The moon’s orbit is tilted 5 degrees to the Earth’s orbital plane. Lunar and solar eclipses can happen only when the moon is between the sun and the Earth at one of its orbital “nodes”.
As the Moon crosses this elliptical path around the Earth each month, its distance away from the Earth varies by more than 10%, between 226,875 miles and 253,125 miles.
Perigee

2010-01-30
356,790 km
34.06 arc-mins
Altitude @ 68.82°

Apogee

2010-08-25
406,357 km
29.74 arc-mins
Altitude @ 44.87°
**SAROS!**

- **Synodic Month (New Moon to New Moon)** = 29.530589 days = 29d 12h 44m 03s
- **Anomalistic Month (perigee to perigee)** = 27.554550 days = 27d 13h 18m 33s
- **Draconic Month (node to node)** = 27.212221 days = 27d 05h 05m 36s

One Saros = 223 synodic months, 239 anomalistic months, and 242 draconic months.

- **223 Synodic Months** = 6585.3223 days = 6585d 07h 43m
- **239 Anomalistic Months** = 6585.5375 days = 6585d 12h 54m
- **242 Draconic Months** = 6585.3575 days = 6585d 08h 35m

With a period of approximately 6,585.32 days (~18 years 11 days 8 hours), the Saros is a valuable tool in investigating the periodicity and recurrence of eclipses. It was first known to the Chaldeans as an interval when lunar eclipses repeat, but the Saros is applicable to solar eclipses as well.
SAROS CYCLE

Saros 136

Orthographic projection centered at 20° North, 110° East.

Orthographic projection centered at 20° North, 140° East.

Orthographic projection centered at 20° North, 90° West.

Each eclipse path shifts 1.2° west of the previous one.
CALCULATE THE MASS OF THE EARTH!

\[ T^2 = \frac{4\pi^2}{GM} r^3 \]

You will need to solve this equation for \( M \), by putting it by itself on one side of the equation (hint: just interchange \( M \) and \( T^2 \)).

Then, plug in the numbers and see how close you come...

\( M \) = the mass of the Earth in kg (this is what you are solving for)
\( r \) = distance between the centers of the Earth and moon (m) = 384,403,000m = 3.84 x 10^8 m
\( T \) is the time it takes the moon to go around the Earth = sidereal lunar month = 27.32 days
\( G \) is the Universal Gravitational Constant (6.672 x 10^{-11} \text{ Nm}^2/\text{kg}^2) and \( \pi \) is 3.14.

** Make sure to convert time into units of seconds!
TOTAL SOLAR ECLIPSE, MARCH 8th, 2016
<table>
<thead>
<tr>
<th>No</th>
<th>Location</th>
<th>Duration</th>
<th>Remarks</th>
<th>Island</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Muko - muko, Bengkulu</td>
<td>1m57.2s</td>
<td>West coast</td>
<td>Sumatra</td>
</tr>
<tr>
<td>2</td>
<td>Palembang</td>
<td>1m48.9s</td>
<td>inland</td>
<td>Sumatra</td>
</tr>
<tr>
<td>3</td>
<td>Bangka</td>
<td>2m09.6s</td>
<td>East coast</td>
<td>Bangka</td>
</tr>
<tr>
<td>3</td>
<td>Belitung</td>
<td>2m13.5s</td>
<td>East coast</td>
<td>Belitung</td>
</tr>
<tr>
<td>2</td>
<td>Sampit, Central Kalimantan</td>
<td>2m29.8s</td>
<td>Inland</td>
<td>Kalimantan</td>
</tr>
<tr>
<td>3</td>
<td>Tanahgrogot, East Kalimantan</td>
<td>2m37.4s</td>
<td>Inland</td>
<td>Kalimantan</td>
</tr>
<tr>
<td>4</td>
<td>Pasang Kayu, West Sulawesi</td>
<td>2m48.0s</td>
<td>West coast</td>
<td>Sulawesi</td>
</tr>
<tr>
<td>5</td>
<td>Kalora, Poso</td>
<td>2m52.2s</td>
<td>East coast</td>
<td>Sulawesi</td>
</tr>
<tr>
<td>6</td>
<td>Ampana Tete, Central Sulawesi</td>
<td>2m56.2s</td>
<td>North coast</td>
<td>Sulawesi</td>
</tr>
<tr>
<td>7</td>
<td>Pagimana, Central Sulawesi</td>
<td>2m59.3s</td>
<td>North coast</td>
<td>Sulawesi</td>
</tr>
<tr>
<td>8</td>
<td>Ternate</td>
<td>2m40.5s</td>
<td>East coast</td>
<td>Ternate</td>
</tr>
<tr>
<td>9</td>
<td>Maba, East Halmahera</td>
<td>3m19.8s</td>
<td>East coast</td>
<td>Halmahera</td>
</tr>
</tbody>
</table>
TRANSIT OF MERCURY
May 9, 2016
Eclipse 2017 Will Touch over 500 Million People
ECLIPSE RESOURCES

Stellarium  www.stellarium.org

Eyes on the Solar System  eyes.nasa.gov