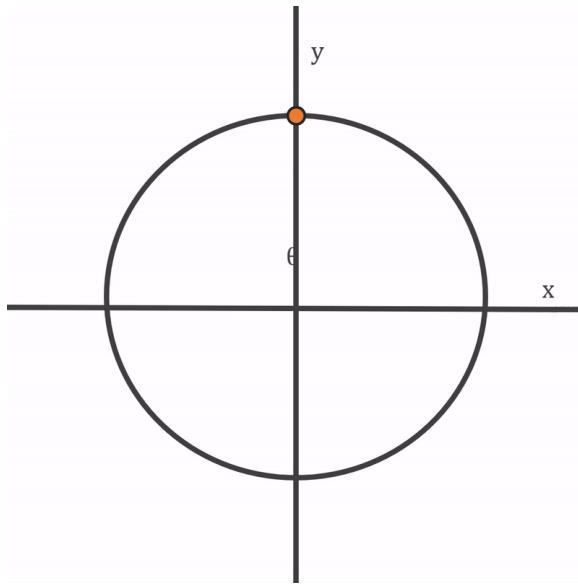


Ball in Circular Motion



Which of the following equations gives the correct relation for the velocity vector \vec{v} in cartesian coordinates for this ball following a circular motion with radius R ?

Solution:

Using the Figure, the transformation to x - and y -coordinates is the following:

$$\begin{cases} x = R \sin \theta \\ y = R \cos \theta \end{cases} \quad (1)$$

Take the first derivative of both components to get relations for the velocity and acceleration. The chain rule is applied.

$$\begin{cases} \dot{x} = R\dot{\theta} \cos \theta \\ \dot{y} = -R\dot{\theta} \sin \theta \end{cases} \quad (2)$$

Combining both components results in the velocity vector $\vec{v} = \langle \dot{x}, \dot{y} \rangle$:

$$\vec{v} = \left\langle R\dot{\theta} \cos \theta, -R\dot{\theta} \sin \theta \right\rangle \quad (3)$$