

2.7.22

Area of triangle

EE25BTECH11010 - Arsh Dhoke

Question

Question:

The area of a triangle whose vertices are $(5,0)$, $(8,0)$, $(8,4)$ (in sq.units) is

Given Data

Variable	Description
A	Vertex (5, 0)
B	Vertex (8, 0)
C	Vertex (8, 4)

Table: Given points

Vectors of Triangle

$$\mathbf{A} = \begin{pmatrix} 5 \\ 0 \end{pmatrix}, \quad \mathbf{B} = \begin{pmatrix} 8 \\ 0 \end{pmatrix}, \quad \mathbf{C} = \begin{pmatrix} 8 \\ 4 \end{pmatrix} \quad (1)$$

$$\mathbf{A} - \mathbf{B} = \begin{pmatrix} -3 \\ 0 \end{pmatrix}, \quad \mathbf{A} - \mathbf{C} = \begin{pmatrix} -3 \\ -4 \end{pmatrix} \quad (2)$$

Area of Triangle

$$(ABC) = \frac{1}{2} \|(\mathbf{A} - \mathbf{B}) \times (\mathbf{A} - \mathbf{C})\| = 6 \quad (3)$$

Hence, the area of $\triangle ABC$ is **6 sq. units**.

Graph of Triangle

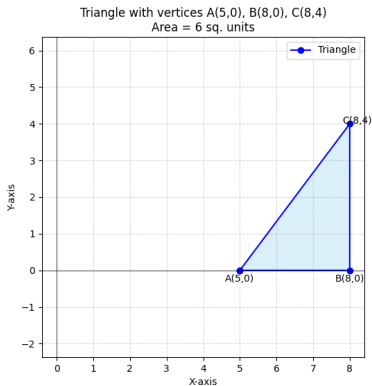


Figure: Graph of the Triangle

C Code

```
#include <stdio.h>
#include <math.h> // for fabs

// Function to compute area of a triangle given three vertices
double triangle_area(double x1, double y1,
                     double x2, double y2,
                     double x3, double y3)
{
    double area = fabs(x1 * (y2 - y3) +
                       x2 * (y3 - y1) +
                       x3 * (y1 - y2)) / 2.0;

    return area;
}

int main() {
    // Given vertices
    double x1 = 5, y1 = 0;
    double x2 = 8, y2 = 0;
    double x3 = 8, y3 = 4;
```

```
double area = triangle_area(x1, y1, x2, y2, x3, y3);  
  
printf("The area of the triangle is: %.2f sq.units\n", area);  
  
return 0;  
}
```


Python Code

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

# Triangle vertices
A = (5, 0)
B = (8, 0)
C = (8, 4)

# Extract x and y coordinates for plotting
x_coords = [A[0], B[0], C[0], A[0]] # Close the triangle by
    returning to A
y_coords = [A[1], B[1], C[1], A[1]]

# Plot the triangle
plt.figure(figsize=(6,6))
plt.plot(x_coords, y_coords, 'bo-', label='Triangle')
plt.fill(x_coords, y_coords, 'skyblue', alpha=0.3) # shaded area

# Label the points
```

Python Code

```
plt.text(A[0], A[1]-0.3, 'A(5,0)', ha='center')
plt.text(B[0], B[1]-0.3, 'B(8,0)', ha='center')
plt.text(C[0]+0.2, C[1], 'C(8,4)', ha='center')

# Add grid, axis, and title
plt.axhline(0, color='black', linewidth=0.5)
plt.axvline(0, color='black', linewidth=0.5)
plt.grid(True, linestyle='--', alpha=0.5)
plt.xlabel('X-axis')
plt.ylabel('Y-axis')
plt.title('Triangle with vertices A(5,0), B(8,0), C(8,4)\nArea =
        6 sq. units')
plt.axis('equal') # Equal scaling on both axes
plt.legend()
plt.savefig("/home/arsh-dhoke/ee1030-2025/ee25btech11010/matgeo
        /2.7.22/figs/q4.png")
plt.show()
```

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

# =====
# Load C shared library
# =====
lib = ctypes.CDLL("./code.so")

# Define function signature
lib.triangle_area.argtypes = [ctypes.c_double, ctypes.c_double,
                               ctypes.c_double, ctypes.c_double,
                               ctypes.c_double, ctypes.c_double]
lib.triangle_area.restype = ctypes.c_double

# Triangle vertices
A = (5.0, 0.0)
B = (8.0, 0.0)
C = (8.0, 4.0)
```

```
# Compute area using the C function
area = lib.triangle_area(A[0], A[1], B[0], B[1], C[0], C[1])
print(f"Area of the triangle (from C): {area:.2f} sq.units")

# =====
# Plotting the triangle
# =====
x_coords = [A[0], B[0], C[0], A[0]] # close the triangle
y_coords = [A[1], B[1], C[1], A[1]]

plt.figure(figsize=(6,6))
plt.plot(x_coords, y_coords, 'bo-', label='Triangle')
plt.fill(x_coords, y_coords, 'skyblue', alpha=0.3)

# Label the points
plt.text(A[0], A[1]-0.3, f'A{A}', ha='center')
plt.text(B[0], B[1]-0.3, f'B{B}', ha='center')
plt.text(C[0]+0.2, C[1], f'C{C}', ha='center')
```

```
# Add grid, axis, and title
plt.axhline(0, color='black', linewidth=0.5)
plt.axvline(0, color='black', linewidth=0.5)
plt.grid(True, linestyle='--', alpha=0.5)
plt.xlabel('X-axis')
plt.ylabel('Y-axis')
plt.title(f'Triangle with vertices A{A}, B{B}, C{C}\nArea = {area
        :.2f} sq. units')
plt.axis('equal')
plt.legend()
plt.savefig("/home/arsh-dhoke/ee1030-2025/ee25btech11010/matgeo
        /2.7.22/figs/q4.png")
plt.show()
```