC} = BC \times \alpha_{BC}$$

$$a_{t,BC} = c_1 c$$

$$\alpha_{BC} = \frac{c_1 c}{BC}$$

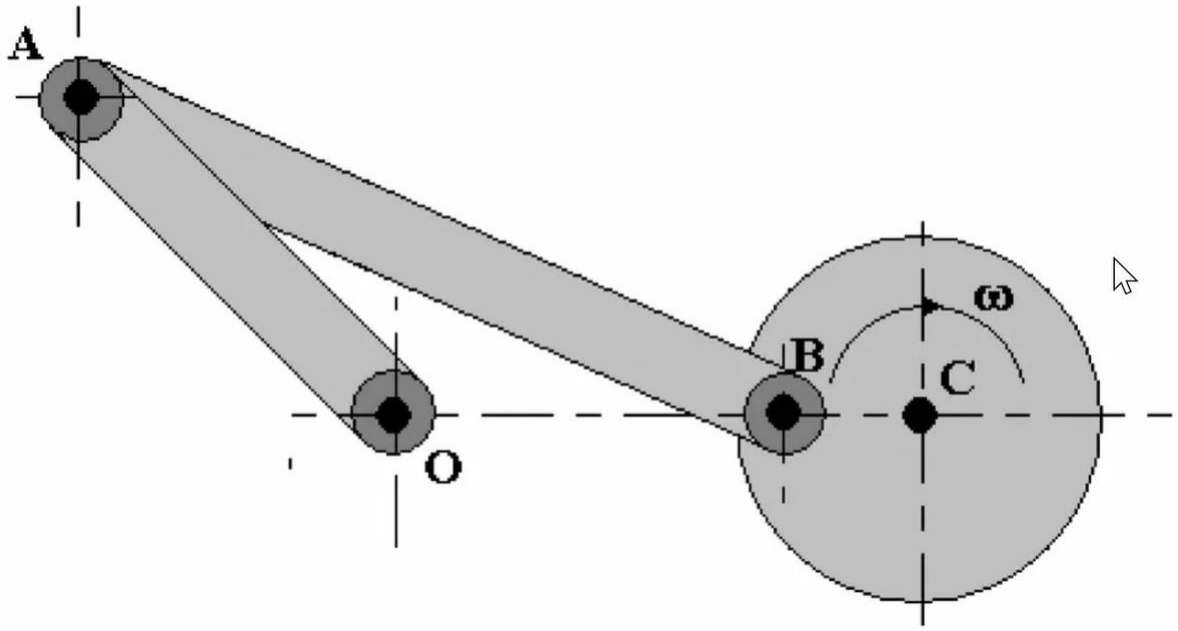


A rocking lever mechanism is used to convert the steady rotation of the wheel CB into an oscillating motion of the lever OA. Both the wheel and the lever are mounted in fixed centers. The wheel rotates clockwise at a uniform angular velocity of 100 rad/s. Find,

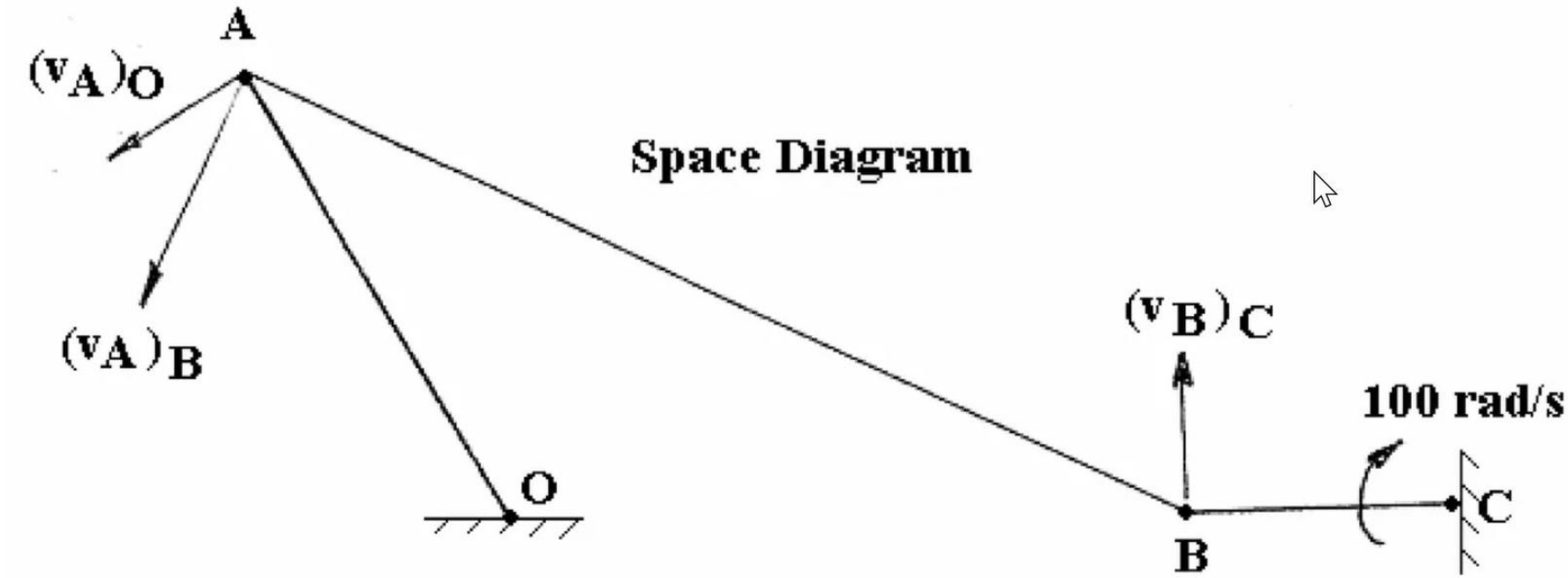
1) Angular velocity of link AB and the absolute velocity of point A.

2) The radial accelerations of BC, AB, OA.

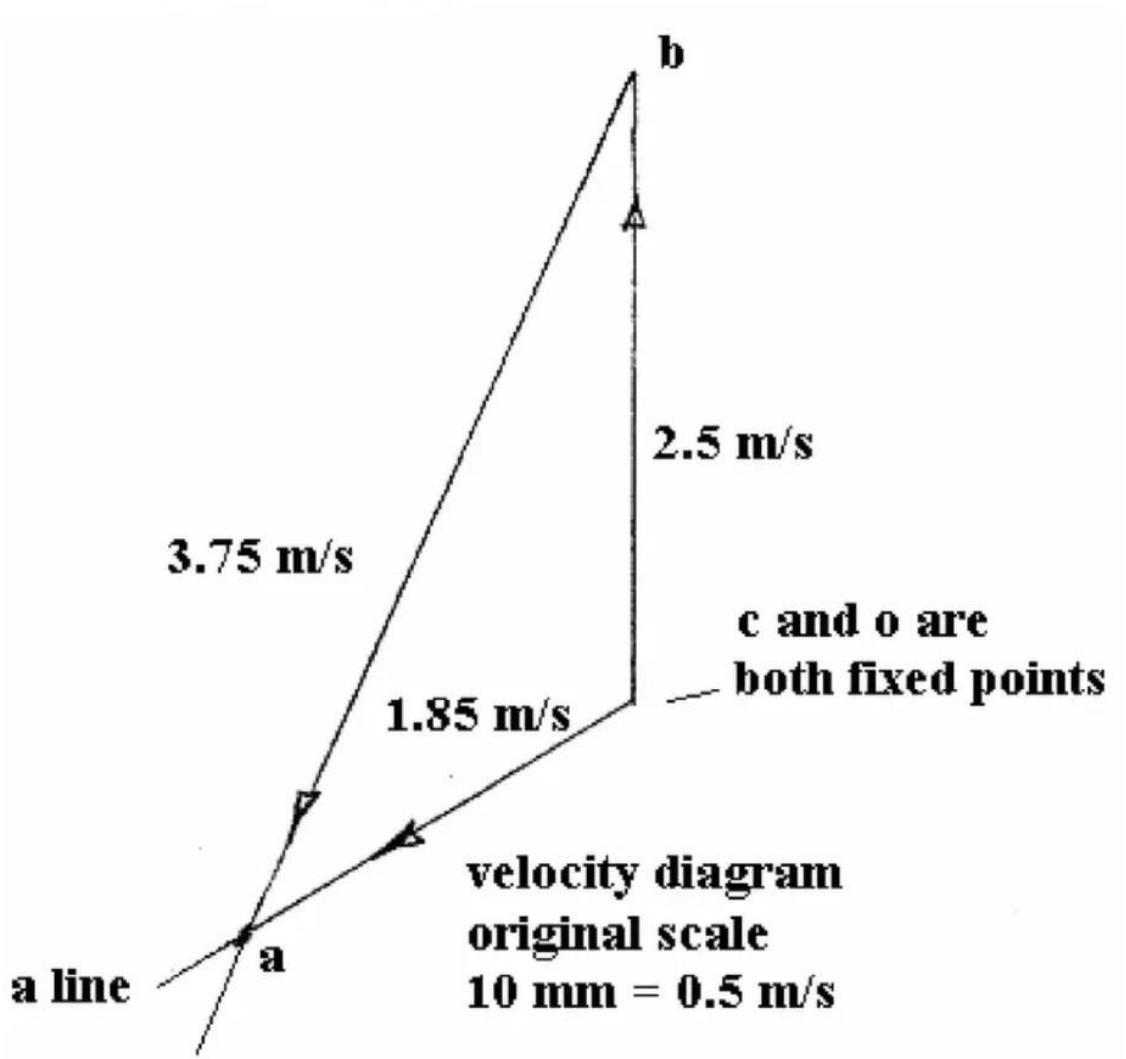
3) Acceleration of A.



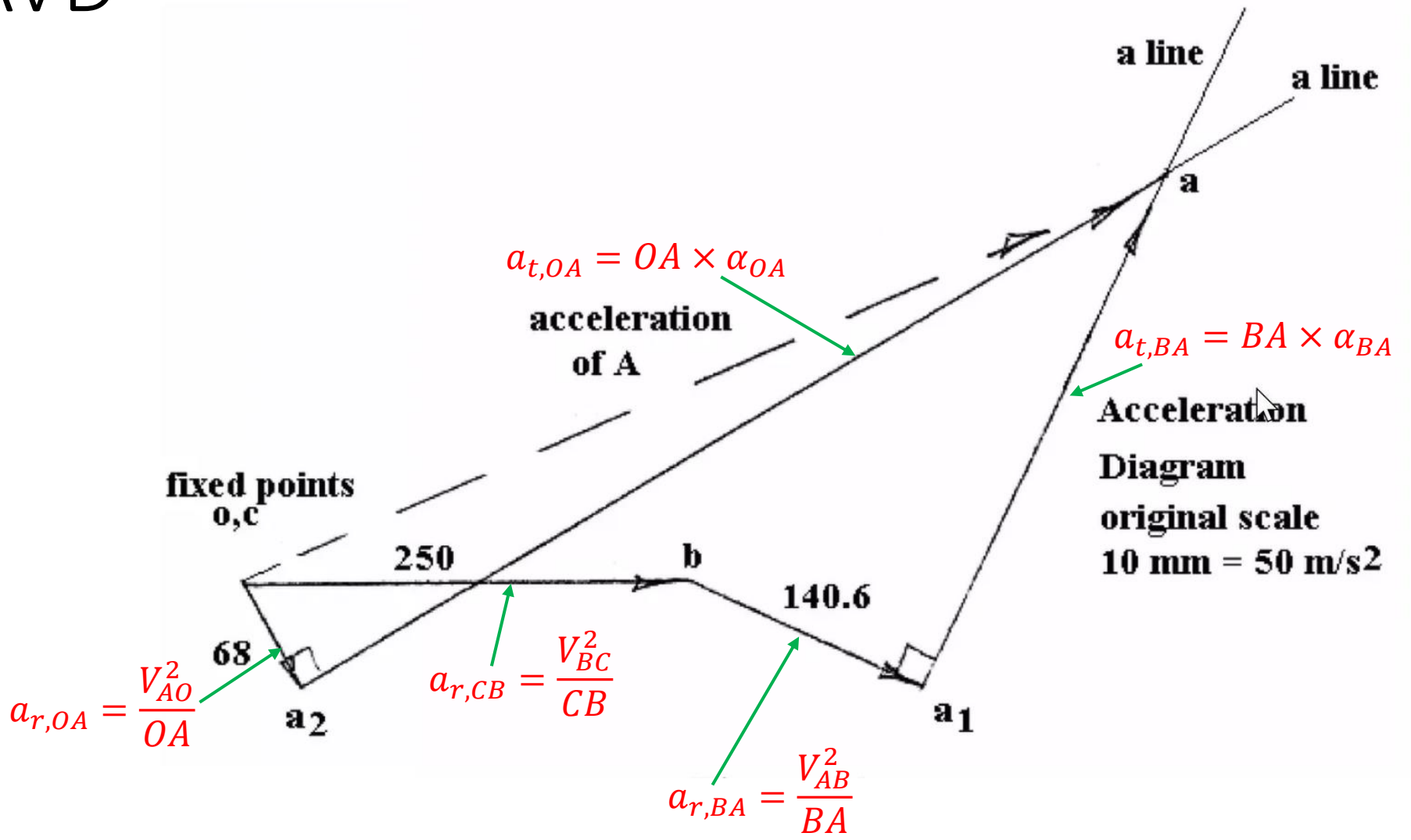
BC = 25 mm
AB = 100 mm
OA = 50 mm
OC = 90 mm


A
$(v_A)_O$
Space Diagram
$(v_A)_B$
$(v_B)_C$
100 rad/s
O
B
C

VVD

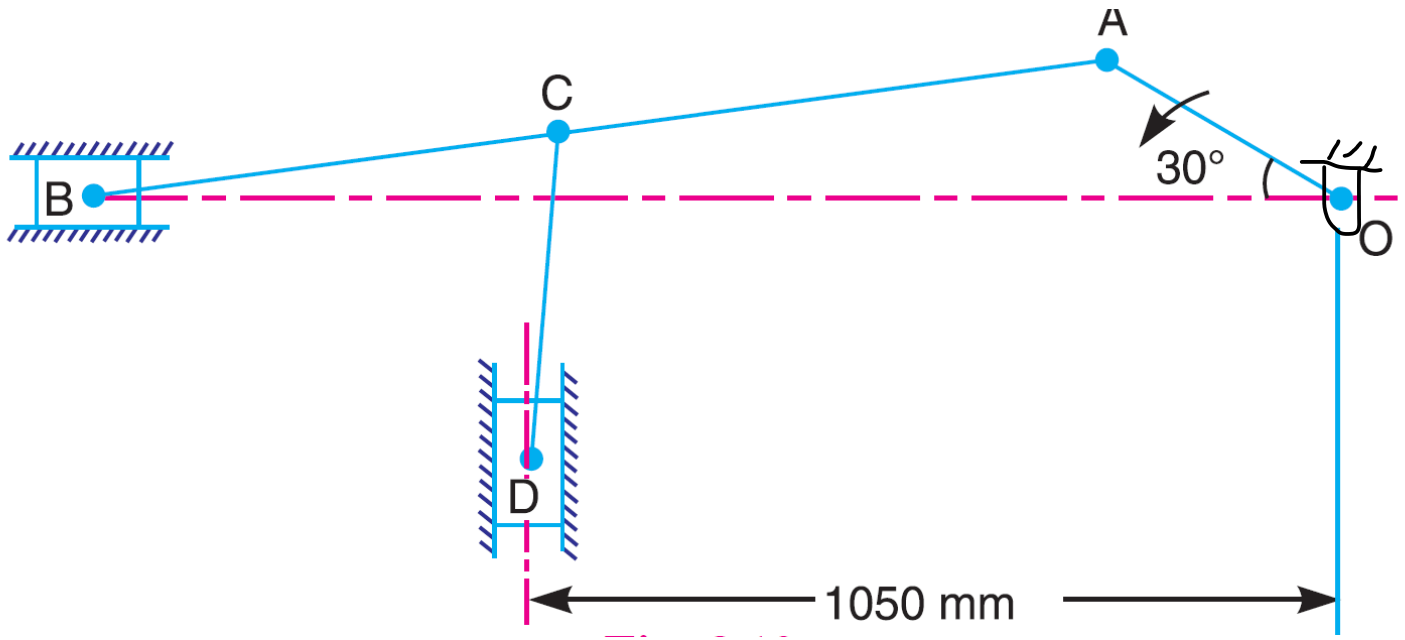

b
2.5 m/s
3.75 m/s
c and o are
both fixed points
1.85 m/s
velocity diagram
original scale
10 mm = 0.5 m/s
a
a line

AVD


a line
a line
a
$a_{t,OA} = OA \times \alpha_{OA}$
acceleration
of A
$a_{t,BA} = BA \times \alpha_{BA}$
Acceleration
Diagram
original scale
10 mm = 50 m/s2
fixed points
o,c
250
b
140.6
68
$a_{r,OA} = \frac{V_{AO}^2}{OA}$
$a_{r,CB} = \frac{V_{BC}^2}{CB}$
$a_{r,BA} = \frac{V_{AB}^2}{BA}$
a2
a1

In the mechanism, the crank OA rotates at 20 rev/min anticlockwise and gives motion to the sliding blocks B and D. The dimensions of the various links are OA = 300 mm; AB = 1200 mm; BC = 450 mm and CD = 450 mm.

*For the given configuration, determine : **1.** velocities of sliding at B and D, **2.** angular velocity of CD, **3.** linear acceleration of D, and **4.** angular acceleration of CD.*



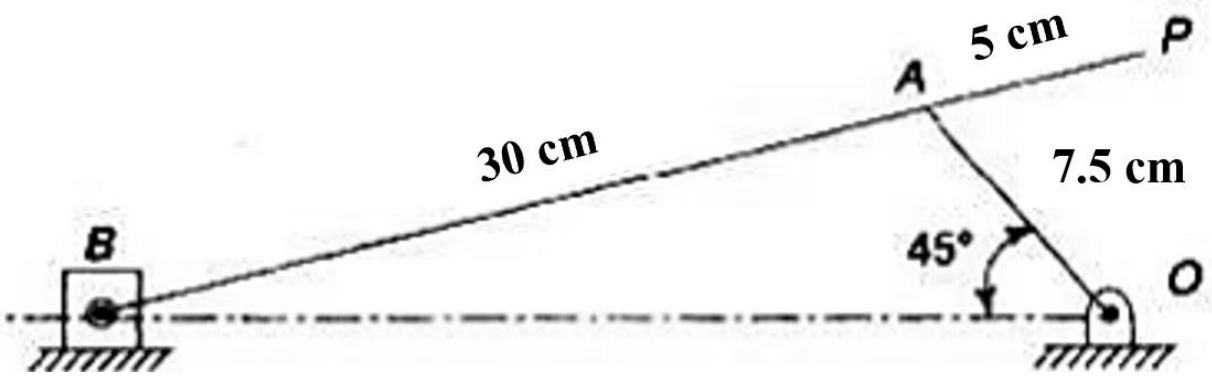
In the slider crank mechanism shown in Figure, the crank OA rotates with a uniform velocity of 600 rev/min in clockwise direction. For the given configuration;

i. draw space diagram, velocity and acceleration vector diagram

and determine;

ii. the linear acceleration of the slider B

iii. the linear acceleration of point P located on the extended connecting rod



Scale

Space diagram 1 cm = 5 cm

Velocity vector diagram 1 cm = 1 m/s

Acceleration vector diagram 1 cm = 50 m/s^2