revisely

Circular motion

Formulae

Angular speed, $\omega = \frac{\theta}{t} = 2\pi f$ unit: rad s-1

Linear velocity, $v = \frac{2\pi r}{T} = 2\pi f r = r\omega$

Magnitude of centripetal acceleration is given by $a = \frac{v^2}{r}$

Using $F = ma,\ F = \frac{mv^2}{r} = mr\omega^2$

Humpback bridge and "looping the loop"

To keep a string taut, the magnitude of the centripetal force must be greater than or equal to the weight.

$mv^2 \geq mg$ or alternatively $mr\omega^2 \geq mg$

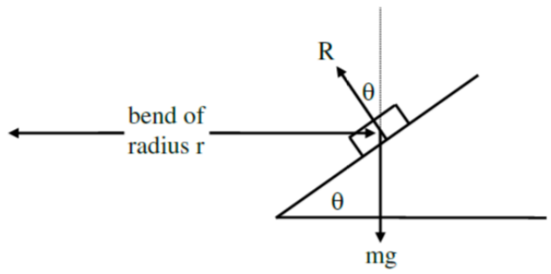
Tension in the string at the top $= \frac{mv^2}{r} - mg$

Tension in the string at the bottom $= \frac{mv^2}{r} + mg$

Keeping a car on a humpback bridge requires weight to equal the centripetal force (i.e. $mg \geq \frac{mv^2}{r}$)

Support force from the road $= mg - \frac{mv^2}{r}$

Motion around a banked track



Motion around a banked track

The vertical component is weight: mg = R cos θ

The horizontal component is centripetal force: F = $\frac{mv^2}{r} = Rsin\theta$

For there to be no sideways friction: $v = \sqrt{gr\ tan\theta}$