Problem 3.4.4

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Question

Question: Construct a rectangle whose adjacent sides are of lengths 5cm and 3.5cm.

Solution

SOLUTION as mentioned in question adjacent sides are of lengths 5cm and 3.5cm.
as nothing is mentioned in question about the points :
so we are taking rectangle as ABCD :
where position vector of respective points are :

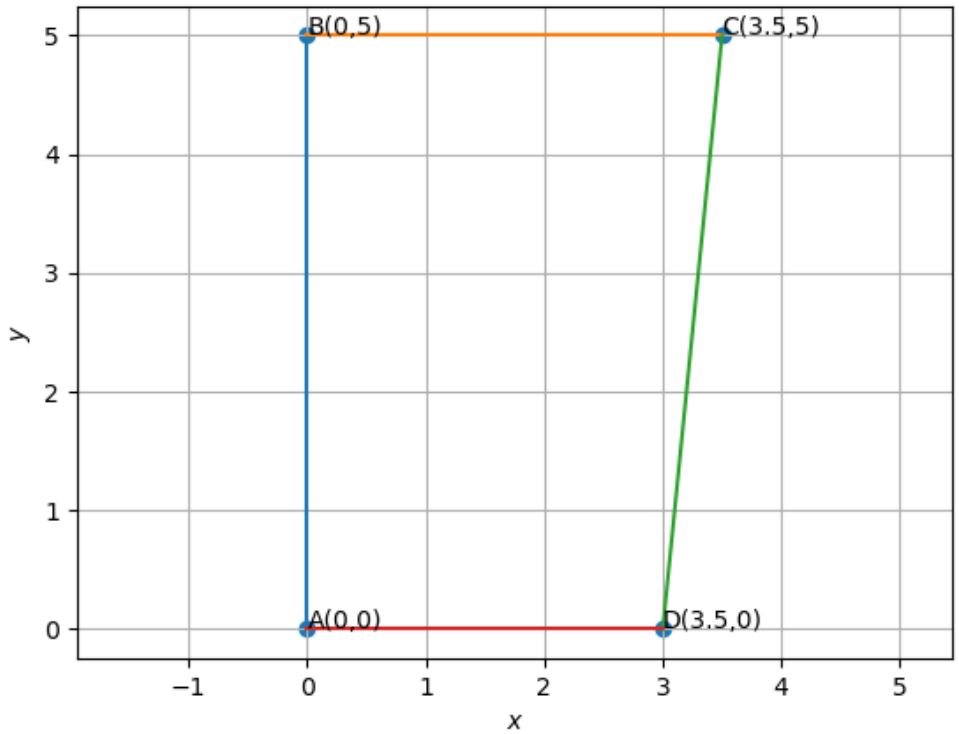
$$\mathbf{A} = \begin{pmatrix} 0 \\ 0 \end{pmatrix}, \mathbf{B} = \begin{pmatrix} 0 \\ 5 \end{pmatrix}, \mathbf{C} = \begin{pmatrix} 3.5 \\ 5 \end{pmatrix}, \mathbf{D} = \begin{pmatrix} 3.5 \\ 0 \end{pmatrix},$$

Solution

our assumed coordinates are satisfying all the properties of rectangle :

$$(\mathbf{B}-\mathbf{A})^{\top}(\mathbf{C}-\mathbf{B})=0$$
$$(\mathbf{C}-\mathbf{B})^{\top}(\mathbf{D}-\mathbf{C})=0$$
$$(\mathbf{D}-\mathbf{C})^{\top}(\mathbf{A}-\mathbf{D})=0$$
$$(\mathbf{A}-\mathbf{D})^{\top}(\mathbf{B}-\mathbf{A})=0$$

$$(\mathbf{B}-\mathbf{A})^{\top}(\mathbf{B}-\mathbf{A})=25$$
$$(\mathbf{C}-\mathbf{B})^{\top}(\mathbf{C}-\mathbf{B})=12.25$$
$$(\mathbf{D}-\mathbf{C})^{\top}(\mathbf{D}-\mathbf{C})=25$$
$$(\mathbf{A}-\mathbf{D})^{\top}(\mathbf{A}-\mathbf{D})=12.25$$


B(0,5)
C(3.5,5)
A(0,0)
D(3.5,0)
y
x
5
4
3
2
1
0
−1
0
1
2
3
4
5

C Code

```c
#include <stdio.h>

int main() {
    // Rectangle vertices
    int Ax = 0, Ay = 0;
    int Bx = 0, By = 5;
    int Cx = 3, Cy = 5;
    int Dx = 3, Dy = 0;
```

C Code

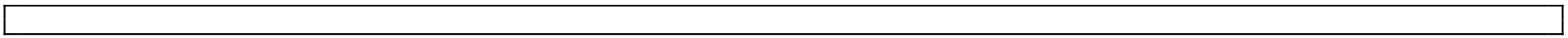
```
      printf("Coordinates of the rectangle are:\n");
    printf("A(%d, %d)\n", Ax, Ay);
    printf("B(%d, %d)\n", Bx, By);
    printf("C(%d, %d)\n", Cx, Cy);
    printf("D(%d, %d)\n", Dx, Dy);

    return 0;
}
```

Python Code for Plotting

```
import numpy as np
import matplotlib.pyplot as plt
from line.funcs import *
# from triangle.funcs import *
# from conics.funcs import circ_gen
# if using termux
import subprocess
import shlex
# end if
```

Python Code for Plotting



Python Code for Plotting

```
# Rectangle vertices
A = np.array([0,0]).reshape(-1,1)
B = np.array([0,5]).reshape(-1,1)
C = np.array([3,5]).reshape(-1,1)
D = np.array([3,0]).reshape(-1,1)

coords = np.block([[A,B,C,D]])
# Generate only rectangle sides
AB = line_gen(A,B)
BC = line_gen(B,C)
CD = line_gen(C,D)
DA = line_gen(D,A)
```

Python Code for Plotting

```
# Plot sides
plt.plot(AB[0,:],AB[1,:], label='AB')
plt.plot(BC[0,:],BC[1,:], label='BC')
plt.plot(CD[0,:],CD[1,:], label='CD')
plt.plot(DA[0,:],DA[1,:], label='DA')
# Scatter points
plt.scatter(coords[0,:],coords[1,:])
plt.text(A[0],A[1],"A(0,0)")
plt.text(B[0],B[1],"B(0,5)")
plt.text(C[0],C[1],"C(3,5)")
plt.text(D[0],D[1],"D(3,0)")
```

Python Code for Plotting

```
plt.xlabel('$x$')
plt.ylabel('$y$')
plt.legend(loc='best')
plt.grid(True)
plt.axis('equal')

plt.savefig('../figs/img.png')
plt.show()
```