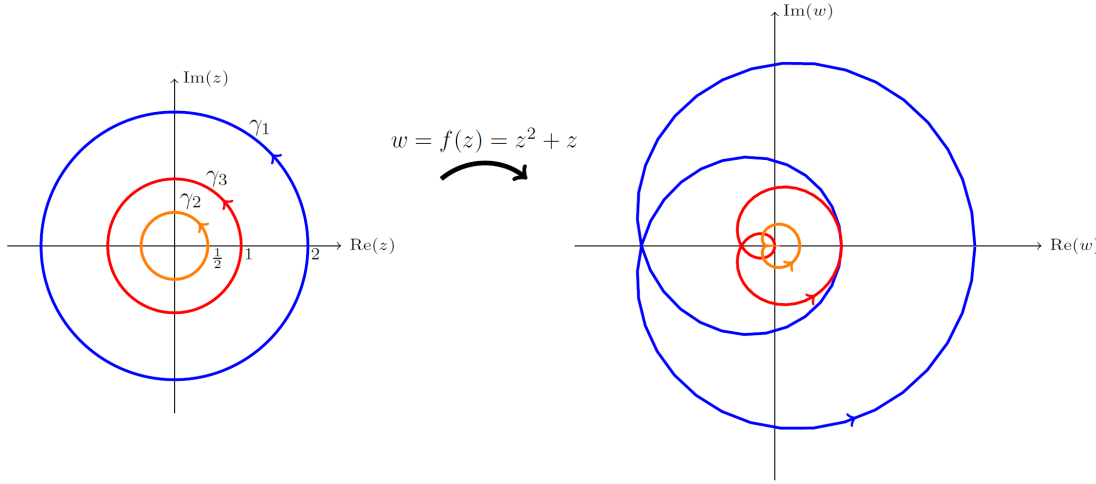


The image of 3 different circles under $f(z) = z^2 + z$.

Let $h(z) = z + z^{-1}$ and note that $h(z) = 0$ iff $z^2 + 1 = 0$, i.e. iff $z = \pm i$.

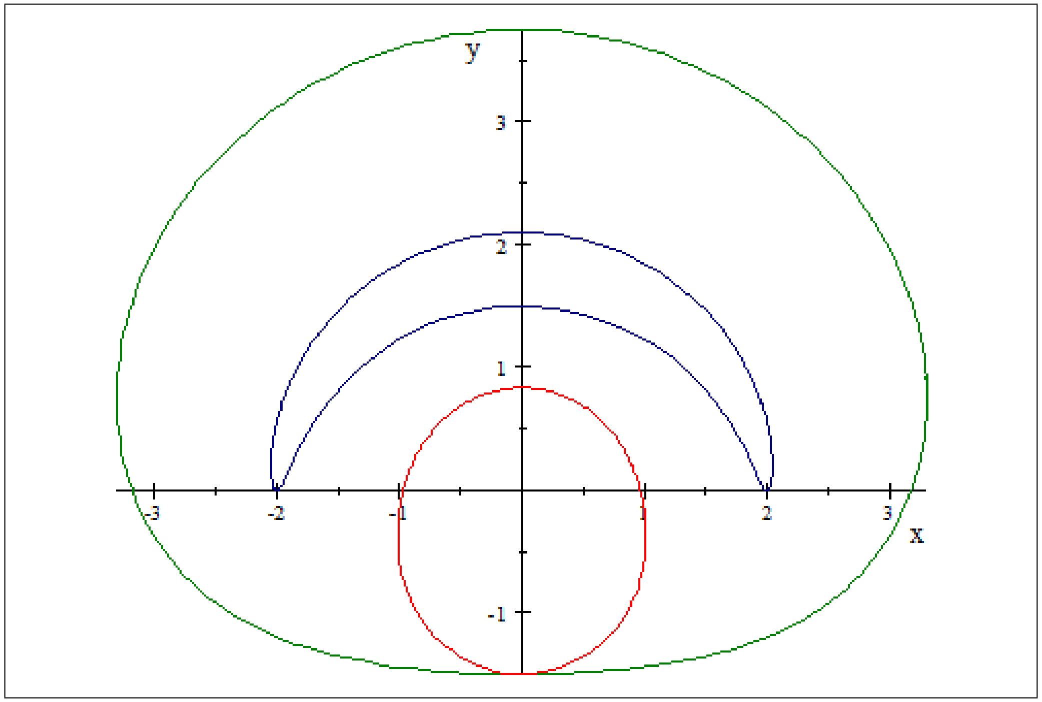


FIGURE 1. Here $h(z) = z + z^{-1}$ and these are plots of $h\left(i + 3e^{i\theta}\right)$ in green, $h\left(i + 1.5e^{i\theta}\right)$ in blue, and $h\left(i + \frac{1}{2}e^{i\theta}\right)$ in red.

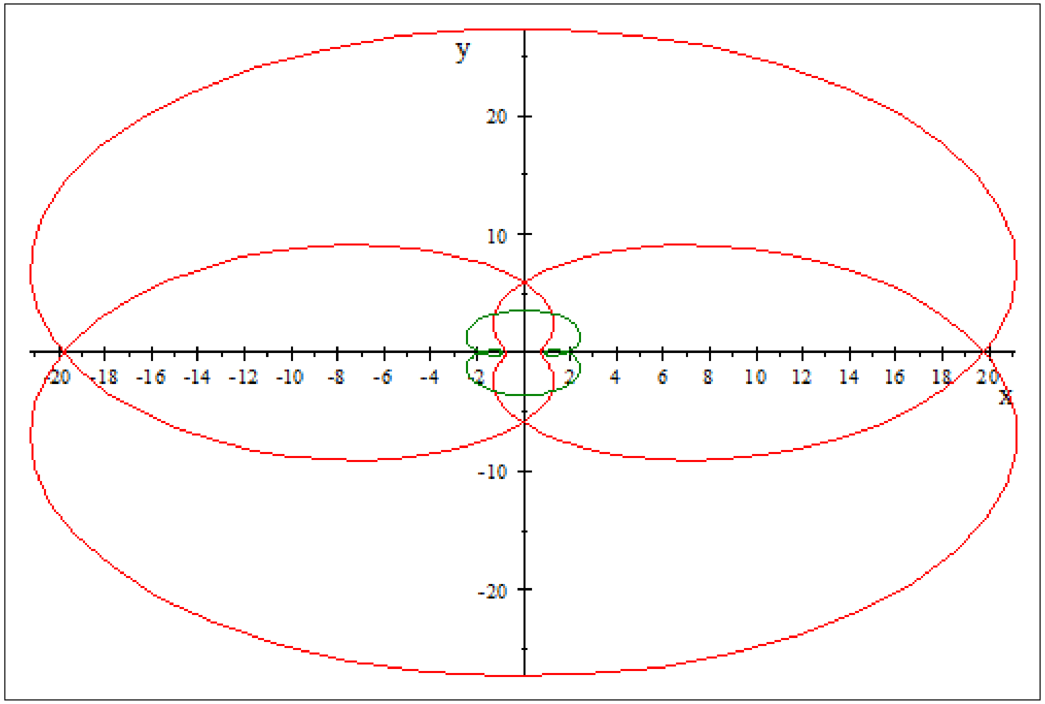


FIGURE 2. Plots of $\sin\left(4e^{i\theta}\right)$ in red and and $\sin\left(2e^{i\theta}\right)$ in green with winding number 3 and 1 respectively.

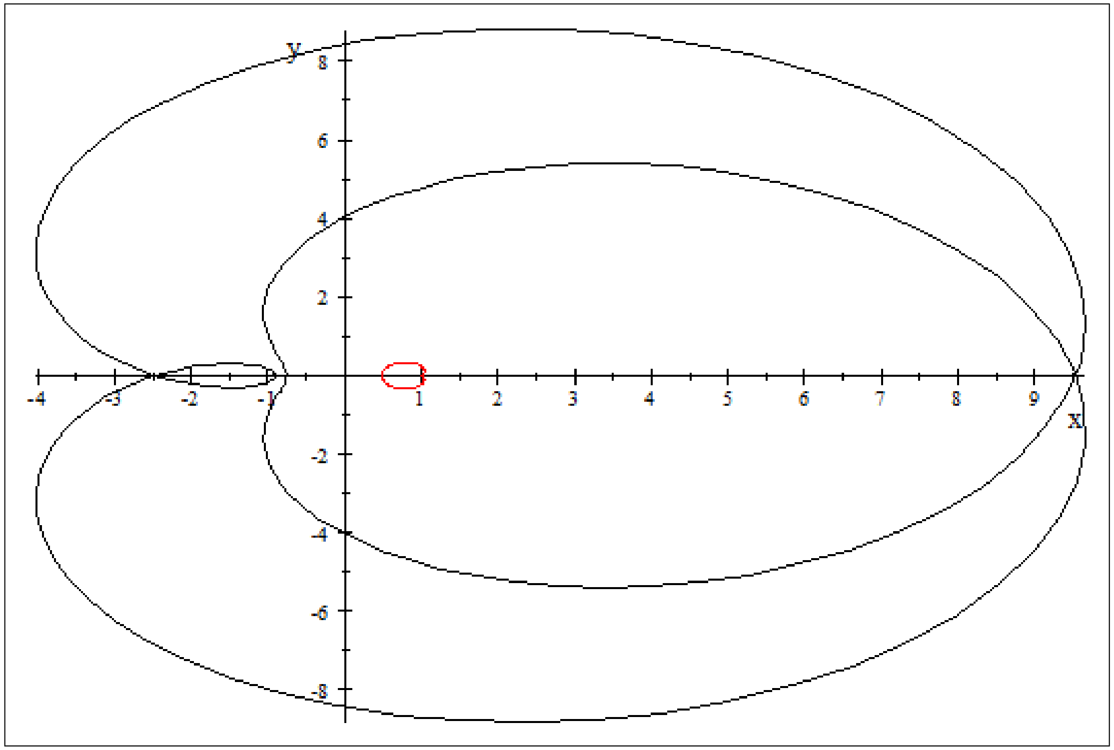


FIGURE 3. Plots of $\sin\left(1+3e^{i\theta}\right)$ in black and $\sin\left(1+\frac{1}{2}e^{i\theta}\right)$ in red with winding numbers about 0 being 2 and 0 respectively.

$$g(z) = z\left(1 + \frac{1}{10}\left(z - \frac{1}{3}\right)^3\left(z - \frac{1}{2}\right)^2\right)$$

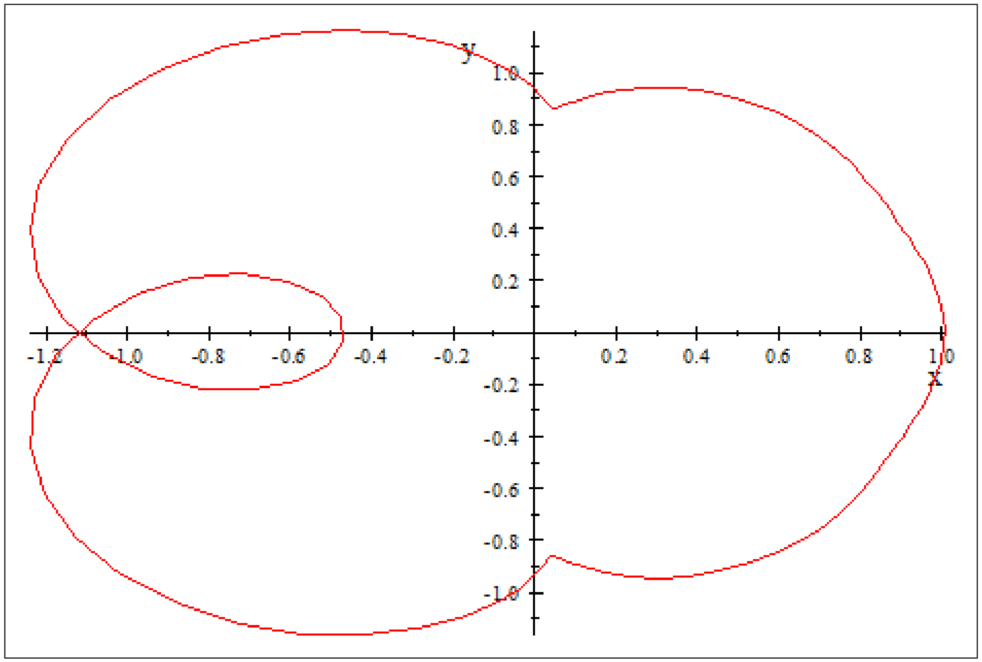


FIGURE 4. Plot of $g\left(e^{i\theta}\right)$ for $0 \le \theta \le 2\pi$ in reference to the inverse function theorem.

`fig.gz`

$$f(z) = z\left(1 + \frac{1}{10}\left(z - \frac{1}{3}\right)^3\left(z - \frac{i}{2}\right)^2\right)$$

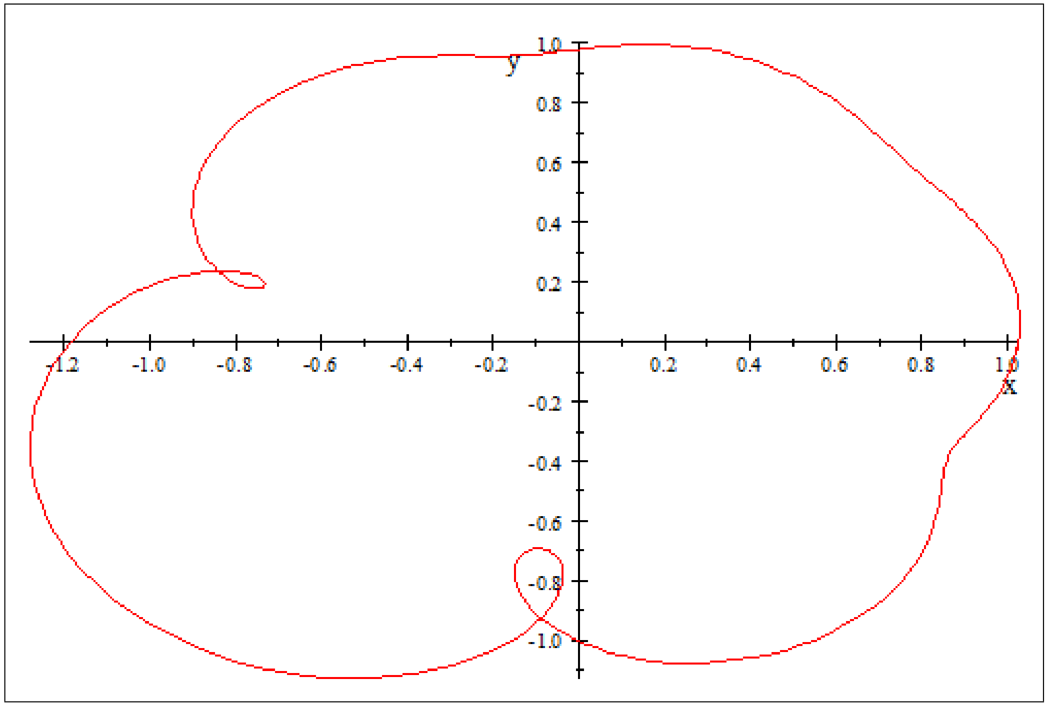


FIGURE 5. Plot of $f\left(e^{i\theta}\right)$ for $0 \leq \theta \leq 2\pi$ in reference to the inverse function theorem.