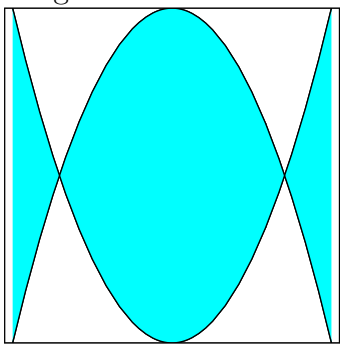
Modeling Project 1 MTH 142 Spring 2004

The Stained Glass Co. (SGC) is a well known company that sells many products. SGC has been doing very well since it became fashionable in urban America to have a house with at least one window with stained glass. Orders have been pouring in, particularly from large corporations specialized in construction. The following is a design that initially sold very well, but whose recent sales are dissapointing:



The Market Research Unit of SGC has determined that buyers want new designs. As a member of the Industrial Design Unit of the Stained Glass Co. you have been given the assignment of producing **two designs** for a window acording to the specifications listed below.

SPECIFICATIONS

[S1] The shape is a square.

[S2] Each design should have exactly two colors, "dark" and "light"

[S3] The curves that determine the design are given in terms of formulas.

[S4] No color should account for more than 75 % of the total area.

[S5] Each design should have at least six regions.

[S6] Each design should have at most one straight line used as boundary.

Also, you are supposed to issue a **REPORT** with the following sections.

Section 1: Name of Project, author, class/section, date.

Section 2: A complete, informative and clear description of the project in your own words.

Section 3: Proposed design number 1. Supply

a) A plot of the design. (Use the auxiliary function found in the Maple worksheet `ftp://www.math.uri.edu/pub/merino/StainedGlassCo.mws`)

b) The formulas for boundary functions (curves).

c) A calculation of the areas corresponding to light and dark colors. (Explain carefully all the steps. Use Maple.)

d) The percent of the total area for each color.

Section 4: Proposed design number 2. Include subsections as in Section 3.

Section 5: Conclusions. Compare the different designs, and state the weak and strong points of each. State whether you believe if the designs meet the specifications.

COMMENTS and additional information

- 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 designs.
- Precede each Maple computation with an English sentence explaining what you are about to do. (Use the "Text Mode" button for this). Maple should be used in all calculations and plots.
- You may use many curves in your designs. Here is a list of models that you may use (in addition to the ones you may come up with). In the formulas below, the letters "a", "b", "r", and "c" represent constants that you choose at your convenience.

  Lines: $y = mx + b, \quad x = a, \quad y = b.$

  Semi-Circles: $y = b \pm \sqrt{r^2 - (x-a)^2}$ (here r=radius, (a,b)=center.)

  parabolas: $y = a\,x^2 + b\,x + c$

  sinusoidal: $y = a\,\sin(b\,x + c)$

  exponential: $y = a\,e^{bx} + c$

  logarithmic: $y = a\,\ln|\,x - b\,| + c$

- For basic information on Maple, see *" Introduction to Maple in Calculus II"(intro142.mws)*, located in *www.math.uri.edu/Center/workc2.html*
- MAPLE HELP in Tyler 101, see `www.math.uri.edu` → `Spring Tutoring Schedule`

USEFUL MAPLE COMMANDS

```
> restart;                  # insert this at the top of worksheet;
> with(student);            # insert at the top; adds extra functionality
> with(plots);              # insert at the top; adds extra functionality
> f:=x->x^2;                # define a function f(x)
> g:=x->evalf(x^3);         # define a function f(x), force it to give decimal result
> plot(f(x),x=-1..1,y=0..2,scaling=constrained); #uses same scaling in x and y axes.
> plot(f(x),x=-1..1,y=0..2,axes=boxed); #a plot in boxed form.
                            # Note: the option tickmarks=[0.0] eliminates ticks.
> plot([f(x),g(x)],x=0..2);# plot two functions for x between 0 and 2.
> solve(f(x)=g(x),x);       # solve the equation f(x) = g(x) for x.
                            # Note: ‘‘fsolve’’ may do a better job than ‘‘solve’’.
> fsolve(f(x)=g(x),x,1..3);# find solutions to f(x)=g(x) in interval from x=1 to x=3.
> int(f(x),x=1..2);         # integral of f(x) for x between 1 and 2.
> evalf(int(f(x),x=1..2)); # integral of f(x) for x between 1 and 2, decimal answer.
> Int(f(x),x=1..2);         # unevaluated integral of f(x) for x bet. 1 and 2.
> Pi ;                      # the number 3.1415...Note the it begins with capital P.
> exp(2.5);                 # exponential function evaluated at 2.5
> ln(2.5);                  # the natural logarithm of 2.5
```