



Curriculum Units by Fellows of the Yale-New Haven Teachers Institute  
2007 Volume III: The Physics, Astronomy and Mathematics of the Solar System

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## **The Mathematical Dynamics of Celestial Navigation and Astronavigation**

Guide for Curriculum Unit 07.03.09  
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This unit introduces and integrates astronomy as a study subject relative to the math curriculum for high school grade levels within the New Haven Public School system. Specific goals and objectives are cited that will enable students to respond to a series of sequential assignments, culminating in one or more definitions of astronavigation and the mathematical dynamics in astronomy that are navigation-implicit. Astronomical reference points have prevailed as universal reference points for position-fixing derived with a variety of mathematical methods to determine the position of a ship, aircraft or person on the surface of the Earth until quite recently, with the advent of inexpensive and highly accurate satellite navigation receivers or GPS. The Algebra, Calculus, Geometry, and Trigonometry processes of Astronavigation are the subject of this presentation of math curriculum.

The first curriculum unit lesson plan constructs a sextant with which the other curriculum unit lesson plans are completed. The other curriculum lesson plans address one of three well known methods for calculating a navigator's position on earth using the astronomical references of celestial navigation: the Intercept Method, or Marc St. Hilaire Method; the Longitude by Chronometer Method; and the Ex-Meridian Method. Each of these three methods demonstrates the four New Haven math curricula: Algebra, Calculus, Geometry, or Trigonometry.

These lesson plans assist teaching navigational mathematics in the classroom with the astronomical content from the "Frontiers of Astronomy" seminar, referencing common celestial objects: the Sun; Moon; other planets; and 57 "navigational stars" described in nautical almanacs. The unit identifies goals, objectives, vocabulary, and assessments.

(Developed for Geometry, grade 10; recommended for Algebra, Calculus, Geometry, and Trigonometry, grades 9-12)

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