MATHEMATICS – PRE-CALCULUS

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 reseach the origin of the number e^pi, 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.