

Problem 10.1

NOTE: This is a great chapter for review. Pretty much everything you have learned for translational motion will be revisited in rotational form. You are about to double (plus some) the volume of information you know!

a.) Determine the angular speed of the Earth about its axis.

Preliminarily, the parameter we call *speed* tells us the number of meters and object moves *per unit time*. The parameter *angular speed* (symbol " ω ") tells us the number of *radians* through which an object rotates *per unit time*.

This problem is actually a *dimensional analysis* problem (that is, a seat-of-the-pants approach in which you start with the *units* of quantities you know, like the fact that the earth rotates through 2π radians every 24 hours (units *radians/hour*), and you multiply that by quantities whose units ultimately cancel out everything except the units of the quantity you are trying to determine). This will make more sense if you just look at what I've done on the next page.

1.)

The angular speed of the earth about its axis:

$$\begin{aligned}\omega(\text{radians/second}) &= \left(\frac{2\pi \text{ radians}}{1 \text{ day}} \right) \left(\frac{1 \text{ hour}}{3600 \text{ sec}} \right) \left(\frac{1 \text{ day}}{24 \text{ hours}} \right) \\ &= 7.27 \times 10^{-5} \text{ rad/sec}\end{aligned}$$

b.) How does this rotation affect the shape of the earth?

This angular speed makes the earth bulge at its equator.

2.)