

# MATH FOR PHYSICS

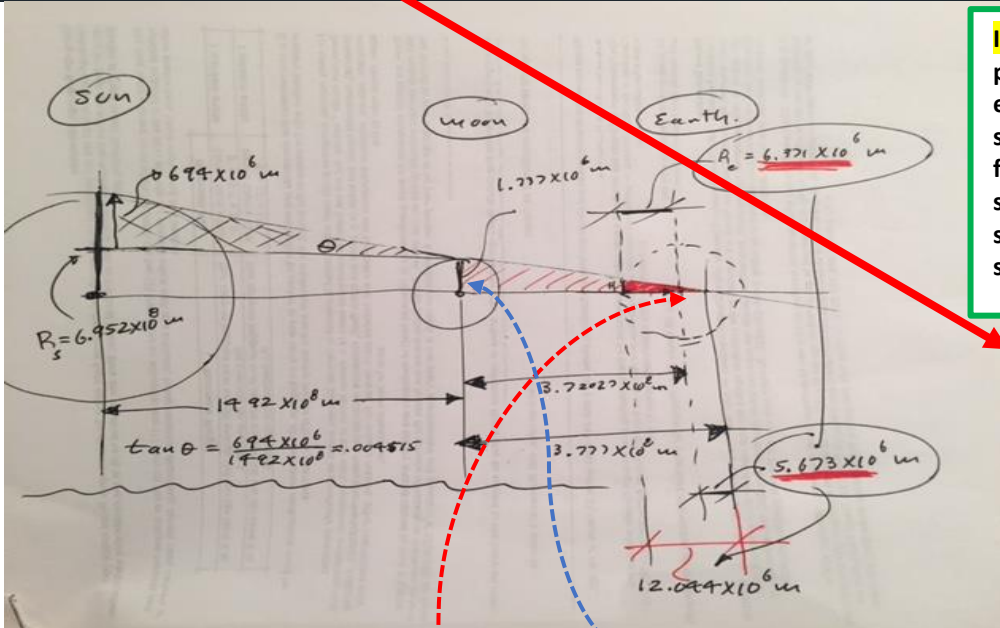
Unit 1 & 2 Dr. John P. Cise, Professor of Physics, Austin

Com. College, Austin Texas, [jpcise@austincc.edu](mailto:jpcise@austincc.edu) & New York Times August 20, 2017 , Dedicated to Galileo Galilee



## How to Watch a Solar Eclips

On Aug. 21, at midday, people who live in, or have ventured to, a band about **70 miles wide** arcing from Oregon to South Carolina will get to see the moon pass directly in front of the sun. For a minute or two day will turn to night. If you are one of the lucky people who will get to see this total eclipse live and in-person, make sure you take advantage. But you will still see a partial eclipse if you are anywhere in North America.



**INTRODUCTION:** This application purpose is using ratios you can find eclipse width (~ 70 miles) on earth's surface. Read NASA article below first. Three triangles at left are similar: Sun-moon, moon-vertex shadow in earth, earth surface -vertex shadow in earth. Continued below.



We can calculate the radius of moon shadow on the Earth's surface over North America from the radius of the moon (1737 km) and by invoking a simple proportion:

**INTRODUCTION CON.:** Thus, as NASA states (at left) we can set up ratios for the two triangles on the right. **Lunar radius/shadow of cone length = H(shadow height on earth)/ distance from earth surface to vertex of shadow cone.**

**QUESTION:** (a) Confirm calculations? (b) Convert diameter to miles ?, (c) How well does calculations compare to stated width of surface eclipse of 70 miles?

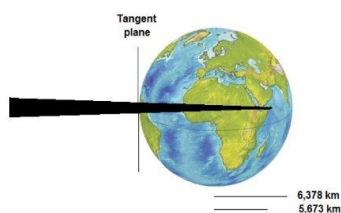
**HINTS:** 0.62 miles/ km

**ANSWERS:** (a) same (-: , (b) D = 68.2 miles , (c) 68.2 miles is very close to stated 70 mile width of eclipse shadow

[eclipse2017.nasa.gov](https://eclipse2017.nasa.gov)

### Lunar Shadow Size on Earth's Surface

The center-to-center distance between Earth and moon is 372,027 kilometers, and the distance of the vertex of the shadow cone from the center of the moon is 377,700 km. That means that the vertex lies below the daytime surface of Earth and stretches 377,700 - 372,027 = 5673 km beyond the center of Earth. It is also 705 km below the surface of Earth diametrically opposite the daytime position of totality.



$$\frac{\text{Lunar radius}}{\text{Shadow cone length}} = \frac{H}{(\text{cone length-earthmoon distance}) + \text{earth radius}}$$

$$H = \frac{(5673+6378) 1737}{377,700} = 55 \text{ km radius or } 110 \text{ km diameter}$$

A detailed calculation at the Greatest Eclipse location near Carbondale, Illinois gives a diameter of about 114 km diameter.