

Ohio Department of Education Web Sites:

http://www.ode.state.oh.us/Academic_Content_Standards/acsmath.asp

http://www.ode.state.oh.us/Academic_Content_Standards/acsscience.asp

INDICATORS

Mathematics: MEASUREMENT

- 4** Derive formulas for surface area and volume and justify them using geometric models and common materials.
 - b.** That the volume of a pyramid (or cone) is one third of the volume of a prism (or cylinder) with the same base area and height.
- 7** Apply proportional reasoning to solve problems involving indirect measurements or rates.
- 9** Demonstrate understanding of the concepts of perimeter, circumference and area by using established formulas for triangles, quadrilaterals, and circles to determine the surface area and volume of prisms, pyramids, cylinders, spheres and cones.
- 10** Use conventional formulas to find the surface area and volume of prisms, pyramids and cylinders and the volume of spheres and cones to a specified level of precision.

Mathematics: GEOMETRY AND SPATIAL SENSE

- 1** Make and test conjectures about characteristics and properties (sides, angles, symmetry) of two-dimensional figures and three-dimensional objects.
- 4** Represent and analyze shapes using coordinate geometry (given three vertices and the type of quadrilateral, find the coordinates of the fourth vertex).
- 5** Draw nets for a variety of prisms, pyramids, cylinders and cones.

Science: SCIENCE AND TECHNOLOGY

- 1** Examine how science and technology have advanced through the contributions of different people, cultures and times in history.

ACTIVITIES

(See the resource listings below for Internet Resources, *Opening the Door West Plus!* Bonus Materials, and the WOUB/Shelburne Films DVD documentary *Opening the Door West* tie-ins to the activities.)

- **Measurement Techniques and Tools**

- ▶ View the description of the Ohio Lands, Chapter 2 in the documentary, where the narrator mentions that some of the trees were 150 feet tall. Explore how people measure such heights. Learn how to measure tall objects with indirect measurement.
- ▶ Study surveying - a method of indirect measurement that solves problems. See the documentary and the bonus materials for information on surveying in the late 1700s.
- ▶ Use the animations of the fortifications of the Ohio Company as the content to meet measurement and geometry indicators.
 - Build models of the fortifications by identifying the three-dimensional subsets of structures.
 - ▶▶ See Pentagonal Fort Harmer had pentagonal bastions at each vertex.
The barracks were rectangular prisms, and barrack roofs were triangular prisms.
 - Campus Martius was built around a 144 square parade ground.
It had rectangular and triangular prisms as well as other shapes.

- **Geometry and Spatial Sense**

- ▶ “Using Nets to Find Surface Area” – 6 pages. Ohio Model Curriculum Lesson Plan
Available as a MS Word or Acrobat PDF file.
See download instructions in the Internet Resources.
 - In this four-part lesson, students explore three-dimensional objects (prisms, pyramids, cylinders and cones) to draw nets. Students use the understanding of drawing nets to find the surface area of pyramids and cylinders. Students discuss surface area by using visual representations of nets to derive formulas for the surface area of each object. Journal writing and “quick-write” prompts allow students to reflect on their understanding.
 - ▶▶ Multiple entry points into the lesson serve students of different abilities.
 - ▶▶ Part One acts as remediation or an introduction for students who have no prior experience with nets.
 - ▶▶ Students who understand nets may begin with Part Two, Making Conjectures about Nets; or Parts Three and Four, Surface Area.

- **Data Analysis**

- ▶ Use Census records from the period for data analysis.

- **Science and Technology**

- ▶ Use the development of human powered saw pits, water powered mills, surveying techniques in the students’ examination of science and technology advances.
- ▶ “Science and Technology Makes the World Go Around” – 8 pages.
Ohio Model Curriculum Lesson Plans
 - Available as a MS Word or Acrobat PDF file. See download instructions in the Resources section on the following page.
 - This lesson highlights the advances of science and technology in communication, rocketry, agriculture and transportation. Students will research advancements in the science and technology of these categories and design and construct posters communicating those advancements.

INTERNET RESOURCES

- **Ohio Model Curriculum Lesson Plans:**
 - ▶ Go to Ohio’s Instructional Management System: <http://ims.ode.state.oh.us/ode/ims/Default.asp?bhcp=1>
 - ▶ Use the IMS SEARCH area to choose:
 - Search Within – choose Lesson Plans
 - Grade Band – choose the one that includes Grade 8
 - Content Area – choose Mathematics (or Science)
 - Navigate through the lists of lessons until you locate the lesson’s title. Then click the download button.
- **Ohio Resource Center for Math and Science:** <http://www.ohiorc.org/>
 - ▶ The “path” listed here was used to find the following online resources for **Measurement Indicator 7**. ORC Features > Ohio Mathematics > Ohio Standards > Ohio’s Academic Content Standards in Mathematics with aligned resources > Grade Level Indicators > 8 > 7. Apply proportional reasoning to solve problems involving indirect measurements or rates. (ORC Resources):
 - In Your Shadow: http://illuminations.nctm.org/index_d.aspx?id=515
 - Tree Measurement:
 - ▶ <http://eduref.org/cgi-bin/printlessons.cgi/Virtual/Lessons/Mathematics/Masurement/MEA0011.html>
 - Surveying: <http://www.horizonshelpr.org/math/survey/overview.html>
- **Geometry and Measurement:**
 - ▶ Exploring Geometric Solids and Their Properties: http://illuminations.nctm.org/index_o.aspx?id=122
 - ▶ K-12 Internet Geometry Resources: <http://mathforum.org/geometry/k12.geometry.html>
 - From the College of Education at Drexel University, Philadelphia, Pennsylvania
 - ▶ Interactive Geometry: <http://www.studyworksonline.com/cda/explorations/main/0,,NAV2-21,00.html>
 - ▶ Mensuration: The measurement of geometric figures:
<http://library.thinkquest.org/C0110248/geometry/menpartcircle.htm>
 - Includes length, angle measure, area and volume.
 - ▶ Resources for the New York Grade Eight Test Preparation -Measurement:
<http://www.oswego.org/mttestprep/math7-8.cfm#5.%20Measurement>
 - Owego City School District, New York
 - ▶ Space figures and basic solids: <http://www.mathleague.com/help/geometry/3space.htm>
 - ▶ Teaching Area And Volume Of Prisms, Cylinders, Pyramids, And Cones (Grades 6-8):
<http://www.sedl.org/scimast/mentoring/answers/105.html>
 - Southwest Educational Development Laboratory
 - ▶ Volumes of inclined prism, cone, cylinder, truncated pyramid and cone:
<http://kr.cs.ait.ac.th/~radok/math/mat2/chap90.htm>
- **Census Data**
 - ▶ U. S. Census Bureau
 - American Indian Data & Links: <http://factfinder.census.gov/home/aian/index.html>
 - ▶ Census of Population and Housing 1790 to 2000: <http://www.census.gov/prod/www/abs/decennial/>
 - Data may be viewed online or downloaded
 - ▶ Indian Census Records: <http://www.accessgenealogy.com/native/census/index.htm>

- **Science and Technology**

- ▶ American Memory Project, Library of Congress:
 - Inventions 1755-1799:
 - <http://memory.loc.gov/ammem/mchtml/corlst.html#B>
 - ▶ Scroll down and click Thomas Jefferson's drawing of a macaroni machine and instructions for making pasta, ca. 1787
 - ▶ Scroll down and click Thomas Jefferson's design for a plow, ca. 1794.
 - ▶ Scroll down and click John Fitch's sketch and description of piston for steamboat propulsion, ca. 1795
- ▶ Chronology of Scientific Developments:
<http://www.txdirect.net/users/richard/science.htm>
- ▶ Center for the Study of Invention & Innovation, Smithsonian:
<http://invention.smithsonian.org/home/>
 - Entering 1790 as a search keyword returned the following:
 - ▶ Unit 2: Early Industrialization
 - ▶ Early Industrialization: Student Essay: Water Power
 - ▶ Early Industrialization: Activity 1: Student Packet
 - ▶ Early Industrialization: Teacher Essay
- ▶ George Mason University Research Center:
<http://echo.gmu.edu/center.php>
 - Use the menu on the right to access Topics, Historical Periods or Content
- ▶ List of Year in Science:
http://en.wikipedia.org/wiki/List_of_years_in_science
 - All years cover events of a science or technology related nature that occurred in the listed year.
 - Each year has four major headings: Exploration, Awards, Births and Deaths
- ▶ Museum of the History of Science, University of Oxford: <http://www.mhs.ox.ac.uk/>

- **Organizations**

- ▶ Ohio Council of Teachers of Mathematics:
<http://www.ohioctm.org/>
- ▶ Ohio University Council of Teachers of Mathematics:
<http://www.ohio.edu/ouctm/>
- ▶ Ohio Mathematics and Science Coalition:
<http://www.oai.org/OMSC/index.html>
- ▶ Ohio Section of the Mathematical Association of America (MAA):
<http://www.math.uakron.edu/ohiomaa/>
- ▶ Science Education Council of Ohio (SECO):
<http://www.ohiosci.org/>

BONUS MATERIALS FROM THE *OPENING THE DOOR WEST PLUS!* DVD

LOCATION	TITLE	SOURCE	LENGTH
DVD	Campus Martius by David Shelburne	computer animation	05:34
DVD	Farmer's Castle by David Shelburne	computer animation	01:48
DVD	Fort Frye by David Shelburne	computer animation	00:22
DVD	Fort Harmar by David Shelburne	computer animation	02:00
DVD	The Floating Mill by David Shelburne	computer animation	00:34
DVD	The Point by David Shelburne	computer animation	03:10
CD	Description of the Settlement at Belpre by Ebner. Batelle. Locate and Read about the building of the floating gristmill.	Hildreth Collection Transcriptions	3 pages
CD	Joseph Barker Manuscript: Memories of the Ohio Company Settlements. Read the section "Diseases and Their Treatment".	Hildreth Collection Transcriptions	5 pages
CD	Journal of the Manassah Cutler, D.D., while on his journey to, & while at Marietta in the year 1788. Read Friday, August 15th to learn about General Tupper's inventiveness.	Hildreth Collection Transcriptions	5 pages
CD	Description of Campus Martius	Pioneer History	1 page

WOUB/SHELburne FILMS DVD DOCUMENTARY *OPENING THE DOOR WEST*

LOCATION	CHAPTER TITLE	TOPIC(S)	START TIME
2	Ohio Lands	Resources, Environment - Northwest Territory, pre-settler resources and environment	02:00
4	Fort Harmar	Mathematics, fort construction	02:05
5	Adv. Galley	Careers – carpenter, millwright, blacksmith	00:54
5	Adv. Galley	Transportation – methods of travel, travel conditions for 1788 settlers, Ohio Company history	00:56
5	Adv. Galley	Careers – boat builders, surveyors	01:49
5	Adv. Galley	Transportation – building flatboats	02:44
6	Field of Mars	Mathematics, fort construction – building of Campus Martius – plans, architecture, measurements	01:47
6	Field of Mars	Careers – Sawyer, construction work	02:19
9	Farmer's Castle	Economics – water powered mill business – grist mill, sawmill	00:54
9	Farmer's Castle	Mathematics U. S. government changes surveying method to rectangular grids and ranges	07:50
10	Starving Year	Disease – smallpox. Ohio Company settlers were not afraid to use new medical advances and inoculated themselves against the deadly disease.	01:48