Centripetal Force and Centripetal Acceleration

An object moving in a circular path at constant speed has an instantaneous acceleration called radial or centripetal acceleration, given by:

$$a_r = \frac{v^2}{r}$$

If there is an acceleration, there is a net external force causing this acceleration (Newton's 2nd Law), called the centripetal force

$$\vec{F}_c = \sum \vec{F}_r = m\vec{a}_r$$

$$F_c = m\frac{v^2}{r}$$

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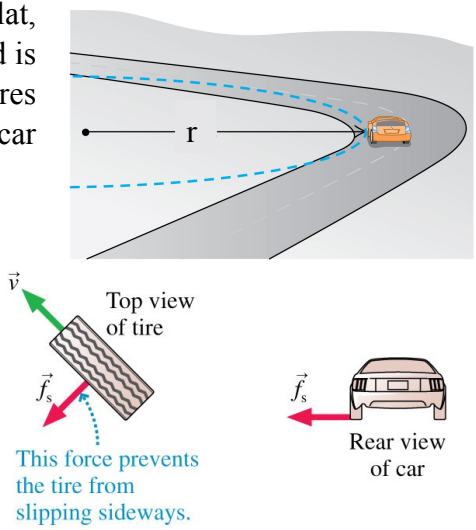
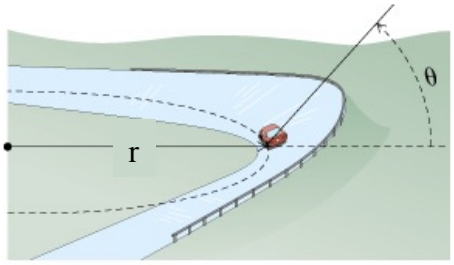
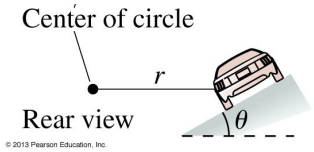
1. **Curves on Flat Road:** A car takes a bend on a flat, horizontal road at constant speed. If the radius of the bend is 30 m and the coefficient of static friction between the tires and dry pavement is 0.5, what maximum speed can the car safely have?



2. **Curves on Banked Road:** A highway curve of radius 70 m is banked at a 15° angle. At what speed v0 can a car take this curve without assistance from friction?





3. **Loop-the-Loop:** A roller coaster does a loop-the-loop. Find the slowest speed at which the car can complete the circle.