

# Function Art Summative

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## Abstract

I wrote a program that takes an image and arranges thousands of smaller functions to produce a series of piecewise functions that when graphed together resemble the original image. I used this program to produce a collage with over 50,000 functions.

## 1 Mini Functions

The program works by translating a collection of small functions that fit in a 1x1 area around to represent pixels of an image. Different functions have different densities of lines, allowing certain pixels to be darker than others.

## 2 Results



Figure 1: Input Image

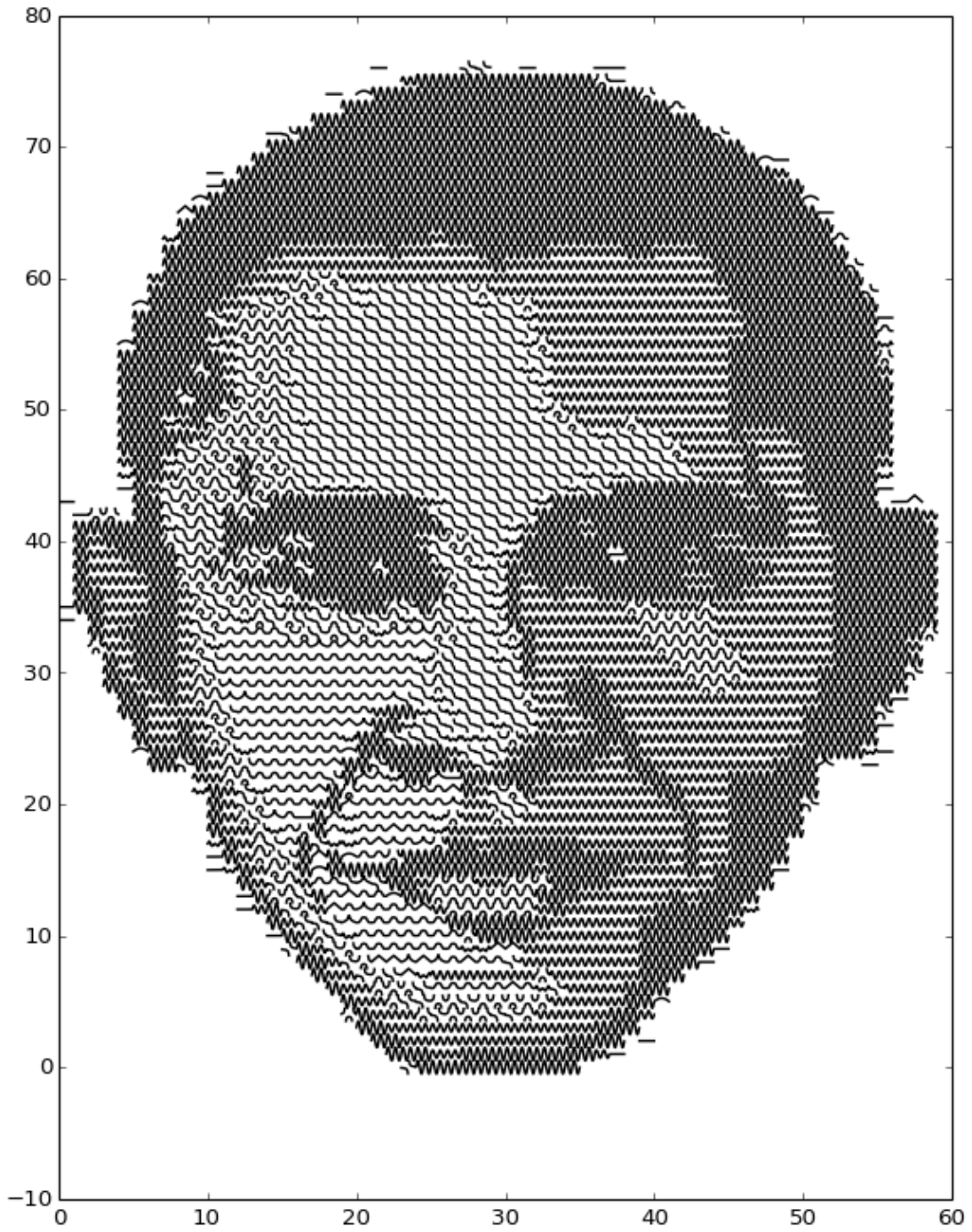


Figure 2: Output of Program Given Obama Photo.

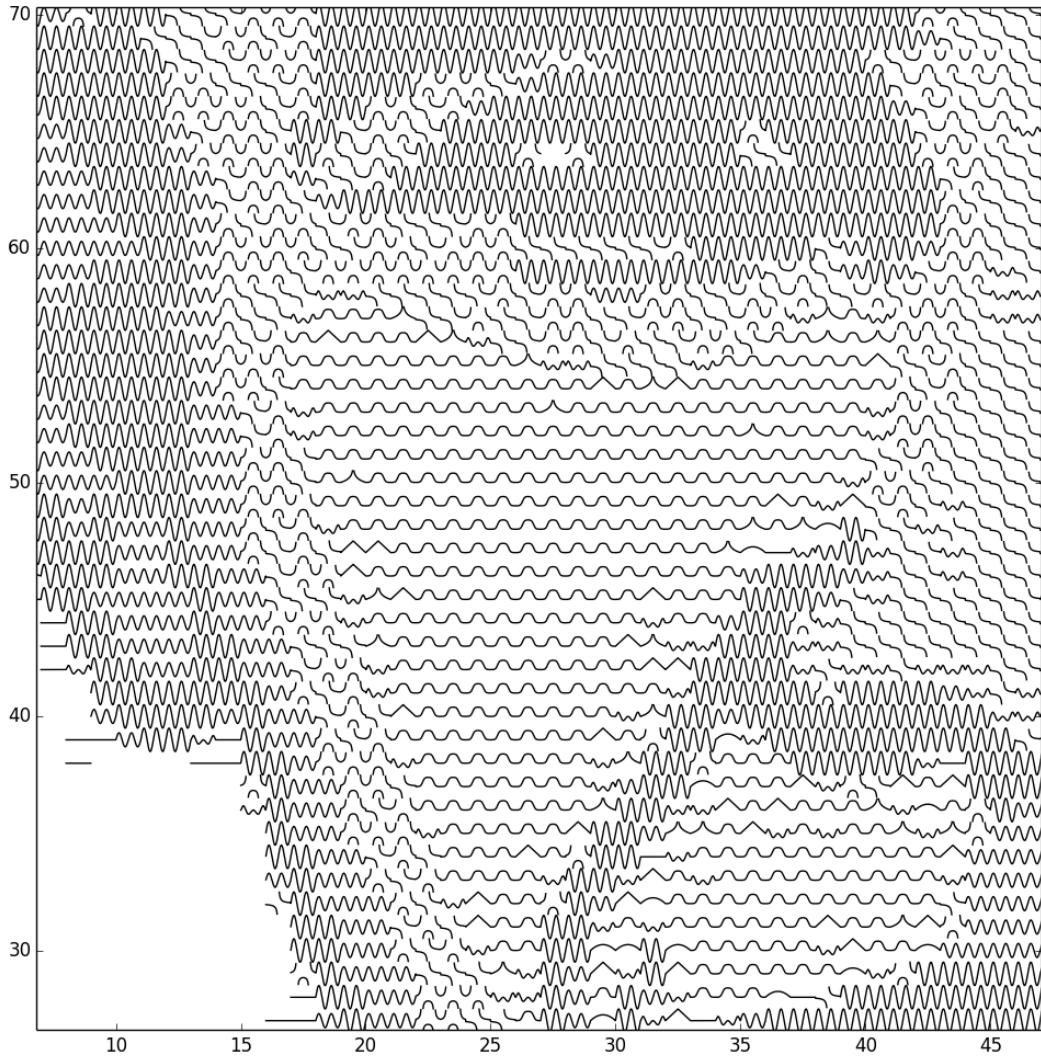


Figure 3: Closeup of output

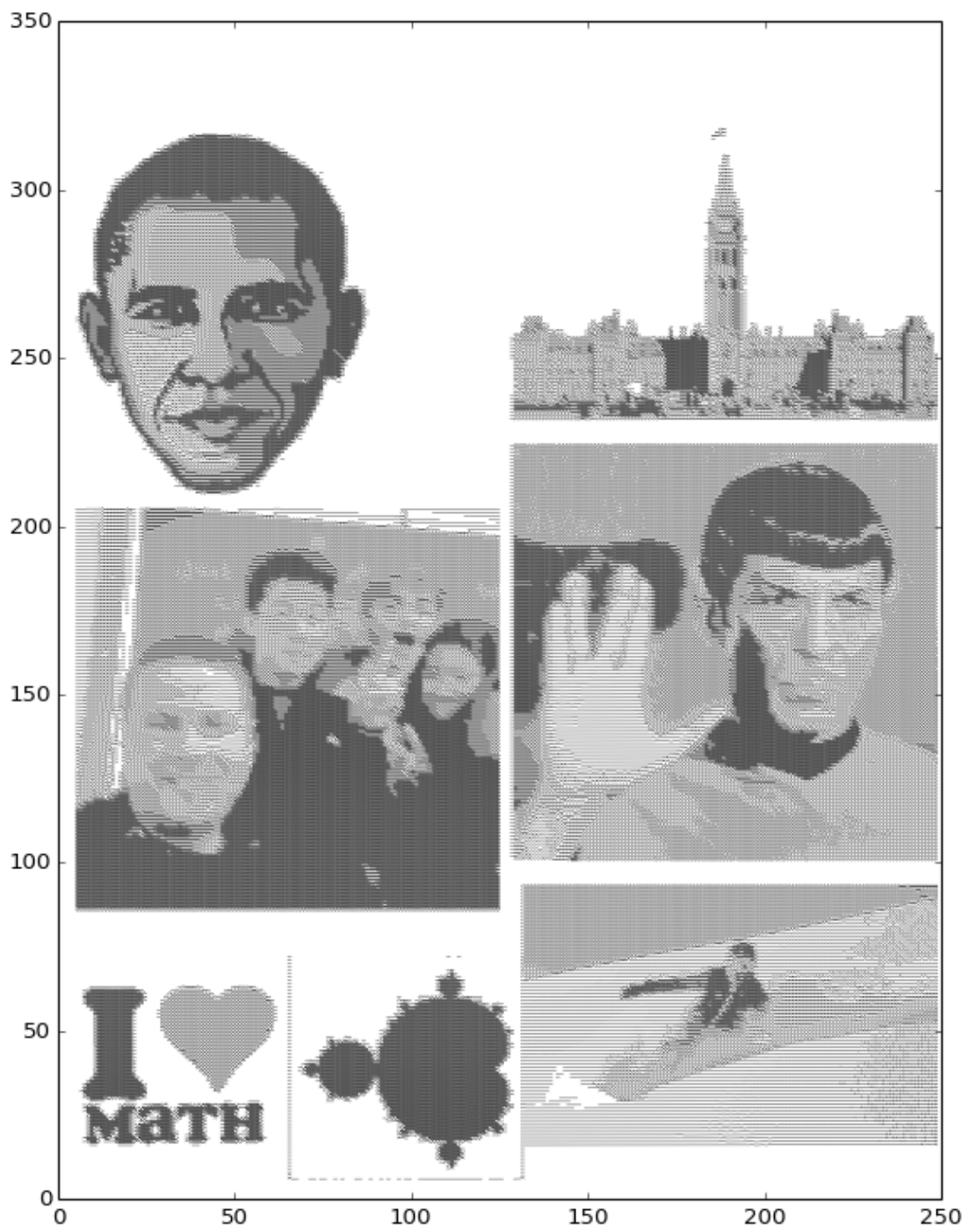


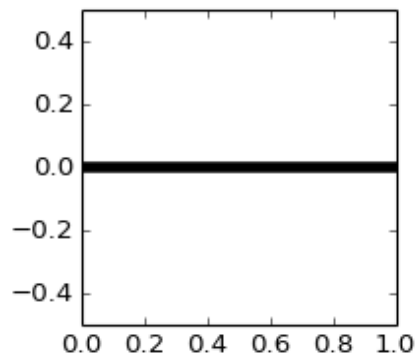
Figure 4: Collage

### 3 The List

These are all the functions that are used in the images. They all fit in 1x1 and are restricted when they exceed the bounds of  $-0.5 \leq y < 0.5$  and  $0 \leq x < 1$ . They are ordered with the lightest/least dense functions first.

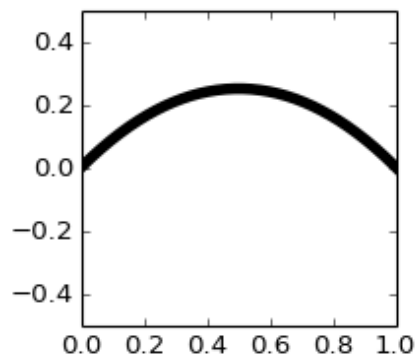
#### 3.1 Horizontal Line

$$f(x) = 0, 0 \leq x < 1$$



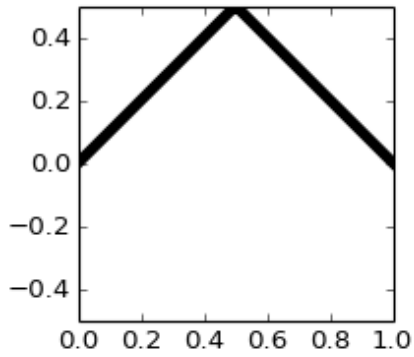
#### 3.2 Quadratic

$$f(x) = -x(x - 1) + 0, 0 \leq x < 1$$



#### 3.3 Absolute Value

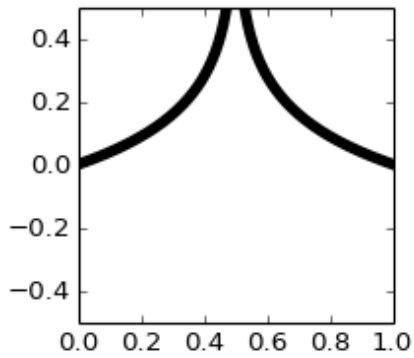
$$f(x) = -|x - 0.5| + 0.5, 0 \leq x < 1$$



### 3.4 Double Logarithm

$$f(x) = -0.4 \log(-2x + 1) + 0, 0 \leq x < 0.47$$

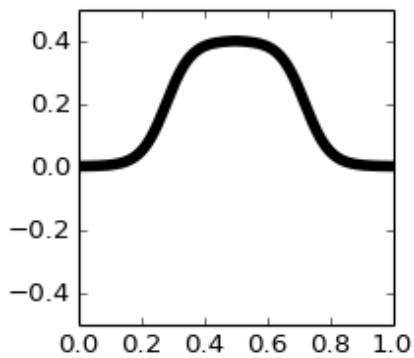
$$f(x) = -0.4 \log(2x - -1) + 0, 0.47 \leq x < 1$$



### 3.5 Double Logistic Function

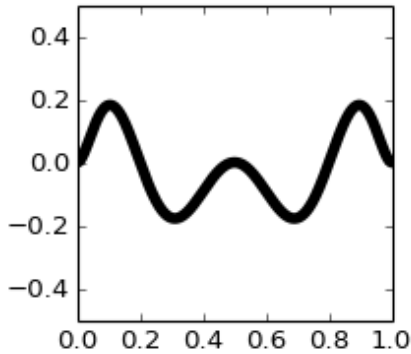
$$f(x) = \frac{0.4}{1 + e^{(-25x+7)}} + 0, 0 \leq x < 0.5$$

$$f(x) = \frac{0.4}{1 + e^{(25x-18)}} + 0, 0.5 \leq x < 1$$



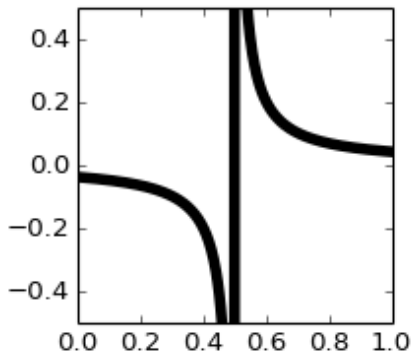
### 3.6 Polynomial

$$f(x) = 2000x^2(x - 0.2)(x - 0.5)^2(x - 0.8)(x - 1)^2 + 0, 0 \leq x < 1$$



### 3.7 Simple Reciprocal

$$f(x) = \frac{0.2}{10x - 5} + 0, 0 \leq x < 0.45, 0.54 \leq x < 1$$



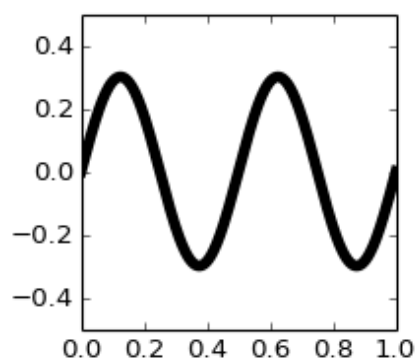
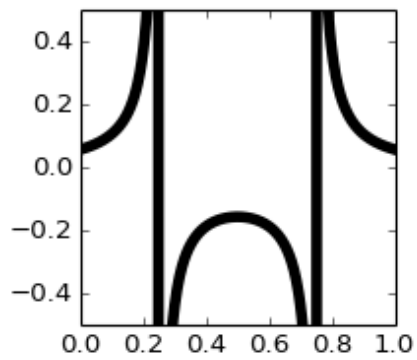
### 3.8 Rational Polynomial

$$f(x) = \frac{0.01}{(x - 0.25)(x - 0.75)} + 0, 0 \leq x < 0.21, 0.3 \leq x < 0.7, 0.79 \leq x < 1$$

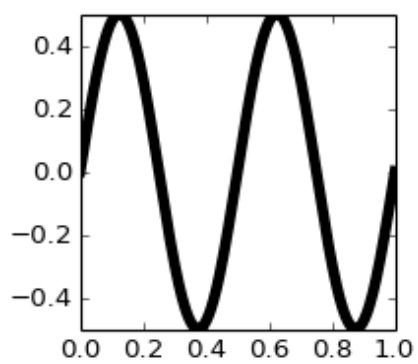
### 3.9 Sine Functions

$$f(x) = 0.3\sin(4\pi x) + 0.5, 0 \leq x < 1$$

$$f(x) = 0.5\sin(4\pi x) + 0.5, 0 \leq x < 1$$



(a) Small Sine



(b) Large Sin

Figure 5: Sine Waves