

## Project 2: Tile Design

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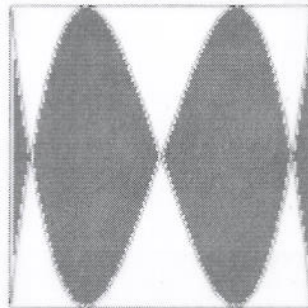
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### Preparation

Be sure to read the *Project Report Guidelines* before beginning your project. Remember, you are to turn in a neat and complete project report. Any figures should have a title and be properly referenced in the report. Do not turn in a Maple worksheet. A complete project report should include all necessary equations and information.

### Portion 1: Analyzing an Existing Tile

You have been hired by Columbia Tile and Flooring to design a new pattern of floor tile. The first portion of your contract calls for you to analyze a tile pattern that the company has recently developed. The foremost concern of the company is cost, and this is based on the amount of color required to tint regions in the various tile patterns. Thus, your task is to discover functions to recreate the tile design below. The design was created using two polynomials. The tile itself is  $1 \text{ ft}^2$ , so you will be working with functions on the window  $[0, 1] \times [0, 1]$ . Once created, you are to determine the area of the darker regions. What percent of the tile will be colored with the darker color?



In your report you should include:

1. any equations you used to determine the exact functions for the design and an explanation of those functions,
2. formulas for the exact functions used to recreate the design,
3. a plot of your functions that illustrates the tile design,  
**Note:** You can either shade the tile by hand, or copy it into Microsoft Paint to color it.
4. the area of each dark region (4 total) and the total area of the darker color and the mathematical processes used to calculate those areas, and
5. the percentage of area covered by the darker tint.

See reverse for Portion 2

### Portion 2: A Unique Tile Design

The second portion of your contract calls for a **unique** tile design. You are to create a new tile design based on the following specifications:

1. Your tile design must fit on a 1 ft<sup>2</sup> tile, so you will be working with functions on the window  $[0, 1] \times [0, 1]$ .
2. Your design should have two colors, "dark" and "light".
3. The curves that determine the design should be given as formulas.
4. No color should account for more than 70% of the total area.
5. Your design should have at least 6 regions determined by at least 2 different curves. (The tile analyzed in Portion 1 has 10 regions determined by 2 curves.)

*Note: Your design should not use 2 parabolas alone or 2 cubics alone as these options have been exhausted by the company.*

You should consider the following while working on your design:

1. **The final project should have only one author.** You may discuss the project with your classmates, but what you turn in should contain your own original design.
2. Maple should be used in all calculations and plots.
3. You may use many curves in your design. Here is a list of models that you may use (in addition to the ones you may come up with).
  - Lines  $y = mx + b$
  - Semi-Circles  $y = b \pm \sqrt{r^2 - (x - a)^2}$  (radius  $r$ , Center  $(a, b)$ )
  - Parabolas  $y = ax^2 + bx + c$
  - Cubics  $y = ax^3 + bx^2 + cx + d$
  - Sinusoidal  $y = a \sin(bx + c)$   
*Note: You can use your PreCalculus skills to change the amplitude and period.*
  - Exponential  $y = ae^{bx} + c$
  - Logarithmic  $y = a \ln|x - b| + c$ .
4. Take advantage of any symmetry that your tile might have when calculating area.
5. Do not forget to include the following:
  - the formulas for the functions used in your design and an explanation of any equations used in their determination,
  - a plot of your functions that illustrates the tile design,  
*Note: You can either shade the tile by hand, or copy it into Microsoft Paint to color it.*
  - the area of each dark region and the total area of the darker color and the mathematical processes used to calculate those areas, and
  - the percentage of area covered by the darker tint.
6. Be creative!