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Course: Analytic & Geometric Calculus

Project: Calculus Maple-Art Project on Culture Symbol Design

## **Incorporating a Maple-Art Project on Culture Symbol Design in Calculus Teaching**

### **1. Project Motivation**

The most barrier for students' success in mathematics learning is the lack of practice on how to apply theoretical knowledge to solve real-world problems. According with the traditional way of math lecturing, students could not gain enough opportunities to use their knowledge as practical skills in classroom. Incorporating projects into undergraduate mathematics education is considered as a new curriculum-based teaching method. Designing feasible projects in the curricular context and implementing projects into classroom teaching are popular.

### **2. Project Description**

I have created an artwork project and will integrate this project into our Calculus classroom teaching. Students in my calculus course will work on a Maple-Artwork project of Culture Symbols Design. Students will be expected to apply their Calculus graphing knowledge to create geometric figures to symbolize a variety of cultures. Cultural symbols can be images of animals, flowers, clothings, food, patterns, architectures, festivals, etc. as any traditional and classical cultural symbolism.

For this 3-month project, students will work in groups to creat 12 images. Students will be required to apply their graphing knowledge of different types of functions to create images of cultural symbols. Students will also be required to use the Maple-Software as graphing technical skills to create computer-generated images in the Math Lab. Students will work on this group project under my guidance with the help from Maple technicians. Scaffolding materials are provided to help students be familiar with project information and Maple technology.

At the end of this project, each group will be required to make a PowerPoint presentation to share their learning experiences to the entire class. Each group will required to submit a wriiten report to describe their teamwork progress. Project evaluation rubric as an assessment tool is created to evaluate students' project performance.

### 3. Project Goals

This project can foster students' creativity, freedom, and diversity in their mathematics thinking. Students can learn how to combine mathematics knowledge with technological skills to create innovation in art.

### 4. Project Implementation (Guideline and Timeline)

To complete this project, students will learn 4 phases that are involved. Here is guideline and timeline for these 4 phases:

#### ***Phase 1-Discuss Cultural Symbolism Selection***

Form groups (3 or 4 students in one group) and Group Discussion to decide the name of one Asian country and one image of its cultural symbolism.

Traditional Asian cultural symbolism can be images of animals, flowers, clothings, food, patterns, architectures, festivals, etc.

Communicate with someone on Asian culture at BMCC or CUNY-wide to ask for suggestions on how to enlighten students on the Asian culture. Looking up a few sites may be useful:

Asian Cultural Center: <https://asiancc.net/>

Asia Society: <https://asiasociety.org/new-york>

You can find any public websites such as Google or YouTube as helpful resources to get information.

Each group (2 up to 4 students in each group) will be assigned to work on one cultural image which symbolize one Asian country.

#### ***Phase 2-Use Graphing Knowledge***

In each group, students will apply graphing knowledge to figure out what math graphing equations can be used and/or composed to obtain the selected cultural figure. Students will be required to use graphing knowledge in Calculus as well as their prior knowledge in Algebra and Trigonometry. For example, students will be expected to use exponential functions, logarithmic functions, parametric functions, multi-variable functions, and polar equations in Calculus. In addition, students will be also expected to use their prior graphing knowledge in Algebra, such as linear functions, quadratic functions, reciprocal functions, functions with absolute value, and others. To create dynamic wave shape images, students can use periodic graphs of trigonometric functions in trigonometry. As an instructor, I will be always available whenever you need help!

#### ***Phase 3-Practice Maple Technology***

Students will be required to produce computer-generated cultural image on the use of Maple Software. Maple Software instruction booklets will be provided for students to obtain necessary technical knowledge. In the math computer lab, students will receive special training and hands-on personal assistance from Maple technicians. For example, students can learn how to use

Maple code of “display” to compose multiple graphing equations in a cohesive diagram. Students can learn how to apply Maple command of “axes=none” for deleting backgrounds of coordinate systems. Students can learn how to use the color command to select their desired colors. Students can use Maple code “filled=true” to paint selected colors. Students can learn how to use Maple code on “thickness=number” to adjust thickness of figure outlines. Students can learn how to convert Maple files to JPEG or PDF files. Students can learn how to add captions. Assistance from Maple technicians can be available if need!

#### **Phase 4-Report Project Outcomes**

Each group is required to submit a written report and make a PowerPoint presentation to an entire class. This report and presentation should answer the following 4 questions:

- 1) Which country and what cultural elements are represented by the selected image?
- 2) What math graph equations or functions do you need in the creation of your image design?
- 3) What Maple codes do you use to generate this digital image?
- 4) What benefits from this project experience?

#### **5. Project Assessment (Rubric and Grading System)**

Two assessment methods will be used to evaluate students’ project work.

The first assessment will be a written assignment. Students in each group will be required to submit one written report to explain how they have completed this project and what each participant has made to the group by answering the following questions:

- 1) Which country and what cultural elements are represented by the selected image? (10 points)
- 2) What math graph equations or functions do you need in the creation of your image design? (10 points)
- 3) What Maple codes do you use to generate this digital image? (10 points)
- 4) What benefits from this project experience? (10 points)

The second assessment method will be a PowerPoint presentation. Students in each group will be asked to make one PowerPoint presentation to show their group accomplishments and to demonstrate how they generated project outcomes by using Maple software.

PowerPoint Presentation will be evaluated according with the following **rubric**:

Checked Items/Rating by Points	Excellent 10 points	Good 8 points	Fair 6 points	Poor 3 points	Missing 0 point
Explanation on how using different graphs of equations to generate outlines of a cultural symbol					
Demonstration on how to apply Maple commands for the computer-generated pictures					
Explanation of each participant's contribution in the group accomplishments					
Benefits from this project experience					

**Project Evaluation and Grading System (100 points):**

This project is worth 10% of an overall final grade during the calculus course study.

The total score of this project is worth 100 points. 3 components of this project are listed below:

- The completion of computer-generated image of one Asian cultural symbol is worth 20 points.
- PowerPoint presentation is worth 40 points.
- Written report is worth 40 points.