Solution. Given : ω_{AP1} = 10 rad/s ; α_{AP1} = 30 rad/s2; P_1A = 300 mm = 0.3 m ; P_2B = AB = 360 mm = 0.36 m

We know that the velocity of *A* with respect to *P*1 or velocity of *A*,

$v_{AP1} = v_A = \omega_{AP1} \times P_1A = 10 \times 0.3 = 3$ m/s

Velocity of B and angular velocities of P_2B and AB

First of all, draw the space diagram, to some suitable scale, as shown in Figure (*a*). Now the velocity diagram, as shown in Figure (*b*), is drawn as discussed below:

1. Since P_1 and P_2 are fixed points, therefore these points lie at one place in velocity diagram. Draw vector $p_1\,a$ perpendicular to P_1A, to some suitable scale, to represent the velocity of *A* with respect to P_1 or velocity of *A i.e.* v_{AP1} or v_A, such that

vector $p_1a = v_{AP1} = v_A = 3$ m/s

2. From point *a*, draw vector *ab* perpendicular to *AB* to represent velocity of *B* with respect to *A* (*i.e.* v_{BA}) and from point p_2 draw vector p_2b perpendicular to P_2B to represent the velocity of *B* with respect to P_2 or velocity of *B i.e.* v_{BP2} or v_B. The vectors *ab* and p_2b intersect at *b*.

By measurement, we find that

$v_{BP2} = v_B$ = vector p_2b = 2.2 m/s **Answer.**

and v_{BA} = vector ab = 2.05 m/s

We know that angular velocity of P_2B,

$$\omega_{P2B} = \frac{v_{BP_2}}{P_2B} = \frac{2.2}{0.36} = 6.1 \text{ rad/s (Clockwise)} \quad \textbf{Ans.}$$

and angular velocity of *A B*,

$$\omega_{AB} = \frac{v_{BA}}{AB} = \frac{2.05}{0.36} = 5.7 \text{ rad/s (Anticlockwise)} \quad \textbf{Ans.}$$

Acceleration of B and angular acceleration of P_2B and AB

We know that tangential component of the acceleration of *A* with respect to P_1,

Radial component of the acceleration of *A* with respect to P_1,

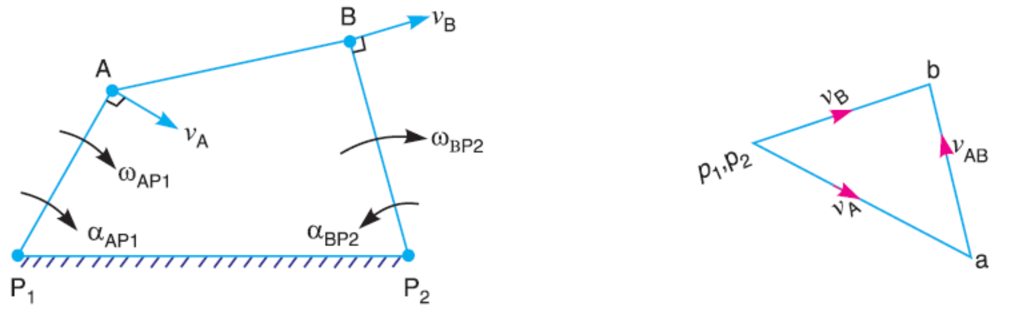
$$a^r_{AP_1} = \frac{v^2_{AP_1}}{P_1A} = \omega^2_{AP_1} \times P_1A = 10^2 \times 0.3 = 30 \text{ m/s}^2$$

Radial component of the acceleration of *B* with respect to *A*.

$$a^r_{BA} = \frac{v^2_{BA}}{AB} = \frac{(2.05)^2}{0.36} = 11.67 \text{ m/s}^2$$

and radial component of the acceleration of *B* with respect to P_2,

$$a^r_{BP_2} = \frac{v^2_{BP_2}}{P_2B} = \frac{(2.2)^2}{0.36} = 13.44 \text{ m/s}^2$$



(*a*) Space diagram. (*b*) Velocity diagram.

Figure

The acceleration diagram, as shown in Figure (*c*), is drawn as follows:

1. Since P_1 and P_2 are fixed points, therefore these points will lie at one place, in the acceleration diagram. Draw vector $p_1'x$ parallel to P_1A, to some suitable scale, to represent the radial component of the acceleration of *A* with respect to P_1, such that

$$\text{vector } p_1'x = a^r_{AP_1} = 30 \text{ m/s}^2$$

2. From point *x*, draw vector *xa′* perpendicular to P_1A to represent the tangential component of the acceleration of *A* with respect to P_1, such that

$$\text{vector } xa' = a^t_{AP_1} = 9 \text{ m/s}^2$$