

1.8.18

EE25BTECH11001 - Aarush Dilawri

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Question

Question:

Given vertices **A**($-4, -5$), **B**($-1, -6$) , **C**($-5, 7$) and **D**($4, 5$) of a quadrilateral. Find the area of quadrilateral $ABCD$.

Solution

Given vertices $\mathbf{A} = \begin{pmatrix} -4 \\ -5 \end{pmatrix}$, $\mathbf{B} = \begin{pmatrix} -1 \\ -6 \end{pmatrix}$, $\mathbf{C} = \begin{pmatrix} -5 \\ 7 \end{pmatrix}$, $\mathbf{D} = \begin{pmatrix} 4 \\ 5 \end{pmatrix}$.

We split the quadrilateral into triangles $\triangle ABC$ and $\triangle ACD$ and add them to get the answer.

Area of $\triangle ABC$

$$\text{Area}_{ABC} = \frac{1}{2} \|(\mathbf{B} - \mathbf{A}) \times (\mathbf{C} - \mathbf{A})\| = 17.5 \quad (1)$$

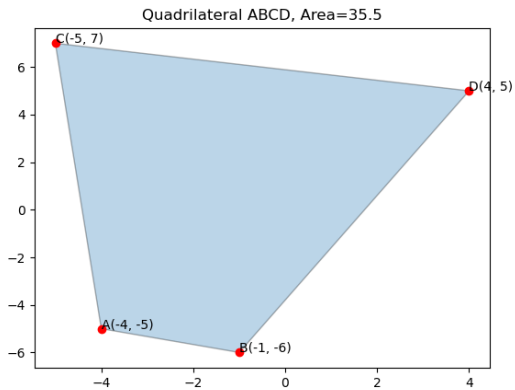
Area of $\triangle ACD$

$$\text{Area}_{ACD} = \frac{1}{2} \|(\mathbf{C} - \mathbf{A}) \times (\mathbf{D} - \mathbf{A})\| = 53 \quad (2)$$

Total Area

$$\text{Area}_{ABCD} = \text{Area}_{ABC} + \text{Area}_{ACD} = 70.5 \quad (3)$$

Figure



C Code (code.c)

```
#include <stdio.h>
#include <math.h>

double area_of_quadrilateral(double x1, double y1,
                             double x2, double y2,
                             double x3, double y3,
                             double x4, double y4) {
    double area = 0.5 * fabs(x1*y2 + x2*y3 + x3*y4 + x4*y1
                             - y1*x2 - y2*x3 - y3*x4 - y4*x1);
    return area;
}
```


Python Code (code.py)

```
import numpy as np
import matplotlib.pyplot as plt

x1, y1 = -4, -5
x2, y2 = -1, -6
x3, y3 = -5, 7
x4, y4 = 4, 5

area = 0.5 * abs(x1*y2 + x2*y4 + x4*y3 + x3*y1 - y1*x2 - y2*x4 -
    y4*x3 - y3*x1)
print("Area:", area)

xs = [x1, x2, x4, x3, x1]
ys = [y1, y2, y4, y3, y1]
```

Python Code (code.py)

```
plt.fill(xs, ys, alpha=0.3, edgecolor='black')
plt.scatter([x1, x2, x3, x4], [y1, y2, y3, y4], color='red')

points = {"A": (x1, y1), "B": (x2, y2), "C": (x3, y3), "D": (x4, y4)}
for p, (x, y) in points.items():
    plt.text(x, y, f"{p} {(x,y)}")

plt.title(f"Quadrilateral-ABCD,-Area={area}")
plt.show()
```

Python Code (nativecode.py)

```
import ctypes
import numpy as np
import matplotlib.pyplot as plt

lib = ctypes.CDLL("./code.so")
lib.area_of_quadrilateral.argtypes = [ctypes.c_double, ctypes.c_double,
                                     ctypes.c_double, ctypes.c_double,
                                     ctypes.c_double, ctypes.c_double,
                                     ctypes.c_double, ctypes.c_double]

lib.area_of_quadrilateral.restype = ctypes.c_double

x1, y1 = -4, -5
x2, y2 = -1, -6
x3, y3 = -5, 7
x4, y4 = 4, 5
```

Python Code (nativecode.py)

```
"A": (x1, y1), "B": (x2, y2), "C": (x3, y3), "D": (x4, y4)}  
for p, (x, y) in points.items():  
    plt.text(x, y, f"{p} {(x,y)}")  
  
plt.title(f"Quadrilateral-ABCD,-Area={area}")  
plt.show()
```