Radians and angular speed

In many physical situations you are concerned with the motion of objects moving in a circle, such as planets in orbit around the Sun or more mundane examples like wheels turning on a bicycle or washing drying in a spin drier. The measurement of speed can be expressed in several different ways; the following questions are designed to help you become confident in their use.

**Rotation**

Since a radian is the angle between two radii with an arc length equal to the radius, there are 2 radians in one complete circle.

1. Use a calculator to complete the table of  in degrees and radians, sin  cos  and tan  when  has values in degrees shown in the table:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  degree |  in radians | sin  | cos  | tan  |
| 0.01 |  |  |  |  |
| 0.1 |  |  |  |  |
| 0.5 |  |  |  |  |
| 1 |  |  |  |  |
| 5 |  |  |  |  |
| 10 |  |  |  |  |
| 20 |  |  |  |  |
| 70 |  |  |  |  |

When  (in radians) is small what are suitable approximations for:

sin , tan , cos ?

The set of questions below consider a simple example of an object moving in a circle at constant speed.

2. Work to two significant figures. Write down the angle in radians if the object moves in one complete circle, and then deduce the number of radians in a right angle.

3. The object rotates at 15 revolutions per minute. Calculate the angular speed in radian per second.

4. A rotating restaurant.

A high tower has a rotating restaurant that moves slowly round in a circle while the diners are eating. The restaurant is designed to give a full 360 view of the sky line in the two hours normally taken by diners.

Calculate the angular speed in radians per second.

5. The diners are sitting at 20 m from the central axis of the tower.

Calculate their speed in metres per second.

Do you think they will be aware of their movement relative to the outside?