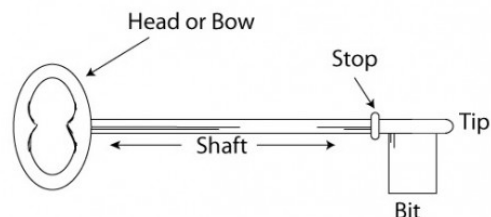


AP Calculus AB KEY project

Introduction

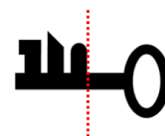
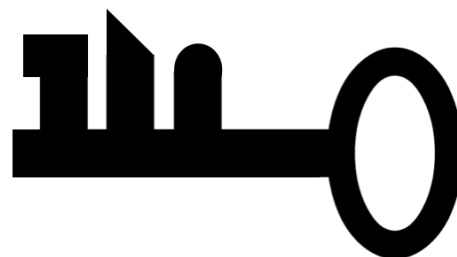
In this project, you will be required to create a key by using functions, then graph it on Grapher, and finally physically build it by cutting it out of a Styrofoam or cardboard. The whole process will be presented as a new chapter in your iBook.



Requirements

The requirements for the key are the following:

- Your key will have 3 distinct parts as in the figure. Note: the figure on the right is merely an examples of a design.
- The width of each bit will be 24 mm wide. Each space will be 12mm wide. The shaft of the key will also be 24mm thick.
- The top of the bits must be (1) one horizontal line that extends horizontally, (2) one slant line and (3) one semi-circle.
- The total “volume” covered by the three bits but not the shaft nor the head (left of the dotted line on the figure) as it is rotated in an imaginary key lock has to be 850 cm^3 .



Task 0

This is an ongoing task: you will eventually publish a chapter in your iBook illustrating the process of this project. Make sure you keep photos, screenshots, and notes of your advance as you go through the tasks!

Task 1

Your task is to choose the height of each bit, the slope of the slant line, the length of the horizontal extension and the length of the shaft and tip so that you satisfy the requirements.

Task 2

Prove that you are satisfying all requirements (in particular the volume of 850 cm³)

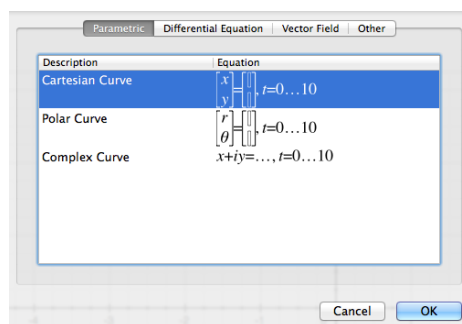
Task 3

Use *Grapher* and create your key with a piecewise functions (including the head). Note that your key will be made up of a great number of pieces of functions. Your units have to be in mm or cm; scaling later on is not allowed.

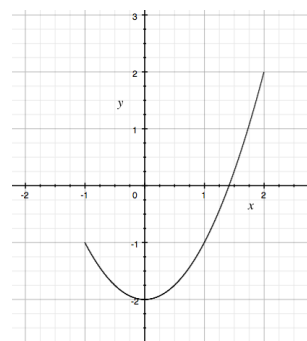
Here is how you can set lower and upper limits to functions on *Grapher*.

Method 1

- Click the + button at the bottom left and select “New Equation from template”
- Select the Cartesian curve.
- Always write t in the top entry of the 2 x 1 matrix
- Write your equation in the bottom in terms of t .
- The right part sets the lower and upper limits of your piece. The example shows the graph of $y = x^2 - 2$ between $x = -1$ and $x = 2$.



$$\begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} t \\ t^2 - 2 \end{bmatrix}, t = -1 \dots 2$$



Method 2

Start with $y =$, then write your limits on x and separate them with $\&$. After you have set the lower and upper limit, use $?$ and write the second part of the equation.

The example is also for graph of the parabola $y = x^2 - 2$ on the interval $[-1, 2]$

$$y = x \geq -1 \& x < 2 ? x^2 - 2$$

Task 4

Buy Styrofoam or cardboard and actually cut the full key to size. Make it look realistic.

Task 5

Create an iBook chapter for this project.