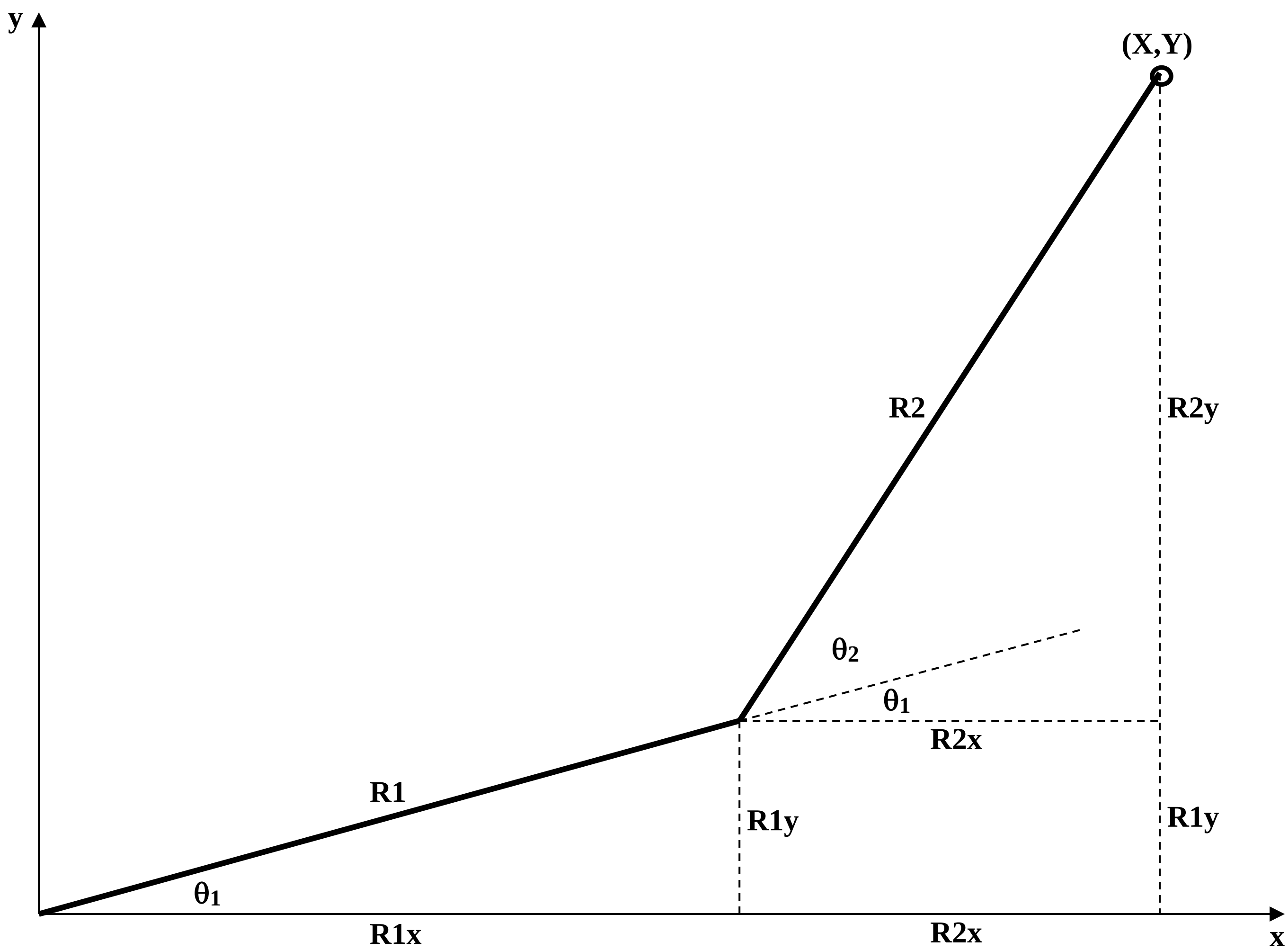
Sample 2




```
R1x + R2x = X
R1y + R2y = Y

R1*cos(θ1) + R2*cos(θ1+θ2) = X
R1*sin(θ1) + R2*sin(θ1+θ2) = Y

R1*cos(θ1) + R2*cos(θ1+θ2) - X = 0
R1*sin(θ1) + R2*sin(θ1+θ2) - Y = 0

f1 = R1*cos(θ1) + R2*cos(θ1+θ2) - X
f2 = R1*sin(θ1) + R2*sin(θ1+θ2) - Y
```

```
df1dt1 = -R1*sin(θ1) - R2*sin(θ1+θ2)
df1dt2 = -R2*sin(θ1+θ2)
df2dt1 =  R1*cos(θ1) + R2*cos(θ1+θ2)
df2dt2 =  R2*cos(θ1+θ2)
```

The robotic arm shown above consists of links R1 and R2, where R1=2.07 ft and R2=1.93 ft. R1 makes an angle θ_1 with the x axis and R2 makes an angle θ_2 with the direction of R1. The arm needs to reach the point (X,Y) where X=2.59 ft .

Write a MATLAB program as follows:

1) Y will go from 2 ft to 3 ft in steps of .01 ft .

2) For each value of Y, call the function newton2 to calculate θ_1 and θ_2 so that the end of the arm will be at the point (X,Y). Use 20° and 40° as the initial guesses for θ_1 and θ_2 and 1e-7 as the accuracy factor. Plot the robotic arm, pausing .02 sec between each orientation. Pause an additional 10 sec after the first orientation. Choose the origin at the lower left_corner. Plot R1 and R2 in blue and red and the point (X,Y) as a black circle. Use the pbaspect statement. The graph for the final orientation should look like the one on the attached sheet.