Matgeo Presentation - Problem 1.2.10

ai25btech11004 - jaswanth

September 12, 2025

Question

Find the area of the triangle whose vertices are (-8,4),(-6,6) and (-3,9).

Solution

Name	Point
A	$\begin{pmatrix} -8 \\ 4 \end{pmatrix}$
B	$\begin{pmatrix} -6 \\ 6 \end{pmatrix}$
C	$\begin{pmatrix} -3 \\ 9 \end{pmatrix}$

Table: variables used

$$A - B = \begin{pmatrix} -8 \\ 4 \end{pmatrix} - \begin{pmatrix} -6 \\ 6 \end{pmatrix} = \begin{pmatrix} -2 \\ -2 \end{pmatrix}, \tag{0.1}$$

$$A - C = \begin{pmatrix} -8 \\ 4 \end{pmatrix} - \begin{pmatrix} -3 \\ 9 \end{pmatrix} = \begin{pmatrix} -5 \\ -5 \end{pmatrix} \tag{0.2}$$

Solution

Now, the area of the triangle is

$$\text{ar}(\triangle ABC) = \frac{1}{2} |(A - B) \times (A - C)| \tag{0.3}$$

$$\text{ar}(\triangle ABC) = \frac{1}{2} \left| \begin{pmatrix} -2 \\ -2 \end{pmatrix} \times \begin{pmatrix} -5 \\ -5 \end{pmatrix} \right| \tag{0.4}$$

$$\therefore \quad \text{ar}(\triangle ABC) = \frac{1}{2}(0) = 0 \tag{0.5}$$

Thus, the three points are collinear, and the triangle has area=0.
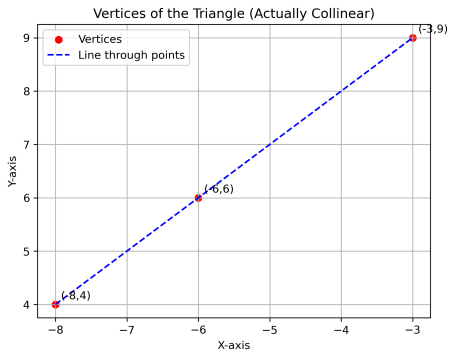
Plot

Figure: Caption

C Code: code.c

```c
#include <stdio.h>
#include <stdlib.h>

int main() {
    // Coordinates of vertices
    int x1 = -8, y1 = 4;
    int x2 = -6, y2 = 6;
    int x3 = -3, y3 = 9;

    // Apply determinant formula for area
    float area = 0.5 * abs(x1*(y2 - y3) + x2*(y3 - y1) + x3*(y1 - y2));

    // Open file to write output
    FILE *fp = fopen("triangle.dat", "w");
    if (fp == NULL) {
        printf("Error opening file!\n");
        return 1;
    }

    fprintf(fp, "The area of the triangle is: %.2f\n", area);

    fclose(fp);

    printf("Output written to triangle.dat successfully.\n");

    return 0;
}
```

Python: plot.py

```python
import matplotlib.pyplot as plt

# Coordinates of the vertices
x = [-8, -6, -3]
y = [4, 6, 9]

# Plot points
plt.scatter(x, y, color='red', label='Vertices')

# Connect the points (straight line since collinear)
plt.plot(x, y, color='blue', linestyle='--', label='Line through points')

# Annotate the points
for i, txt in enumerate([f"({x[i]},{y[i]})" for i in range(len(x))]):
    plt.annotate(txt, (x[i], y[i]), textcoords="offset points", xytext=(5,5))

# Labels and title
plt.xlabel("X-axis")
plt.ylabel("Y-axis")
plt.title("Vertices of the Triangle (Actually Collinear)")
plt.legend()
plt.grid(True)

# Save the figure
plt.savefig("triangle.png", dpi=300, bbox_inches="tight")

# Close the figure to free memory
plt.close()

print("Graph saved as triangle.png")
```