

# KINEMATICS & MATH FOR PHYSICS

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## Why Is the Eclipse Longer in Some Places Than in Others?



**NOTE:** Distances in sketch below are NASA data from their eclipse 2017 site.

**INTRODUCTION:** Application goals:(1) Find size of eclipse shadow diameter on earth,(2) Vertex Triangle ABC is similar to triangle DEC below.

**QUESTIONS:** (a) Convert 2 min. 41 sec. to hrs.?, (b) Find eclipse shadow diameter DE in miles?, (c) **Show ratio  $[AB/\text{moon-C}] \approx [DE/\text{earth surface -C}]$**

**HINTS:** 60 s./min. , 60 min./hr.,  $X = v t$

**ANSWERS:** (a)  $t = 0.044722$  hrs., (b)  $x = \text{diameter} = \sim 65.38$  mi., (c)  $\sim 5.716 \times 10^{-6}$  mi./m.  $\sim \sim 5.428 \times 10^{-6}$  mi./m. ....ratios are within 5% close.

**COMMENT:** DE(shadow diameter) actually averages 68.5 mi. When 68.5 mi. used for DE, the ratio  $[DE/\text{earth surface to C}] \approx 5.7 \times 10^{-6}$  ....close to  $[AB/\text{moon to C}]$

A sign in Makanda, Ill., promoting the town as the “Solar Eclipse Crossroads of America.” Makanda will have the distinction of experiencing totality for nearly three minutes, longer than anywhere else in the United States. The village of Makanda, Ill., is about to experience nearly three minutes of fame. **That’s roughly the amount of time the moon will completely block the sun on Aug. 21 in this small community in southern Illinois** — the longest duration of totality anywhere in the United States during the solar eclipse, according to NASA. The total solar eclipse is expected to start around 10:16 a.m. in Oregon and move diagonally across the country until it ends in South Carolina around 2:48 p.m. (The times are local.) **The duration of totality, the period during which the moon completely covers the sun, varies by location.**



The difference has to do with the geometry of the Earth and its distance from the moon, said Ernie Wright, a data visualizer at NASA. Totality will be shorter in Oregon because that part of the Earth is tilted away from the moon and farther from it.

The moon’s shadow also will move more quickly across Oregon, compared with the middle of the country. “When it hits the edge of the Earth, it has to swoop around the whole curve, so it moves quite a bit faster,” Mr. Wright said.

Eclipse calculators predict the moon’s shadow will move about 2,410 miles per hour in western Oregon, **1,462 m.p.h. in**

**western Kentucky**=(v) and 1,502 m.p.h. near Charleston, S.C. Totality is longest where the Earth is farthest from

the sun and closest to the moon. During this solar eclipse, that period will occur above Makanda, which will go dark **for**

**two minutes and 41 seconds** =(t).

