# Homework 3

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# 1 Problem 6.5

Figure 1 shows the required plot.

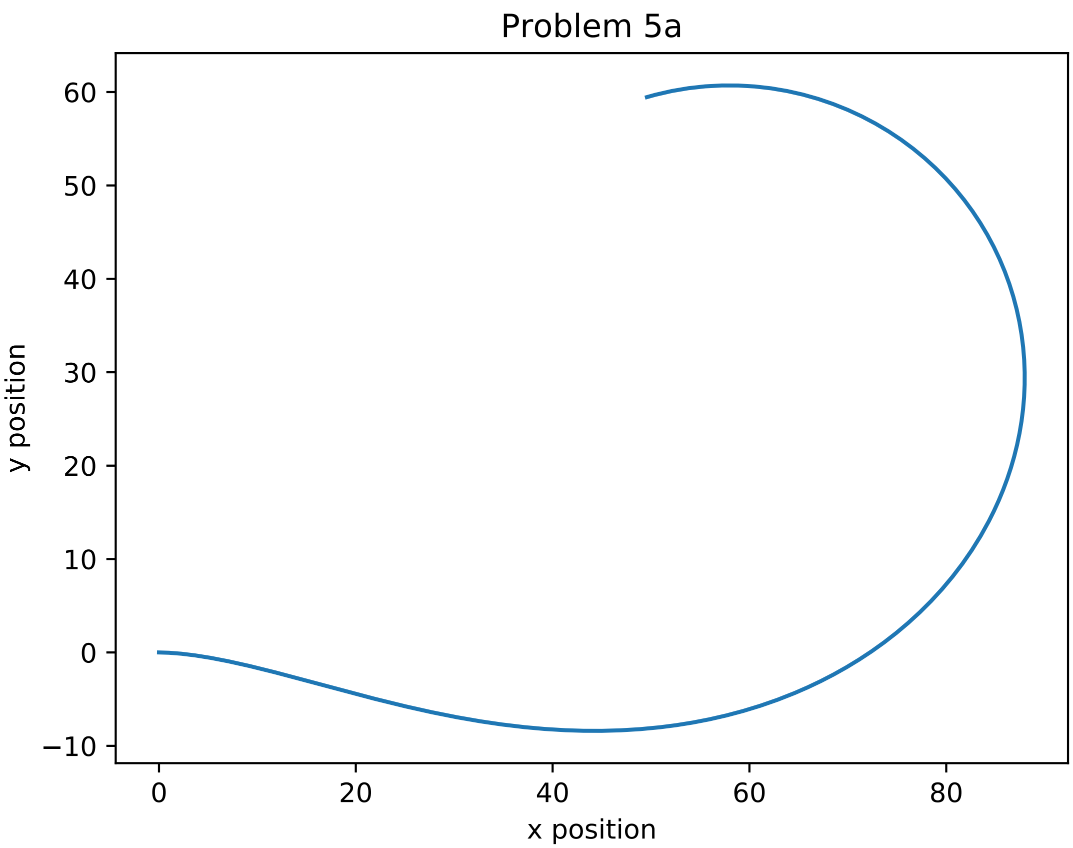


Figure 1: Problem 6.5.a

Figure 2 shows the data points that were saved.

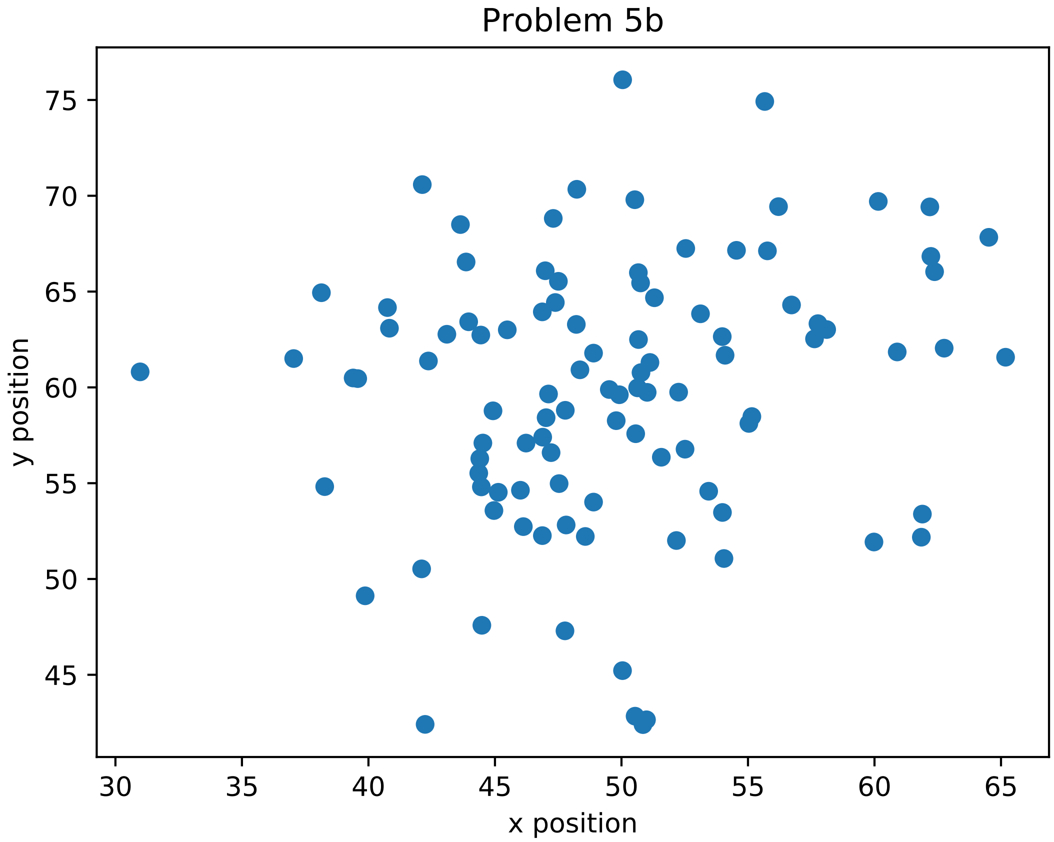


Figure 2: Problem 6.5.b

Figure 3 shows the data points that were saved.

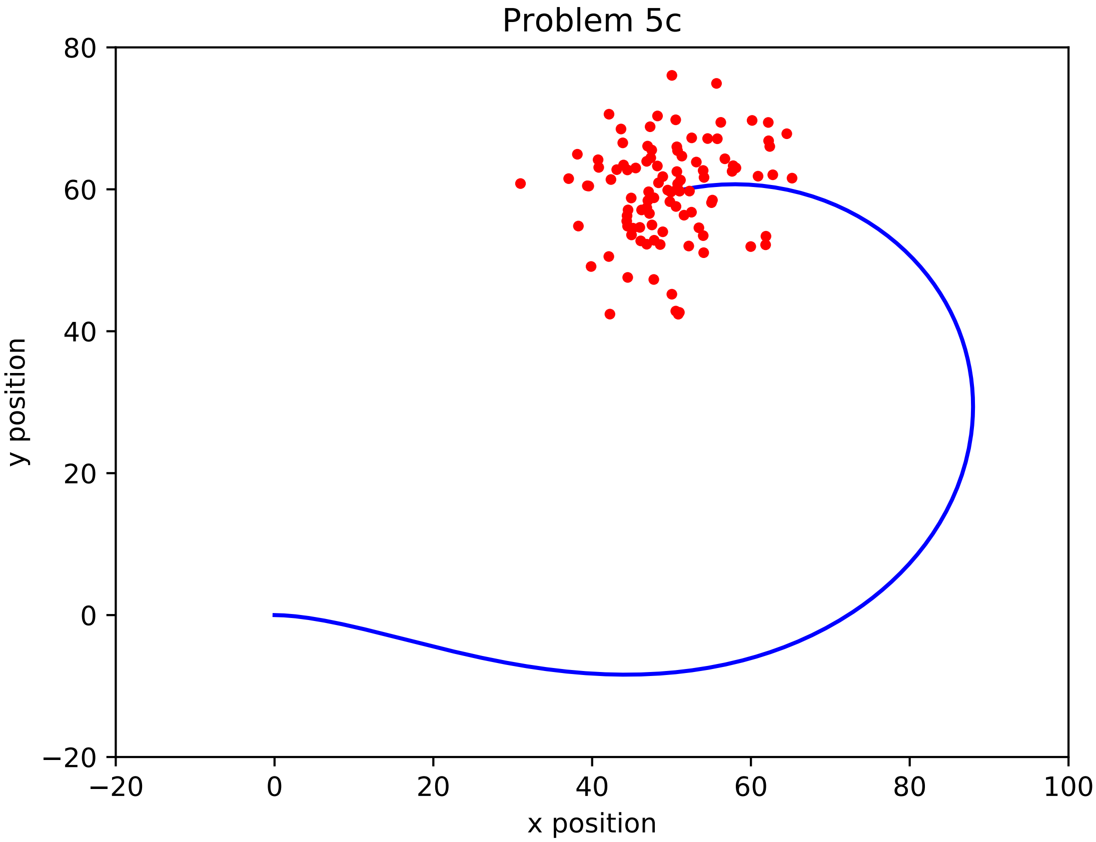


Figure 3: Problem 6.5.c

Figure 4 shows the data points that were saved.

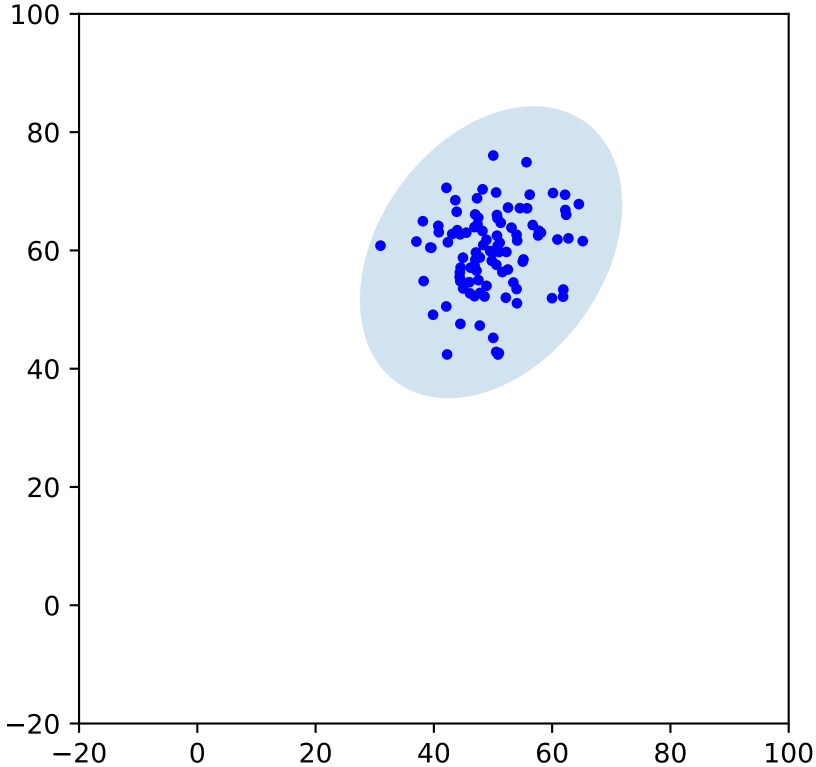


Figure 4: Problem 6.5.d

## 2 Problem 6.8

For this problem we have to take into account $x$, $y$, and $\theta$ derivatives with respect to time for the parametric form of an ellipse. We also make the assumption that velocity is constant. Parametric forms of $x$, $y$, and $\theta$ are as follows:

$$x(t) = 3 + 4cos(t)$$

$$y(t) = 2 + 3sin(t)$$

$$\theta(t) = \pi + \phi(t)$$

The derivatives are as follows:

$$\hat{x}(t) = -4sin(t)$$

$$\hat{y}(t) = 3cos(t)$$

$$\hat{\theta}(t) = \frac{12sec^2(t)}{9tan^2(t) + 16}$$

The only reason $\hat{\theta}(t)$ is differentiable without chaos is because as the robot moves around, the angle is independent of the starting $x$ and $y$ position, so the equation used to calculate $\hat{\theta}(t)$ are as follows:

$$\theta(t) = \pi + arctan\Big(\frac{3sin(t)}{4cos(t)}\Big)$$

You then plug and chug those into the inverse kinematic equations to get wheel speed of each wheel at every time step.