MATH 270 PROJECT WRITE-UP SPRING 2020 NAMES: Hannah Thompson
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**I. Complete Technical Work:**

$x = cos(t)$
$y =$

$$\begin{cases} 4e^t tsin(3t) + 6 & -4.3 \leq t < -0.9 \\ -t^{3/8} - 2 & -0.9 \leq t < 4 \\ sin(t) & 4 \leq t \leq 10.4 \\ \frac{t}{4} & 10.4 < t \leq 15 \end{cases}$$

To graph circles and loops in parametric form with only one equation, we set x equal to cos(t) and constructed y as a piece-wise function.

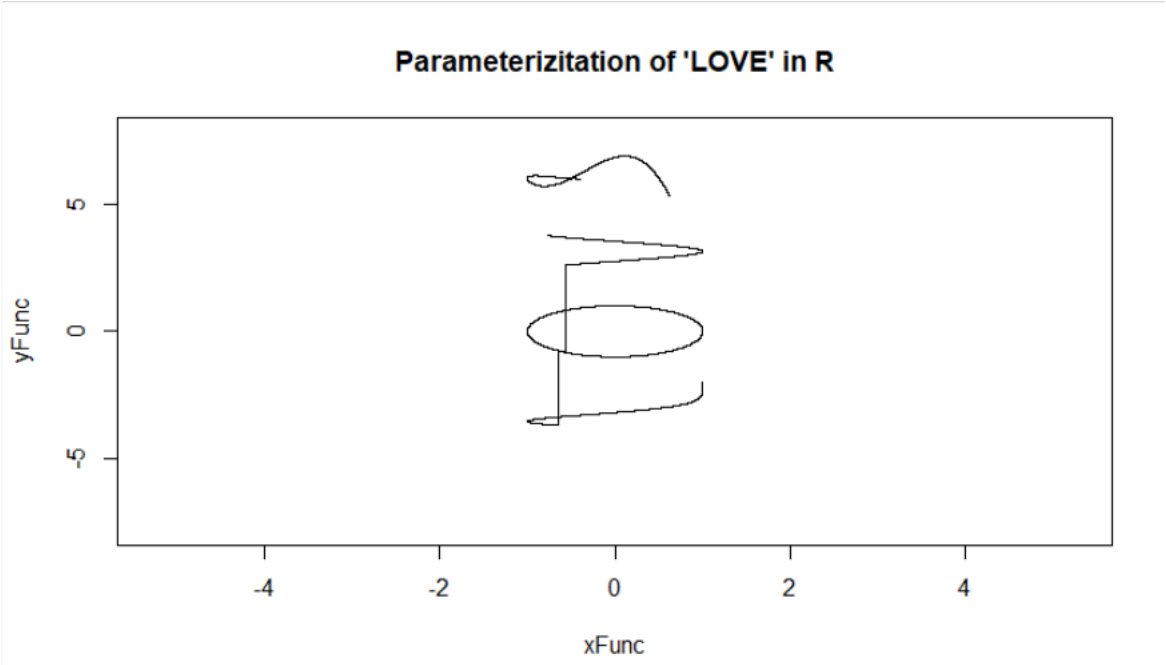
**L:** The equation ($y = -t^{3/8} - 2$) gives an L-shape. The negative sign of the $t$ provides the direction, the exponent altered the equation to appear more stretched, and the $-2$ altered the L's position on the y-axis.

**O:** Since $cos^2 + sin^2 = 1$, by setting x=cos(t)and y=sin(t), $x^2 + y^2 = 1$. This yields a a circle centered at zero with a radius of 1.

**V:** For the V of this graph, setting y equal to t created a wave-like function that resembled a V. To alter this wave to the desired frequency, we multiplied it by $\frac{1}{4}$.

**E:** After discovering that $y = e^t sin(3t)$ creates a looping function that resembled a backwards E, we multiplied the function by t to flip its direction. Next, we multiplied this function by 4 to fix its proportions. Lastly, we added 6 to the equation to place it in line with the other letters.
Finally, we restricted the boundaries of t for each function in the piece-wise function to complete the appearance of each letter.

**II. The Plot:**



```r


t <- seq(-4.3, 15, 0.0001)

xFunc <- cos(t)

yFunc <- ifelse(t >= -4.3 & t < -0.9, 4*exp(t)*sin(3*t)+6,
        ifelse(t >= -0.9 & t < 4, -t^(3/8)-2,
          ifelse(t >= 4 & t <= 10.4, sin(t),
            ifelse(t > 10.4 & t <= 15, t/4, 0))))

plot(xFunc, yFunc,
     type = "l",
     main = "Parameterizitation of 'LOVE' in R",
     xlim = c(-5.25, 5.25),
     ylim = c(-7.75, 7.75))

```

## III. A Brief Narrative:

To divide up the work for this project, Matthew and I (Hannah) agreed to determine the necessary equations together, sending messages back and forth to notify the other of any progress or problems. Since Matthew had prior experience with programming, he agreed to graph the equations in *R*, while I was tasked with composing our final write-up. Throughout the scope of this assignment, we accomplished the majority of our work through trial-and-error. At first, we found equations in rectangular coordinates and combined them all into this single equation:

$$(-\frac{6x}{5x+0.9} - 1.99 - y)((2x-7.5)^2 + (1.3y+2)^2 - 4)(3|x-6.75| - 3 - y)((x-9)^2 + y(\,13y+0.7)^2) = 0,$$
$$-3.08 < y < 0.1$$

To keep the transition to parametric coordinates simple, we set x=t. However, we ran into difficulties deriving parametric equations for the circle and the loop while maintaining $x = t$. For the sake of ease and the ability to construct circles and loops in parametric form with only one equation, we decided to set x equal to cos(t) and organized y as a piece-wise function. However, this decision created unforeseen restrictions while moving the pieces of "LOVE" along the x-axis. To get around this, we constructed the word along the y-axis. For the L of the graph, the equation $y = t$ was proposed since it had an L-like shape. We then adjusted the exponents to make it sit vertically. Since we had experimented in class with creating a circle from parametric functions, this was the most straightforward equation. Likewise, the V was simple since we had already discovered that setting $y = t$ would create a bending shape. Originally, we attempted to write the final E as a loop or a spiral, by setting y equal to sin(t) and experimenting with different factors of multiplication. While we failed at this, we discovered the equation $y = 4e^t tsin(3t) + 6$, which looked like a cursive E. Matthew took our results and graphed them by using the program *R*, and I complied our findings.