PHYS 1443 – Section 003
Lecture #17

Wednesday, Oct. 27, 2004
Dr. Jaehoon Yu

1. Fundamentals on Rotational Motion
2. Rotational Kinematics
3. Relationship between angular and linear quantities
4. Rolling Motion of a Rigid Body
5. Torque

2nd Term Exam Monday, Nov. 1!! Covers CH 6 – 10.5!!

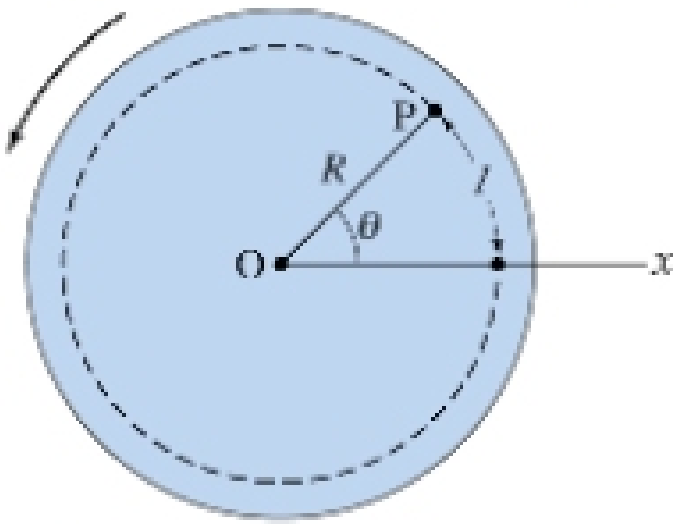
No homework today!!

Fundamentals on Rotation

Linear motions can be described as the motion of the center of mass with all the mass of the object concentrated on it.

Is this still true for rotational motions?

No, because different parts of the object have different linear velocities and accelerations.



Consider a motion of a rigid body – an object that does not change its shape – rotating about the axis protruding out of the slide.

The arc length, or sergita, is $l = R\theta$

Therefore the angle, θ, is $\theta = \frac{l}{R}$.

And the unit of the angle is in radian. It is dimensionless!!

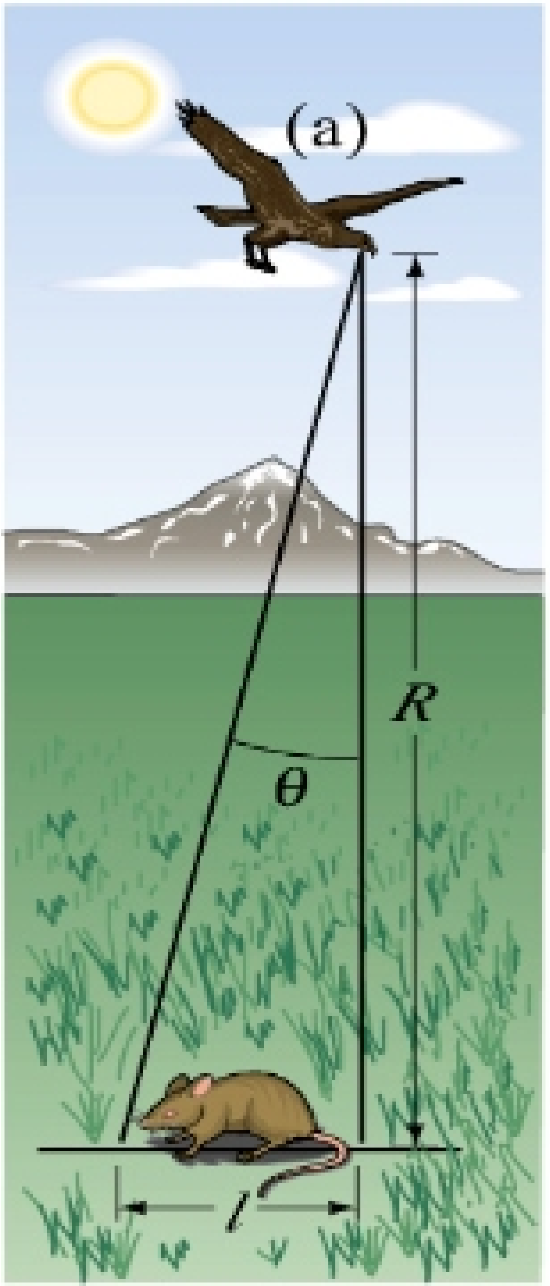
One radian is the angle swept by an arc length equal to the radius of the arc.

Since the circumference of a circle is 2πr, $360^\circ = 2\pi r / r = 2\pi$

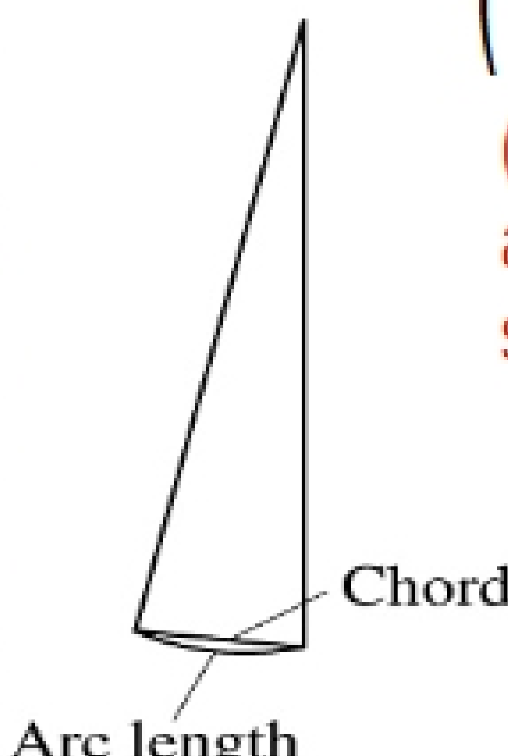
The relationship between radian and degrees is $1\,\text{rad} = 360^\circ / 2\pi = 180^\circ / \pi \cong 180^\circ / 3.14 \cong 57.3^\circ$

Example 10 – 1

A particular bird's eyes can barely distinguish objects that subtend an angle no smaller than about $3\text{x}10^{-4}$ rad. (a) How many degrees is this? (b) How small an object can the bird just distinguish when flying at a height of 100m?



(b)



(a) One radian is 360°/2π. Thus

$$3\times10^{-4}\,rad = \left(3\times10^{-4}\,rad\right)\cdot\left(360^\circ/2\pi\,rad\right) = 0.017^\circ$$

(b) Since l=rθ and for small angle arc length is approximately the same as the chord length.

$$l = r\theta = 100m\cdot3\times10^{-4}\,rad = 3\times10^{-2}\,m = 3cm$$