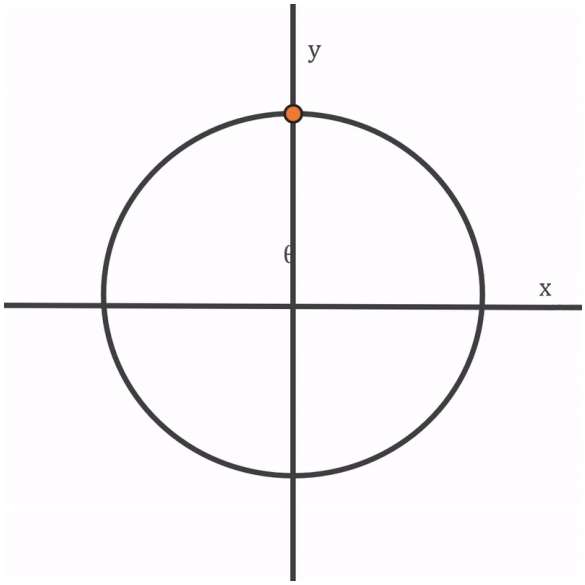
Ball in Circular Motion



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

Define x and y to be:

$$x = R \cdot \sin\theta \tag{1}$$

$$y = R \cdot \cos\theta \tag{2}$$

Take the first and second derivatives of both to get relations for the velocity and acceleration:

$$\dot{x} = R \cdot \cos\theta \cdot \dot{\theta} \tag{3}$$

$$\dot{y} = -R \cdot \sin\theta \cdot \dot{\theta} \tag{4}$$

$$\ddot{x} = R \cdot \ddot{\theta} \cdot \cos\theta - R \cdot \dot{\theta} \cdot \sin\theta \cdot \dot{\theta} \tag{5}$$

$$\ddot{y} = -R \cdot \ddot{\theta} \cdot \sin\theta - R \cdot \dot{\theta} \cdot \cos\theta \cdot \dot{\theta} \tag{6}$$

Combining both results in an acceleration vector $\vec{a} = \ddot{x} \cdot \mathbf{i} + \ddot{y} \cdot \mathbf{j}$:

$$\mathbf{a} = (R\ddot{\theta}\cos\theta - R\dot{\theta}^2\sin\theta)\mathbf{i} + (-R\ddot{\theta}\sin\theta - R\dot{\theta}^2\cos\theta)\mathbf{j} \tag{7}$$