

# Basic Geodesy

Issue 2

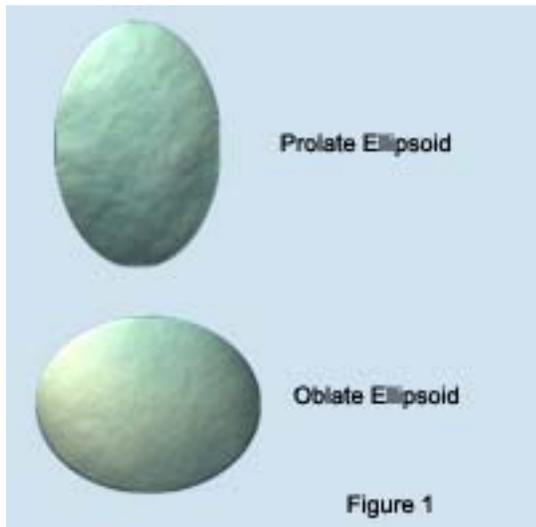
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## Shape of the Earth – An Ellipsoid

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As discussed in Issue 1 of the Basic Geodesy newsletter, around 250 BC, Eratosthenes and other scholars began to realize the earth was not flat. From measurements and observations, they concluded the earth is a sphere.

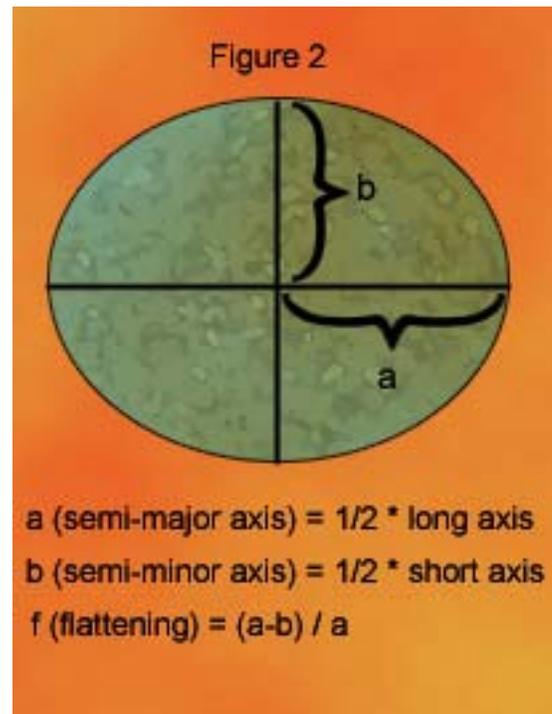
Sir Isaac Newton theorized the earth's shape should be an oblate ellipsoid (bulges at the equator) due to centrifugal force on a spinning body. (See figure 1 for a comparison of a prolate versus an oblate ellipsoid.)



Newton's theory was supported by the fact that the pendulums used on ship's clocks traveling north or south of the latitude of the homeport would have time differences from the land-based harbor clock. This is due to the fact, in general, the gravitational force is stronger in polar regions than the equator. Surveys of one degree of latitudinal arc near the equator covered less ground distance than a same sized survey

completed in areas nearer to the poles.

Once enough measurements were taken and it was agreed that an oblate ellipsoid is the best mathematical model that could be generated for the earth's shape, the parameters could be generated for the ellipsoid. (See Figure 2.) Any one of the three parameters (a, b, f) can be determined as long as two of the three parameters are known. The actual earth shape is irregular, but an ellipsoid is a very good approximation of the true shape of the earth. Also, the flattening of the earth is small and is exaggerated in the diagrams. (The difference between the semi-major axis (a) and the semi-minor axis (b) is only 22 kilometers.)



## Earth-Centered vs. Non-Earth Centered Ellipsoids

In a future article, the differences in ellipsoids will be discussed along with the earth-centered vs. non-earth centered ellipsoids.