

Topic 7 Motion in a circle

Summary

- Angles may be measured in radians (rad). One radian is the angle subtended at the centre of a circle by an arc of the circle equal in length to its radius.
- Angular speed ω is the angle swept out per unit time by a line rotating about a point.
- A particle moving along a circle of radius r with linear speed v has angular velocity ω given by $v = r\omega$.
- A resultant force acting towards the centre of the circle, called the centripetal force, is required to make an object move in a circle.
- An object moving along a circle of radius r with linear speed v and angular speed ω has an acceleration a towards the centre (the centripetal acceleration) given by $a = v^2/r = r\omega^2$.
- For an object of mass m moving along a circle of radius r with linear speed v and angular speed ω , the centripetal force F is given by $F = mv^2/r = mr\omega^2$.

Definitions and formulae

- One radian is defined as the angle subtended at the centre of a circle by an arc equal in length to the radius.
- θ (in radians) = arc distance \div radius of circle (i.e. 2π radians = 360° for 1 complete circle)
- Angular speed = $\Delta\theta/\Delta t$
- Recall and use $v = r\omega$

- Centripetal acceleration = $\frac{v^2}{r} = r\omega^2$
- A constant force acting perpendicular to the direction of motion is required for circular motion

Time period $T = \frac{2\pi}{\omega}, T = \frac{1}{f}$

centripetal force $F = \frac{mv^2}{r} = mr\omega^2$ in circular motion.