



Internationalizing the Academic Standards: Indiana ~ Comments From Educators

...This work represents a solid resource for teachers in Indiana to use to internationalize their lesson plans as they consider Indiana's standards. It also provides a wonderful launching point for teachers to envision their own methods for bringing learning about the world into their classrooms in Indiana...

- Jennifer Manise, Executive Director, Longview Foundation: For Education in World Affairs and International Understanding, Inc., Falls Church, VA

...Children's knowledge of the rest of the world can't be taught just in social studies for ten minutes a day. Outside of taking them abroad, Internationalizing the Academic Standards: Indiana is the best resource I've seen to promote global competence in the next generation...

- Philip Boley, Retired Indiana District Superintendent, Executive Director, Global Indiana: A Consortium for International Exchange, Director of International Education, Central Indiana Educational Service Center, Indianapolis, IN

...An increasingly clear fact of living in the 21st century is that the world is shrinking at a shocking pace and teachers have a responsibility to their students to prepare them for their place in this world. This resource, which clearly connects teachable and relevant skills for students to the standards that guide decision-making, is a tremendous aid to any teacher...

- Kevin M. Cline, Department Chair, Social Studies, Frankton High School, Frankton, IN

Invitation to Contribute:

Please submit suggestions for incorporating international content when teaching Indiana's K-12 academic standards for the core subjects at:

<http://www.indiana.edu/~global/educational/standardsSuggestion.php>

Suggestions will be shared with other educators after review.

URL:

<http://www.indiana.edu/~global/resources/standardsInd.php>

Quick Response code:



Printing by locally owned and operated Metro Printed Products Inc., Greenwood, IN.
Mailing services provided by The Herald Times, Direct Mail Division, Bloomington, IN.



INTERNATIONALIZING THE ACADEMIC STANDARDS:

INDIANA

Middle School & High School:

Mathematics

Internationalizing the Academic Standards: Indiana

Developed by Indiana University's

Center for the Study of Global Change

Office of the Vice President for International Affairs

Center for International Business Education and Research

Kelley School of Business

Center for Latin American and Caribbean Studies

College of Arts and Sciences

(U.S. Department of Education Title VI National Resource Centers)

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<http://www.indiana.edu/~global/educational/standardsInd.php>



 INDIANA UNIVERSITY

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Acknowledgements

The leadership team of the *Internationalizing the Academic Standards: Indiana* project gratefully acknowledges the contributions of the following organizations and individuals. The affiliations of individuals reflect the time in which they worked on this project.

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Each teacher in this list provided the project with critical guidance and/or authored valuable *suggestions* to integrate international content into one or more of Indiana's K-12 academic standards for her or his respective grade level(s) and core subject(s). We are grateful for the enormous time, effort, and creativity that each of them committed to this project. Indiana students - citizens and leaders of the 21st century - will be the beneficiaries.

*Acronyms: ES – Elementary School; HS – High School; IU – Indiana University; JHS – Junior High School; MS – Middle School

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Preface

The purpose of the series, *Internationalizing the Academic Standards: Indiana* (IASI), is to suggest ways for educators to incorporate international content into the teaching of Indiana's K-12 academic standards for the core subjects: English/language arts, mathematics, science, and social studies. As the world becomes increasingly interdependent and complex, the need for international knowledge, skills, and attitudes is more clear and compelling, as is the call for relevant teacher resources that are readily accessible. The underlying principle of IASI is to integrate content and pedagogy into the approved curriculum already being taught in the classroom. A unique strength of this resource is that it was created *for* classroom teachers *by* classroom teachers interested in sharing their creative ideas.

IASI evolved from the *Indiana in the World III* project. Our initial goal was to create the third edition of a book for K-12 educators to help them teach about Indiana's global connectedness using complete lesson plans. To this end, three teacher focus group meetings were held to gather information and generate ideas. A presentation was also given to members of the Lotus Education and Arts Foundation Board, a diverse Bloomington community group, which offered perspectives about the need for citizens to be internationally competent. From this process a very different product emerged: subject-based booklets containing brief, easy-to-use ideas for internationalizing the existing academic standards. An IASI draft sampler was then created and shared with the participants (primarily K-12 school principals) of the December 2009 Indiana International Education Leadership Retreat. It was extremely well received, thereby solidifying this concept of IASI.

The IASI series consists of five booklets: one for elementary school teachers focusing on all four core subjects and four for middle and high school teachers, each addressing one of the core subjects. Not all standards are included because some standards lend themselves more easily to the integration of international content than others. In addition, the booklets include a variety of suggestions for differentiated instruction, where appropriate, for both special needs and highly able students. The standards were identified directly from the Indiana Department of Education Web site (<http://www.doe.in.gov/>).

Indiana University's Center for the Study of Global Change, Center for International Business Education and Research, and Center for Latin American and Caribbean Studies are very proud to have facilitated the development of this resource which was created by and for teachers.

Booklets can be downloaded in PDF format for free, in their entirety or in part, at:
<http://www.indiana.edu/~global/educational/standardsInd.php>



How to Use this Book

Within this booklet are *suggestions* for how to integrate international content when teaching selected Indiana academic standards of the four core subjects.

How suggestions were created:

Each teacher-author selected academic standards or indicators from those listed on the IDOE Web site (<http://www.doe.in.gov/>) and then provided suggestions about how to incorporate international content, including knowledge, skills, and/or attitudes. Sometimes the teacher-author also suggested a specific resource, such as a book, web link, or poem that s/he has used successfully in the past.

What a suggestion looks like:

Grade/Subject: 8

Academic Standard: 8.6

Academic Standard Indicator: 8.6.3

Core Standard: Yes

Standard Description (Academic or Indicator): Understand the meaning of, and be able to identify or compute the minimum value, the lower quartile, the median, the upper quartile, the interquartile range, and the maximum value of a data set.

Suggestion for Integrating International Content: Have students use mean, median, and mode to compare data sets such as water availability and life expectancy in the U.S. and a selection of other countries. **Suggested resource:** <http://www.nationmaster.com/>.

What you do with a suggestion:

Entries are suggestions only, meant to get you thinking about how to internationalize your own curriculum. You may like entire suggestions or only parts of them. Think of different ways to best integrate these suggestions into your lesson plans and daily pedagogy.

Notes:

Web links are correct as of the date of publication.

All **Standard Descriptions** were copied directly from the IDOE Web site, dated 2011.

Some **Standard Descriptions** and **Suggestions for Integrating International Content** call for cultural/country comparisons. To avoid over-generalizations and the possibility of stereotyping, the IASI leadership team encourages teachers and their students to appreciate not only the differences and similarities among cultures/countries, but also the diversity and extreme variation within them.

How to Make Your Own Suggestions

1. Add your own ideas to this book in the blank spaces provided on the last pages.
2. Submit your own suggestions to share with other educators at*:
<http://www.indiana.edu/~global/educational/standardsSuggestion.php>



*Note: Your e-mail address is required only to confirm details before your ideas are posted.

MATHEMATICS

Grade: 6

Academic Standard: 6.1

Academic Standard Indicator: --

Core Standard: No

Standard Description (Academic or Indicator): Students compare and order positive and negative integers, decimals, fractions, and mixed numbers. They find multiples and factors.

Suggestion for Integrating International Content: Have students explore "number sense" in different cultures, such as Mayan mathematics or the Babylonian base 60 system.

Grade: 6

Academic Standard: 6.1

Academic Standard Indicator: 6.1.1

Core Standard: Yes

Standard Description (Academic or Indicator): Understand and apply the basic concept of negative numbers (e.g., on a number line, in counting, in temperature).

Suggestion for Integrating International Content: Have students compare world high and low temperatures above and below zero, in both Fahrenheit and Celsius. Have students examine U.S. and world locations that fall above or below sea level.

Grade: 6

Academic Standard: 6.2

Academic Standard Indicator: 6.2.2

Core Standard: Yes

Standard Description (Academic or Indicator): Multiply and divide positive and negative integers.

Suggestion for Integrating International Content: Have students use math to solve the riddle presented in the traditional Indian folktale, *One Grain of Rice* by Demi (Scholastic Press, 1997). A greedy raja must reward a young village woman for her honesty. Have students determine if her quick-witted mind will turn a

single grain of rice into enough to feed all the hungry.

Grade: 6

Academic Standard: 6.2

Academic Standard Indicator: 6.2.4

Core Standard: Yes

Standard Description (Academic or Indicator): Explain how to multiply and divide positive fractions and perform the calculations.

Suggestion for Integrating International Content: Have students select international recipes, and double the amount of servings by multiplying the fractions of each ingredient, or halve the recipes using division.

Grade: 6

Academic Standard: 6.2

Academic Standard Indicator: 6.2.6

Core Standard: Yes

Standard Description (Academic or Indicator): Interpret and use ratios to show the relative sizes of two quantities. Use the notations: a/b , a to b , $a:b$.

Suggestion for Integrating International Content: Have students use ratios to study ethnic and racial diversity in a variety of international city or country populations in order to understand demographics.

Grade: 6

Academic Standard: 6.2

Academic Standard Indicator: 6.2.10

Core Standard: No

Standard Description (Academic or Indicator): Use mental arithmetic to add or subtract simple fractions and decimals.

Suggestion for Integrating International Content: Have students convert data on global topics into fractions and decimals, using mental math. **Suggested resource:** *If the World Were a*

Village: A Book about the World's People by David Smith (Kids Can Press, 2002), which condenses world statistics to a village of 100 people.

Grade: 6
Academic Standard: 6.4
Academic Standard Indicator: --
Core Standard: No

Standard Description (Academic or Indicator): Students identify, describe, and classify the properties of plane and solid geometric shapes and the relationships between them.

Suggestion for Integrating International Content: Have students explore architecture and consider why some cultures build round buildings. **Example:** Why do traditional Inuits live in hemisphere-shaped homes (igloos)?

Grade: 6
Academic Standard: 6.4
Academic Standard Indicator: 6.4.1
Core Standard: Yes

Standard Description (Academic or Indicator): Identify and draw vertical, adjacent, complementary, and supplementary angles and describe these angle relationships.

Suggestion for Integrating International Content: Have students observe tessellations found in Greek or Islamic patterned mosaics or Mayan art and then design their own.

Grade: 6
Academic Standard: 6.4
Academic Standard Indicator: 6.4.6
Core Standard: No

Standard Description (Academic or Indicator): Draw the translation (slide) and reflection (flip) of shapes.

Suggestion for Integrating International Content: Have students use patterned African kente cloth, Eastern European embroidery, or Mexican *papel picado* as inspiration. Similarly,

world landmarks can be viewed for their symmetry. **Examples:** Eiffel Tower; Taj Mahal.

Grade: 6
Academic Standard: 6.5
Academic Standard Indicator: 6.5.2
Core Standard: No

Standard Description (Academic or Indicator): Understand and use larger units for measuring length by comparing miles to yards and kilometers to meters.

Suggestion for Integrating International Content: Use an Internet search engine such as Google Images to find photos of road mileage markers from around the globe. Then have students convert kilometers to miles.

Grade: 6
Academic Standard: 6.5
Academic Standard Indicator: 6.5.9
Core Standard: No

Standard Description (Academic or Indicator): Use a formula to convert temperatures between Celsius and Fahrenheit.

Suggestion for Integrating International Content: Have student use today's weather forecasts around the world and convert temperatures of major world cities.

Grade: 6
Academic Standard: 6.6
Academic Standard Indicator: 6.6.3
Core Standard: No

Standard Description (Academic or Indicator): Compare the mean, median, and mode for a set of data and explain which measure is most appropriate in a given context.

Suggestion for Integrating International Content: Have students explore mean, median, and mode for data from different countries. **Examples:** Area; population density; per capita income; daily caloric intake; life expectancy; literacy rate. **Suggested resource:** *Material World: A Global Family Portrait* by Peter Menzel (Sierra Club Books, 1995).

Grade: 7
Academic Standard: 7.1
Academic Standard Indicator: 7.1.1
Core Standard: Yes

Standard Description (Academic or Indicator): Read, write, compare and solve problems using whole numbers in scientific notation.

Suggestion for Integrating International Content: Have students use scientific notation to express the populations of various countries.
Extension: Have students create problems for each other to solve using international country data. **Suggested resource:**
<http://www.nationmaster.com>.

Grade: 7
Academic Standard: 7.1
Academic Standard Indicator: 7.1.6
Core Standard: No

Standard Description (Academic or Indicator): Understand and apply the concept of square root.

Suggestion for Integrating International Content: Have students explore different methods for finding the square root of a number.
Examples: Heron's method; Chinese method; observing patterns.

Grade: 7
Academic Standard: 7.3
Academic Standard Indicator: 7.3.10
Core Standard: Yes

Standard Description (Academic or Indicator): Identify and describe situations with constant or varying rates of change and know that a constant rate of change describes a linear function.

Suggestion for Integrating International Content: Have students use diverse situations from around the world to obtain data that will produce linear relationships. Students can examine online newspapers from around the world to gather their data and analyze if the relationships are linear. **Example:** Using data from biologists studying the Irish Elk, which is

an extinct animal, have students explore the changes over time of the length of the skull and the antler.

Grade: 7
Academic Standard: 7.4
Academic Standard Indicator: 7.4.4
Core Standard: No

Standard Description (Academic or Indicator): Construct two-dimensional patterns (nets) for three-dimensional objects, such as right prisms, pyramids, cylinders, and cones.

Suggestion for Integrating International Content: Have students study architecture around the world and, working in groups, construct 2D patterns and then fold them to form miniature 3D models of cities or buildings.
Examples: Pyramids in Egypt; cities in Israel, Greece, Mexico.

Grade: 7
Academic Standard: 7.6
Academic Standard Indicator: 7.6.1
Core Standard: Yes

Standard Description (Academic or Indicator): Analyze, interpret, and display data in appropriate bar, line, and circle graphs and stem-and-leaf plots, and justify the choice of display.

Suggestion for Integrating International Content: Display international demographic or economic data using appropriate bar graphs, frequency tables, time plots, histograms, or circle graphs. **Suggested resource:**
<http://www.nationmaster.com>.

Grade: 7
Academic Standard: 7.6
Academic Standard Indicator: 7.6.2
Core Standard: Yes

Standard Description (Academic or Indicator): Make predictions from statistical data.

Suggestion for Integrating International Content: Have students explore and make

predictions from statistics about sports popular in non U.S. countries, such as cricket or rugby. Have students learn the meaning of these statistics, converting the information into appropriate decimals, fractions, and percents.

Grade: 8
Academic Standard: 8.2
Academic Standard Indicator: 8.2.2
Core Standard: No

Standard Description (Academic or Indicator): Solve problems by computing simple and compound interest.

Suggestion for Integrating International Content: Have students visit various online newspapers from around the world to investigate bank interest rates and mortgage rates. **Example:** They can use these rates to calculate the amount of interest that would be paid, in different international locations, on a \$10,000 loan. **Extension:** They can also explore the average cost of buying a vacation home in various countries, using the classified ads from the online newspapers, and make a case for their choice of house. **Suggested resource:** <http://www.oanda.com/currency/converter/>.

Grade: 8
Academic Standard: 8.3
Academic Standard Indicator: --
Core Standard: No

Standard Description (Academic or Indicator): Students solve simple linear equations and inequalities. They interpret and evaluate expressions involving integer powers. They graph and interpret functions. They understand the concepts of slope and rate.

Suggestion for Integrating International Content: Have students study plant or crop growth patterns and use data to analyze plant or crop choice versus population needs in the U.S. and a selection of other countries.

Grade: 8
Academic Standard: 8.3
Academic Standard Indicator: 8.3.5
Core Standard: Yes

Standard Description (Academic or Indicator): Identify and graph linear functions, and identify lines with positive and negative slope.

Suggestion for Integrating International Content: Have students use linear functions and linear equations to represent, analyze, and solve problems, such as demographic data-inverse and direct relationships like literacy rate or infant mortality in the U.S. and a selection of other countries.

Grade: 8
Academic Standard: 8.4
Academic Standard Indicator: 8.4.5
Core Standard: Yes

Standard Description (Academic or Indicator): Use the Pythagorean Theorem and its converse to solve problems in two and three dimensions.

Suggestion for Integrating International Content: Have students use the Pythagorean Theorem to solve problems with international contexts. **Example:** Calculate the height of pyramids in Egypt; Eiffel Tower in France; pyramid of Kukulcán, in Mexico's ancient Mayan city of Chichen Itza. **Suggested resource:** http://en.wikipedia.org/wiki/El_Castillo,_Chichen_Itza.

Grade: 8
Academic Standard: 8.6
Academic Standard Indicator: 8.6.2
Core Standard: Yes

Standard Description (Academic or Indicator): Identify different methods of selecting samples, analyzing the strengths and weaknesses of each method, and the possible bias in a sample or display.

Suggestion for Integrating International Content: Have students use online magazines and newspapers from around the world to evaluate the reasonableness of claims about depleted natural resources or any aspects of climate change, based on statistical data. **Example:** Claims by environmentalists;

conservation activists; scientists; marine biologists.

Grade: 8

Academic Standard: 8.6

Academic Standard Indicator: 8.6.3

Core Standard: Yes

Standard Description (Academic or Indicator): Understand the meaning of, and be able to identify or compute the minimum value, the lower quartile, the median, the upper quartile, the interquartile range, and the maximum value of a data set.

Suggestion for Integrating International

Content: Have students use mean, median, and mode to compare data sets such as water availability and life expectancy in the U.S. and a selection of other countries. **Suggested resource:** <http://www.nationmaster.com/>.

Subject: Algebra I

Academic Standard: A1.1

Academic Standard Indicator: A1.1.4

Core Standard: Yes

Standard Description (Academic or Indicator): Use the laws of exponents for rational exponents.

Suggestion for Integrating International

Content: Spark student interest in comparing linear versus exponential growth by using this comment from the 19th-century controversial British economist and mathematician, Thomas Malthus: "Population, when unchecked, increases in a geometrical ratio. Subsistence increases only in an arithmetical ratio. A slight acquaintance with numbers will shew the immensity of the first power in comparison of the second." Have students consider Malthus' vision of a bleak future for the world and discuss whether he was correct. **Suggested resource:** http://members.optusnet.com.au/exponentialist/Linear_Vs_Exponential.htm/.

Subject: Algebra I

Academic Standard: A1.1

Academic Standard Indicator: A1.1.5

Core Standard: No

Standard Description (Academic or Indicator): Use dimensional (unit) analysis to organize conversions and computations.

Suggestion for Integrating International

Content: Have students look at population and geographic data for a variety of countries to determine various rates of growth and population density. Have them compare rates in various countries, convert them into different units, and then use these rates to answer questions and to make projections for future levels.

Subject: Algebra I

Academic Standard: A1.1

Academic Standard Indicator: A1.1.5

Core Standard: No

Standard Description (Academic or Indicator): Use dimensional (unit) analysis to organize conversions and computations.

Suggestion for Integrating International

Content: Have students use current exchange rates to compare the relative value of international currencies. Then have them examine average working wages in various countries, comparing how much workers are compensated for a given period of work. **Suggested resource:** <http://www.oanda.com/currency/converter/>.

Subject: Algebra I

Academic Standard: A1.3

Academic Standard Indicator: A1.3.2

Core Standard: Yes

Standard Description (Academic or Indicator): Interpret a graph representing a given situation.

Suggestion for Integrating International

Content: Have students use graphs that display greenhouse gas emissions and projections to anchor a discussion of graphic representation. Students can work with various graphs to make interpretations, answer questions related to the graph, and then discuss the implications of future projections. **Suggested resource:** <http://www.epa.gov/>.

Differentiated Instruction - Highly Able Accommodations: Have students use tables

from various Internet sources to track correlating information. **Example:** Amount of ice that is melting at the polar icecaps. Have students create graphs comparing the two icecaps and draw their own conclusions on the validity of the theory.

Subject: Algebra I
Academic Standard: A1.3
Academic Standard Indicator: A1.3.2
Core Standard: Yes

Standard Description (Academic or Indicator): Interpret a graph representing a given situation.

Suggestion for Integrating International Content: Have students look at graphs representing the change in glacial formations around the world over the past few decades. Students could discuss trends in the graph or perhaps write an op-ed piece citing patterns or trends shown by the graph. **Suggested resource:** <http://www.NSIDC.org/>.

Subject: Algebra I
Academic Standard: A1.4
Academic Standard Indicator: A1.4.1
Core Standard: Yes

Standard Description (Academic or Indicator): Graph a linear equation.

Suggestion for Integrating International Content: Have students use trend data related to population growth or other indices in various countries to create linear equations to predict future population levels. Then have them graph the equations and make comparisons.

Subject: Algebra I
Academic Standard: A1.4
Academic Standard Indicator: A1.4.5
Core Standard: Yes

Standard Description (Academic or Indicator): Write the equation of a line that models a data set and use the equation (or the graph of the equation) to make predictions. Describe the slope of the line in terms of the data, recognizing that the slope is the rate of change.

Suggestion for Integrating International Content: Have students use trend data related to population growth or other indices in various countries to create linear equations to predict future population levels.

Subject: Algebra I
Academic Standard: A1.5
Academic Standard Indicator: A1.5.1
Core Standard: Yes

Standard Description (Academic or Indicator): Use a graph to estimate the solution of a pair of linear equations in two variables.

Suggestion for Integrating International Content: Have students use trend data related to population growth in various countries to create linear equations to predict future population levels. Then have them create graphs of these equations and use the graphs to determine if and when various countries would have equal populations.

Subject: Algebra I
Academic Standard: A1.8
Academic Standard Indicator: A1.8.1
Core Standard: Yes

Standard Description (Academic or Indicator): Graph quadratic, cubic, and radical equations.

Suggestion for Integrating International Content: Have students use actual data from a variety of arched (parabolic) bridges in various countries to match or create quadratic equations that describe their structures.

Subject: Algebra II
Academic Standard: A2.1
Academic Standard Indicator: A2.1.1
Core Standard: No

Standard Description (Academic or Indicator): Recognize and graph various types of functions, including polynomial, rational, and algebraic functions.

Suggestion for Integrating International Content: Have students explore whether the

global climate is warming by collecting and graphing average annual temperature data from countries around the world over a period of time. Then have them look for a possible pattern and determine if the relation can be modeled by a function.

Subject: Algebra II
Academic Standard: A2.1
Academic Standard Indicator: A2.1.7
Core Standard: No

Standard Description (Academic or Indicator): Graph functions defined piecewise.

Suggestion for Integrating International Content: Have students determine the highway speeding fines in different countries. Then have them graph and write the piecewise functions associated with each fine increase due to higher speeds.

Subject: Algebra II
Academic Standard: A2.2
Academic Standard Indicator: A2.2.4
Core Standard: No

Standard Description (Academic or Indicator): Find a linear equation that models a set of data using the media-median method and use the model to make predictions.

Suggestion for Integrating International Content: Have students compare the monetary values of currencies of other countries to the U.S. dollar. Then have them graph and model the relation with a linear equation to determine the exchange rate. **Suggested resource:** <http://www.oanda.com/currency/converter/>.

Subject: Algebra II
Academic Standard: A2.3
Academic Standard Indicator: A2.3.6
Core Standard: No

Standard Description (Academic or Indicator): Solve equations that contain radical expressions.

Suggestion for Integrating International Content: Using "distance to horizon" equations,

have students determine the largest possible distance that could be viewed from the highest point on each continent.

Subject: Algebra II
Academic Standard: A2.7
Academic Standard Indicator: --
Core Standard: No

Standard Description (Academic or Indicator): Students graph exponential functions and relate them to logarithms. They solve logarithmic and exponential equations and inequalities. They solve word problems using exponential functions.

Suggestion for Integrating International Content: Have students analyze the change in population of different countries around the world over time to determine whether their growth has been exponential. If so, have students graph and model the populations over time.

Subject: Algebra II
Academic Standard: A2.7
Academic Standard Indicator: A2.7.8
Core Standard: Yes

Standard Description (Academic or Indicator): Solve word problems involving applications of exponential functions to growth and decay.

Suggestion for Integrating International Content: Have students examine the spread of international diseases such as HIV-AIDS or Ebola over time, either in selected countries or across the world as a whole. Then have them determine a growth or decay model for the relationship between number of victims and time.

Subject: Algebra II
Academic Standard: A2.9
Academic Standard Indicator: A2.9.1
Core Standard: Yes

Standard Description (Academic or Indicator): Understand and apply counting principles to compute combinations and permutations.

Suggestion for Integrating International

Content: For each of the continents except Antarctica, have students determine the number of ways to arrange its countries from first to last.

Subject: Calculus AB. Advanced Placement

Academic Standard: C.4.3

Academic Standard Indicator: --

Core Standard: No

Standard Description (Academic or

Indicator): Interpret a definite integral as a limit of Riemann Sums.

Suggestion for Integrating International

Content: Have students use the (Greek) Archimedes' Method of Exhaustion to find an estimate for pi. Then have students consider how this method is similar to finding limits of the (German) Riemann Sums.

Subject: Calculus AB. Advanced Placement

Academic Standard: C.5

Academic Standard Indicator: C.5.3

Core Standard: No

Standard Description (Academic or

Indicator): Solve differential equations of the form $y' = ky$ as applied to growth and decay problems.

Suggestion for Integrating International

Content: Have students find census data from two countries of their choice dating back to, for example, 1920 and 1930. Then have them solve the exponential growth differential equation and use the data to solve for the constant of integration, as well as the growth rate. Students can then determine how predictive their model for the current population of the two countries is and comment on improvements they could make to their models.

Subject: Discrete Mathematics

Academic Standard: DM.1

Academic Standard Indicator: DM.1.3

Core Standard: No

Standard Description (Academic or

Indicator): Use combinatorial reasoning to solve problems.

Suggestion for Integrating International

Content: Indian mathematics is credited with early interest in combinations. Research the Bhagabati Sutra, an Indian mathematical text dating about 300 BC, which provides a variety of formulas. **Example:** To calculate the number of groups that can be formed from the five senses.

Subject: Discrete Mathematics

Academic Standard: DM.2

Academic Standard Indicator: DM.2.5

Core Standard: No

Standard Description (Academic or

Indicator): Use Markov chains to solve problems.

Suggestion for Integrating International

Content: Have students research the life and work of Andrey Markov, a 19th-century Russian mathematician.

Subject: Discrete Mathematics

Academic Standard: DM.4

Academic Standard Indicator: DM.4.1

Core Standard: No

Standard Description (Academic or

Indicator): Use graphs consisting of vertices and edges to model a problem situation.

Suggestion for Integrating International

Content: Have students research the Konigsberg (located in present day Kaliningrad, Russia) Bridge problem as elucidated by German mathematician, Leonhard Euler, in 1735.

Subject: Discrete Mathematics

Academic Standard: DM.4

Academic Standard Indicator: DM.4.3

Core Standard: No

Standard Description (Academic or

Indicator): Use graph coloring techniques to solve problems.

Suggestion for Integrating International

Content: Have students determine how to color a map of the world using the minimum number of colors needed so that no adjacent states or countries are the same color. **Suggested**

resource:

<http://serendip.brynmawr.edu/playground/fourcolor/> - scroll down until you see the applet for running the 4-color map problem on maps of your own creation.

Subject: Discrete Mathematics

Academic Standard: DM.7

Academic Standard Indicator: --

Core Standard: No

Standard Description (Academic or Indicator): Students use game theory.

Suggestion for Integrating International

Content: Have students explore game theory using the ancient Hawaiian game of Konane.

Suggested resource:

<http://www.cs.washington.edu/homes/mernst/pubs/konane-tr9524.pdf/>.

Subject: Geometry

Academic Standard: G.2

Academic Standard Indicator: G.2.2

Core Standard: Yes

Standard Description (Academic or Indicator): Find measures of interior and exterior angles of polygons, justifying the method used.

Suggestion for Integrating International

Content: Have students find the sum of measures of interior and exterior angles of convex polygons and deduce formulas by using examples from Islamic, Greek, or Mayan art.

Subject: Geometry

Academic Standard: G.2

Academic Standard Indicator: G.2.4

Core Standard: Yes

Standard Description (Academic or Indicator): Apply transformations (slides, flips, turns, expansions, and contractions) to polygons in order to determine congruence, similarity, symmetry, and tessellations. Know that images formed by slides, flips, and turns are congruent to the original image.

Suggestion for Integrating International

Content: Have students look at national flags from a variety of countries to discuss geometric transformations and symmetries that exist.

Subject: Geometry

Academic Standard: G.2

Academic Standard Indicator: G.2.4

Core Standard: Yes

Standard Description (Academic or Indicator): Apply transformations (slides, flips, turns, expansions, and contractions) to polygons in order to determine congruence, similarity, symmetry, and tessellations. Know that images formed by slides, flips, and turns are congruent to the original image.

Suggestion for Integrating International

Content: Have students study rotational symmetry by looking at Tibetan mandalas and Native American images.

Subject: Geometry

Academic Standard: G.4

Academic Standard Indicator: G.4.7

Core Standard: No

Standard Description (Academic or Indicator): Find and use measures of sides, perimeter, and areas of triangles, and relate these measures to each other using formulas.

Suggestion for Integrating International

Content: Have students use notable triangular architecture from a variety of cultures to examine relationships and measures.

Subject: Geometry

Academic Standard: G.5

Academic Standard Indicator: G.5.1

Core Standard: Yes

Standard Description (Academic or Indicator): Prove and use the Pythagorean Theorem.

Suggestion for Integrating International

Content: Have students trace the historical uses and manifestations of the Pythagorean Theorem in early civilizations, including the various

proofs that were given. **Suggested resource:**
http://en.wikipedia.org/wiki/Pythagorean_theorem/.

Subject: Geometry
Academic Standard: G.6
Academic Standard Indicator: --
Core Standard: No

Standard Description (Academic or Indicator): Students define ideas related to circles; e.g. radius, tangent. They find measures of angles, lengths, and areas. They prove theorems about circles. They find equations of circles.

Suggestion for Integrating International Content: Have students imagine that they are transmitting a signal to a country on the other side of the world, either assigned by the teacher or chosen by students. Have them use their knowledge of tangents to properly place satellites for successful transmission.

Subject: Geometry
Academic Standard: G.6
Academic Standard Indicator: G.6.2
Core Standard: Yes

Standard Description (Academic or Indicator): Define and identify relationships among: radius, diameter, arc, measure of an arc, chord, secant, and tangent.

Suggestion for Integrating International Content: Have students analyze the configurations that exist at Stonehenge, both within the structure itself as well as in relation to astronomical phenomena.

Subject: Geometry
Academic Standard: G.6
Academic Standard Indicator: G.6.5
Core Standard: Yes

Standard Description (Academic or Indicator): Define, find, and use measures of arcs and related angles (central, inscribed, and intersections of secants and tangents).

Suggestion for Integrating International Content: Have students use the locations of various major cities around the world, as given by longitude and latitude, to determine the distance between cities.

Subject: Geometry
Academic Standard: G.7
Academic Standard Indicator: G.7.4
Core Standard: No

Standard Description (Academic or Indicator): Describe symmetries of geometric solids.

Suggestion for Integrating International Content: Have students look at major architecture from early civilizations, such as Egyptian pyramids or Mayan temples, to determine and compare the various symmetries within these structures.

Subject: Geometry
Academic Standard: G.7
Academic Standard Indicator: G.7.7
Core Standard: Yes

Standard Description (Academic or Indicator): Find and use measures of sides, volumes of solids, and surface areas of solids, and relate these measures to each other using formulas.

Suggestion for Integrating International Content: Have students consider the story of the golden crown and Archimedes' principle to explore the volume of solids. Then have them use this method to verify the accuracy of various regular solids, using international examples.

Subject: Geometry
Academic Standard: G.7
Academic Standard Indicator: G.7.7
Core Standard: Yes

Standard Description (Academic or Indicator): Find and use measures of sides, volumes of solids, and surface areas of solids, and relate these measures to each other using formulas.

Suggestion for Integrating International

Content: Have students use historical data relating to the thickness and area of glaciers around the world to determine their volume at various points in time.

Subject: Pre-Calculus

Academic Standard: PC.1

Academic Standard Indicator: PC.1.10

Core Standard: Yes

Standard Description (Academic or

Indicator): Write the equations of conic sections in standard form (completing the square and using translations as necessary), in order to find the type of conic section and to find its geometric properties (foci, asymptotes, eccentricity, etc.).

Suggestion for Integrating International

Content: Have students research and model Ibrahim Ibn Sina's construction of a parabola, ellipse, and hyperbola.

Subject: Pre-Calculus

Academic Standard: PC.2

Academic Standard Indicator: PC.2.1

Core Standard: Yes

Standard Description (Academic or

Indicator): Solve word problems involving application of logarithmic and exponential functions.

Suggestion for Integrating International

Content: Have students research the origin of the number e^{π} , which is sometimes known as Gelfond's number. Aleksandr Gelfond was a 20th-century Russian mathematician.

Subject: Pre-Calculus

Academic Standard: PC.2

Academic Standard Indicator: PC.2.1

Core Standard: Yes

Standard Description (Academic or

Indicator): Solve word problems involving applications of logarithmic and exponential functions.

Suggestion for Integrating International

Content: Have students examine exponential

and logistic growth in the context of world populations and the spread of disease.

Subject: Pre-Calculus

Academic Standard: PC.2

Academic Standard Indicator: PC.2.1

Core Standard: Yes

Standard Description (Academic or

Indicator): Solve word problems involving applications of logarithmic and exponential functions.

Suggestion for Integrating International

Content: Have students explore how we measure the magnitude of an earthquake and how this measure relates to an earthquake's intensity. Then have students research and compare recent earthquake magnitude measures in Chile, Haiti, and Japan. **Extension:** Challenge students to use this measure to help non-mathematicians understand the percent difference in intensity level.

Subject: Pre-Calculus

Academic Standard: PC.4

Academic Standard Indicator: PC.4.7

Core Standard: No

Standard Description (Academic or

Indicator): Draw and analyze graphs of translations of trigonometric functions, including period, amplitude, and phase shift.

Suggestion for Integrating International

Content: Have students use tide tables to plot, model, and compare the behavior of tides. **Examples:** Bay of Fundy in Nova Scotia; Caribbean; Atlantic.

Subject: Pre-Calculus

Academic Standard: PC.4

Academic Standard Indicator: PC.4.9

Core Standard: Yes

Standard Description (Academic or

Indicator): Find values of trigonometric and inverse trigonometric functions.

Suggestion for Integrating International

Content: Have students explore how

trigonometry stems from the Indo-Arab exchange of cultures and ideas. India is considered to have introduced the sine function to the Arab world through the famous Indian astronomical text *Surya Siddhanta* in which are located sine tables. Have students research the etymology of the word *sine*, as well as the origin of the tangent and cotangent functions.

Subject: Pre-Calculus

Academic Standard: PC.6

Academic Standard Indicator: PC.6.1

Core Standard: Yes

Standard Description (Academic or Indicator): Define polar coordinates and relate polar coordinates to Cartesian coordinates.

Suggestion for Integrating International Content: A slight variation on polar coordinates is used to form the coordinate system for modern air navigation. Have students use this coordinate system to chart a course for a pilot flying from Indianapolis, IN, to international cities of their choice.

Subject: Pre-Calculus

Academic Standard: PC.7

Academic Standard Indicator: PC.7.3

Core Standard: Yes

Standard Description (Academic or Indicator): Prove and use the sum formulas for arithmetic series and for finite and infinite geometric series.

Suggestion for Integrating International Content: Have students research the work of 16th-century Indian mathematician and astronomer Nilakantha Somayaji and use his geometric model for the sum of an arithmetic series to add $2+4+6+10$.

Subject: Pre-Calculus

Academic Standard: PC.8

Academic Standard Indicator: PC.8.3

Core Standard: No

Standard Description (Academic or Indicator): Find a quadratic, exponential, logarithmic, power, or sinusoidal function to

model a data set and explain the parameters of the model.

Suggestion for Integrating International Content: Have students research an average Body Mass Index (BMI) set of data for U.S. women or men and develop a model that describes the data. Then have them research BMI data for a comparable demographic from another country and adjust their model to fit the new data set. Students should comment on the change in parameters and provide an analysis of the difference in the two models.

Subject: Probability and Statistics

Academic Standard: PS.1

Academic Standard Indicator: PS.1.1

Core Standard: No

Standard Description (Academic or Indicator): Create, compare and evaluate different displays of the same data, using histograms, frequency polygons, cumulative distribution functions, pie charts, scatter plots, stem-and-leaf plots, and box-and-whisker plots. Draw these by hand or use a computer spreadsheet program.

Suggestion for Integrating International Content: Have students conduct a survey (census, if possible) to determine what percent of the students in each class of the high school, freshmen to seniors, can name the seven continents. Then have them graft the resulting data in numerous ways to compare the results by class, such as pie chart and side-by-side bar graph.

Subject: Probability and Statistics

Academic Standard: PS.1

Academic Standard Indicator: PS.1.2

Core Standard: No

Standard Description (Academic or Indicator): Compute and use mean, median, mode, weighted mean, harmonic mean, geometric mean, range, quartiles, variance and standard deviation.

Suggestion for Integrating International Content: Have students calculate the five-number summary, plus mean and standard deviation, of the data by continent. **Examples:** Oil production and oil consumption; rainfall and

water consumption; rice production and rice consumption. Then have them write a paragraph comparing and contrasting each data pair.

Subject: Probability and Statistics

Academic Standard: PS.2

Academic Standard Indicator: PS.2.1

Core Standard: No

Standard Description (Academic or Indicator): Understand the counting principle, permutations, and combinations, and use them to solve problems.

Suggestion for Integrating International Content: Calculate the number of ways (combinations) by which a given country can choose two trading partners from adjacent first tier and second tier (two away) countries.

Subject: Probability and Statistics

Academic Standard: PS.2

Academic Standard Indicator: PS.2.3

Core Standard: No

Standard Description (Academic or Indicator): Understand and use the multiplication rule to calculate probabilities for independent and dependent events.

Suggestion for Integrating International Content: Have students calculate the probability that it will rain for three days in a row for each individual month in a given year for the U.S. and selected other countries of their choice.

Subject: Probability and Statistics

Academic Standard: PS.2

Academic Standard Indicator: PS.2.5

Core Standard: No

Standard Description (Academic or Indicator): Understand conditional probability and Bayes' Theorem and use them to solve problems.

Suggestion for Integrating International Content: Have students explore probability by considering if a random person is chosen from a country (assigned by the teacher), what the probability is that the person is a doctor. Then

have students assess if the person from the student's assigned country is a millionaire, what the probability is that s/he is a government official.

Subject: Probability and Statistics

Academic Standard: PS.2

Academic Standard Indicator: PS2.8

Core Standard: No

Standard Description (Academic or Indicator): Use and apply the normal distribution.

Suggestion for Integrating International Content: Have students research and gather data from various countries to determine if the data are normally distributed. Then have them locate the 1-2-3 standard deviation points from the mean. **Examples:** Water consumption; oil consumption; percent wetlands; percent desert; rice production; life expectancy; active military personnel.

Subject: Probability and Statistics

Academic Standard: PS.3

Academic Standard Indicator: PS.3.1

Core Standard: No

Standard Description (Academic or Indicator): Compute and use confidence intervals to make estimates.

Suggestion for Integrating International Content: Have students research upcoming government elections throughout the globe. Have them find recent poll results and create a 95% confidence interval for the percentage of expected votes for a specific candidate. Have students conduct follow up research at a later date to see who won the election.

Subject: Probability and Statistics

Academic Standard: PS.3

Academic Standard Indicator: PS.3.3

Core Standard: No

Standard Description (Academic or Indicator): Use the principle of least squares to find the curve of best fit for a set of data.

Suggestion for Integrating International

Content: Have students draw a scatterplot of the data pairs by continent. Then have them determine the line of best fit to predict the next explanatory variable. **Examples:** Carbon dioxide production vs Number of species extinctions over time; Cost of health care vs Life expectancy; Percent desert vs Percent malnourished population.

Subject: Probability and Statistics

Academic Standard: PS.3

Academic Standard Indicator: PS.3.4

Core Standard: No

Standard Description (Academic or

Indicator): Calculate and interpret the correlation coefficient of a set of data.

Suggestion for Integrating International

Content: Have students draw a scatterplot and calculate the correlation coefficient for data sets by continent. **Example:** Carbon dioxide production vs Number of species extinctions over time; Cost of health care vs Life expectancy; Percent desert vs Percent malnourished population. Then have students interpret the coefficient of determination (r^2) in the context of the data set.

MATHEMATICS

Create Your Own Suggestions for Integrating International Content

Grade/Subject:

Academic Standard:

Academic Standard Indicator:

Core Standard:

Standard Description (Academic or Indicator):

Suggestion for Integrating International Content:

Grade/Subject:

Academic Standard:

Academic Standard Indicator:

Core Standard:

Standard Description (Academic or Indicator):

Suggestion for Integrating International Content:

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Core Standard:

Standard Description (Academic or Indicator):

Suggestion for Integrating International Content: