**Astronomy 103H: Mathematical Skills Handout #1**

*(Distance equals rates times time)*

**Problem #1:** The earth rotates once a day and has a radius of 6378 km. With what speed is the equator moving eastward in km/sec? In miles/hour?

Solution: This problem uses the equation \( d \text{ (distance)} = r \text{ (rate)} \times t \text{ (time)} \) where the distance is the circumference of the earth and the time is one day. Let’s first figure out the number of seconds in one day.

\[
1 \text{ day} = (1 \text{ day}) \left( \frac{24 \text{ hr}}{1 \text{ day}} \right) \left( \frac{60 \text{ min}}{1 \text{ hr}} \right) \left( \frac{60 \text{ sec}}{1 \text{ min}} \right) = 86,400 \text{ sec}
\]

Solving for rate yields:

\[
r = \frac{d}{t} = \frac{2\pi r}{t} = \frac{(2)(3.1416)(6378 \text{ km})}{(86,400 \text{ sec})} = 0.46 \text{ km/sec}
\]

We can now convert this to mi/hr.

\[
0.46 \text{ km/sec} = 0.46 \text{ km/sec} \left( \frac{1 \text{ mi}}{1.609 \text{ km}} \right) \left( \frac{3600 \text{ sec}}{1 \text{ hr}} \right) = 1029 \text{ mi/hr}
\]

**Problem #2:** How long does it take sunlight to reach the Earth?

Solution:
- We call the Earth’s average distance from the sun an astronomical unit and 1 AU is equal to \( 1.5 \times 10^{11} \text{ m} \).
- Light moves through the vacuum of space with a speed of: \( c = 3.0 \times 10^8 \text{ m/s} \)

\[
t = \frac{d}{r} = \left( \frac{1.5\times10^{11} \text{ m}}{3.0\times10^8 \text{ m/s}} \right) = 500 \text{ s} \left( \frac{1 \text{ min}}{60 \text{ s}} \right) = 8.3 \text{ min}
\]

**Problem #3:** What is the velocity that the Earth has due to its revolution around the sun in km/s?

Your Solution: