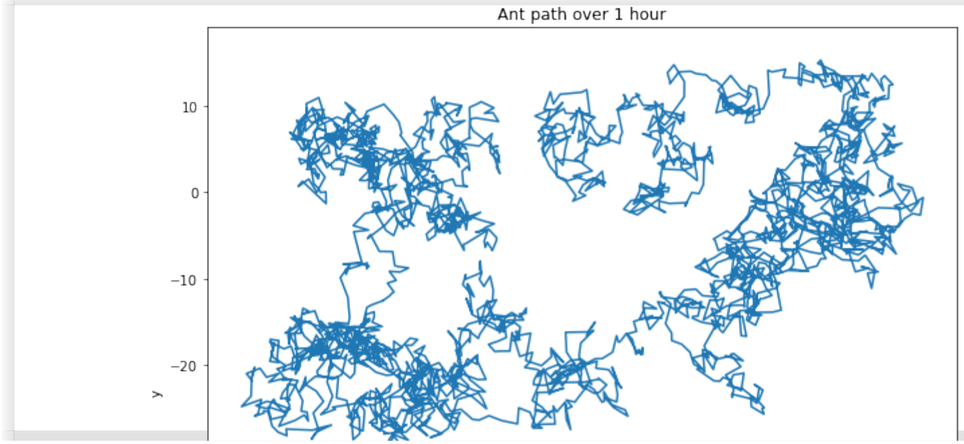
1a. [5pts, HELP] Suppose that an ant wandered randomly by taking steps (x,y), one per second, where at each ant step, x and y each come from a normal distribution with a mean of 0 and a standard deviation of 1.0mm (assume this for all questions below). Plot a trace of the ant's path over the course of an hour.

In [22]:
```
#1a
import numpy as np
import matplotlib
import matplotlib.pyplot as plt

pathx = np.cumsum(np.random.normal(0, 1, 3600))
pathy = np.cumsum(np.random.normal(0, 1, 3600))

plt.figure(figsize = (10, 10))
plt.plot(pathx, pathy)
plt.title('Ant path over 1 hour')
plt.xlabel('x')
plt.ylabel('y')
plt.show()
```



1b. [10pts, HELP] Let's think about why ants need to perform path integration. Suppose that instead of path integration, when an ant found food, it just continued to wander with random steps until it got back to the nest. Using a simulation, estimate the probability that an ant who finds food after 1 hour will make its way back to within 5mm of the nest over the course of the next hour (note that if it comes within 5mm of a nest, it stops). How many simulations do you need to run? Do the results show that this is a good strategy? Why or why not?

In [53]:
```
#1b
import numpy as np
import matplotlib
import matplotlib.pyplot as plt

def simulate():
    pathx = np.cumsum(np.random.normal(0, 1, 3600))
    pathy = np.cumsum(np.random.normal(0, 1, 3600))
    x = pathx[3599]
    y = pathy[3599]
    i = 0
```