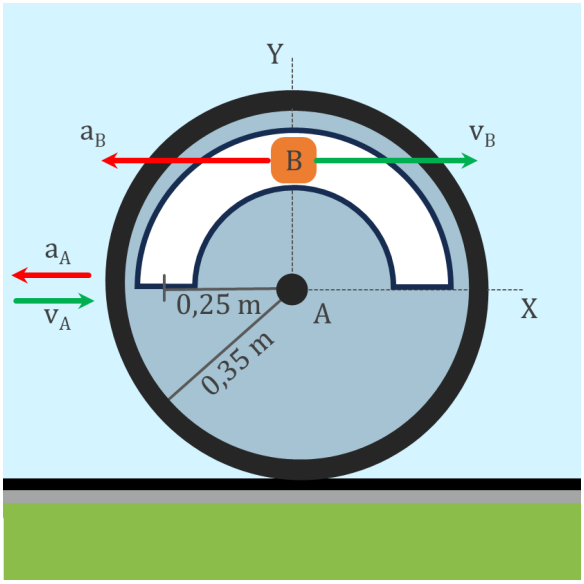
2.7.7 Disk with curved slot



A disk is rolling without slip on a flat ground. At a certain time the disk has a horizontal velocity $v_A = 5$ m/s **and horizontal acceleration** $a_A = 9$ m/s^2**. Particle** B **moves through a curved slot in the disk with velocity** $v_B = 6$ m/s **and acceleration** $a_B = 3$ m/s^2**, both relative to the disk. Determine the absolute velocity of particle** B**.**

Using known expressions:

$$\mathbf{V}_{abs} = \mathbf{V}_A + \boldsymbol{\omega} \times \boldsymbol{r} + \boldsymbol{V}_{rel} \tag{1}$$

Given:
Horizontal velocity of A: $\boldsymbol{V}_A = 5\boldsymbol{i}$ m/s
Relative velocity of B: $\boldsymbol{V}_{rel} = 6\boldsymbol{i}$ m/s
Diameter of the disk: $\boldsymbol{R} = 0.35$m
Diameter of the slot: $\boldsymbol{r} = 0.25$m

Since the diameter of the disk and it's velocity is known, the angular velocity $\boldsymbol{\omega}$ can be calculated. This can be done by dividing the velocity by the diameter.

$$\boldsymbol{\omega} = -\frac{\boldsymbol{V}_A}{\boldsymbol{R}} = -\frac{5}{\mathbf{0.35}} \tag{2}$$

Now all the variables for equation 1 are known. Filling in all these variables into the equation results in a velocity of **14.57** m/s.