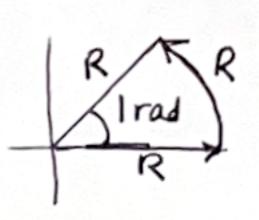
Angular Position and Velocity



1. What is the definition of a radian? (see p.93)
$$\Theta = \underbrace{arc \ length}_{radius} = \underbrace{s}_{radius}$$



2. The tip of the second hand moves in a circular path of radius 4.0 cm. (a) When the tip has moved a distance of 4.0 cm along its circular path, what angle has it moved through in radians? (b) What

about when the tip has moved a distance of 8.0 cm along its circular path?

a)
$$\Delta\Theta = \frac{\Delta S}{r} = \frac{4.0 \text{ cm}}{1 \text{ rad}!} = \frac{8 \text{ cm}}{1 \text{ rad}!} = \frac{2 \text{ rad}}{1 \text{ rad}!}$$

3. The magnitude of the radial acceleration is $a_r = v^2/r$ in terms of an object's tangential speed and the radius of its circular path. Show that in terms of an object's angular speed, the magnitude of the $a_r = \frac{V^2}{r} = (\omega r)^2 = \omega^2 r^2 = \omega^2 r$ radial acceleration is $a_r = \omega^2 r$.

- 4. The blade of a certain blender rotates at 3000 rpm in the clockwise direction on low speed. The diameter of the blade is 4.0 cm.
- a) What is the angular velocity of the blade in rad/s? What is it in degrees/s?

$$|\omega| = \frac{2\pi}{T} = \frac{2\pi}{0.02s} = \frac{100\pi \, rad/s}{100\pi \, rad/s} = \frac{314 \, rad/s}{100\pi \, rad/s}$$

So it makes 3000 rev/60s = 50 rev in I second,

$$\omega = \frac{360^{\circ}}{7} = \frac{-360^{\circ}}{0.025} = \frac{-18000^{\circ}}{18000^{\circ}}$$

c) What is the blade's angular position at t = 3.0 minutes if its initial position was \circ radians? ω=40 -x60s= 180s

d) How many complete revolutions did the blade make during the 3.0 minutes?

e) Where is the blade located between 0° and 360° at the end of the 3.0 minutes?

It made 0.44 of the last revolution

- But it is going CW, So it is at -1580 or + 202°.
- f) What is the tangential speed of a speck of soup on the tip of the blade?

$$V = Wr$$

= $(-314 \text{ rod/s})(0.02\text{ m})$
= -6.28m/s
Speed is 6.28m/s

