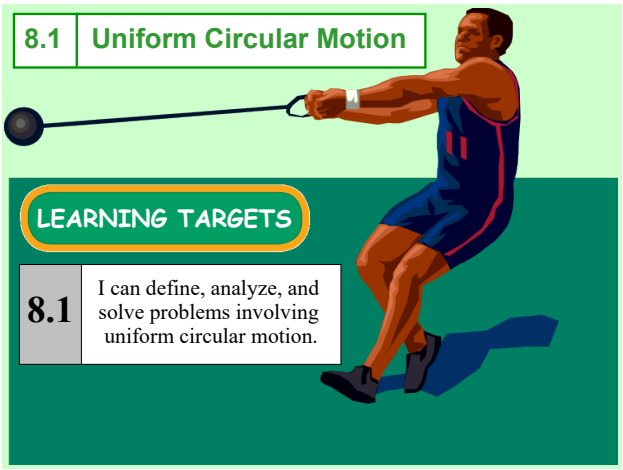


WARM UP

A new favorite ride at the fair is Speed. The ride is a 37 meter arm, connected midway to the main support of the ride. Two sets of two seats are mounted at the end of each arm, back to back. The arm rotates at up to 13 revolutions per minute.

1. What is the frequency of the ride in hertz?
2. What is the period of rotation for the riders?
3. What is the linear speed of the riders?

Uniform Circular Motion

- An object that moves in a circle at a constant speed is said to experience **uniform circular motion.**
- Circular motion is often described in terms of the **frequency,** f, the number of revolutions per second.
- The **period,** T, of an object revolving in a circle is the time required for one complete revolution.

$$T = \frac{1}{f} \quad \text{and} \quad f = \frac{1}{T}$$

$$\text{speed} = \frac{2\pi(\text{radius})}{\text{period}} \quad \text{or} \quad v = \frac{2\pi r}{T}$$

WARM UP

A new favorite ride at the fair is Speed. The ride is a 37 meter arm, connected midway to the main support of the ride. Two sets of two seats are mounted at the end of each arm, back to back. The arm rotates at up to 13 revolutions per minute.

1. What is the frequency of the ride in hertz?

$f = \frac{13\ \text{rev}}{\text{min}} \times \frac{1\ \text{min}}{60\ \text{s}} = 0.22\ \text{Hz}$

2. What is the period of rotation for the riders?

$T = \frac{1}{f} = \frac{1}{0.22} = 4.6\ \text{s}$

3. What is the linear speed of the riders?

$v = \frac{2\pi r}{T} = 25\ \text{m/s}$

Centripetal Acceleration

The center-seeking acceleration of an object moving in a circle at a constant speed.

Centripetal Acceleration = $a_c = \frac{v^2}{r}$

(v = linear velocity, r = radius of circle)

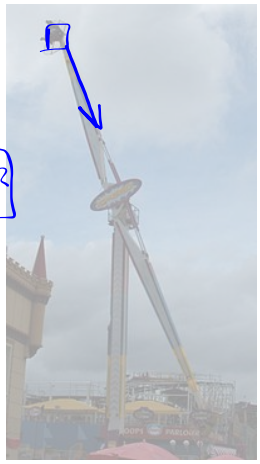
* Always points to the center of the circle.

SPEED

a) What is the acceleration of a person on the Speed ride when it is rotating at top speed?

$a_c = \frac{v^2}{r} = \frac{(25\ \text{m/s})^2}{18.5\ \text{m}} = 34\ \text{m/s}^2$

b) What force causes that acceleration? (Draw a free-body diagram)



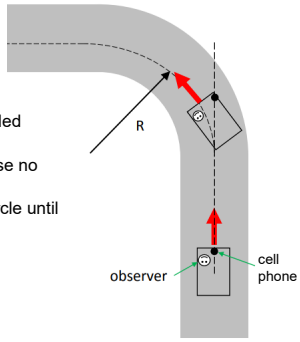
CENTRIPETAL FORCE
The inward force necessary to maintain uniform circular motion is defined as centripetal force.
From Newton's Second Law, the centripetal force is given by:

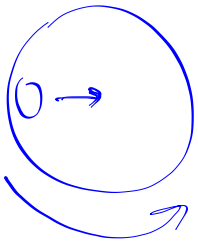
$$F_c = ma_c$$

$$F_c = \frac{mv^2}{r}$$

Centrifugal vs. Centripetal

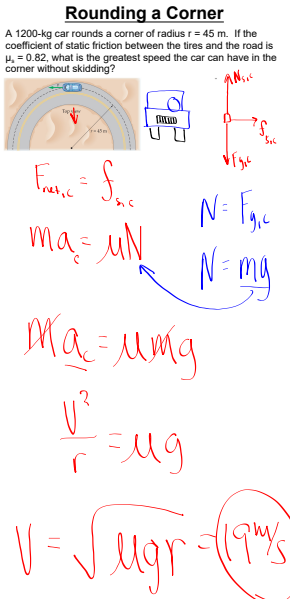
- The cell phone will only stay on the roof if there is enough friction to keep it in place.
- Otherwise it will keep going in a straight line.
- The phone will appear to be pulled outward by "centrifugal" force.
- This is not a REAL force because no force actually pulls it outward.
- The phone will not move in a circle until a something forces is to.





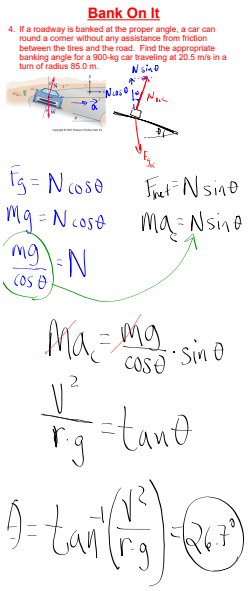
Rounding a Corner

A 1200-kg car rounds a corner of radius r = 45 m. If the coefficient of static friction between the tires and the road is μ_s = 0.82, what is the greatest speed the car can have in the corner without skidding?



Bank On It

4. If a roadway is banked at the proper angle, a car can round a corner without any assistance from friction between the tires and the road. Find the appropriate banking angle for a 900-kg car traveling at 20.5 m/s in a turn of radius 85.0 m.



BOBSLED, LUGE, SKELETON

PRACTICE

UNIT 8 PROBLEMS (1-5)