



MaTh & the CoSMoS™

A Cross-Curricular Course for Middle and High School

USER'S GUIDE



Division of Wildridge Software, Inc.

Math & the Cosmos™

Subjects Covered: Mathematics, Astronomy, Physics, Literature and History

Overview

Math & the Cosmos is one multimedia course of a thematic cross-disciplinary Middle and High School curriculum series, *A Bigger World™*. In the *Math & the Cosmos* program, students study **Astronomy** and its connections to **Mathematics, Physics, History and Mythology**. Students learn about constellations, graphing star charts, planetary motion, parallax, the motion of the sun, Newton's Laws, and more! Learn real world applications of such math fundamentals as graphing, angles, trigonometry, and scientific notation. Explore the connections to Greek literature.

Math & the Cosmos combines a **Textbook, Student Guide, and Teacher's Guide** with **Interactive, Multimedia Lessons**. As students study each section in the textbook, the multimedia lessons help them understand and apply the information being learned.

- **Single Version:** The Administrative Tool allows you to view, edit and print individual student progress reports, and keep track of scores.
- **Network Version:** This version has expanded features intended for Multiple Teachers and Classes using the program in a Network Environment. Up to five teachers can have the same student on a class list. Each list can hold an Unlimited Number of Students.

A Typical Assignment Consists of:

- A Chapter Reading in the Textbook
- Project or Problems within the Chapter Reading
- Study Questions and Vocabulary based on the reading and found in the Student Guide
- An associated Multimedia Lesson and Quiz accessed through the main menu of the Math & the Cosmos program
- An Internet or Written Lesson
- Final Challenge (50 questions)

Ages: Middle School and High School

Availability: Microsoft® Windows® 95/98/2000/ME/XP/NT and network version

Purchase

Options: Single version
Lab pack – 5
Lab pack –10
Network

Volume pricing available — Associated Textbook and Guides can be printed from the program or purchased separately

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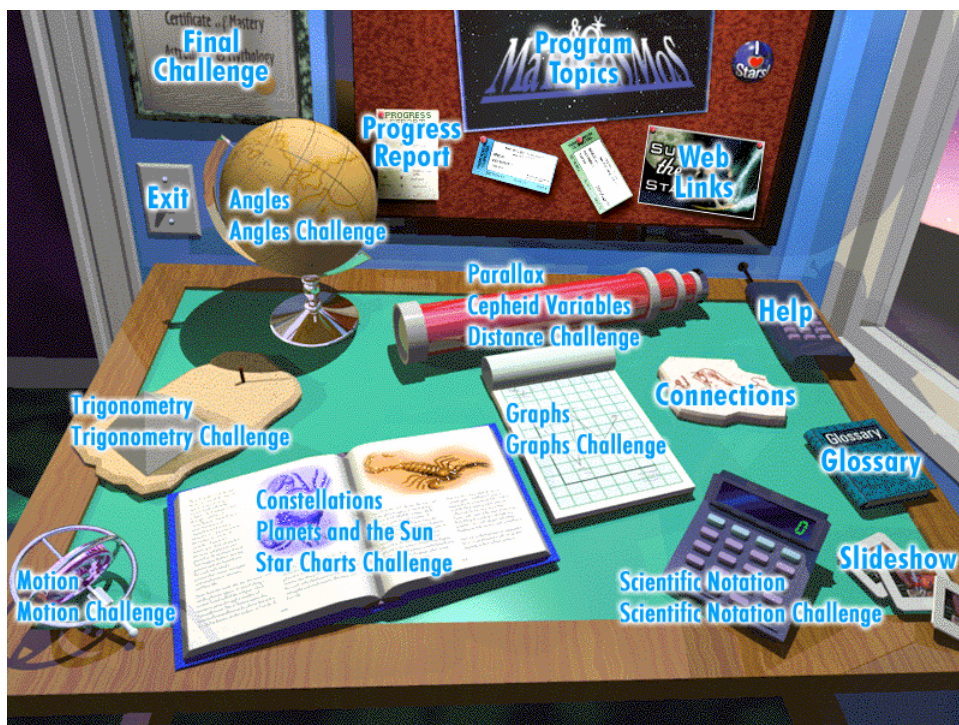
Associated Print Components

- **Textbook** — The reading material upon which the investigation of *Math & the Cosmos* is based. The textbook is divided into several sections. In the left-hand margin are directions explaining which multimedia lessons to do.
- **Student Guide** — containing general instructions and information about *Math & the Cosmos*; an assignment checklist, vocabulary, study questions, project worksheets, and helpful tables.
- **Teacher Guide** — containing general instructions and information about *Math & the Cosmos*; learning objectives, answers for study questions, and problems in textbook.

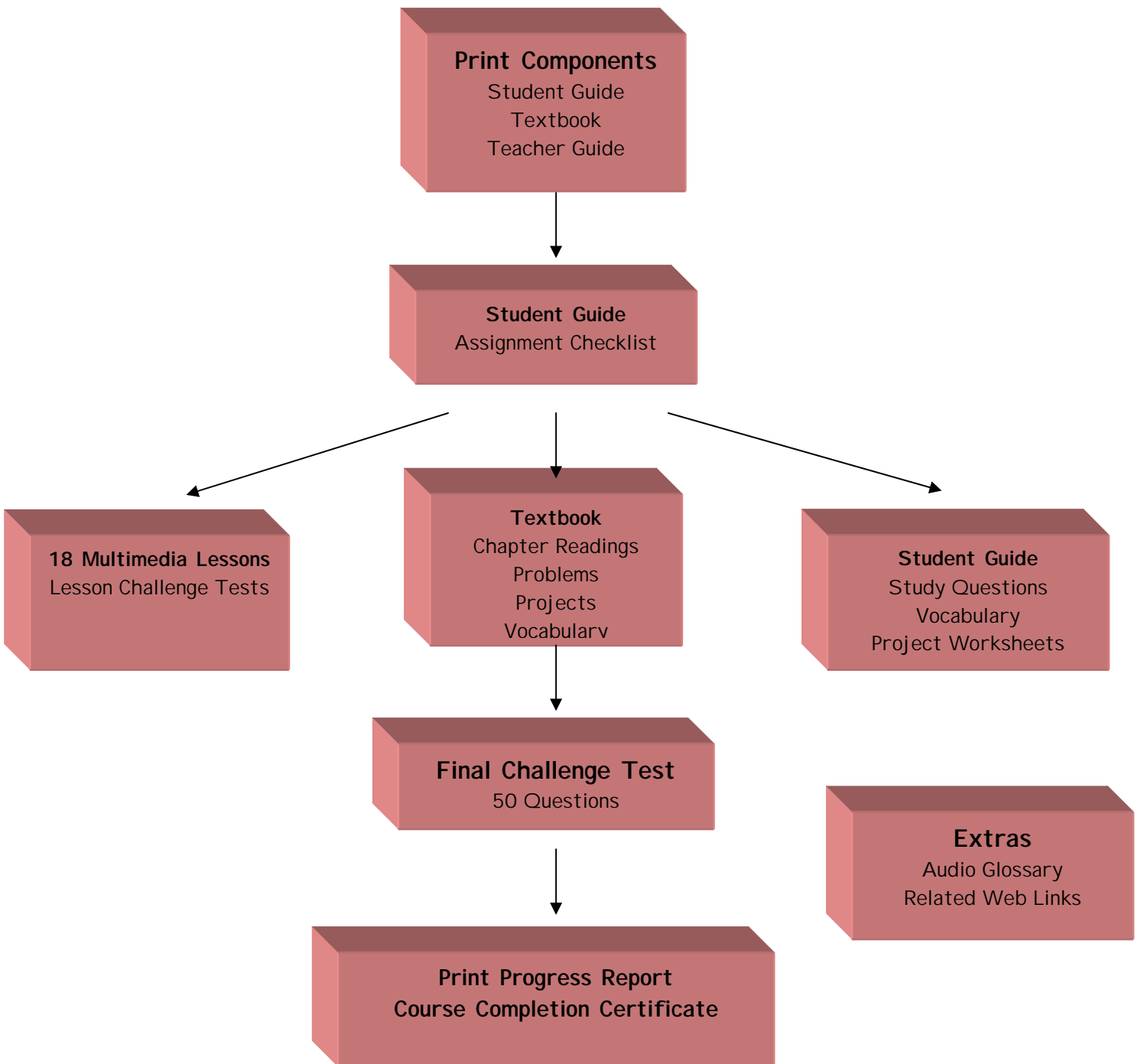
Multimedia Components

The multimedia exercises and tools are the other major component of *Math & the Cosmos*. Nine exercises, seven challenge tests, an audio glossary, and a final challenge test are included on the CD-ROM. The main menu is a picture of a study with a variety of objects in it (see below).

Clicking the objects in the room will take the student to the menu for a particular topic or s/he can access all of the multimedia exercises through the Program Topics icon on the poster on the bulletin board. Each of the multimedia lessons will help students investigate the Math & the Cosmos topics that are presented in the textbook. *(For a complete description of multimedia topics please refer to the end of this guide.)*

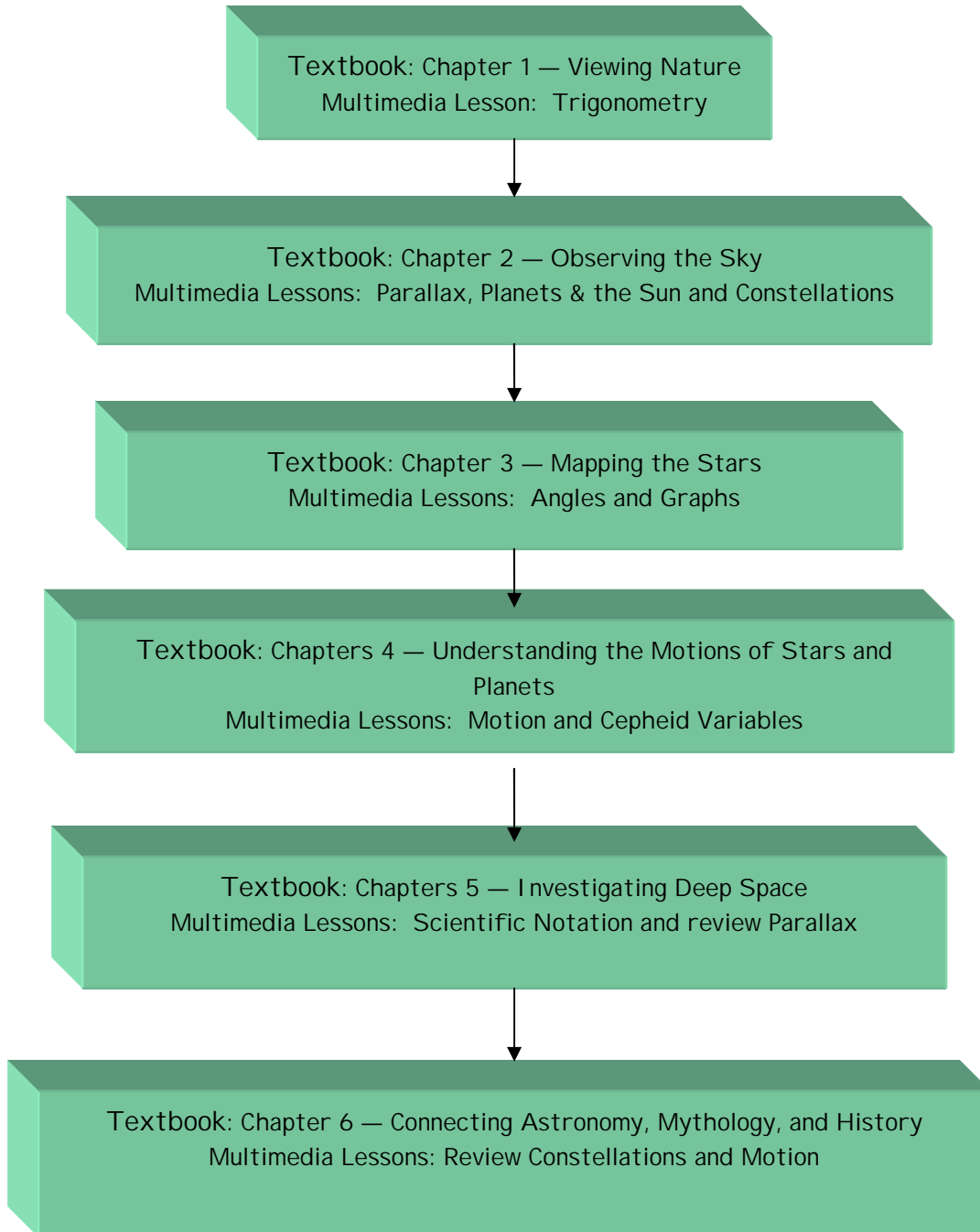


Navigating the Course



Assignment Overview/Lesson Order

Math & the Cosmos combines traditional and technological teaching methods. Below is a progression chart showing which multimedia lessons integrate with which chapter readings.



Multimedia Lesson Descriptions

- **Angles** - The Angles program teaches you how to measure angles. Learn how angles are used as coordinates of latitude and longitude, which help us pinpoint locations on the surface of the Earth.
- **Trigonometry** - The Trigonometry program covers some of the basic properties of right triangles. The ratios called sine, cosine, and tangent are explained. Learn how to determine distances that cannot be measured directly. Astronomers use trigonometry to determine the distance to near-by stars.
- **Parallax** - The Parallax program explains how parallax observed in nearby stars allows astronomers to use trigonometry to measure the distance to stars.
- **Cepheid Variables** - The Cepheid Variables program explains how astronomers are able to measure the distance to stars that are too far away for parallax to be observed.
- **Constellations** - The Constellations program presents many of the major constellations and the myths that are related to each one. Learn where to look for each constellation in the night sky.
- **Planets and the Sun** - The Planets and the Sun program explains how to use the constellations as guideposts for observing the motion of the sun, planets, and even comets. The phenomenon of the apparent backward motion of the planets at certain times, called retrograde motion, is demonstrated and explained. The apparent movement of the sun through the constellations of the ecliptic during the course of the year is shown. Also learn why Venus is sometimes called the evening star and sometimes the morning star.
- **Graphs** - The Graphs program explains how to plot coordinates to create a map. Learn how to use coordinates on the x-y axes to plot points. Also, learn how the coordinates of longitude and latitude correspond to right ascension and declination, the coordinates used to locate stars.
- **Scientific Notation** - In the Scientific Notation program learn how to use scientific notation to manipulate very large numbers. Astronomers are confronted with very large numbers and scientific notation serves as a convenient way to express large numbers.
- **Motion** - The Motion program explains different types of motion and discusses the effects they have on the phenomena that can be observed. The Earth, sun, planets, and even the stars are in motion relative to one another. We must take these motions into account to create explanations for the things we observe in the sky and here on Earth. Three basic types of motion—linear, rotary, and oscillatory—are discussed.
- **Connections** - Explaining connections between astronomy and mythology and encouraging words inspiring students to continue their pursuit of knowledge.

Learning Objectives for Math & the Cosmos

Angles

- ✓ Define vertex.
- ✓ Define angle.
- ✓ Measure angles in a circle.
- ✓ Measure angles greater than 360 degrees.
- ✓ Explain the origin of using 360 degrees.
- ✓ Define right angle.
- ✓ Define obtuse angle.
- ✓ Define straight angle.
- ✓ Define acute angle.
- ✓ Explain the divisions of degrees in terms of minutes and seconds.
- ✓ Explain the origin of the base 60 number system.
- ✓ Measure angles using a protractor.
- ✓ Define index.
- ✓ Define latitude.
- ✓ Define longitude.
- ✓ Measure latitude and longitude.
- ✓ Define Prime Meridian.
- ✓ Explain the importance of the prime meridian when measuring longitude.
- ✓ Define parallels.
- ✓ Define meridians.
- ✓ Define International Date Line.
- ✓ Know that there are 90 circles of latitude between equator and the poles.
- ✓ Understand the importance of the equator when measuring latitude.
- ✓ Explain the role of the Earth and the sun in seasonal change.
- ✓ Know the tilt of the Earth is 23 degrees 26 minutes.
- ✓ Location of Tropic of Cancer.
- ✓ Location of Tropic of Capricorn.
- ✓ Location of Arctic Circle in terms of latitude and longitude.
- ✓ Location of Antarctic Circle in terms of latitude and longitude.
- ✓ Know which areas on Earth receive 24 hours of sun at least one day a year.
- ✓ Describe the Greek myth associated with seasonal change.
- ✓ Determine latitude and longitude by the position of the North Star.
- ✓ Know where Polaris is located.
- ✓ Explain why one can see the same star overhead every 24 hours.
- ✓ Remember for calculating latitude and longitude that 1 hour = 15 degrees.

Parallax

- ✓ Define parallax.
- ✓ Give examples of parallax.
- ✓ Explain the measurement of parallax angle for stars.
- ✓ Remember the diameter of Earth's orbit around the sun = 186,000,000 miles.
- ✓ Calculate distance to nearby stars using parallax.

Cepheid Variables

- ✓ Explain how energy is emitted from a star.
- ✓ Factors that determine the brightness of a star.
- ✓ Describe some of the types of magnitude for stars.
- ✓ Define cepheid variables.
- ✓ Describe the contribution to astronomy made by Henrietta Leavitt.
- ✓ Describe the use of cepheid variables to measure distance to stars.

Graphs

- ✓ Describe the properties of a coordinate system.
- ✓ Define axis of abscissa.
- ✓ Define axis of ordinates.

- ✓ Define origin.
- ✓ Plot points on coordinate plane.
- ✓ Define declination.
- ✓ Define right ascension.
- ✓ Calculate declination and right ascension.
- ✓ Explain the role of the celestial equator as the reference line for declination.
- ✓ Explain the role of the vernal equinox meridian as the reference line for right ascension.

Scientific Notation

- ✓ Define exponent.
- ✓ Solve problems involving exponents.
- ✓ Convert numbers to scientific notation.
- ✓ Convert scientific notation to a numeral.
- ✓ Solve problems involving negative exponents.
- ✓ Learn how decimals are represented as powers of 10.
- ✓ Solve problems combining powers of 10.
- ✓ Solve problems involving the multiplication of exponents.

Trigonometry

- ✓ Identify the properties of a right triangle.
- ✓ Solve problems involving the addition of angles in a right triangle.
- ✓ Learn the names given to the sides of right triangle.
- ✓ Identify the size of an angle using a trig table when given a value for sine, cosine, or tangent.
- ✓ Calculate the length of a side of a right triangle when given the measurement of one of the angles and the measurement of one of the other sides.
- ✓ Calculate sine, cosine, and tangent when given the lengths of the opposite, adjacent, and hypotenuse of a right triangle.
- ✓ Solve word problems involving sine, cosine, and tangent.

Motion

- ✓ Define motion.
- ✓ Explain and give examples of linear, rotary and oscillatory motion.
- ✓ Learn Newton's 1st Law of motion.
- ✓ Learn the relationship between velocity, speed and acceleration.
- ✓ Explain Coriolis force.
- ✓ Define precession and its significance.
- ✓ Define pole star.
- ✓ Understand the formula $\text{Torque} = \text{force} \times \text{distance}$.
- ✓ Describe evidence that the Earth is rotating.
- ✓ Describe the Earth's rotations on its axis/precession.
- ✓ Describe the revolution of sun.
- ✓ Understand the relevance of fixed frames of reference.
- ✓ Explain the stories of Mithra and its relevance to the vernal equinox.

Constellations

- ✓ Identify prominent spring constellations in terms of location and notable facts.
- ✓ Identify prominent summer constellations in terms of location and notable facts.
- ✓ Identify prominent autumn constellations in terms of location and notable facts.
- ✓ Identify prominent winter constellations in terms of location and notable facts.
- ✓ Identify prominent circumpolar constellations in terms of location and notable facts.
- ✓ Learn Greek myths associated with various constellations along the zodiac.

Planets and the Sun

- ✓ Describe the motion of the planets Venus, Mars, Jupiter, and Saturn.
- ✓ Explain retrograde motion.
- ✓ Learn why Venus is the morning and evening star.
- ✓ Learn about the ecliptic.
- ✓ Describe the movement of a comet.