

P R O P O S A L D E S I G N : O V E R V I E W

Name of Project: Viewing graphs of multivariable functions **Semester:**

Subject/Course: MTH 33 **Instructor(s):** Luis Fernandez

Other subject areas to be included, if any:

Key Knowledge and Understanding	Hands-on understanding of the graph of a function of two variables. Learning how different functions have different graphs and develop intuition. Understanding that many shapes (all, really) can be described using mathematics. Learning the basics of Mathematica to graph functions and export pictures into .stl files.
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Success Skills (to be taught and assessed)	Critical Thinking/Problem Solving Students will have to decide which formulas to enter in order to obtain a shape that they find interesting. This requires a trial and error process until the desired shape is found.	Self-Management While the assignment can be done in a few hours, it requires the students to either download Mathematica in their computers (recommended) or use a computer on campus, meet with their group and organize the project.	
	Collaboration Students will work in groups of 2 or 3. They will need to collaborate in the design of their graph and how to obtain a formula that produces that graph.	Other:	

Project Summary (expectations of this module) (include student role, issue, problem or challenge, action taken, and purpose/beneficiary)	Students will have to either download Mathematica or use computers on campus. They will receive instructions on how to graph a function of two variables in Mathematica and how to export the graph into a .stl file. Working in groups, they will have to draw the graph of a function that they find interesting, or challenging, or aesthetically pleasing. Once they have the desired graph, they will have to convert it to a .stl file and send it to me. I will print the graphs and pedestals (I may have to change some things so that they print properly) and grade them according to originality, quality, and thoughtfulness. I will bring the final products to class and we will have a session to discuss what each group did and then do a vote on which graph is more interesting.
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Driving Question	How does the formula of a function in two variables determine its graph?		
Software(s) that will be used	Mathematica. This is very expensive, advanced software, but the student edition is free for BCC students. Also, many computers on campus have it installed.		
Products and Skill acquisition vs time	<p>Individual: Hands-on understanding of the graph of a function of two variables. Learning how different functions have different graphs and develop intuition. Understanding that many shapes (all, really) can be described using mathematics. Learning the basics of Mathematica to graph functions and export pictures into .stl files.</p> <p>Team: Organization of different skills as well as sharing of knowledge: some students may be more familiar with computers, while other may have the mathematical concepts clearer. They will have to collaborate in order to have a good finished product.</p>	Specific content and competencies to be assessed: Originality, tidiness, thoughtfulness.	
Use of class time	There will be a session in class to discuss what each team did and why, and how they accomplished it. Then there will be a class discussion to decide which graph is the most original, interesting, or beautiful.		
Completion Time	Students will have 2 weeks to come up with the final product.		
Resources and Sets of Objects Needed	Computer with Mathematica installed. Internet connection to send the file.		
Reflection Methods (how individual, team, and/or whole class will reflect during/at end of project)	Journal/Learning Log		Focus Group
	Whole-Class Discussion There will be a class discussion to decide which graph is the most original, interesting, or beautiful.		Fishbowl Discussion There will be a session in class to discuss what each team did and why, and how they accomplished it.
	Survey		Other:

PROJECT DESIGN - CLASSROOM ACTIVITY: STUDENT LEARNING OUTCOMES (SLOS) AND ASSESSMENT

Project: Viewing graphs of multivariable functions

Driving Question: How does the formula of a function in two variables determine its graph?

Student Learning Outcomes/Targets
(knowledge, understanding & success skills needed by students to successfully complete products)

- Gain a deeper understanding of the meaning of the graph of a function of two variables.
- Learn how different functions have different graphs and develop intuition.
- Understand that many shapes (all, really) can be described using mathematics.
- Learn about Mathematica, a computer algebra program that can do essentially any computation they will learn in their Mathematics studies.
- Learn the basics of Mathematica, which will be an asset for their future careers.

Checkpoints/Formative/Summative Assessments to check for learning and ensure students are on track (Key Knowledge, Understanding, and Success Skills)

- A week after assigning the project, students will be asked in class to give a report on their progress, and answer any questions they may have.
- Students will be in contact with the professor by email at all times in case they have problems in any of the steps of the project.

Instructional Strategies for All Learners provided by instructor(s), other staff, experts; includes scaffolds, materials, lessons aligned to learning outcomes and formative assessments

- Before the project is assigned, graphs, sections of graphs, and how to find them will be covered in class.
- Students will be able to use the textbook, their notes, and any other resources they may find.

Final Product(s)
Presentations, Performances, Products and/or Services

- Mathematica file where the function is printed.
- 3D-printed graph of a function.
- Presentation on why they chose that function and why the graph has that shape.